Geographical divide led inequality in accessing maternal healthcare services between hills and valley regions of Manipur state, India

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ABSTRACT

Geographically, Manipur is composed of two sets of landmasses known as the valley and the hills districts. As compared to the valley districts, the hilly district is largely remained undeveloped and lack basic infrastructure and services like healthcare facilities, educational institutions, public distribution system, transportation, etc. Little is known about the differentials in the utilization of maternal healthcare services between the hills and the valley of Manipur state of India. The paper tries to understand the inequalities in accessing maternal healthcare services between the hills and valleys region. Logistic regression and concentration index was adopted to assess the utilization of maternal healthcare services. Results indicate low utilization of maternal healthcare services in the hilly region, with only 19%, 22%, and 21% have access to 4+ ANC visit, institutional delivery, and PNC visits respectively. The odds of utilizing 4+ ANC visits [Odds Ratio (OR): 0.47, Confidence Interval (C.I):0.26–0.82], Institutional delivery [OR: 0.42, C.I:0.28–0.62], and PNC visits [OR: 0.42, C.I:0.28–0.60] were less likely in the hilly region as compared to the valley region. Valley region indicates low inequality in accessing maternal healthcare services, however high inequality in accessing to institutional delivery and PNC visits was observed in the hilly region. Inequality is significantly higher in hilly areas (CI_{ANC} :0.276; $CI_{inst.delivery}$:0.277; CI_{PNC} : 0.206) than in valley regions (CI_{ANC} :0.070; $CI_{inst.delivery}$ 0.088; CI_{PNC} : 0.081). Further, mother education, household wealth, and exposure to television are the main contributor to inequality. Better educational opportunities and economic activities may improve the utilization of maternal health services.

1. Introduction

Geographically, Manipur is composed of two sets of landmasses popularly known as the valley and the hills. The hills are occupied by the tribals and the valley is occupied by the non-tribal Meiteis. In terms of population, Meiteis are the dominant community and had a fair amount of political dominance with socio-economically development.¹ Moreover, they live in the valley which is highly fertile as a result, they are more prosperous than tribals who live mostly in hill areas.² Hill areas in Manipur are largely remained undeveloped and lack basic infrastructure and services like healthcare facilities, educational institutions, public distribution system, transportation, etc. On the other hand, the Valley districts of Manipur are among the most developed districts in Northeast India.² Health inequalities which differ mainly across space and socio-economic inequalities are often disadvantageous to the hilly

people.³² The child mortality rate was higher in the hill community.³ According to NFHS-4, the highest degree of fertility (TFR) is among the projected tribe (3.19) who are predominantly Christians (3.18) living in the hill districts. The current use of family planning method is still very low in the hill districts like Chandel (15.4%) and Ukhrul (12.7%).⁴ In the hill districts like Chandel, Senapati, Tamenglong and Ukhrul, institutional delivery is less than 40%. Further, the condition in the hills was further worsened during the COVID-19 pandemic. For instance, tribal women from the hill district died with her unborn child due to denied treatment by the Imphal valley-based hospitals.^{2,5}

There is plenty of literature that talks about inequality between the hills and the valley in terms of development. In most of the research regarding the hills-valley divide, the focus has been given to ethnic conflict and political demands^{3,6–8}. However, there is no substantial literature on the disparity between Hills and Valleys in the context of

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maternal health care services. Little is known about the differentials in the utilization of maternal healthcare services between the hills and the valley of Manipur state of India. The disparity in maternal healthcare services between hills and valleys received little attention in academic research. Therefore the present paper tries to understand the inequalities in maternal healthcare services between the hills and valleys in the Manipur state of India.

2. Material and methods

The data from the National Family Health Survey round four (NFHS-4) was used to understand maternal healthcare service utilization in the Manipur state of India.⁴ NFHS is a cross-sectional national representative survey, conducted in 2015–16 under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India. NFHS used a two-stage stratified sampling design in both rural and urban areas to give the estimates at state as well as district level.

