BASE University Working Paper Series: 10/2021

Horizontal Inequity in the Utilisation of Continuum of Maternal Health Care Services in India: An Investigation of Pre and Post-NRHM Period

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June 2021

Horizontal Inequity in the Utilisation of Continuum of Maternal Health Care Services in India: An Investigation of Pre and Post-NRHM Period[1]

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Abstract

Background : Continuum of Maternal Health Care Services (CMHS) have garnered attention in the recent times and reducing socio-economic disparity and geographical variations in its utilisation becomes crucial from an egalitarian perspective. In this study, we have estimated inequity in the utilisation of CMHS in India between 2005-06 and 2015-16.

Methods: We used two rounds of National Family Health Survey (NFHS) - 2005-06 and 2015-16 encompassing a sample size of 34,560 and 178,857 pregnant women respectively. The magnitude and variations in horizontal inequities (HI) in the utilisation of CMHS was captured by adopting Erreygers Corrected Concentration indices method. Need-based standardisation was conducted to disentangle the variations in the utilisation of CMHS across different wealth quintiles and state groups. Followed by this, a decomposition analysis was undertaken to enumerate the contribution of legitimate and illegitimate factors towards health inequity.

Results: The study indicated the pro-rich inequity in the utilisation of CMHS have increased by around 2 percentage points since the implementation of National Rural Health Mission (NRHM). Majority of contribution was made by illegitimate factors. Decomposition analysis revealed that the contribution of access related barriers plummeted in the considered period of time. While, mother's education and access to media continuous to remain major contributors of pro-rich inequity in India. Region-wide variations were quite pervasive- percentage of pro-rich inequity in high focused group states increased by around 3% between 2005-06 and 2015-16. Among states, the performance of southern states of India are commendable. We suggest that, special attention to vulnerable sections is paramount to ensure equitable distribution of CMHS.

Key words : Inequality in Health; Inequality
JEL: I14; D63

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[1] This paper was presented in International Health Economic Association Conference (2020), held in Switzerland, we would like to thank the participants for their suggestions and comments which has been incorporated in this paper.

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Horizontal Inequity in the Utilisation of Continuum of Maternal Health Care Services in India: An Investigation of Pre and Post-NRHM Period

1. Introduction

Concern for equity imbibes a positive spirit and any systematic deprivations resulting in poor maternal and child health outcomes should be eliminated from the society. A Transformative shift from Millennium Development Goals (MDGs) to an overarching Sustainable Development Goals (SDGs) underscores the need to address maternal health issues in a more innovative manner [1] . Studies divulging the utilisation of maternal health care services in the past have highlighted an abysmally poor condition of maternal health in the developing countries of the world including India. Around 15% of world's maternal deaths are contributed by India alone [2]. Although Maternal Mortality Rates (MMR) in India fell from 556 (1990) to 113 (2016-18) [3]. The progress was pervasive across different geographical contours. For instance, the MMR in high focus group states were fell from 520 in 1997-98, 375 in 2004-05 and 161 in 2016-18 [4,5]. Whereas in the southern states, the corresponding estimates were much lesser- 187 (1997-98), 149 (2004-05), and 67 (2016-18) [4,5]. The high MMRs are mainly attributed to the negligence of continuum of maternal health care services (CMHS) [6,7,8]. In this regard, the concept of CMHS indicating a need to undertake maternal health care services throughout the lifecycle of pregnancy, including full antenatal care services (ANC), delivery under the supervision of skilled birth attendant (SBA) and post-natal care services (PNC) becomes imperative [9]. The proponents of CMHS have indicated that the utilisation these services are intertwined with each other's and yields better health outcomes when consumed in a continuous/ sequential manner [10]. Existing studies have also highlighted that the utilisation of CMHS has the potential to reduce MMR by 15% [11].

One of the major concerns of India's health system is prevalence of iniquitous distribution of maternal health care services across the states and income quintiles [10,12,13]. The exacerbated amount of socio-economic and geographical inequalities in the utilisation of health care services led to the culmination of National Rural Health Mission (NRHM) in 2005-06, later renamed as National Health Mission (NHM) in 2013 [14]. The implementation of NRHM is rooted in an egalitarian framework and promulgated two important objectives- First, reduction of maternal and child deaths by promoting utilisation of CMHS and second, curtailing disparity in the utilisation of CMHS across different socio-economic strata's and geographical horizons.

The NRHM encompassed a set of crucial strategies such as increasing public health funding, decentralisation of health planning at village and district levels, promoting social and community participation and strengthening community empowerment [15,16]. Under NRHM, supply strengthening interventions such as employing Accredited Social Health Activists (ASHA) and demand side financing were implemented to increase utilisation of maternal health care services among poor women [15]. The implementation of NRHM varied across high-focused and non-high focused group states. The categorisation of these groups were determined by the performance of maternal health indicators. NRHM was initially rolled out in high focused group states which are considered as deprived / less developed states of India- these states were entitled for higher financial, technical and managerial assistance from the central government [15].

Studies investigating the utilisation of maternal health care services in the pre and post NRHM period [16, 17, 18, 19] have indicated that, implementation of NRHM witnessed a consistent increase in the utilisation of ANC, SBA and PNC. Few of them have highlighted a reduction of rich-poor gap in the utilisation of delivery and post-delivery care after the implementation of NRHM [17,18,19]. Others have highlighted that the implementation of NRHM had favoured high focused group states more [17]. The existing studies have conducted inequality analysis by encompassing both need and non-need based indicators together [17, 19] or they have taken series of maternal health interventions and denoted it as continuum of maternal health care services [19]. Such insights are crucial but does not indicate the extent of inequality caused by illegitimate indicators or non-need based factors. Moreover, consideration of individual maternal health interventions (even if it sways from pregnancy to post-pregnancy care) alone is not sufficient to reveal inequality in continuum of maternal health care interventions. Hence, the review of previous studies indicates two important gaps. First, standardisation of need based factors is crucial to understand the extent of inequity because any variation in the distribution caused by the need-based factor (biological need) is not an unfair event and cannot corrected through policy interventions. On the other hand, variations caused by illegitimate factors such as social determinants are dangerous from an egalitarian perspective and hence ending this becomes a major distributional concern for policy makers and health system. Second, to illuminate disparity in CMHS, the definition of CMHS has to be followed in a more structured manner.

