Maternal Healthcare in the Indian Himalayan Region: Evidence from NFHS-5, 2019-21

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Abstract

Quality and adequate maternal healthcare services are crucial to reduce the risks of maternal deaths. Utilising National Family Health Survey (NFHS)-5 data (2019-21), this study presents an analysis of maternal healthcare use in a geopolitically strategic mountainous Himalayan region of India. Using descriptive statistics and multivariate procedures, we observe poor utilisation of several maternal healthcare services in the region. Logistic regressions show that, adjusting for other factors, women in the region are more likely to complete at least 4 antenatal care (ANC) visits but are less likely to have at least 100 days of Iron & Folic Acid (IFA) intake, choose institutional childbirths, use full antenatal care services (full ANC), or to receive adequate quality antenatal care (AQC), compared with their counterparts in the rest of India. Intra-region disparities remain glaring, and utilisation is determined by various factors. Findings suggest measures to address the diverse concerns in maternal healthcare access and use in the region. Long term measures are need to improve the overall performance, but, as short term solution, priority may be given to the more vulnerable population sub-groups. Studies on medico-clinical quality of care, especially in the present contexts of high maternal mortality risks, hold paramount importance in the region.

Introduction

Maternal deaths remain a global public health concern. An estimated 287,000 maternal deaths occurred globally in 2020, with such incidences mostly reported from the low and lower middle-income countries (WHO, 2023). During 1990s, with a substantially high maternal mortality ratio (MMR) of 556, in India, about 138,000 women died every year due to pregnancy and childbirth related complications. Between 1997 and 2020, there were estimated 1.3 million maternal deaths in the country (Meh et al., 2022). MMR in India has declined nevertheless, and as per the latest Sample Registration System (SRS) report, it stood at 97 per 100,000 live births during 2018-20. Meh et al. (2022) similarly estimate a decline in MMR, by about 70% from 398 in 1997-98 to only 99 per 100,000

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live births in 2020. India thus achieved its National Health Policy (NHP), 2017 target MMR of less than 100, but the figure continues to remain well above the Sustainable Development Goal (SDG) target of 70 maternal deaths per 100,000 live births. MMR also varies widely across states/UTs in India, and it remains markedly high in a few, warranting examinations of maternal healthcare use, care quality and its adequacy at least in certain regions of the country.

Restricted to the mountainous Indian Himalayan Region (IHR, hereafter), this study covers the states/UTs of Jammu & Kashmir, Ladakh, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya and Tripura (Figure 1), but excludes the states of Assam and West Bengal, which predominantly comprise plain areas. Bordered with Pakistan on the northwest, the People's Republic of China, Bhutan and Nepal on the north, and Myanmar and Bangladesh on the south, the Himalayan region with distinct topography holds profound geopolitical and strategic importance for India. This region, despite being sparsely populated, is socio-culturally diverse, and economically, it is recovering from sluggishness. Previously, the sample states/UTs were granted the status of Special Category States (SCS), and, as reiterated by the Thirteenth Finance Commission of India, their development impediments stem mostly from physical geography, sparse terrains, remoteness and their histories (Bhattacharjee, 2014). On health domains, excepting Tripura and Mizoram, all other States/UTs in the region were accorded 'achiever' or 'aspirant' category status, having the lower performance index (NITI Aayog, 2021). The situation for maternal health, as would be stated soon, is worrying as well. In terms of health infrastructures, while the population pressure per health facility tends to be low, average distance to health facilities remains concerning, particularly in view of difficult and mountainous terrains in the region. For most states/UTs, the average radial distance to health facility, according to the *Rural Health Statistics* (2021-22), is higher than the national average. For instance, barring Tripura, the average radial distance to a Sub-Centre in all other states/UTs is larger than the national average of 2.49 KMs. Similar is the scenario observed for Primary Health Centre (PHC), with the average radial distance varying from 5.45 KMs in Tripura to 24.25 KMs in Ladakh against the national average of 6.28 KMs. For Community Health Centre (CHC), it varies from 12.37 KMs in Tripura to 51.85 KMs in Ladakh, compared to the all India average of 13.39 KMs. The average rural area covered under each health facility is also larger in the region. Comprehensive discussions on health and healthcare, in such contexts, are necessary as well as worth undertaking. Many areas on the subject remain under-researched, the present analysis concentrates on utilisation of maternal care services in this geographically challenged region of India. In this region, the risks of maternal deaths remain evidently high, at least relative to the SDG-3.1 target, and as compared with many other states/UTs in India. For instance, based on the Health Management Information System (HMIS) data for 2017-19, Goli et al. (2022) estimate an MMR of 284 for Arunachal Pradesh, followed by Manipur (282), Meghalaya (266), Sikkim (228), Jammu and Kashmir (151), Nagaland (143), Himachal Pradesh (127), Mizoram (131), Tripura (119) and Uttarakhand (107), against the national average of 122 and the SDG target of 70. These facts rationalise discussions on critical aspects of maternal healthcare in the region.

There exists extensive literature on maternal healthcare use in India. Some studies on the subject can be found in the region as well (e.g. Cáceres et al., 2023; Kumar et al., 2022; Bora et al., 2022; Kaur, 2023; Saxena et al., 2020; Prochaska et al., 2016; Apum & Nochi, 2017; Nienu & Longkumer, 2015), offering valuable insights on certain aspects of maternal healthcare in the region. However, these studies mostly rely on small samples and are usually limited in their scope or geographical coverage. More recently, a comprehensive discussion was presented by Mustafa and Shekhar (2021), using data from NFHS-4 (2015-16). However, the study, examining certain specific maternal care components, missed out on two crucial composite indicators –'full antenatal care services (full ANC)' and 'adequate quality antenatal care (AQC)'. Determinants of maternal healthcare use in the region similarly remain less understood. The paper tries to bridge some of these gaps, by presenting an analysis of utilisation of maternal healthcare services in this mountainous region. More specifically, the questions raised are: (a) what is the current state of maternal healthcare use in the region? (b) How does the region compare to the national level attainments, or with its counterpart rest of India? , and (c) What are the determinants of maternal healthcare use in the region?. Utilising data from NFHS-5 (2019-21), this study observes a poor attainment in several maternal healthcare use indicators in the region – in absolute term, as well as in comparison to the national level performance or with its counterpart rest of India. Intra-region disparity remains glaring and utilisation is determined by various factors.

The rest of the article is structured as follows. Section 2 describes the data and methods of the study, followed by results in Section 3 and their discussion in Section 4. We then conclude the study with Section 5, highlighting the key findings, policy implications and identifying a few areas for future studies.

Materials and Methods

Data

The study utilises National Family Health Survey (NFHS)-5 data collected by the International Institute for Population Sciences (IIPS), Mumbai, under the aegis of the Ministry of Health and Family Welfare (MoHFW), Government of India (GOI). The survey, carried out during June 17, 2019 - April 30, 2021, collected information on several aspects, including maternal healthcare use for the live births during the preceding five years. In the survey, 724115 women, aged 15-49, were sampled, recording a total of 232,930 live births. For this study, however, we consider only the most recent live births, giving a sample size of 176,843 for India overall, and 28691 for the IHR – the present study area. The sample distribution in the region is as follows – Jammu & Kashmir (4898), Himachal Pradesh (2145), Uttarakhand (2966), Sikkim (569), Arunachal Pradesh (4570), Nagaland (2205), Meghalaya (4602), Mizoram (1896), Manipur (2511), Tripura (1860) and Ladakh (469) (Figure 1).