2.1. Inclusion and exclusion criteria

Only women belonging to the states of Manipur were included in the study, which results to a total sample size of 5636 ever-married women between the age of 15–49. Further, women living in the hilly region are those women from the districts of Chandel, Tamenglong, Ukhrul, Senapati, and Churachandpur. Women living in the valley region are those women from the districts of Imphal West, Imphal East, Bishnupur, and Thoubal.

2.2. Outcome variables

To analysis, the maternal healthcare services, key outcomes variables are used such as four and more ante-natal care (ANC), institutional delivery (both public and private) and post natal care (PNC). In the context of PNC services, women who had given birth in the five years preceding the survey were asked “Did you have any check-up within 42 h after delivery?” and “How many days after delivery did the first check-up take place?” In this study, women who went for a check-up to health facilities or saw a doctor within two weeks of delivery are considered to have used PNC services. The nature of outcomes variables are dummy which is categorized as ‘0’ for No and ‘1’ for Yes. For example, in case of ‘four and more ANC visits’, for those women who had less than four ANC visits we assigned them as ‘0’ whereas those women who had four & more ANC visits we assigned them ‘1’. The similar pattern is adopted for other outcomes variables in this study.

2.3. Predictor variables

The predictor variables are sex of the head of the household (male, female); mother’s age group (15–24 years, 25–29 years, 30 years and above); mother’s education (Incomplete primary, Primary and above); birth order (First order, Second order, Third order and above); social groups (SCs/STs, Non-SCs/STs); Religion (Hindu, Christian, Others); wealth quintile (poor, non-poor); place of residence (Urban, Rural); and Whether having exposure to mass media (No, Yes).

2.4. Statistical analysis

Descriptive statistics was used to show the distribution of the study population. Further, bivariate and multivariable logistic regression analysis was used to identify the factors associated with the outcome variable. A Chi-square test was performed to understand the association between outcome variables and predictors. And these variables were fitted in the multivariable logistic regression model to check its independent effect on each of the maternal health care use examined. The logistic regression model was defined as below:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon$$

Where, p is the probability of utilization of health care and α is intercept, β s are regression coefficients, X is set of predictors and ε is an error term. STATA 13 was used to analyze data.

2.5. Concentration index

The study used wealth score for decomposition analysis and for the calculation of Concentration Index (CI). The wealth score was divided by ranking the score into five equal categories, each comprising 20% population. Concentration Index (CI) and Concentration curve (CC) was calculated to measure the socio-economic inequality in maternal health care use between hilly and valley region in the state of Manipur. Concentration index represents as twice the covariance of the health care outcome variable and an individual’s relative ranking terms of economic status (wealth score in the present study), divided by the variable mean, as defined by the equation below.⁹

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

Where C is the concentration index; y_i is the outcome variable index; R is the fractional rank of individual i in the distribution of socio-economic position; μ is the mean of the outcome variable of the sample, and cov denotes the covariance.⁶ The index value lies between -1 and $+1$.

2.6. Decomposition of the concentration index

The study used Wagstaff decomposition analysis to decomposing the concentration index. Wagstaff’s decomposition demonstrated that the concentration index could be decomposed into the contributions of each factor to the income-related inequalities.¹⁰ Each contribution is the outcome of the sensitivity of health concerning that socio-economic factor and the extent of income-related inequality in that factor. Based on the linear regression relationship between the outcome variable y_i , the intercept α , the relative contribution of x_{ki} and the residual error ε_i

$$y_i = \alpha + \sum \beta_k x_{ki} + \varepsilon_i$$

Where ε_i is an error term, given the relationship between y_i and x_{ki} , the CI for y (C) can be rewritten as

$$C = \sum \left(\frac{\beta_k \bar{x}_k}{\mu} \right) C_k + \frac{GC_e}{\mu}$$

Where μ is the mean of y_i , $\bar{x}_k$ is the mean of x_k , β_k is the coefficient from a linear regression of outcome variable, C_k is the concentration index for x_k (defined analogously to C , and GC_e is the generalized concentration index for the error term (ε_i).