Our study makes a novel contribution in the realm of equity based research in maternal health. In this study, we attempt to understand the horizontal inequity in the utilisation of CMHS in India and across states in the pre and post NRHM period. To define the utilisation of CMHS, we have considered those seeking neither ANC, SBA or PNC or any one of the services as 'not seeking CMHS' and those seeking ANC, SBA and PNC as 'seeking CMHS'. Researchers have suggested that the measure of horizontal inequity is not possible without specifying the norm of vertical equity [20]. The concept of vertical equity ascertains that the distribution of resources should be apportioned according to their needs [21]. Considering this, the horizontal inequity aims to explain whether equal utilisation is provided to equal needs. To capture this, we have adopted Erreygers corrected concentration index [22] which satisfies all four basic assumptions of rank dependent indices to measure horizontal inequity as against the standardised concentration method [23,24,25] which satisfies only one assumption. This method is considered to be the most suitable when health variable is bounded and ordinal in nature. Finally, we employ decomposition analysis technique to enumerate the contribution of individual level covariates on inequity in the utilisation of CMHS.

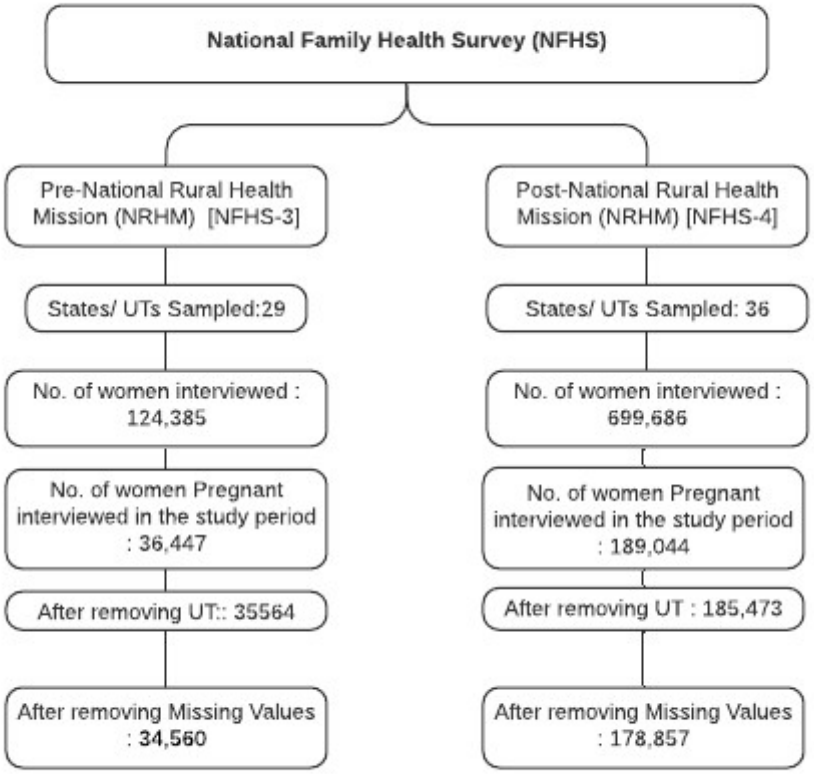
2. Empirical Framework

2.1 Data Sources

Individual level cross-sectional dataset was adopted from two rounds of NFHS conducted in 2005-06 and 2015-16. NFHS is carried out at regular intervals in India under the stewardship of the Ministry of Health and Family Welfare and International Institute for Population Sciences (IIPS). The former one is representative at state level, while, the latter one is representative of district level. In both the rounds of NFHS, stratified random sampling design was adopted for sampling. In rural areas, two stage sampling procedure was followed, where primary sampling units or villages were selected through probability proportional to population size (PPS) and households were selected by using equal probability approach. In the urban areas, sampling was conducted at three stages. In the first stage, wards were selected using probability population size, in the second stage, census enumeration blocks (CEB) were selected from each of the chosen ward through probability population size (PPS). In the third stage, households were randomly selected from each of the CEB. A total of 699,686 (NFHS - 4) and 124,385 (NFHS-3) women belonging to an age group of 15–49 years were successfully interviewed, after removing the missing values, we arrived at a final sample of 34,560 (2005-06) for pre NRHM period and 178,857 (2015-16) for the post NRHM period. To ensure

compatibility in these two rounds we have removed information of Union territories from NFHS-4. The details are provided in Figure 1.

Figure 1: Study Flow Chart



2.2 Selection of Variables

Outcome variable is a binary variable indicating 1 (if all three maternal health services (ANC, SBA and PNC) are undertaken) and 0 (if either or none of the three maternal health services are undertaken). In this case, 1 represent CMHS and 0 represents partial/ no care. Explanatory variables of this study were broadly categorised into legitimate/need based factors and illegitimate or non-need based factors. Although need is an elusive concept, we have chosen a set of the most appropriate indicators to represent the need of a pregnant women. According to the literature, Body Mass Index (BMI) status of the pregnant women, birth order and age of the pregnant women can be used as a proxy for need based indicators [26] . The set of non-need based indicators considered in this study were mother's education, caste, religion, residence, access to media exposure, barriers related to access and community level education.

2.3 Empirical Methodology :

The standard concentration index (CI) has been extensively used for the calculation of health inequality [23,24,25]. This can be computed using following formulae:

$$CI = \frac{2}{\bar{h}} cov(h_i, y_i) \quad (1)$$

Where, h_i, is the health condition, y_i is the socio-economic rank of an individual (i) and $\bar{h}$ is mean health status of the entire population. The CI is twice the area between concentration curve and line of equality (45-degree line). The value of CI ranges between -1 and +1, positive value indicates pro-rich distribution and negative value represents pro-poor distribution.