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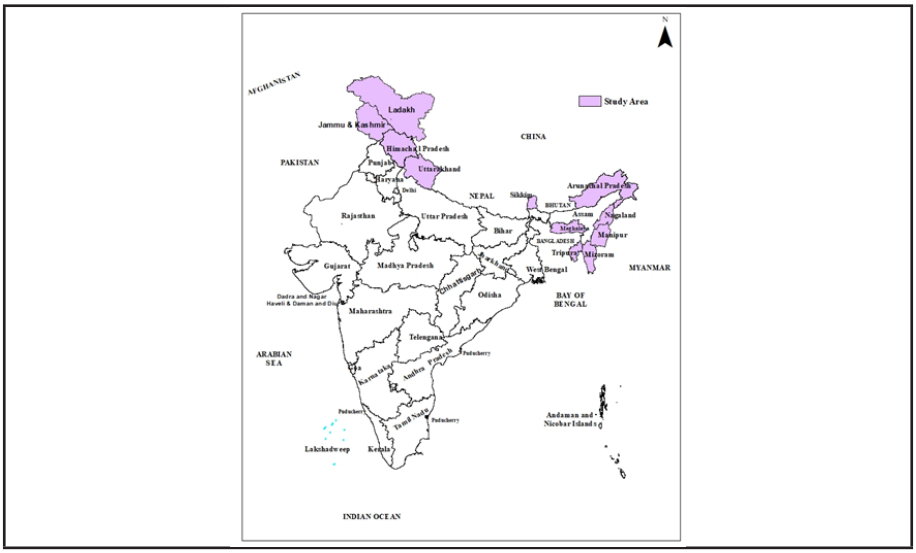
Figure 1: Study Area



Source: *Authors*

Variables and Measurements

Delimited to utilisation of 'antenatal care services' and 'childbirths', a range of outcome variables are used for analysis. Two of them need to be defined explicitly - full antenatal care services (full ANC) and adequate quality antenatal care (AQC). Following Singh et al. (2023), we define full ANC to include 'four or more ANC visits', 'two or more TT injections' and 'IFA intake for 100 days or more'. Similarly, a woman is considered to have received adequate quality antenatal care (AQC) if she reported receiving antenatal care components including (a) weight measurement (b) blood pressure measurement (c) blood sample tests (d) urine test (e) two or more doses of TT injections, (f) IFA intake for 100 days or more, and (g) abdomen test. The previous studies tend to consider items from (b) to (f) (e.g. Girotra et al., 2023), but, in present context definition of AQC, we include the items in (a) and (g) as well, at least for two reasons: one, mother's body weight serves as an indicator for her own health as well as growth of the fetus, and; two, abdomen screening is essential to estimate gestational age, fetal anomalies or multiple pregnancies. The predictor variables, described in Table 1, are largely identified from the literature, and their selection is guided by healthcare access models or frameworks (Andersen, 1968; Levesque et al., 2013).

Analytical Framework

Descriptive statistics and multivariate procedures are used for analysis. First, a description of utilisation of maternal care services is presented –by states/UTs and women's socioeconomic profiles – to provide an understanding of its current state in the region. Regression analysis are then carried out to identify the determinants of maternal healthcare use in the region, and to estimate the odds ratios for use of such services in

the region vis-à-vis the rest of India. In all estimations, the Demographic and Health Surveys (DHS) data analysis guidelines have been followed, and unless otherwise stated, sample weights are used and the survey design accounted for.

Empirical Specification

The outcome variables, defined as binary in their measurement, are coded 1 or 0, with the former indicating use of a given maternal healthcare service, while the latter the otherwise. For multivariate analysis, logistic regressions are performed – a widely used procedure preferred due to its simplicity and ease of interpretation. To put the procedure formally, assume -

$$y_i^* = x_i^{'}\beta + u_i \text{ ----------(1)}$$

where, y_i^* is a latent continuous variable, linked to observed discrete y_i such that $y_i = 1 if y_i^* > 0; y_i = 0$ otherwise $x_i^{'} = \left[x_{i1}, x_{i2}, \ldots . x_{ik}\right]^{'}$. is a vector of predictor variables; β is vector of parameters to be estimated; u_i is error term assumed to follow logistic distribution.

Logistic regression models the log odds of the probability of occurrence of an event to that of non-occurrence as a linear function of the independent variables.

$$\text{Logit} = \ln \frac{p\left(y_i = 1\right)}{p\left(y_i = 0\right)} = x_i^{'}\beta \text{ ----------(2)}$$

Solving (1) and (2) gives

$$p\left(x;\beta\right) = \frac{e^{x_i^{'}\beta}}{1+e^{x_i^{'}\beta}} = \frac{1}{1+e^{-x_i^{'}\beta}}$$

Empirically, in this contexts, the probability of a woman using a given maternal care service is given by-

$$p\left(use\ of\ maternal\ care\ services\right) = 1/\left(1+e^{-x'\beta}\right) = 1/\left(1+e^{-z_i}\right)$$

Regressions are carried out for utilisation of *specific* care services such as ‘at least 4 ANC visits’, ‘at least 100 days of IFA intake’, ‘2 or more doses of TT injection before birth’, and ‘institutional delivery’ as well as for two *composite* indicators – ‘full ANC use’ and ‘receipt of AQC’. Two sets of empirical specifications are employed–one, for the full survey sample, *with dummy* for the IHR (N=176843) and the other on sub-sample data for the study area (N=28691). The first set of specifications is used to estimate the odds for women’s use of maternal healthcare services in the IHR vis-à-vis the rest of India, while the latter to identify its determinants within the region. For the first, step-wise regression is followed, starting with the predictor variable *IHR* to

examine its bivariate association with maternal healthcare use, and then adding the other control variables in order of their presentation. In the procedure, no significant changes could be observed, at least qualitatively, in coefficient estimates for the variable of interest, Probit estimations are additionally performed as a check of robustness of the reported results, and sub-sample regressions are carried out (on 50% sub-sample data) to check the sensitivity of the results to sampling variations. The alternative procedures produced estimates consistent with the reported results.