Here C is the outcome of two components: First, the determinants or ‘explained’ factors, which are equivalent to the weighted accumulation of the concentration indices of the repressor, where one unit change in the outcome variable is to be associated with the one unit change in the explanatory variable. The explained factors indicate that the proportion of inequalities in the outcome variables ANC, institutional delivery and PNC is explained by the selected explanatory factors, i.e., x_k . Second, a residual or ‘unexplained’ factor $\left(\frac{GC_e}{\mu} \right)$, indicating the inequality in health variable that cannot be explained by selected explanatory factors across various socioeconomic groups.

3. Results

The percentage distribution of the study population across both

valley and hilly regions of the state by background characteristics. Overall, 33.4% population resides in urban areas and even that highly varies between valley (47%) and hills (9%). In the wealth quintile, overall 42% of women belonged to the poor category. It varied between valley and hills regions as 32% to 61.4% respectively. In the distribution of social group, hill region are populated by SCs/STs with 96% as compared to only 13% in the valley region. The hills region is occupied by the Christian religion (94%), however, the other religion category such as Muslims and other categories are mainly occupied in the valley region (Supplementary Table 1).

Table 1 depicts the level and pattern of maternal health care service utilization across hills and valley regions of the state with background characteristics. In the case of four and more ANC service, which is highly varied across hills and valley regions, further within the region it also found a huge difference in receiving maternal services with rural-urban areas. In the valley region with the urban resident, 84% of women have gone for four and more ANC visits as compared to 58% in the hills region. Regarding the mother's education category, women who have less than five years of schooling received 25.5% of ANC services in the hills region as compared to 60.5% in the valley region. While in the birth order of the child, receiving ANC services among women varied across regions. In the context of religion, the Hindu women belonged to the hills region are less affected by ANC services (received 61.4%) compared to Christian women (received 41.7%) in the same region, however, it varied from valley region as the Hindu women received 83% and Christian women 84.7% respectively.

In the case of institutional delivery among women between the regions of the state, it found that within the urban area, women belonged

Table 1
Percentage distribution of MCH services received by background characteristics across Valley and Hilly regions of Manipur state, India, 2015-16.

Background Characteristics	4 + ANC visit ^a		Institutional delivery ^a		PNC visit ^a	
	Valley	Hilly	Valley	Hilly	Valley	Hilly
Mother age-group*						
15–24	83.6	44.9	80.0	49.0	79.6	52.4
25–29	81.0	44.3	82.1	41.6	80.3	48.1
30 & above	79.9	40.5	85.6	43.3	82.7	48.6
Sex of the Head of Household*						
Male	80.6	42.4	82.9	41.9	81.1	48.0
Female	82.9	44.3	86.7	63.5	83.0	60.5
Child Birth Order*						
First	86.9	56.1	90.6	59.6	87.4	65.4
Second	82.5	50.8	83.2	45.6	81.8	49.1
Three & more	68.3	31.5	69.9	32.7	70.3	41.3
Mother Education*						
Incomplete primary	60.5	25.5	60.4	24.7	58.4	33.5
Above Primary	83.9	48.6	86.8	51.2	84.6	54.8
Wealth quintile*						
poor	67.1	26.6	66.0	27.5	66.2	35.4
non-poor	87.0	65.9	91.6	70.1	88.0	69.6
Social group*						
SCs/STs	81.8	41.6	82.2	42.9	82.6	48.4
Non-SCs/STs	82.5	58.5	83.6	60.0	81.9	63.4
Religion*						
Hindu	83.0	61.4	90.7	65.3	86.1	67.0
Christian	84.7	41.7	82.5	43.0	82.4	48.5
Other	76.7	43.8	71.5	45.8	72.6	48.7
Place of Residence*						
Urban	83.7	58.1	87.9	73.3	85.5	71.1
Rural	78.4	41.1	79.5	41.2	77.6	47.2
Mass media*						
No	65.2	20.5	60.8	22.8	61.8	29.4
Yes	82.3	49.9	85.6	51.9	83.1	55.9
N	2737	1692	3214	2422	2737	1692
Total	80.82	19.18	77.57	22.43	78.53	21.47