However, when the outcome variable is binary in nature, the application of concentration index approach might provide flawed estimates [22]. Some of the set-backs of this approach is. First, these bounds range between $\bar{h}$-1 and 1-$\bar{h}$, where $\bar{h}$ the mean of the outcome, thereby limiting the measurement of is socioeconomic related inequalities in health. Second, CI ranks countries by inequalities in health and ill-health differently [27]. Third, the maximum and minimum value of CI depends on the mean of the health outcome in the society (Erreygers, 2009), and finally, the value of CI depends on the scale of the health variable and might produce flawed estimates when the health variable is binary. To resolve these issues, Wagstaff proposed a corrected version of CI accounting for the feasible bounds of the CI for binary variable. It is calculated by dividing standard CI by $\left(1 - \bar{h}\right)$

$$W = \frac{1}{\bar{h}\left(1 - \bar{h}\right)} 2\, cov(h_i, y_i) \quad (2)$$

This approach was criticized by Erreygers (2009) mainly because; it normalized CI arbitrarily (Erreygers, 2009), it did not measure absolute or relative inequality [28], and it was not invariant to equal treatments in health. Therefore, Erreygers Correct Concentration Index Method [22]. This is an alternative normalization technique measuring absolute inequalities in health. It is expressed using a normalized sum of weighted health levels and can be computing using equation (3).

$$EI = f^E(\mu_h, n) \sum_{i=1}^{n} z_i\, h_i = \frac{8}{n^2} \sum_{i=1}^{n} z_i\, h_i \quad (3)$$

Where $z_i = \frac{n+1}{2} - \lambda_i, f(\mu_h, n) > 0, n$ is the number of individuals in a given population, and λ_i denotes the socioeconomic rank of the individual ranging from the richest($\lambda_i = 1$) to the poorest($\lambda_i = n$). h_i is the vector of binary health variable while μ_h represents the mean health status of the total population.

We can also express Erreygers Index (EI) in the following algebraic form:

$$EI = \frac{4}{b_H - a_H} 2\, cov(h_i, y_i) \quad or \quad EI = 8cov(h_i, r_i) \tag{4}$$

Where h_i is the health variable of interest, r_i is the individual or respondent's relative rank in the socioeconomic variable distribution. The size of EI reflects the strength and variability in the health variable of interest. Positive (negative) values of EI indicate a pro-rich (pro-poor) distribution. One of the major advantages of this index is that it satisfies four essential criteria (Erreygers, 2009). They are: 1) **Transfer:** A small transfer of the variable of interest from a richer to a poorer individual is translated into a pro-poor change in the inequality index, 2) **Mirror:** The inequality index of the variable of interest, and the inequality index of the shortfall of the variable of interest should be mirror images of each other, 3) **Level independence:** An equal increment of the variable of interest for all individuals does not affect the inequality index and 4) **Cardinal Invariance:** A linear transformation of the variable of interest does not affect the value of the index. We followed this approach to demonstrate horizontal inequity in health. Additionally, we conducted decomposition analysis to unravel the contribution of socio-economic covariates.

The formulation of decomposition analysis is presented in Equation (5) , assuming the utilisation of CMHS (h_i). The explanation of this provided via nonlinear modelling:

$$h_i = G\left(\alpha + \sum\nolimits_j \beta_j\, x_{ji} + \sum\nolimits_k \gamma_k\, z_{ki}\right) + \varepsilon_i \tag{5}$$

Where G (.) will take the form of nonlinear model (Probit), x_j are the need-proxies and z_k are the non-need control variables. If there were no z variables, then predicted values obtained from the model could be interpreted as need-expected utilisation. Linear approximation of the model can be estimated by estimating partial effects of non-linear model [25]. That is, linear approximation to previous equation and is given by:

$$h_i = \alpha^m + \sum_j \beta^m x_{ji} + \sum_k \gamma_k^m z_{ki} + u_i \quad (6)$$

Need predicted utilisation provides the estimate that would be expected given the distribution of need and it is expressed in equation (7)

$$\hat{h}_i^x = \hat{\alpha}^m + \sum_j \hat{\beta}_j^m x_{ji} + \sum_k \hat{\gamma}_k^m \bar{z}_k \quad (7)$$

Then indirect standardised utilisation is understood using equation (8) :

$$\tilde{h}_i^{IS} = h_i - \hat{h}_i^x + \hat{\bar{h}} \quad (8)$$

Where $\hat{\bar{h}}$ the mean predictions with all variables at actual values is, $\hat{h}_i^x$ is the need predicted utilisation and h_i represents the actual utilisation. Actual healthcare utilisation refers to the healthcare utilisation of the respondent indicated in the household survey. Need-predicted healthcare utilisation was used to capture variation in healthcare utilisation predicted only by need-based factors. Need-standardised healthcare utilisation was used to capture the gap between actual healthcare utilisation and need-predicted healthcare utilisation.

By undertaking a decomposition analysis technique, we derived the contribution of individual covariates to socioeconomic related inequalities in health. We employed EI approach considering the binary nature of health variable (dependent/ outcome variable) instead of standard concentration index (CI), and decomposition of concentration index was multiplied by 4 to obtain EI.

$$EI = 4\left[\sum_j \beta_j \mu_{x_j} C_{x_j} + \sum_j \gamma_k \mu_{z_k} C_{zk}\right] \quad (9)$$

Where μ represents the mean, β and γ represents the coefficient of the variable x and z, respectively. CI represents the standard concentration index and horizontal inequity (HI) is obtained by subtracting the need contributions from the unstandardised HI.

3. Results and Findings

3.1 Descriptive Statistics

Table (1) provides the descriptive statistics of the covariates along with their mean and standard-deviation (SD) values for 2005-06 and 2015-16. Age group of sampled population was mainly 25-29 years in 2005-06 (Mean = 0.346; SD = 0.472) and 2015-16 (Mean = 0.368; SD= 0.482). Majority of women had birth order less than 4 in 2005-06 (Mean = 0.746; SD=0.435) and these proportions increased in 2015-16 (Mean= 0.822; SD= 0.383). Households with less than or equal to 6 members increased between 2005-06 (Mean =0.589; SD=SD=0.492) and 2015-16 (Mean= 0.618; SD=0.486) indicating a fall in the household size. The mean value of the sampled population hailing from rural areas were around 0.75 in both 2005-06 and 2015-16. Age of marriage mostly ranged between 18-23 in 2005-06 (Mean= 0.418; SD=0.493) and 2015-16 (Mean= 0.529; SD=0.499). Further, women mainly belonged to Hindu religion in 2005-06 (Mean = 0.700; SD=0.458) and 2015-16 (Mean: 0.729; SD = 0.444). Percentage of women possessing secondary education is highest in 2005-06 (Mean=0.384; SD= 0.486) and 2015-16 (Mean=0.463; SD=0.499).