Table 1: Description of the predictor variables

Variables	Definition/Description	Unweighted IHR sample(%) N=28691
IHR	Dummy for the study area (Ref. Rest of India)	-
Birth order	Most recent live birth order(Ref. 1st Birth)	34.91a
2-3	=1 if birth order is 2 or 3; 0 otherwise	48.49
4 or more	=1 if birth order is 4 or higher; 0 otherwise	16.60
Education	Highest level of education completed (Ref. No schooling)	14.85a
Primary	=1 if completed primary level; 0 otherwise	13.61
Secondary	=1 if completed secondary level; 0 otherwise	58.06
Higher	=1 if graduation or higher; 0 otherwise	13.49
Social group	Social categories (Ref. Scheduled Castes or SC)	9.39a
ST	=1 if Scheduled Tribes (ST); 0 otherwise	53.18
OBC	=1 if Other Backward Classes (OBC); 0 otherwise	8.78
Others	=1 if none of the above groups; 0 otherwise	28.65
Religion	Religion (Ref. Hindu)	32.87a
Muslim	=1 if Muslim; 0 otherwise	16.62
Christian	=1 if Christian; 0 otherwise	39.67
Others	=1 if other religions such as Sikhism, Jainism, Buddhism etc.; 0 otherwise	10.84
Residence	Place of residence (Ref. Urban)	17.59a
	=1 if rural; 0 otherwise	82.41
Wealth	Household wealth quintile (Ref. Poorest)	23.78a
Poorer	=1 if'poorer' quintile household; 0 otherwise	27.30
Medium	=1 if 'medium' quintile household; 0 otherwise	21.94
Richer	=1 if 'richer' quintile household; 0 otherwise	16.78
Richest	=1 if 'richest' quintile household; 0 otherwise	10.19
Distance	Difficulty in getting medical help (Ref. Not a problem)	32.82a
Big problem	=1 if big problem; 0 otherwise	34.41
Not a big problem	=1 if not a big problem; 0 otherwise	31.78
ANC visits	Number of antenatal care (ANC) visits(Ref. <4 visits)	43.82a
	=1 if completed at least 4 ANC visits; 0 otherwise	56.18
State dummies	Dummy variables for states/UTs in the IHR	-

Results

Utilisation of Maternal Healthcare Services

Utilisation of maternal healthcare services, in the region, remains far from being universal, and in several indicators, it fares poorly compared to the national level attainments (Table 2). For instance, for the most recent live births, about 42.2% women reported completing the recommended minimum100 days of IFA intake, compared to the national average of 44.1%. Similar is the observation about IFA intake for 180 days or more, with only four states - Himachal Pradesh, Sikkim, Uttarakhand and Manipur - comparing with the national average of 26%. The estimate for the region remains at 22.3% - the lowest among various maternal healthcare indicators. Full ANC utilisation remains low as well, estimated at 26.4% against the national average of 28.5%. As for AQC, it is 31.9% compared to the national average of 35.4%. The region also lags behind in institutional delivery, estimated at 84.6%, compared to the national average of 90.1%. With regard to ANC visits, the region fares well, however. An estimated 65.4% women completed at least 4 ANC visits in the region: the national average being 58.5%. The region also performs well in terms of the first trimester antenatal check-up. Antenatal care components such as 'body weight measurement' and 'blood pressure measurement', 'blood sample test', 'urine test' and the 'abdomen test' are near universal, as is the situation for the country in general.

Intra-region disparities in maternal care indicators remain stark (Table 2). Nagaland remains at the bottom in most of these indicators. Moreover, compared to the national level attainments, three northeastern states- Arunachal Pradesh, Nagaland and Meghalaya - underperform in all the maternal care utilisation indicators considered in this study. Manipur stands out, on the other hand, lagging behind in only one parameter, followed by Himachal Pradesh and Sikkim staying behind in two parameters each. Himachal Pradesh tops the region in receipt of adequate quality care i.e. AQC (46.1%), followed by Manipur (44.7%), Mizoram (42.2) and Sikkim (41.6); the lowest being observed for Nagaland (7.1%) and Ladakh (10.8%).

Utilisation also varies across cross-sectional groups in the region (Table 3). Full ANC use and AQC in particular are lower, *inter alia*, for women with no formal schooling, in rural areas and for women with higher birth order. Maternal healthcare utilisation tends to improve with the household wealth and women's education, On the other hand. utilisation also remains lower for the Christian and the Muslim women, among others, for full ANC and AQC. Noticeably, among the social groups, Scheduled Tribes (ST) mothers perform poorly in several maternal care indicators in the region.

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Table 2:Women's use of maternal healthcare services for the most recent live births (in %)

Indicator	ANC checkup in first trimester	At least 4 ANC visits	At least 2 doses of TT injection before birth	At least 100 days of IFA intake	At least 180 days of IFA intake	Institutional delivery	full ANC use	Receipt ofAQC	No. of indicatorswith shortfall (out of 8)
	I	II	III	IV	V	VI	VII	VIII	
Nagaland	49.5	20.7	75.6	10.2	4.1	48.3	5.1	7.1	8
Meghalaya	53.9	52.2	63.9	43.1	20.6	63.2	20.1	25.5	8
Arunachal Pradesh	53.1	36.6	67.2	23.8	8.6	81.1	13.6	18.5	8
Tripura	63.2	55.2	92.8	26.7	8.9	90.4	15.0	20.3	6
Ladakh	85.8	78.9	87.8	14.3	7.3	95.5	9.5	10.8	4
Jammu & Kashmir	86.6	81.1	84.5	29.8	15.9	93.1	21.9	24.1	4
Mizoram	72.7	58.1	72.6	61.9	10.5	86.8	30.9	42.2	4
Uttarakhand	68.8	61.8	88.3	46.6	25.0	84.9	30.1	38.5	3
Himachal Pradesh	72.4	70.6	77.6	67.2	43.0	89.0	38.4	46.1	2
Sikkim	63.7	58.4	86.3	54.7	31.5	95.2	34.2	41.6	2
Manipur	79.9	79.4	84.7	52.3	30.3	82.6	43.1	44.7	1
IHR	71.4	65.4	82.2	42.2	22.3	84.6	26.4	31.9	6
India	70.0	58.5	83.1	44.1	26.0	90.1	28.5	35.4	NA

Source: Authors' estimationfrom NFHS-5 data (2019-21)

Table 3:Cross-sectional distribution of maternal healthcare use in the study area, for the most recent live births (in %)

	At least 4 ANC visits	At least 100 days of IFA intake	At least 2 doses of TT injections before birth	Institutional Delivery	Full ANC use	AQC
Birth order						
1	69.55	44.32	89.34	92.09	30.78	36.20
2-3	65.96	42.46	79.98	84.98	25.56	31.17
4 or more	49.97	34.22	68.57	59.41	16.45	21.42
Education						
No schooling	56.15	29.68	76.38	71.40	17.05	21.07
Primary	54.83	36.07	77.16	69.66	19.93	25.66
Secondary	65.60	42.05	82.75	86.94	25.41	31.35
Higher	77.85	55.20	87.54	96.22	40.17	45.08
Social group						
SC	62.82	44.63	81.69	86.20	26.67	32.15

ST	50.56	36.34	72.92	70.67	18.90	24.62
OBC	67.57	43.64	87.09	88.04	29.50	33.63
Others	74.46	44.26	86.00	91.12	29.74	35.55
Religion						
Hindu	66.49	48.94	85.24	89.22	30.66	37.65
Muslim	75.68	30.88	85.61	88.70	22.00	24.80
Christian	49.08	38.51	69.12	65.85	19.83	25.03
Others	62.60	39.41	79.83	83.63	27.61	30.87
Residence						
Urban	73.59	46.75	86.40	92.61	33.62	38.34
Rural	62.67	40.65	80.73	81.93	24.05	29.76
Wealth quintiles						
Poorest	46.48	28.61	72.23	62.60	13.60	18.32
Poorer	58.83	35.92	79.61	77.56	19.81	25.46
Medium	64.69	42.03	83.68	87.13	25.66	31.94
Richer	73.70	46.61	86.45	93.37	32.03	37.73
Richest	78.68	54.49	86.27	96.87	38.05	42.80
Distance						
Not a problem	71.62	49.27	83.83	90.61	32.51	37.48
Big problem	56.67	34.94	78.45	76.14	20.01	26.08
Not a big problem	64.56	38.69	83.15	83.82	23.69	29.29
ANC visits						
<4 visits	-	33.41	73.84	72.85	-	19.03
4 or more visits	-	46.81	86.54	90.81	-	38.71
IHR	65.40	42.17	82.15	84.60	26.44	31.90