Note: *Indicates significance at 5% level (i.e.: p-value<0.05); ^a Chi-square test for categorical variables; SC/ST: Scheduled Caste & Scheduled Tribe.

to the hills region received 73% institutional delivery services as compared to 88%, however, in the rural area; the differences were high between regions (41% in hills to 79% in a valley). Regarding the birth order of the child, the increased birth order of children among women has decreased in utilizing institutional delivery within and between regions of the state. Mother age has also affected the utilization of institutional delivery between regions. Exposures to mass-media among women have played a significant role in accessing and utilizing health services. Similarly, in receiving PNC among women between the regions, socio-economic and demographic factors always play a major role.

Table 2 shows the probability of different types of maternal health-care services utilized by women with different predictor variables. As bivariate analysis clearly showed that there are huge variations in utilizing maternal healthcare services within and between groups across regions of the state. This multivariate analysis also showed that women who belonged to rural areas were less likely to be used of four and more

Table 2

Logistic regression model showed the association with predictor's variables in response to accessing MCH services in Manipur, India.

Predictor variables	4 + ANC (n = 4214) OR [95% CI]	Institutional Delivery (n = 5374) OR [95% CI]	PNC (n = 4214) OR [95% CI]
Mother's age group			
15–24	Ref	Ref	Ref
25–29	1.02(0.78–1.29)	1.11(0.87–1.39)	1.08 (0.84–1.40)
30 and Above	1.10(0.85–1.41)	1.83*** (1.43–2.31)	1.52*** (1.16–1.96)
Sex of Head of the Household			
Male	Ref	Ref	Ref
Female	1.02 (0.78–1.32)	1.58*** (1.22–2.05)	1.23* (0.93–1.62)
Child birth order			
First order	Ref	Ref	Ref
Second order	0.68*** (0.53–0.85)	0.46*** (0.36–0.55)	0.51*** (0.40–0.64)
Three & more	0.40*** (0.31–0.50)	0.30*** (0.24–0.37)	0.39*** (0.31–0.50)
Mother Education			
Less than Primary	Ref	Ref	Ref
Primary and Above	1.65*** (1.32–2.05)	1.66*** (1.36–2.01)	1.68*** (1.35–2.07)
Wealth Quintile			
Poor	Ref	Ref	Ref
Non-poor	3.03*** (2.52–3.64)	3.55*** (2.97–4.23)	2.56*** (2.11–3.08)
Social groups			
SC/ST	Ref	Ref	Ref
Non-SC/ST	1.60*** (1.14–2.23)	1.82*** (1.31–2.51)	1.48*** (1.07–2.04)
Religion			
Hindu	Ref	Ref	Ref
Christian	0.44*** (0.31–0.61)	0.34*** (0.24–0.47)	0.48*** (0.34–0.67)
Others	1.04 (0.80–1.34)	0.48*** (0.38–0.61)	0.66*** (0.51–0.84)
Place of Residence			
Rural	Ref	Ref	Ref
Urban	1.20** (0.96–1.48)	1.65*** (1.34–2.02)	1.58*** (1.28–1.96)
Region			
Valley	Ref	Ref	Ref
Hilly	0.47*** (0.26–0.82)	0.42*** (0.28–0.62)	0.42*** (0.28–0.60)
Media Exposure			
No	Ref	Ref	Ref
Yes	1.78*** (1.42–2.22)	1.86*** (1.51–2.30)	1.75*** (1.39–2.18)

Note: Ref: refers to the base/reference group; SC/ST: Scheduled Caste & Scheduled Tribe; *** p-value<0.01; ** p-value<0.05; * p-value <0.1.