While, prevalence of community education was relatively low in 2005-06 but improved by around 10 percentage points in 2015-16. Caste-wise differentials asserted that most of the sampled population were from OBC category in 2005-06 (Mean = 0.336; SD=0.472) and 2015-16 (Mean = 0.392; SD = 0.488). Majority of the pregnant women had access to at least one source of medium of information in 2005-06 (Mean= 0.635; SD= 0.482) and it marginally increased in 2015-16 (Mean = 0.646; SD=0.478). Region wise estimates ascertained that, most of the women resided in high focused states (major) in 2005-06 (Mean = 0.442; SD = 0.496) and 2015-16 (Mean= 0.607; SD= 0.488). The distribution of sampled women across wealth quintiles remained almost same; with majority of them from poorest quintile population compared to the richest quintile population. Most of the women faced barriers related to availability as compared to affordability and accessibility hinderances in both the time period. The prevalence of those suffering from availability issues increased over time. In 2005-06, around 0.45 of women faced availability issues while accessing CMHS, and this number rose to around 0.55 in 2015-16.

Table 1: Descriptive Statistics

List of Covariates	2005-2006		2015-2016	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Non-need based factors/ illegitimate factors				
Household Size *(Ref : Greater than 6)*				
Less than 6 Members	0.589	0.492	0.618	0.486
Number of Under-five *(Ref : Greater than 2)*				
Less than or equal to two children	0.129	0.335	0.441	0.497
Residence *(Ref : Rural)*				
Urban	0.377	0.485	0.760	0.427
Mother's Education *(Ref : No Education)*				
Primary Education	0.144	0.351	0.141	0.348
Secondary Education	0.384	0.486	0.463	0.499
Higher Education	0.085	0.279	0.103	0.304
Media Exposure *(Ref : No Media)*				
Access to at least 1 medium of information	0.635	0.482	0.646	0.478
Caste *(Ref : SC)*				
ST	0.158	0.364	0.193	0.395
OBC	0.336	0.472	0.392	0.488
Others	0.298	0.457	0.229	0.420
Community Educational Status *(Ref : Low)*				
High	0.397	0.489	0.514	0.500
Age at Marriage *(Ref : Less than 17)*				
18-23	0.418	0.493	0.529	0.499
24-34	0.092	0.289	0.114	0.318
Above 35	0.002	0.039	0.002	0.041
Religion *(Ref : Muslim)*				
Hindu	0.700	0.458	0.729	0.444
Christian	0.094	0.292	0.075	0.263
Others	0.047	0.212	0.042	0.201
Wealth Index *(Ref: Poorest)*				
Poor	0.181	0.385	0.232	0.422
Middle	0.203	0.402	0.201	0.401
Rich	0.219	0.414	0.171	0.376
Richest	0.222	0.415	0.145	0.352
State Group *(Ref : Non-High Focused Group)*				
High Focused	0.442	0.496	0.607	0.488
North-East	0.191	0.393	0.147	0.354
Access Related Barriers *(Ref: No barrier)*				
Acceptability	0.088	0.284	0.092	0.288
Availability	0.449	0.497	0.549	0.497
Affordability	0.075	0.263	0.074	0.263
Need based factors/ legitimate factors				
Birth Order *(Ref : Equal or greater than 4)*				
Less than 4	0.746	0.435	0.822	0.383

BMI Status *(Ref : Less than 18.5 & greater than 25)*				
Less than 18.5 and greater than 25	0.447	0.497	0.615	0.487
Mother's Age (Ref : Less than 20)				
20-24	0.308	0.462	0.297	0.457
25-29	0.336	0.472	0.368	0.482
30-34	0.188	0.391	0.195	0.396
35-49	0.108	0.311	0.110	0.313
Total	**34,560**		**1,78,857**	

Source: Author's Computation

3.2 Mean of Continuum of Maternal Healthcare: A Comparison of Standardized and Unstandardized estimates

Figure 2, depicts a comparison of standardized and unstandardized mean estimates of the utilization of CMHS across wealth quintiles and state groups. The differences between standardized and unstandardized mean values indicate the differences attributed by legitimate and illegitimate factors. If the difference between these two values is low, it ascertains that the contribution of legitimate factor is marginal. Quintile wise estimation and state-wise estimation indicates that the differences between standardized and un-standardized values are quite low indicating that a lower contribution by legitimate factors. However, the mean utilization of CMHS in both high and non-high focused states increased in the considered time period, the improvement was however much higher for high-focused group states (4.5 percentage) in comparison to non-high focused group states (10 percentage). The utilization was clearly more among the rich/ richest quintile population compared to the poor/poorer/ middle quintile population indicating an existence of pro-rich disparity in the utilization of CMHS. The pattern is quite noticeable for 2005-06 and 2015-16.

Figure 2: Mean of Continuum of Maternal Healthcare in 2005-06 and 2015-16: Standardised Vs. Unstandardised Estimates