Source: Authors' estimation from the NFHS-5 data (2019-21)

Determinants of Maternal Healthcare Use

The adjusted odds ratios (AOR) for the IHR vis-à-vis its counterpart rest of India, for utilisation of *specific* maternal care services, are presented in Table 4. It shows that, after controlling for other factors, women in the study area are *more likely* to complete at least 4 ANC visits (AOR: 1.14; CI: 1.08-1.21), but they are *less likely* to complete minimum 100 days of IFA intake (AOR: 0.69; CI: 0.65-0.73), receive 2 doses of TT injection (AOR: 0.86 CI: 0.80-0.92), or to have childbirths at health facilities (AOR: 0.50, CI: 0.46-0.55).

Table 5 presents the regression results for the *study area*, specifically. In the region, odds for completing at least 4 ANC visits are lower for birth order 4 or higher as compared to the first birth (AOR: 0.76, CI: 0.66-0.87). Odds are also lower for rural areas (AOR: 0.80, CI: 0.68-0.94), and for those reporting high degree of difficulty in health facility

access (AOR: 0.74, CI: 0.65-0.84), compared with their reference categories. The odds increase with women's formal education (AOR: 1.21 to 1.79) and household wealth (AOR: 1.37 to 2.24). Similarly, for *IFA intake for 100 days or more*, odds are lower for birth order 4 or higher (AOR: 0.83, CI: 0.71-0.96) but they increase with mother's education, and household wealth (AOR: 1.14 to 1.71). Compared with the Hindus, odds are lower for the Muslims (AOR: 0.78; 95%CI: 0.63-0.96) and the Christians (AOR: 0.72; 95%CI: 0.57-0.90). For *institutional delivery*, the odds are lower for higher birth order, but they increase with women's education (AOR: 1.07 to 2.53) and household wealth (AOR: 1.56 to 6.09). Odds are lower for women reporting high degree of difficulty in health facility access (AOR: 0.62, CI: 0.53-0.73). Odds are lower for the Muslims (AOR: 0.67; CI: 0.51-0.89) and the Christians (AOR: 0.68; CI: 0.53-0.87), as compared with the Hindus. Odds for institutional delivery are higher for those reporting at least 4 ANC visits (AOR: 2.18, CI: 1.93-2.46) compared with fewer antenatal visits. *TT injection* is near universal but tends to decrease with birth order.

Logistic regression results for *composite* indicators viz. *full ANC use* and *AQC* are presented in Table 6. It shows that, adjusting for other factors, women in the IHR are less likely to have full ANC use compared with their counterparts in the rest of India (AOR: 0.71; CI: 0.66-0.76), and so is the finding about AQC, with women in the region demonstrating lower odds of receiving AQC for the most recent live births (AOR: 0.63, CI: 0.59-0.67). *Within the region,* odds for *full ANC use* are higher for women with higher education (AOR: 1.52, CI: 1.20-1.92) and for those belonging to the wealthier households (AOR: 1.27-2.10). The odds are, on the other hand, significantly lower for rural areas (AOR: 0.82, CI: 0.70-0.96) and for birth order 4 or higher (AOR: 0.62, CI: 0.51-0.74). Similar are the findings about *AQC*. The odds are higher for women reporting at least 4 ANC visits (AOR: 2.43, CI: 2.17-2.71) and they increase with household wealth (AOR: 1.17-1.59). The odds of receiving AQC are lower for the Muslims (OR: 0.79, CI: 0.63-0.99) and the Christians (AOR: 0.71, CI: 0.57-0.89) compared with the Hindus. Education shows positive association. Compared with mothers with no formal schooling, in the region, odds for receiving AQC are higher for those who did higher education (AOR: 1.35; CI: 1.08-1.68).

Table 4: Logistic regression results forspecific maternal healthcare services, with IHR dummy(N=176843)

	At least 4 ANC visits			At least 100 days of IFA intake			At least 2 doses of TT Injection before birth;			Institutional Delivery		
	AOR	95% CI		AOR	95% CI		AOR	95% CI		AOR	95% CI	
IHR (Ref. Rest of India)	1.14***	1.08	1.21	0.69***	0.65	0.73	0.86***	0.80	0.92	0.50***	0.46	0.55
Birth Order (Ref. 1st birth)												
Birth order 2-3	0.84***	0.81	0.86	0.89***	0.86	0.92	0.61***	0.58	0.63	0.54***	0.51	0.57
4 or more	0.59***	0.56	0.62	0.66***	0.62	0.69	0.53***	0.50	0.57	0.34***	0.31	0.36
Education (Ref. No schooling)												
Primary	1.46***	1.39	1.53	1.32***	1.25	1.39	1.11***	1.04	1.18	1.36***	1.27	1.44
Secondary	1.68***	1.61	1.75	1.56***	1.49	1.63	1.08***	1.03	1.13	1.94***	1.84	2.06
Higher	1.85***	1.74	1.97	1.80***	1.70	1.92	1.13***	1.04	1.22	3.80***	3.35	4.32
Social Group(Ref. SC)												
ST	1.38***	1.30	1.47	1.36***	1.28	1.45	1.01	0.94	1.08	0.85***	0.79	0.92
OBC	0.93***	0.90	0.98	0.95**	0.91	1.00	0.95*	0.91	1.00	1.08**	1.01	1.15
Others	1.11***	1.06	1.17	1.08***	1.02	1.14	0.99	0.93	1.05	1.07	0.99	1.16
Religion (Ref. Hindu)												
Muslim	0.98	0.93	1.04	0.98	0.93	1.04	1.11***	1.05	1.19	0.67***	0.62	0.72
Christian	1.07	0.97	1.20	1.65***	1.49	1.83	0.97	0.85	1.10	0.69***	0.62	0.78
Others	0.85***	0.76	0.94	1.18***	1.07	1.30	0.91	0.80	1.02	0.99	0.85	1.16
Residence (Ref. Urban)												
Rural	0.83***	0.78	0.87	0.85***	0.81	0.89	1.01	0.95	1.07	1.04	0.95	1.15
Wealth (Ref. Poorest)												
Poorer	1.39***	1.33	1.45	1.12***	1.07	1.17	1.05**	1.00	1.11	1.64***	1.55	1.73