ANC services compared to urban women [OR; 1.20, CI; 0.96–1.48]. In reference to mother education, those women who had primary and above years of schooling were more likely to utilize ANC services compared to those who less than five years of schooling [OR; 1.65, CI; 1.32–2.05], similarly for religion, women belonged to Hindu community were more likely to utilize ANC services compared to Christian (OR; 0.40, CI: 0.31–0.61], in the wealth quintile, poor women were less likely to be utilized in the odds of non-poor women [OR; 3.03, CI; 2.52–3.64].

A similar pattern has also been seen in the institutional delivery. Among the social group, the odds of receiving institutional delivery among SC/ST women is lesser compared to non-SC/ST [OR; 1.82, CI; 1.31–2.51], further, women who had completed the primary and above schooling were more likely to go for institutional delivery [OR; 1.66, CI; 1.36–2.01] compared to those women who had less than five years. In reference to the wealth quintile non-poor women have more probability to utilize institutional delivery [OR; 3.55, CI; 2.97–4.23] compared to poor women. Head of the household was also found significantly with those who were female compared to male in the institutional delivery. Similar patterns were also seen in the PNC services. Socio-economic vulnerability appeared one of the important factors that influenced women in utilizing maternal and child health care services in the state.

3.1. Concentration index and decomposition of concentration index

Table 3 shows levels of inequality in ANC, institutional delivery, and PNC. At the state level, the inequality in ANC use is 0.161, inequality in institutional delivery is 0.184 and the inequality in PNC use is 0.147. Inequality is significantly higher in hilly areas ($CI_{ANC}: 0.276$; $CI_{inst. delivery}: 0.277$; $CI_{PNC}: 0.206$) than in valley regions ($CI_{ANC}: 0.070$; $CI_{inst. delivery}: 0.088$; $CI_{PNC}: 0.081$). Both in hilly areas and the valley region the institutional delivery is more unequally distributed than ANC and PNC use.

Table 4 shows that both in the hilly region and valley region, the largest contributions to inequality in ANC use come from household wealth followed by access to television (12.8%), and educational status (11%). For example, inequality in household wealth contributed to 54% of the inequality in ANC use in a hilly region and household wealth contributed to 46% of the inequality in ANC use in valley areas, while access to television in the hilly region contributed to 12% of the inequality in ANC use and educational status of the women contributed to 3% of the inequality in ANC use in valley areas.

Similarly, in Table 5 it can be observed that household wealth contributes, even more, 56%, of the inequality in institutional delivery in hilly regions while it contributed to around 33% of the inequality in institutional delivery in valley regions. Maternal education contributes 13% and 5% of the inequality in institutional delivery in hilly regions and valley areas respectively. Further, having access to television explained 12% of the inequality in institutional delivery in hilly regions.

Table 6 shows that actual contributions of household wealth are higher in hilly areas than valley areas for PNC. Similarly, observed determinants overall contributed to a greater percentage of inequality in PNC use in hilly areas than inequality PNC used in valley areas. Further Fig. 1 indicates high inequality in accessing institutional delivery and PNC visit in the hilly region, whereas low inequality in accessing all the three maternal healthcare services was observed in the valley region.

Table 3
Concentration Indices (CI) of outcomes variables across different hills and valley regions, Manipur state, India, 2015–16.

Regions	Ante-natal Care		Institutional Delivery		Post-natal Care	
	CI	S.E	CI	S.E	CI	S.E
Hilly region	0.276	0.014	0.277	0.011	0.206	0.013
Valley region	0.070	0.006	0.088	0.004	0.081	0.005
Total	0.161	0.006	0.184	0.005	0.147	0.005

S.E: Standard Error.