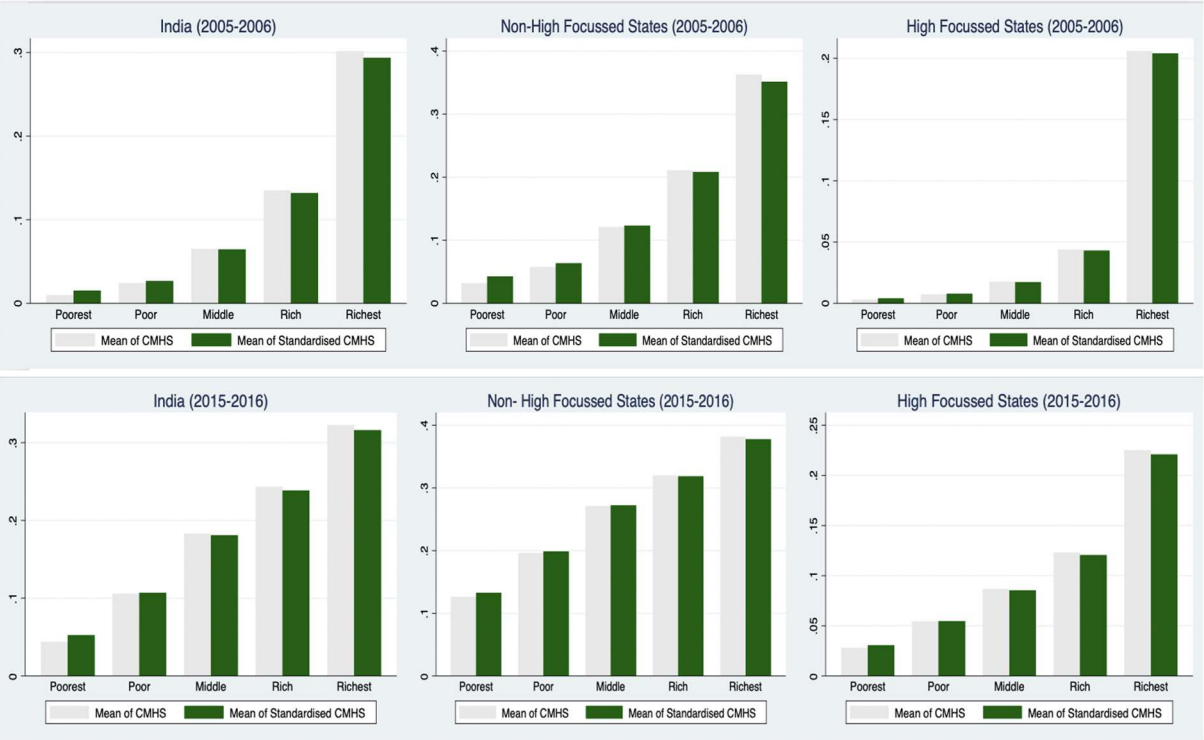
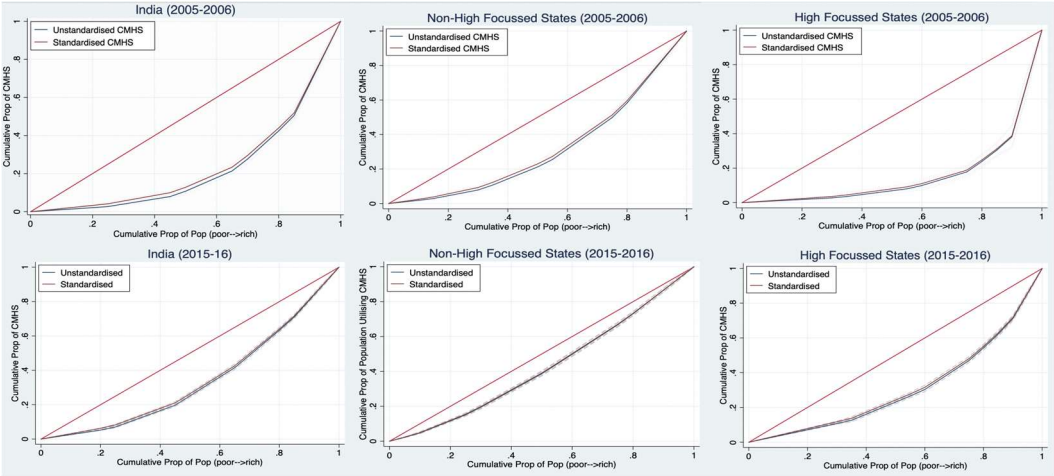


Figure 3 captures the pattern of inequality using concentration curves (CC) disaggregated for high and non-high focused group states in 2005-06 and 2015-16. The concentration curves explain the relationship between the cumulative proportions of the population arranged from poorest to richest quintile group against the cumulative proportion of population's arranged from lowest to highest utilization of CMHS. Here, the 45-degree line indicates the line of equality- when the CC falls towards the left, the distribution is comparatively more amongst poorer quintile population highlighting a pro-poor distribution, when CC falls towards the right, pro-rich distribution is witnessed. The difference between the 45-degree line and the CC explains the magnitude of health disparity. Clearly, the gap between CC and 45-degree line is prominent across regions and time period. The gap is consistently high in 2005-06 in comparison to 2015-16 but the magnitude of the gap shrunk between the time period. The region-wise estimation indicates that in the non-high focused states, pro-rich inequality plummeted massively, while in high-focused grouped states, the level of pro-rich inequality was higher despite having witnessed a reduction between 2005-06 and 2015-16.

Figure 3: Concentration Curves of the utilization of CMHS across different regions in 2005-06 and 2015-16



Source: Author's Computation

3.3 Erreygers Corrected Concentration Index

The Erreygers Corrected concentration Indices was constructed to discern the magnitude of HI after controlling the influence of need based factors. The index value ranges between +1 and -1. Where, a positive value signals an orientation towards pro-rich rich inequity, while a negative number manifests pro-poor inequity.

Figure 4 (a) demonstrates the EI values disaggregated across state-groups - the contribution of legitimate and illegitimate factor have been separately captured. Overall, the utilisation of continuum of maternal healthcare services is pro-rich in the considered period of time. The magnitude of pro-rich inequity increased between 2005-06 and 2015-16.

The level of pro-rich inequity have been compounded by a disparity in the high-focused group states. Factor wise disaggregation indicates a major contribution of illegitimate factors, thereby raising an alarming situation for the health system which is desperately fighting towards the reduction of inequity in the utilisation of CMHS due to variations in socio-economic determinants. In comparison to high-focused, the non-high focused group states witnessed a greater reduction in the pro-rich inequity in the considered period of time.

Figure 4.a & 4.b: Erreygers Corrected Concentration Index in 2005-06 and 2015-16: Across state-groups and individual maternal health interventions