Middle	1.81***	1.73	1.90	1.30***	1.24	1.37	1.02	0.97	1.08	2.28***	2.12	2.46
Richer	2.02***	1.90	2.14	1.48***	1.40	1.56	1.08**	1.01	1.16	3.08***	2.79	3.40
Richest	2.13***	1.99	2.28	1.62***	1.52	1.72	1.19***	1.10	1.29	4.49***	3.90	5.18
Distance (Ref. Not a problem)												
Big problem	0.82***	0.78	0.86	0.90***	0.86	0.94	0.90***	0.86	0.95	0.79***	0.75	0.84
Not a big problem	0.88***	0.85	0.91	0.91***	0.87	0.94	0.95**	0.90	0.99	0.92***	0.87	0.98
ANC visits (Ref. <4 visits)												
4 or more ANC	-	-	-	2.56***	2.47	2.65	1.65***	1.59	1.72	2.15***	2.05	2.26
Constant	0.87***	0.80	0.94	0.31***	0.29	0.34	5.07***	4.58	5.60	4.55***	4.00	5.17

*Source: Authors'estimation from NFHS-5 (2019-21); Notes: ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively*

Table 5: Logistic regression results for specific maternal healthcare services, for the study area (IHR)(N=28691

	At least 4 ANC visits			At least 100 days of IFA intake			At least 2 doses of TT injections before birth			Institutional Delivery		
		95% CI		AOR	95% CI		AOR	95% CI		AOR	95% CI	
Birth order (Ref. 1st birth)												
2-3	0.94	0.86	1.03	1.00	0.91	1.09	0.51***	0.45	0.57	0.61***	0.53	0.70
4 or more	0.76***	0.66	0.87	0.83**	0.71	0.96	0.40***	0.34	0.46	0.35***	0.29	0.41
Education(Ref. No schooling)												
Primary	1.21**	1.02	1.43	1.05	0.87	1.26	1.12	0.94	1.34	1.07	0.90	1.27
Secondary	1.30***	1.14	1.49	1.14	0.97	1.35	1.08	0.92	1.26	1.55***	1.34	1.79
Higher	1.79***	1.47	2.18	1.37***	1.11	1.68	1.15	0.92	1.44	2.53***	1.90	3.37
Social group(Ref. SC)												
ST	0.88	0.72	1.08	0.94	0.76	1.15	1.20	0.95	1.51	0.81	0.63	1.04

OBC	1.23**	1.01	1.50	1.00	0.83	1.21	1.29**	1.01	1.66	1.28*	0.97	1.71
Others	1.18**	1.01	1.37	1.05	0.89	1.24	1.25**	1.03	1.52	1.05	0.84	1.31
Religion (Ref. Hindu)												
Muslim	1.10	0.92	1.32	0.78**	0.63	0.96	1.05	0.83	1.34	0.67***	0.51	0.89
Christian	0.95	0.76	1.18	0.72***	0.57	0.90	0.88	0.70	1.11	0.68***	0.53	0.87
Others	1.00	0.80	1.24	0.74**	0.58	0.94	1.03	0.83	1.29	0.81	0.63	1.05
Residence (Ref. Urban)												
Rural	0.80***	0.68	0.94	0.95	0.81	1.11	0.93	0.76	1.13	0.71***	0.57	0.89
Wealth (Ref. Poorest)												
Poorer	1.37***	1.21	1.55	1.14**	1.01	1.29	1.22***	1.08	1.38	1.56***	1.36	1.78
Middle	1.54***	1.34	1.78	1.31***	1.14	1.51	1.44***	1.24	1.67	2.51***	2.10	3.00
Richer	2.02***	1.69	2.41	1.42***	1.19	1.69	1.58***	1.31	1.91	3.92***	3.07	5.01
Richest	2.24***	1.82	2.75	1.71***	1.39	2.11	1.27**	1.01	1.60	6.09***	4.24	8.75
Distance (Ref. Not a problem)												
Big problem	0.74***	0.65	0.84	0.90	0.79	1.03	0.97	0.84	1.12	0.62***	0.53	0.73
Not a big problem	0.97	0.86	1.09	0.96	0.85	1.08	1.09	0.95	1.25	0.84**	0.71	0.99
ANC visits (Ref. <4 visits)												
4 or more visits	-	-	-	1.59***	1.43	1.76	2.04***	1.84	2.27	2.18***	1.93	2.46
Constant	2.46***	1.82	3.31	0.24***	0.16	0.34	2.97***	2.05	4.31	8.44***	5.44	13.12

*Source: Authors' estimation based on NFHS-5 data (2019-21); Notes: state dummies included in regressions for the study area i.e. IHR; ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively*

Table 6: Logistic regression results for composite maternal healthcare services –full antenatal care (full ANC) and adequate quality care (AQC)

	Regression with IHR dummy (N=176843)						Regression for the IHR (N=28691)					
	full ANC			AQC			full ANC			AQC		
	AOR	95% CI		AOR	95% CI		AOR	95% CI		AOR	95% CI	
IHR(Ref. Rest of India)	0.71***	0.66	0.76	0.63***	0.59	0.67	NA	NA	NA	NA	NA	NA
Birth Order (Ref. 1st birth)												
Birth order 2-3	0.77***	0.75	0.80	0.81***	0.78	0.84	0.84***	0.76	0.92	0.85***	0.77	0.94
4 or more	0.49***	0.46	0.53	0.57***	0.54	0.61	0.62***	0.51	0.74	0.66***	0.56	0.78
Education (Ref. No schooling)												
Primary	1.54***	1.44	1.64	1.28***	1.21	1.36	1.09	0.88	1.36	1.08	0.88	1.34
Secondary	1.82***	1.73	1.92	1.51***	1.44	1.58	1.11	0.91	1.35	1.10	0.92	1.32
Higher	2.16***	2.02	2.31	1.72***	1.61	1.83	1.52***	1.20	1.92	1.35***	1.08	1.68
Social Group (Ref. SC)												
ST	1.36***	1.27	1.45	1.36***	1.27	1.44	0.88	0.69	1.14	1.07	0.86	1.35
OBC	0.92***	0.88	0.97	0.95**	0.90	0.99	1.11	0.92	1.36	1.02	0.84	1.23
Others	1.05	0.99	1.11	1.04	0.99	1.10	1.04	0.88	1.24	1.14	0.96	1.34
Religion (Ref. Hindu)												
Muslim	1.04	0.98	1.11	1.04	0.99	1.11	0.86	0.68	1.10	0.79**	0.63	0.99
Christian	1.57***	1.41	1.75	1.58***	1.42	1.77	0.81	0.63	1.04	0.71***	0.57	0.89
Others	0.94	0.85	1.04	1.11**	1.00	1.22	0.92	0.72	1.17	0.81*	0.64	1.01
Residence (Ref. Urban)												
Rural	0.81***	0.77	0.85	0.86***	0.82	0.91	0.82**	0.70	0.96	0.88*	0.75	1.02

Wealth (Ref. Poorest)												
Poorer	1.25***	1.19	1.32	1.16***	1.10	1.21	1.27***	1.08	1.49	1.17**	1.02	1.33
Middle	1.56***	1.47	1.65	1.37***	1.30	1.45	1.59***	1.35	1.89	1.40***	1.20	1.63
Richer	1.77***	1.67	1.89	1.56***	1.47	1.65	1.95***	1.59	2.40	1.59***	1.33	1.90
Richest	1.86***	1.74	2.00	1.69***	1.58	1.81	2.10***	1.68	2.63	1.59***	1.29	1.97
Distance (Ref. Not a problem)												
Big problem	0.78***	0.74	0.82	0.87***	0.83	0.91	0.87*	0.76	1.00	1.01	0.89	1.16
Not a big problem	0.81***	0.78	0.85	0.88***	0.84	0.92	0.95	0.83	1.08	1.02	0.90	1.16
ANC visits(Ref. <4 visits)												
4 or more ANC	-	-	-	3.14***	3.03	3.26	-	-	-	2.43***	2.17	2.71
Constant	0.26***	0.24	0.28	0.20***	0.18	0.21	0.21***	0.14	0.33	0.12***	0.08	0.18