4. Discussion

The present study investigates the different determinants of accessing ANC visits, institutional delivery, and PNC visits among 15–49 aged ever-married women in Manipur. We used the decomposition of concentration index method to further determine the inequality in accessing maternal healthcare services. In agreement with the previous study^{7,11} the result suggest that accessibility to ANC visit, institutional delivery, and PNC visit was significantly low among the ever-married women living in the hilly region of Manipur. Existing studies from Manipur and other parts of India acknowledge that the lack of health facilities and unavailability of proper transportation is the main deterrent factor for maternal health care use in the hilly areas.^{7,12} Further, the results reveal that factors such as social groups, maternal education, religion, child-birth order, exposure to media, and household economic status appear to have an effect on maternal health service use.

Caste was found to have an independent effect on the utilization of maternal health services.¹³ In agreement with the studies of Kumar and Singh, (2015) and Paul and Chouhan, (2020),^{14,15} our study show lower use of maternal healthcare services among the women belonging to the SC/ST communities. The possible explanation, for this reason, is mainly because these social groups are at a disadvantage across nearly all the determinants that affect maternal healthcare utilization.¹⁴ In addition, low economic status and education level was the result of low health status among the hilly tribal community in Manipur.¹¹ Our finding regarding the positive association between women's education and utilization of maternal health services agrees with many previous studies in Nigeria, in Manipur, and in Africa and so on.^{7,16,17} Women who have acquired primary and above education were more likely to receive all maternal healthcare services with reference to the low educated women.¹⁸ The probable explanations for the low use of maternal healthcare services among the low educated women were due to the lack of knowledge about the availability, accessibility, and utilization and the other reason is that low educated women were not so open to discussing the different care at the time of pregnancy, delivery, and post-delivery.¹⁹ However, educated women may have a greater decision making power in and outside the household, have more confidence in communicating about their health problems, and have the ability and willingness to travel outside the home to seek care.²⁰ Exposure to mass media increased the likelihood of women utilizing maternal healthcare services.^{21,22} The findings of this study also confirmed that exposure to mass media has a significant impact on maternal healthcare utilization. Evidence suggests that mass media such as reading newspaper, watching television, and listening to the radio is an effective information dissemination, which helps to access health care information and increases the awareness of people on healthcare facilities.^{21,23}

The effect of birth order which is consistent with the previous studies suggests that women are significantly more likely to use all maternal healthcare services for their first child.^{16,20} A study from India highlighted a sizeable proportion of young women reported having experienced at least one pregnancy-related complication during pregnancy, delivery, or postpartum period for the first pregnancy.²⁴ Further, the study highlighted that care-seeking during the antenatal period and at delivery for the second and higher-order birth was limited as compared to the first birth. There are three possible explanations for this. First, women with a first child pregnancy pose a great health risk and probably more cautious about their pregnancy and hence more likely to seek maternal health care.^{25,26} Second, as the number of borne children increases, women may develop confidence and tend to believe that modern health care is not necessary and may rely on past experience and knowledge from previous pregnancies and birth.²⁷ Third, a higher birth order indicates the greater family size and hence lack of time and money to seek formal health care.²⁸ The problem due to cost, travel, and waiting time in accessing maternal health care services in the hilly district of Manipur is well documented in the previous studies.^{7,29}

Table 4
Contributions of inequalities in determinants to inequalities in ANC use.