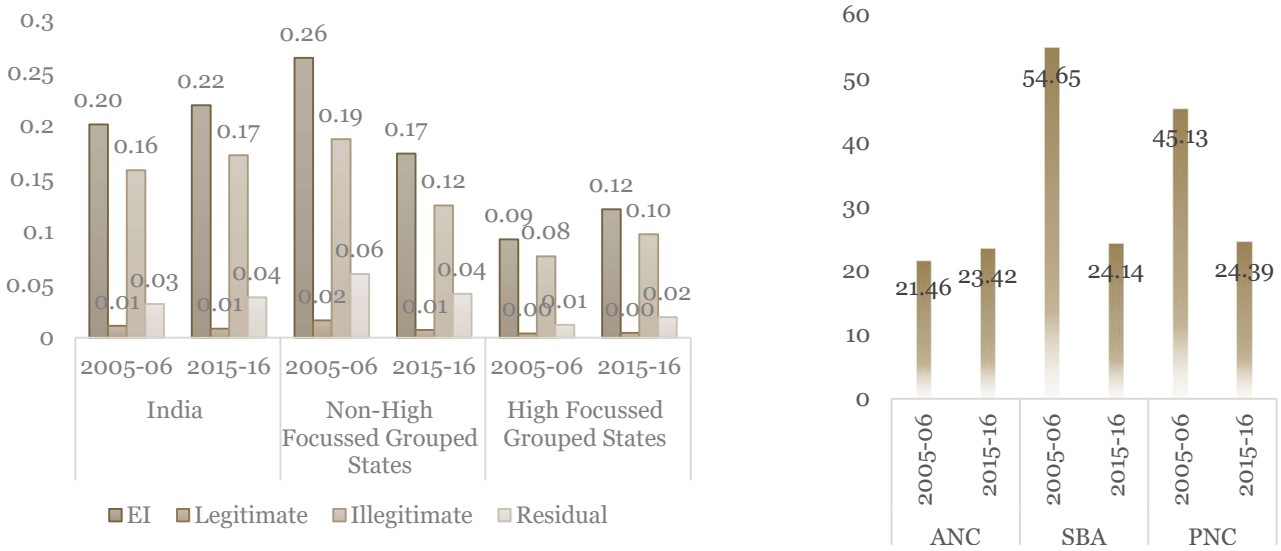
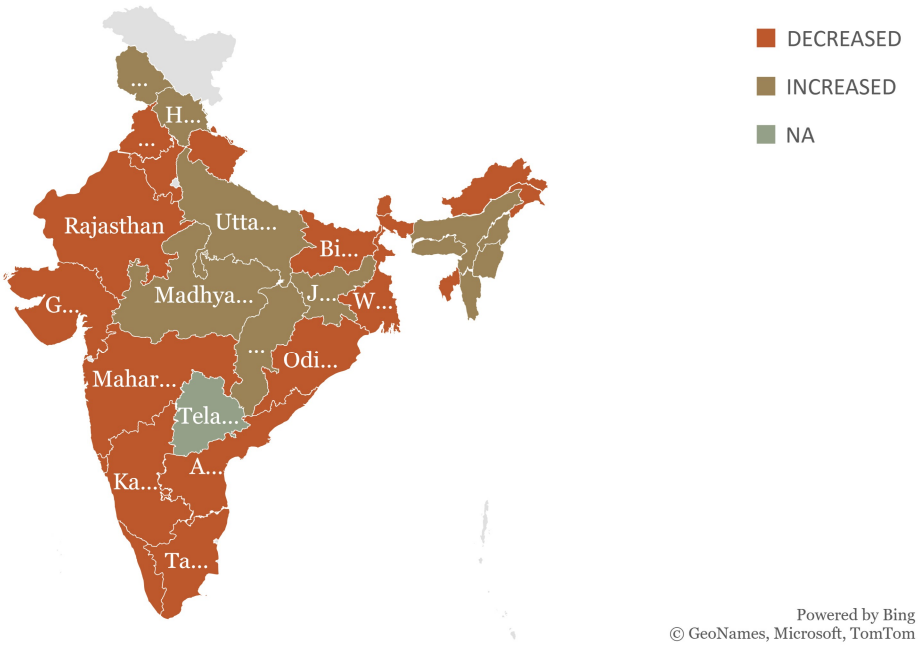


Figure 4 (b) highlights EI values for individual maternal health interventions and disentangles the variations in 2005-06 and 2015-16. The results provide some interesting insights with delivery (SBA) and post-delivery care services (PNC) witnessing a reduction in the pro-rich inequity, while pre-delivery care services represented by ANC have shown an increase in the pro-rich inequity in the utilisation of CMHS (2005-06 vs 2015-16).

Figure 5 illustrates the state-level variation in the Erreygers Index (EI) for the utilization of CMHS in the states of India between 2005-06 and 2015-16. As discussed earlier, the horizontal inequity for CMHS in India had increased by around 1.08% between 2005-06 and 2015-16. The state-level estimation reveals unconscionably wide disparities with regard to the utilization of CMHS after the implementation of NRHM/NHM. Although inequity in utilization of CMHS at national level increased, we found that some states experienced a fall in the level of inequity, while others witnessing a rise in the considerable period of time.

Figure 5: Changes in Horizontal Inequity before and after NRHM: State-wise estimation



3.3.1 States recording a fall in the health inequity: A positive signaling

We found that, all southern states- Tamil Nadu, Karnataka, Kerala and Andhra Pradesh recorded a reduction in the level of pro-rich inequity in the utilization of CMHS. The reduction was highest in Karnataka (27.06%) and Tamil Nadu (22.4) compared to other two states. Other states to have experienced a similar level of reduction is Sikkim (24.98) from north-eastern region and Goa (23.99%) from the western part of India. Gujarat, Haryana, Bihar Maharashtra, Rajasthan and Tripura fell on the same trajectory witnessing a reduction of pro-rich inequity by around 2 to 4 percentage points after 10 years of implementation of NRHM.

3.3.2 States recording an increase in the health inequity: A Worrying Phenomenon

Between 2005-06 and 2015-16, the inequity in the utilization of CMHS in some of the north eastern states, namely Assam (10.58%), Meghalaya (13.11%), Mizoram (16.96%) and Manipur (29.97%) and Nagaland (3.5%) had shown an increase in the level of wealth-based inequities in the utilization of CMHS. This indicates that the implementation of NRHM had not been able to improve the situation of most of the north-eastern states, who were the primal focus of NRHM programs. The states of Himachal Pradesh, Jharkhand, Madhya Pradesh, Nagaland,

Chhattisgarh, Uttar Pradesh and Jammu and Kashmir experienced a rise in the pro-rich inequity of around 3% to 6% between 2005-06 and 2015-16.

3.4 Decomposition Analysis

We carried out a decomposition analysis to capture the contribution of individual covariates- both relative and absolute contribution for each of the factor have been gleaned. The sign of the contributing factor is either positive or negative. Negative value indicates a negative contribution, in other words, the extent to which a particular variable has increased the level of inequity. Positive value on the other hand reflects a positive contribution, in other words, the extent to which a particular variable has been responsible for the reduction of level of inequity. Relative and absolute contribution is divulged for 2005-06 and 2015-16 to ascertain the pattern of the variable in both years.