*Source: Authors' estimation from NFHS-5 data for 2019-21; Notes: State dummies included in regressions for the IHR; NA-Not Applicable; ***, **, * indicate statistical significance at 1%, 5% and 10% levels respectively*

Discussion

Using large scale survey data, the paper attempted to present an analysis of utilisation of maternal healthcare services in select states/UTs in the Indian Himalayan Region (IHR), also examining how the region performs relative to the national level attainments or as compared with the rest of India. Results show poor performance in several indicators in the region. In particular, full ANC use and receipt of AQC are far from being satisfactory, as is the situation in the country in general. The situation is even more distressing in certain states such as Nagaland, Meghalaya and Arunachal Pradesh. Low utilisation of maternal care services poses risks not only for the mothers but also equally for the newborn health, and is concerning due to the present contexts of high maternal mortality in the region. Comparatively, women in the region are observed less likely to use many maternal healthcare services such as IFA intake, TT injection, institutional delivery, full ANC use or to receive AQC, as compared with their counterparts in the rest of India. Notably, the region fares well in terms of antenatal visits, though its attainment in this indicator remains far from the desired goal.

The findings intrigue to explore what explains low maternal healthcare use in the region. However, in the survey, except for non-institutional childbirths, reasons for non-use of other maternal care services were not elicited. There is also a paucity of literature on the subject, but the deterrents to maternal healthcare use, to some extent, are evident from previous studies in the region. Following Levesque et al. (2013), the potential barriers identified in the region can be broadly grouped into two – supply side and demand side barriers. In literature, distance to health facility or poor transportation services are often cited as major supply-side barriers to healthcare access in the region. The remoteness and difficult terrains exacerbate the problem, often resulting in longer travel time, delaying health service delivery and utilisation in the region (Mustafa & Shekhar, 2021; Prochaska et al., 2016; Nienu & Longkumer, 2015). Insufficient workforce and non-availability of services at emergency hours are other reasons, as was observed in Nagaland (Nienu & Longkumer, 2015), or in the mountainous state of Uttarakhand (Joshi et al., 2017). Similar evidence of supply-side barriers can be found in NFHS-5 survey data. For instance, estimates for the region show close to 15% of the most recent live births delivered outside health facilities - the stated reasons, among others, included *high costs (15.73%), health facility not open (7.2%), distance to health facility, no transport (27.8%), poor service (4.3%) or absence of female provider (1.3%)*. Ineffective health information system may constitute yet another supply-side barrier. Cáceres et al. (2023), for example, observe health related information being largely presented in English, instead of *Liangmai*-a local language.[3] There are several demand-side factors too. Traditional customs/cultural practices as potential barriers to maternal healthcare use cannot be entirely disregarded in the region. For instance, Saxena et al. (2020), in Uttarakhand, document childbirth in cow-dung demarcated cowsheds and performing several cultural practices. Kaur (2023), in Himachal Pradesh, similarly highlights some maternal-care related myths that can obstruct the scientifically proven recommendations, and so are the beliefs in traditional medicine/treatments forming

[3] Liangmai' is a Tibeto-Burman language *spoken in Manipur and Nagaland states* in India (Mataina, 2022).

potential barriers in Nagaland, as was observed by Cáceres et al. (2023). Furthermore, women's tendency to depend on men and the importance of the latter's permission, albeit not by customs or rules, are feared to adversely affect maternal healthcare utilisation (Cáceres et al., 2023). Lack of awareness constitutes yet another major deterrent. The survey data provides some evidence thereof, particularly with regard to non-institutional childbirths. In the region, a major proportion of non-institutional deliveries were due to *perceived lack of necessity (41.9%), being not allowed by husband/family (5.33%),* or feeling of institutional births *not customary (2.1%)*. Thus, the survey findings and previous studies offer some explanations for the current state of maternal healthcare use in the region. Nevertheless, it is not to argue that these deterrents are exclusive to the region; rather, they may be more general in their prevalence, albeit in varying degrees. Hence, these evidence may be insufficient to explain the *relatively* poor performance in the region, but they do explain, to some extent, why it remains poor.

Multivariate procedures have also been employed to identify the determinants of maternal healthcare use in the region. Birth order is found to negatively affect utilisation of several maternal care services. This finding is worrying, and while it remains largely unexplained, absence of complications in previous pregnancies may be a leading factor. Utilisation increases with household wealth. On the other hand, wealthier women are observed more likely to utilise various maternal care services, aligning with many previous studies in India in general (Ghosh & Ghosh, 2020; Hamal et al., 2020; Kumar et al., 2019). There is no doubt that household wealth is one of the *enabling* factors, as conceptualised in Andersen's behavioral model (Andersen 1968), that enhance financial accessibility to healthcare services (Levesque et al., 2013). Utilisation is also seen to differ with women's religion. In particular, in the region, Muslim mothers are observed less likely to complete recommended 100 days of IFA intake or to do institutional childbirths, as are the findings in other studies in India in general (Yadav et al., 2021; Paul & Chauhan, 2020; Mondal et al., 2020; Hamal et al., 2020). Similar is the finding about receiving adequate quality of care, with the odds being statistically significantly lower for Muslims as compared with the Hindus. Cultural factors constitute crucial *predisposing* factors in healthcare access. Specific reasons for Muslim mothers' poor utilisation of maternal care services are not well documented in India's contexts, but studies in other parts of the world, for example in Northern Ghana, point to religious obligations and insensitivity of the healthcare providers to their cultural and religious practices as one of the barriers (Ganle, 2015). In the United Kingdom (UK), Hassan (2022) similarly observes that Muslim mothers preferred not to be seen by male health professionals, especially during clinical examinations or labour. Health professionals, on the other hand, may not be trained enough to address these specific cultural and religious aspects of maternity care (Hassan et al., 2020). In the region, based on findings in Nagaland, integration of cultural sensitivity to contemporary maternal care was suggested by Shohe (2024). Rural-urban disparities in maternal healthcare use are similarly reported in numerous studies in India (Mondal et al., 2020; Paul & Chouhan, 2020), and so are the observation for the study area. The rural-urban disparity may be attributable, among others, to the distance or the difficulty rural households encounter in access to health facilities, especially in contexts of hilly terrains and poor transport

services. Estimate from the survey data shows close to 64% of the women in *rural* areas pronouncing some degree of difficulty in health facility access in the region. Controlling for other factors, results also show that antenatal visits positively impact utilisation of many other maternal care services including IFA intake, institutional delivery and receipt of AQC, showcasing their importance in improved maternal healthcare in the region. Similar findings can be found in Billah et al. (2022). This finding may be attributable to the awareness created through mother-healthcare provider interactions during antenatal visits. Cautiously, while the region performs *relatively* better in antenatal visits, in *absolute* term, however, the attainment remains far from being universal. Last but not the least, formal education appears as a significant contributor to maternal healthcare use in the region, and is supported by several other studies on the subject.