Background Characteristics	ANC- Hilly				ANC- Valley			
	CI	Elasticity	Contribution	Contribution (%)	CI	Elasticity	Contribution	Contribution (%)
Age 25–29 years	−0.021	0.044	−0.001	−0.338	−0.047	−0.012	−0.001	−0.313
Age 30–49 years	0.034	0.082	0.003	1.017	0.095	−0.026	−0.002	−0.906
SC/ST	0	0.479	0	−0.032	−0.012	0.045	−0.001	−0.191
Below Primary	−0.33	−0.093	0.031	11.156	−0.482	−0.022	0.011	3.913
Muslim	−0.204	−0.002	0	0.151	−0.369	−0.011	0.004	1.493
Christians	−0.003	0.009	0	−0.012	0.287	0.002	0.001	0.213
Second birth order	0.058	−0.055	−0.003	−1.164	0.048	−0.01	0	−0.177
Third birth order	−0.096	−0.276	0.027	9.619	−0.216	−0.028	0.006	2.18
Rural	−0.036	−0.121	0.004	1.575	−0.143	−0.007	0.001	0.346
Non-poor	0.615	0.244	0.15	54.407	0.308	0.104	0.032	11.594
Reading news paper	0.516	0.055	0.028	10.255	0.277	0.013	0.004	1.332
Listen to radio	0.11	0.002	0	0.093	0.054	0.041	0.002	0.804
Watch television	0.251	0.142	0.036	12.899	0.144	0.006	0.001	0.338
Female Head of the Household	0.113	−0.012	−0.001	−0.478	0.054	0.005	0	0.101
ANC	0.276		0.273	99.151	0.07		0.057	20.728
Residual			0.002	0.849			0.013	18.311

Table 5
Contributions of inequalities in determinants to inequalities in institutional delivery.

Background Characteristics	Institutional Delivery- Hilly				Institutional Delivery- Valley			
	CI	Elasticity	Contribution	Contribution (%)	CI	Elasticity	Contribution	Contribution (%)
Age 25–29 years	−0.021	−0.027	0.001	0.204	−0.047	0.006	0	−0.341
Age 30–49 years	0.034	0.078	0.003	0.964	0.095	0.033	0.003	3.589
SC/ST	0	0.331	0	−0.022	−0.012	0.019	0	−0.261
Below Primary	−0.33	−0.116	0.038	13.792	−0.482	−0.011	0.005	5.839
Muslim	−0.204	−0.002	0	0.153	−0.369	−0.032	0.012	13.57
Christians	−0.003	0.005	0	−0.006	0.287	−0.009	−0.003	−2.95
Second birth order	0.058	−0.1	−0.006	−2.106	0.048	−0.039	−0.002	−2.098
Third birth order	−0.096	−0.298	0.029	10.338	−0.216	−0.037	0.008	9.056
Rural	−0.036	−0.523	0.019	6.806	−0.143	−0.013	0.002	2.166
Non-poor	0.615	0.255	0.157	56.622	0.308	0.097	0.03	33.798
Reading news paper	0.516	0.032	0.017	5.962	0.277	0.026	0.007	8.129
Listen to radio	0.11	0.015	0.002	0.575	0.054	0.001	0	0.068
Watch television	0.251	0.138	0.035	12.483	0.144	0.031	0.005	5.107
Female Head of the Household	0.113	0.036	0.004	1.477	0.054	0.005	0	0.328
Institutional Delivery	0.277		0.297	107.24	0.088		0.067	76.002
Residual			−0.02	−7.24			0.021	23.998

Table 6
Contributions of inequalities in determinants to inequalities in PNC use.