In this analysis, we found that contribution of legitimate factors was considerably low. These factors are immutable factors and remains unaffected through policy initiatives. On the other hand, the contribution of illegitimate factors is significantly high. These factors are determined by sociodemographic determinants such as religion, caste, age at marriage, number of under children, place of residence, media exposure, mother education, size of the household, access-related barriers and community education – the impact of these factors can be influenced by policy initiatives. Decomposition analysis, unveils the contribution of each of this variable in a detailed manner. The unexplained gap (residual) in the health inequity might be attributed to other structural factors not included due to data constraints issues.

Our key findings are as follows. First, the contribution of illegitimate factors remained high in 2005-06 and 2015-16. In fact, the positive contribution of legitimate factors has reduced by around 2 percentage points, while the contribution of illegitimate factors remained almost same. This indicates that the inequity attributed to a variation in biological factors fell, while inequity contributed by socio-economic variations remained unchanged even after the implementation of NRHM. The variations are evident across state-groups. For instance, in the high-focused grouped states (80.34), the contribution of illegitimate factors is exorbitantly high compared to non-high focused state groups (71.89). During the considered time period, the contribution of illegitimate factors reduced in the high focused grouped states while, in non-high focused group states, it increased. Among the legitimate factors, birth order had a

substantial impact on health inequity, and its impact increased over time. Among the illegitimate factors, the contribution of mother's education, media exposure and community education were immense. Between 2005-06 and 2015-16, the contribution of access to media has increased over time, while that of mother's education have plummeted. We also found that, the impact of access related barriers was quite pronounced in pre-reform period, however it is important to note that the contribution of these factors reduced in the post reform period. The changes in the relative and absolute contributions are provided in appendix.

Table 2: Contribution of individual covariates towards the Level of Inequity in CMHS

Individual Covariates	India		Non-High Focused Group states		High Focused Group states	
	05-06	**15-16**	**05-06**	**15-16**	**05-06**	**15-16**
Age	0.49	0.11	2.45	1.54	0.24	0.28
Birth Order	5.16	3.73	3.68	2.65	3.81	3.43
BMI Status	-0.02	0.11	0.08	-0.02	0.22	-0.01
Legitimate Factors	***5.63***	***3.95***	***6.21***	***4.18***	***4.27***	***3.70***
Religion	-0.07	*1.06*	*-0.75*	*1.27*	-0.61	*-0.61*
Caste	1.68	0.78	2.61	5.20	6.19	2.85
Age at Marriage	7.85	5.05	9.13	7.18	7.73	6.54
Under-Five Children	0.04	0.85	0.04	0.44	-0.30	1.33
Residence	5.03	8.68	2.60	7.38	11.42	8.52
Access to Media	10.75	21.97	9.69	12.22	9.01	21.70
Mother's Education	32.52	21.02	34.45	28.22	38.14	27.48
Household Size	-0.31	-0.36	-0.27	-0.45	0.13	-0.42
Access Related Barriers	2.87	0.67	1.74	1.34	2.48	0.63
Community Education	18.20	18.89	11.75	9.09	8.39	12.32
Illegitimate Factors	***78.57***	***78.62***	***70.97***	***71.89***	***82.57***	***80.34***
Residual	*15.81*	17.43	22.82	23.93	*13.15*	15.95
Total Inequity	100	100	100	100	100	100

Source: Author's Computation

4. Discussion

This paper is the first to measure changes in horizontal inequity in the utilization of CMHS after 10 years of the implementation of NRHM. The inclusion of important covariates such as access related barriers, community level indicators and other socio-economic determinants in the model enable us to generate insightful information.

The level of pro- rich inequity in the utilization of CMHS have increased between 2005-06 (20.8) and 2015-16 [22]. In other words, the utilization of CMHS increased among richest

quintile population compared to their poorest counterparts, although both had similar levels of need. It is well known that the richer population holds higher socio-economic positioning, greater levels of education and better access to different mediums of information [29, 30,31,32,33,34,35]. To address these disparities, an umbrella of schematic interventions was implemented under the NRHM in 2005 and our results claim that health care system in India has not been able to play an effective role in protecting the poorest population from various socio-economic impediments.

Although, the level of pro-rich inequity increased for the utilization of CMHS but uniformity in the pattern was not witnessed for individual maternal health interventions. Our analysis infers that inequity in the utilization of delivery and post-delivery care services have reduced, as indicated by a fall in the horizontal inequity in SBA and PNC in the considered period of time. The greater uptake of these services could be mainly due to the obvious conjecture that implementation of JSY which provides financial benefits to pregnant women and outcome-based incentives for community health workers for promoting delivery and post-delivery care services has been successful in protecting poor and vulnerable population. The impact of these programmatic interventions is well-established in the available literature [17, 36, 37]. Even though the consultation costs, medications and diagnosis in public health system is provided at free of cost. Transportation costs associated with multiple ANC visits exacerbates the problem of poor women, especially in the absence of financial incentives. This might demotivate poor women from seeking adequate antenatal care services even if the cost of services is negligible. Important measures have to be undertaken to address the problems of poor women. Previous studies provide inconclusive evidence with regard to the inequity in the utilisation of ANC services, few have indicated that inequality in the utilisation of ANC have risen over time [36, 37]. While, others have divulged that inequality in the utilisation of ANC services in India reduced between 2005-06 and 2015-16 [19]. The divergence from our main findings can be explained by the differences in the methodologies adopted. We have standardised the need-based factors while [19] has computed inequalities using standardised concentration indices method.

Increase in the value of HI in the post reform period is an indicative of the need to distinguish between the contribution of legitimate and illegitimate factors. Our analysis discerned that the utilization of CMHS is driven by illegitimate factors such as media exposure, mother's education, place of residence and access-related hinderances. An evaluation across different

regions and time horizon illuminates that the contribution of illegitimate factors has increased, on the other hand, contribution of legitimate factors has plummeted. One possible explanation would be that mother's education, media exposure and community education reflect the importance of awareness pertaining to both benefits of the utilization of CMHS and ill-effects of under-utilization of CMHS. Undoubtedly, such information is mostly available among rich women while poor women are often found to grapple with the problem of information asymmetry.