The findings and their discussion reveal useful insights for maternal healthcare policies in the region. More specifically, they suggest measures to address both demand and supply side concerns in maternal care in the region. *First,* the hilly terrains, without a doubt, produce difficulties in healthcare access, but, as an alternative, expansive use of mobile health camps, Mobile Medical Units (MMUs), mobile distribution posts and depots for IFA and other supplements, especially in remote and interior locations, may be emphasised in the region (also see Nongdhar et al., 2018; Bora et al., 2022). *Second,* crucial supply side measures such as improved health facility infrastructure, suitable opening hours and availability of health workers and emergency care services are needed. *Third*, socio-cultural and demographic diversity in the region also requires training of healthcare staff to handle area-specific religious, cultural and traditions related concerns in maternity care. Widespread availability of female healthcare providers can be similarly useful in this regard. These will enhance service acceptability and psychosocial accessibility to maternal healthcare. *Fourth,* efforts are needed to create awareness and to educate mothers as well as their partners. Lack of awareness was identified as a major reason for poor antenatal visits in the region, for instance, by Limbu, Kamei and Haloi (2022). Similarly, as already stated elsewhere in the study, perceived *lack of necessity*, suggesting lack of awareness, appears as a major deterrent to institutional childbirths in the region, as revealed by NFHS-5 survey. ASHAs (Accredited Social Health Activists) can play a pivotal role in this regard, through sensitizing the couples, and making arrangements for healthcare visits and institutional deliveries (Gebremedhin et al., 2022). Notably, some studies in the region observe ASHAs being held at high esteem and considered the most influential by the mothers (Cáceres et al., 2023). *Fifth*, incentive-based schemes such as *Janani Suraksha Yojana* (JSY) and provision of affordable medical transports can incentivise and enable healthcare use, especially among the poorer sections, who are observed less likely to utilise many maternal care services. Similarly, an effective implementation of other schemes such as *Pradhan Mantri Surakshit Matritva Abhiyan* (PMSMA) – that seeks to provide assured, comprehensive, quality and free-of-cost antenatal care to all pregnant women - will be useful in this regard (Mustafa & Shekhar, 2021). Though not strictly comparable, Mustafa and Shekhar (2021) show lower probability of receiving financial assistance such as under JSY by women in the region. *Finally*, besides the long term solutions, as short term measures, priority may be given to certain cross-sectional groups with poorer utilisation of maternal care services in the

region. To sum up, our findings and insights from existing literature allow us to conclude that while frequently prioritised measures such as betterment of health infrastructures are necessary, equally important are the measures to educate and create awareness, to ensure affordability and financial accessibility, and to increase acceptability of maternal care services in the region.

This study is subject to certain limitations. *First,* by utilising only the NFHS-5 data, it fails to identify the underlying reasons for non-use of *specific* maternal care services in the region. An effort was made, however, to provide an overview of the plausible barriers, by drawing insights from the literature. *Second,* it offered a discussion on utilisation or receipt of various maternal care services/components, but medico-clinical quality of care remains outside the scope. *Third,* the data is largely based on respondents' recollection, and, hence, response biases cannot be ruled out entirely. *Finally*, the study, relying on the eventual *use or non-use* of maternal healthcare services, leaves a major gap with regard to the lived experiences of the mothers. To sum up, however, despite these limitations, the present study contributes to the scant literature on maternal healthcare in the mountainous Himalayan region of India.

Conclusion

Risks of maternal deaths can be reduced through quality and adequate maternal care services. Using large scale survey data, in this study, analysis on utilisation of maternal healthcare services in a geographically challenged and geopolitically strategic Himalayan region of India has been taken up. The analysis presented a comparison of the attainments in crucial maternal care indicators in the region vis-à-vis the rest of India. Three observations emerge from the study: First, maternal healthcare use and its adequacy remain far below the desired goals of universal and adequate maternal care utilisation in the region. Second, relative to the national level attainments and compared with its counterpart rest of India, the region performs poorly in several indicators, including full antenatal care use and receipt of adequate quality care. Third, there remain stark intra-region disparities among the states/UTs and significant variations across cross-sectional groups. The study carries certain limitations, but, the findings, largely supported by previous studies, reveal useful insights for policies to address the various concerns in maternal healthcare in the region. Besides long term measures, as short term approach, priority may be given to more vulnerable groups such as the poor, Muslims and the Christian mothers, higher birth order cases, and those with less formal education in the region Crucial literature gaps remain, however. In particular, in view of high maternal mortality ratio in the region, studies on medico-clinical quality of care hold paramount importance. Studies are also needed to comprehend the lived maternity experiences of the mothers. Furthermore, future large scale surveys should collect information on key barriers to maternal healthcare access, at least at the narrower geographical levels such as village, and elicit the reasons for non-use of critical care components. Such information will facilitate context and region-specific understanding of the subject and help design sub-national policies for improved maternal healthcare not only in the present study area but in the country in general.

References

Andersen, R. (1968) A behavioral model of families' use of health services (Research Series No. 25). Center for Health Administration Studies, University of Chicago. Chicago.

Apum A. & Nochi, L. (2017). Status of the Utilisation of Maternal Health Care Services In Rural Arunachal Pradesh A case Study of Mebo Sub-Division. *Asian Journal of Multidisciplinary Studies*, 5(7).

Bhattacharjee, G. (2014). The Reality of Special Category States. *Economic and Political Weekly,* 49(40), 48–56.

Bora, K., Barman, B., Pala, S., Das, A., Doke, G., & Tripura, A. (2022). Coverage of antenatal iron-folic acid and calcium distribution during pregnancy and their contextual determinants in the northeastern region of India. *Frontiers in Nutrition*, *9*, 894245. https://doi.org/10.3389/fnut.2022.894245

Billah, S. M., Raynes-Greenow, C., Ali, N. B., Karim, F., Lotus, S. U., Azad, R., Sari, M., Mustaphi, P., Maniruzzaman, M., Rahman, S. M. M., Dibley, M. J., Kelly, P. J., & El Arifeen, S. (2022). Iron and Folic Acid Supplementation in Pregnancy: Findings from the Baseline Assessment of a Maternal Nutrition Service Programme in Bangladesh. *Nutrients*, *14*(15), 3114. https://doi.org/10.3390/nu14153114

Cáceres, Á. L., Ramesh, R. M., Newmai, P., Kikon, R., & Deckert, A. (2023). Perceptions, health seeking behavior and utilization of maternal and newborn health services among an indigenous tribal community in Northeast India-a community-based mixed methods study. *Frontiers in Public Health*, *11*, 1139334. https://doi.org/10.3389/fpubh.2023.1139334

Ganle J. K. (2015). Why Muslim women in Northern Ghana do not use skilled maternal healthcare services at health facilities: a qualitative study. *BMC International Health and Human Rights*, *15*, 10. https://doi.org/10.1186/s12914-015-0048-9