Background Characteristics	PNC- Hilly				PNC- Valley			
	CI	Elasticity	Contribution	Contribution (%)	CI	Elasticity	Contribution	Contribution (%)
Age 25–29 years	−0.021	0.013	0	−0.137	−0.047	−0.003	0	0.181
Age 30–49 years	0.034	0.066	0.002	1.097	0.095	0.014	0.001	1.678
SC/ST	0	0.359	0	−0.032	−0.012	0.023	0	−0.34
Below Primary	−0.33	−0.067	0.022	10.742	−0.482	−0.011	0.005	6.386
Muslim	−0.204	−0.002	0	0.213	−0.369	−0.036	0.013	16.533
Christians	−0.003	0.083	0	−0.139	0.287	−0.001	0	−0.391
Second birth order	0.058	−0.111	−0.006	−3.139	0.048	−0.034	−0.002	−1.992
Third birth order	−0.096	−0.235	0.023	10.916	−0.216	−0.026	0.006	6.946
Rural	−0.036	−0.312	0.011	5.451	−0.143	−0.03	0.004	5.304
Non-poor	0.615	0.169	0.104	50.393	0.308	0.095	0.029	35.775
Reading news paper	0.516	0.011	0.006	2.847	0.277	0.041	0.011	14.073
Listen to radio	0.11	0.048	0.005	2.569	0.054	0.012	0.001	0.782
Watch television	0.251	0.139	0.035	16.932	0.144	0.02	0.003	3.539
Female Head of the Household	0.113	0.015	0.002	0.843	0.054	0.005	0	0.345
PNC	0.206		0.203	98.556	0.081		0.072	88.817
Residual			0.003	1.444			0.009	11.183

The study further provides important evidence to highlight the inequality in accessing maternal health use and identify the determinants. The result from the concentration indices suggests that the hilly region has high inequalities in maternal healthcare use as compared to the valley region. Further, after decomposition the inequality of maternal health services utilization, this study showed that

women education, household wealth and watching television was the main contributor to inequality in maternal health services utilization in the hilly districts. This is because a substantial proportion of ST in the hills of Manipur is living below the poverty line due to low level of economic activity and high transportation cost further impact the utilization of maternal health services.^{8,11,30} The three concentration index

Fig. 1. Concentration curves showing inequality in maternal health care services between Valley and Hilly regions of State, 2015-16.

of maternal healthcare services utilization (i.e. ANC visit, Institutional delivery, and PNC visit) were positive, suggest that a disproportionate share of maternal healthcare services resources is utilized by the richer people in spite of lower need. Compared to the valley, the inequality in institutional delivery and postnatal care was high in the hilly region of Manipur. The wide disparity between the valley and hill districts of Manipur in terms of health infrastructure, economic resources, job employment, level of economic activities and quality of education could be the reason for low health scores in the hilly region.^{11,31}

The study has some limitations. First, the study relied on cross-sectional data, the cause and effect cannot be investigated. Second, some known predictors of maternal health services use such as distance to health facilities are missing from our analyses. However, in spite of the above limitations, the study has some important findings which could be helpful for the policy implication.

5. Conclusions

In conclusion, this study demonstrates that there is a wide gap between the valley and hills in terms of utilizing maternal health services, as clearly depicted by the three major maternal health indicators. This

suggests that strong effort must be made to address the issues of inter-state variation of maternal health utilization in order to meet the sustainable development goal target in relation to infant and maternal mortality. The main reason for not utilizing maternal health services was the low level of education, poor household economic status, lack of women exposure to mass media, and women of higher parity, suggests that intervention programme and policymakers should focus on these vulnerable groups for improving the utilization of maternal health services. Improving the educational opportunity for women may have a big impact on the utilization of maternal health. However, this is a long-term investment. An alternative is a short term; health programme should target attracting women with little or no education. As women at higher parity levels were less likely to utilize maternal health, suggest that parity should be one of the conditions for targeting health education campaigns to increase the utilization of such programs. Lastly, improving the economic activities in the hilly region may indirectly increase the utilization of maternal health services.

CRediT authorship contribution statement

Prem Shankar Mishra: Conceptualization, Formal analysis, Writing

– original draft. **N. Pautunthang:** Conceptualization, Writing – original draft. **Strong P. Marbaniang:** Writing – original draft, Writing – review & editing. **Anushree K. N:** Formal analysis, Writing – review & editing.

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Appendix A. Supplementary data

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Ethical statement

NFHS data is publicly available, respondents de-identified and the institutional review board (IRB) of IIPS, Mumbai exempted from requiring IRB approval.

Data source

https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag = 1.

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