Reduction of pro-rich inequities in non-high focused group states have reduced after the implementation of NRHM- the overall reduction is mainly compounded by two southern states namely, Tamil Nadu and Karnataka. This could be could be attributed to the large contributions of the state governments, which suggests that government-led initiatives emphasized egalitarian principles. This echoes the findings of [38] who found that both these states attained more equitable access to maternal health care services by implementing interesting schemes such as expansion of delivery and emergency services to 24h by asserting greater emphasis in lagging districts. Provision of high standard of antenatal care and delivery care at lower cost. In both the states, democratic decentralization has played a significant role in shaping variation at the local level. This suggests an urgent need for state-led initiatives and decentralization of health care across districts, emphasizing poorest and more of neglected sections of the states. Even-though gamut of nation-wide interventions were implemented, state-wise variations in the magnitude and differences in inequities in the utilization of CMHS indicates that state-level targeted interventions can pay off. The authors also emphasized that such schemes take considerable time to affect inequity but it would prove to be noteworthy to considerate state-level targeted interventions and democratic decentralization of CMHS.

On the other hand, the increase in the level of inequity in high-focused grouped states were mainly contributed by few states of north eastern part of India - Manipur, Mizoram and Meghalaya. However, it is important to observe that few of the north-eastern states like Assam and Sikkim did record a reduction in the level of inequality in the utilization of CMHS. This indicates that, despite asserting greater attention in terms of financial incentives, technical assistance, only few states have been able to reduce the level of pro-rich inequity in high-focused group states. The reduction in the level of inequality in Assam and Sikkim could be attributed to the successful implementation of JSY in these two states [37]

We carried out a decomposition analysis to explain the significant contributors to health inequity by delineating the contribution of legitimate (need-based) and illegitimate factors (non-need-based). Among the legitimate factors, birth order had a substantial impact on health inequity, and its impact increased over time. It could be mainly because an increase in birth order is associated with a greater level of experience and knowledge about the importance of maternal healthcare services [39,40]

Among the illegitimate factors, the contribution of mother's education towards the pro-rich inequality in both 2005-06 (32.52%) and 2015-16 (21.02%) was enormous. Our results support the hypothesis that women with higher educational levels are endowed with more resources in terms of cognition, communication and relationship, making them better decision-makers resulting in better utilisation of healthcare resources [41]. Also, they possess more confidence in handling the officials and are willing to travel far to seek maternal health services [7]. Whereas, those with lower educational levels tend to ignore the benefits of healthcare and are likely to underutilise health services [42]. Our findings are in line with the previous studies suggesting a substantial contribution of education in explaining the amount of pro-rich inequity in the utilisation of maternal health services [10, 43,44]. Our findings contradicts to the findings of [45] who revealed that having a secondary/higher education increased the pro-poor inequity in healthcare utilisation.

We also found that access to media had a massive contribution towards the pro-rich inequity. Our analysis supported the hypothesis that compared to poorest women, wealthier women were more privileged to have access to more than one medium of information. Generally, access to media opens avenues to gather more information about the availability of healthcare services and benefits associated with its utilisation. Between 2005-06 and 2015-16, the contribution of access to media has increased by three times in high focused group states. Our results were comparable to the findings of [39, 40].

This study also showed that community literacy had a significant contribution towards pro-rich inequity in the utilisation of CMHS It could be possibly because the concentration of illiterate women in the community indicates problems of limited awareness, lower autonomy and higher incidence of child marriages. These factors together correspond to low decision-making capacity related to healthcare access. Our results were consistent with the findings of Singh and others [46] who revealed that prevalence of higher levels of community poverty and lower levels community education is related to lower utilisation of maternal healthcare services.

Finally, access related barriers had significant contribution in the pro-rich inequity in the pre-reform period at national level and in high-focused group states, the contribution of these variables reduced in the post reform period indicating that, NRHM had made some contribution in reducing access related barriers in high-focused group states of India.

5. Strengths and Limitations

Richer quintile population are more likely to keep track of CMHS during lifecycle of pregnancy. Looking at inequity in the utilization of choice of provider for continuum of maternal health care services is more likely to provide deeper insights into it. However, it requires information about the range of provider choice which is not captured in NFHS dataset.

6. Conclusion and Policy Recommendations

We observed that inequity in the utilization of CMHS increased in post reform period compared to pre-reform period. Prominent variations were witnessed across interventions and states. In some states, the level of inequity in the utilization of CMHS reduced between pre and post reform period, while in others it increased. Across interventions, the pro-rich inequity in ANC increased, whereas for SBA and PNC, the pro-rich inequity in the post reform period witnessed a fall. Important contributing factors for pro-rich inequity are access to media exposure, mother's education and community level education. On the basis of these findings, we suggest following policy recommendations.

The level of inequity increased in the post-reform period calling for immediate policy recommendations. First, it is important to undertake immediate steps to increase the utilization of ANC services among poor women. Both state and central government might consider expanding financial incentives for availing ANC services. Outreach programs can be upscaled to provide access to adequate ANC services which entails multiple visits to the facility. Democratization of decentralization as adopted by Tamil Nadu and Karnataka can be followed by other states as well. Greater contribution of exposure to media and mother's education indicates the crucial role played by dissemination of knowledge and information related to the benefits of CMHS among poor woman. Government might adopt innovative strategies like advertising on local channels, conducting campaigns and folk shows at village level to spread awareness. Finally, the role of ASHA worker can be strengthened by providing competitive wages and providing proper training facilities to them.

Abbreviations

ANC: Antenatal care services

ASHA: Accredited Social Health Activists

BMI: Body Mass Index

CEB: Census enumeration blocks

CC: Concentration Curves

CMHS: Continuum of Maternal Healthcare Services

HI : Horizontal Inequity

IIPS: International Institute for Population Sciences

JSY: Janani Suraksha Yojana

MDGs: Millennium Development Goals

MMR: Maternal Mortality Rate

NFHS : National Family Health Survey

NHM: National Health Mission

NRHM: National Rural Health Mission

PNC: Post-natal care services

PPS: Probability Population Size

SBA: Skilled birth attendant

SDGs: Sustainable Development Goals

Ethics approval and consent to participate

Not applicable as study used the secondary data from DHS

Consent for publication

Not applicable

Availability of data and materials

The dataset analysed during the current study are available in the DHS Program website, https://dhsprogram.com/data/available-datasets.cfm

Competing interests

The authors declare that they have no competing interests

Funding

No funding sources has supported this study

Authors' contributions

SG designed and conceptualized the study, conducted data analysis and drafted the manuscript, and hence the production of this paper. UD & SB has guided the formulation of the research gap, supported during study conceptualization and in analysis, reviewed and edited the writing, and production of the final version of the paper. All authors read and approve the final manuscript.

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