Gebremedhin, T. A., Mohanty, I., & Niyonsenga, T. (2022). Public health insurance and maternal health care utilization in India: evidence from the 2005-2012 mothers' cohort data. *BMC Pregnancy and Childbirth*, *22*(1), 155. https://doi.org/10.1186/s12884-022-04441-4

Girotra, S., Malik, M., Roy, S., & Basu, S. (2023). Utilization and determinants of adequate quality antenatal care services in India: evidence from the National Family Health Survey (NFHS-5) (2019-21). *BMC Pregnancy and Childbirth*, *23*(1), 800. https://doi.org/10.1186/s12884-023-06117-z

Ghosh, A., & Ghosh, R. (2020). Maternal health care in India: A reflection of 10 years of National Health Mission on the Indian maternal health scenario. *Sexual & reproductive healthcare : Official Journal of the Swedish Association of Midwives*, *25*, 100530. https://doi.org/10.1016/j.srhc.2020.100530

Goli, S., Puri, P., Salve, P. S., Pallikadavath, S., & James, K. S. (2022). Estimates and correlates of district-level maternal mortality ratio in India. *PLOS Global Public Health*, *2*(7), e0000441. https://doi.org/10.1371/journal.pgph.0000441

Hamal, M., Dieleman, M., De Brouwere, V., & de Cock Buning, T. (2020). Social determinants of maternal health: a scoping review of factors influencing maternal mortality and maternal health service use in India. *Public Health Reviews*, *41*, 13. https://doi.org/10.1186/s40985-020-00125-6

Hassan, S. M., Leavey, C., Rooney, J. S., & Puthussery, S. (2020). A qualitative study of healthcare professionals' experiences of providing maternity care for Muslim women in the UK. *BMC*

Pregnancy and Childbirth, *20*(1), 400. https://doi.org/10.1186/s12884-020-03096-3

Hassan, S.M. (2022). Religious practices of Muslim women in the UK during maternity: evidence-based professional practice recommendations. *BMC Pregnancy and Childbirth* 22, 335. https://doi.org/10.1186/s12884-022-04664-5

Kumar, G., Choudhary, T. S., Srivastava, A., Upadhyay, R. P., Taneja, S., Bahl, R., Martines, J., Bhan, M. K., Bhandari, N., & Mazumder, S. (2019). Utilisation, equity and determinants of full antenatal care in India: analysis from the National Family Health Survey 4. *BMC Pregnancy and Childbirth*, *19*(1), 327. https://doi.org/10.1186/s12884-019-2473-6

Kumar R, Chauhan J S, Sanotra, A. (2022) Antenatal care services utilization in rural Jammu and Kashmir: an empirical study from the northwestern Himalayan state of India. *Demography India*, 51(2), 158-176.

Kaur S (2023). Cultural Health Practices and its Impact on MCH Care: Perspective of Tribal Women of Himachal Pradesh (India). *Nursing Journal of India*, 114(6), 256-261.

Levesque, JF., Harris, M.F. & Russell, G. (2013). Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *Int J Equity Health* **12**, 18. https://doi.org/10.1186/1475-9276-12-18

Limbu D. K., Kamei C. and Haloi A. (2022). The quality of antenatal care received by the Kabui Naga women of the Tamenglong district of Manipur, India and its impact on their infant and child mortality: A cross-sectional study. *Antrocom J. of Anthropology* 18-2a, 211-220

Meh, C., Sharma, A., Ram, U., Fadel, S., Correa, N., Snelgrove, J. W., Shah, P., Begum, R., Shah, M., Hana, T., Fu, S. H., Raveendran, L., Mishra, B., & Jha, P. (2022). Trends in maternal mortality in India over two decades in nationally representative surveys. *BJOG : An International Journal of Obstetrics and Gynaecology*, *129*(4), 550–561. https://doi.org/10.1111/1471-0528.16888

Mataina W (2022). Liangmai phonology: An overview. *Himalayan Linguistics,* 21(2). https://doi.org/10.5070/H921252177

Mondal, D., Karmakar, S., & Banerjee, A. (2020). Women's autonomy and utilization of maternal healthcare in India: Evidence from a recent national survey. *PloS one*, *15*(12), e0243553. https://doi.org/10.1371/journal.pone.0243553

Mustafa, A., & Shekhar, C. (2021). Contrast in utilization of maternal and child health services between Himalayan region and rest of India: Evidence from National Family Health Survey (2015-16). *BMC Pregnancy and Childbirth*, *21*(1), 606. https://doi.org/10.1186/s12884-021-04081-0

Nienu T, Longkumer K (2015) Maternal health care in Nagaland-Some contemporary issues. EPRA *Int J Econ Bus Rev*, 3, 52-60.

NITI Aayog. (2021). Healthy States, Progressive India: Report on the Ranks of States and Union Territories (Round IV, 2019–20). (Published in collaboration with the Ministry of Health and Family Welfare [MoHFW], Government of India [GoI], and the World Bank). https://www.niti.gov.in/sites/default/files/2021-12/NITI-WB_Health_Index_Report_24-12-21.pdf

Nongdhar, J., Vyas, N., Rao, P. A., Narayanan, P., & Pala, S. (2018). Factors influencing utilization of reproductive health services among mothers in Meghalaya, India. *Journal of Family Medicine and Primary Care*, *7*(3), 557–560. https://doi.org/10.4103/jfmpc.jfmpc_242_17

Paul P., & Chouhan P. (2020). Socio-demographic factors influencing utilization of maternal

health care services in India. *Clinical Epidemiology and Global Health*. 8(3): 666-670. https://www.sciencedirect.com/science/article/pii/S2213398420300075

Prochaska, E. C., Uniyal, V. P., Lanham, M., Heisler, M., Quasin, S., & Bisht, M. (2016). A Survey of Obstetric Healthcare Utilization in the Rural Western Indian Himalayas. *Maternal and child health journal*, *20*(12), 2431–2436. https://doi.org/10.1007/s10995-016-1963-7

Saxena V, Jelly P, & Sharma R (2020). An exploratory study on traditional practices of families during the perinatal period among traditional birth attendants in Uttarakhand. *Journal of Family Medicine and Primary Care*, *9*(1), 156–161. https://doi.org/10.4103/jfmpc.jfmpc_697_19

Singh A., Kumar V., Singh H., Chowdhury S, & Sharma, S. (2023). Assessing the coverage of full antenatal care among adolescent mothers from scheduled tribe and scheduled caste communities in India. *BMC public health*, 23(1), 798. https://doi.org/10.1186/s12889-023-15656-1

Shohe, A. (2024). Traditional Childbirth Practices and Belief System among the Sumi Nagas of Nagaland: A Sociological Exploration. *South India Journal of Social Sciences*, *22*(4), 177-186. https://doi.org/10.62656/SIJSS.v22i4.1479

World Health Organisation (WHO) (2023). Trends in maternal mortality 2000 to 2020: estimates by WHO, UNICEF, UNFPA, World Bank Group and UNDESA/Population Division. Geneva: World Health Organization; 2023. License: CC BY-NC-SA 3.0 IGO

Yadav A K, Jena PK, Sahni B., & Mukhopadhyay D. (2021). Comparative study on maternal healthcare services utilisation in selected Empowered Action Group states of India. *Health Soc Care Community* 29: 1948–1959; https://doi.org/10.1111/hsc.13309