



## A quantitative perspective of the maternal health care status of Assam, India: Evidences from National Family Health Survey-4 and 5

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### Abstract

*Maternal health acts as vital indicator in ascertaining the health and status of women. Reinforcing of maternal health care that encompasses antenatal care, natal care and postnatal care is indispensable to corroborate safe motherhood. Maternal health has been becoming a universal consternation because the lives of millions of women in reproductive age can be safeguarded through adequate maternal health care services. Situated within this background a persuasion was aimed to understand the status of maternal health care and to quantify the district wise coverage of maternal health care facilities of Assam, a state in north eastern part of the country, based on the secondary sources in general and the data furnished by National Family Health Survey (NFHS-4, 2015-16) in particular. A comparative study based on NFHS-4 (2015-16) and NFHS-5 (2019-20) will be performed for the mothers belonging to the stratum of districts of very low utilization of maternal health service. The study attempts to explore various socioeconomic factors that attribute to the significantly large share in skimpy utilization of maternal health care and findings will be conducive for administering public health budget to different districts so as to diminish the gaps of dispensing medical facilities among the vulnerable mothers of Assam.*

**Keywords:** National family health survey, maternal health, inequalities, index of maternal health facilities, Assam.

### Introduction

Maternal health ascertains the well-being of women during pregnancy, childbirth and the postnatal period. Women experience numerous changes with respect to biological, physiological and psychological during the child bearing period. As a matter of fact motherhood seems notably to be a positive and fulfilling experience in developed countries, but unfortunately the state is not uniform for many women belonging to developing countries where it is correlated with suffering, ill-health and even death. Maternal and neonatal mortality is the indication of erroneous utilization of maternal health care services as well as miserable health care system which sounds as the alarming threat worldwide<sup>1-3</sup>. According to the statistics of WHO, near about 295,000 maternal deaths were recorded during 2017 over the whole world, of which lion's share (approximately 86%) were reported from Sub-Saharan Africa and Southern Asia<sup>4</sup>. While Southern Asia accounts for nearly one fifth of all maternal deaths, the region has achieved the highest overall percentage reduction in MMR by nearly 60%, that is, from 384 to 157 maternal deaths per 100,000 live births due to life threatening pregnancy related complications and childbirth<sup>4</sup>. Although it is propitious that India has witnessed substantial flourishing in the reduction of MMR from 167 in 2011-2013 to 130 in 2014-2016 and further, from 122 in 2015-17 to 113 in 2016-18, but failed to achieve the millennium development goal (MDG-5) target of reducing the MMR to 109/100000 live births by three quarters between 1990

and 2015 and is still struggling to achieve the third sustainable development goal with a aim to achieve less than 70 maternal deaths per 100,000 live births by 2030<sup>4,5</sup>. The MMR declined by 6.2% and 7.4% in the country during the periods 2014-2016 to 2015-2017 and 2015-17 to 2016-18 respectively, paving the way for the SDG target to be achieved much before the due year of 2030<sup>5</sup>. In India, there are wide variations in MMR across different states, ranging from 215 in Assam to 43 in Kerala<sup>5</sup>. In order to eradicate persistent inequalities among the vulnerable populations in the utilization of health care services the Govt. of India has launched National Rural Health Mission (NRHM-2005) / National Health Mission (NHM-2013). It aspires to accumulate all health and family well-being along with allied sector under one roof in order to ensure the reduction of maternal mortality through appropriate maternal health care across the length and breadth of the country. Proliferating access to quality healthcare and comprehensive spectrum of health services are the mainstays to provide a thrust to lower MMR, infant mortality, and child mortality rates under the flagship programme of the central government of India. Several studies conducted in different parts of India have corroborated a consequential association of different socio-demographic factors such as rural-urban residence, geographical region, educational status, ethnic group, religion, wealth index, parity/birth order, etc. on the practices of maternal health care services of women during reproductive periods<sup>6-10</sup>. The condition of maternal deaths is even worse in Assam, one of the socioeconomically disadvantaged states of India. We still have a long way to go as

Assam is contributing to the highest maternal mortality rate (MMR) in the country with a figure of 215<sup>11</sup>. Under National Health Mission (NHM) state government of Assam initiated various schemes related to maternal and child health care. However, the key for the accomplishment of these schemes is the level of awareness among the beneficiaries. Despite these introductions of programmes, the utilization of maternal healthcare services is still low in Assam due to sluggishness in healthcare progress, uneven distribution of healthcare services. Lack of proper health infrastructure and meager utilization of maternal health care services between different subgroups of population were the potent determinant for the low access to maternal health<sup>12,13</sup>. Utilization of proper maternal healthcare during pregnancy, delivery and postnatal periods could diminish the likelihood of maternal death and ameliorate overall health not only of mother but also of new-born<sup>14,15</sup>. The reason that limit the utilization of health care services by the mothers in Assam was found to be significantly associated with multiple factors like, most of the people in Assam belong to rural areas, rigid hierarchy and class structure moulded by tradition and long-standing customs, ignorance and illiteracy, isolation from the health care system caused by distance, poor communication and transport<sup>16</sup>.

**Objectives:** The paper aims to fulfill the following objectives: i. To quantify the extant heterogeneity in the practices of maternal health care facilities among young married women in different districts of Assam using pooled data from the 4<sup>th</sup> round of NFHS data (2015–16). ii. To rank the districts of Assam according to the composite index (to be named as Maternal Health Care Index) to be developed based on some indicators that have an inherent comportment on maternal health care services.

## Date and Methodology

The study conducted a secondary data analysis using the fourth round (NFHS-4, 2015–16) of nationally representative National Family Health Survey (NFHS) that cover about 99 percent of Indian population, an Indian version of Demographic Health Survey (DHS). The NFHS is a comprehensive and multi-round survey imparted in a representative sample of households across India by the International Institute for Population Sciences (IIPS), Mumbai, since 1992–93. Up to now, a series of five rounds have been executed, the current one having been scanned during 2019–20 (NFHS-5). The NFHS furnishes vital data not only on health and family welfare but also on other issues related to them at both national and state levels. The data sets (NFHS-4, 2015–16) of different districts of Assam were compared for various maternal health indicators and are freely accessible from NFHS website (<http://rchiips.org/nfhs/>). Depending upon the availability and accessibility of data at district level, we have identified eight indicators from the above mentioned source to be used to develop the composite index IMHF that can be used as a measure of echelon of maternal health care situation in Assam. The indicators considered in this study include the following maternal health care services:

Antennal Care Services (ANC): Percentage of mothers ( $A_1$ ) having four or more visits for ANC, ( $A_2$ ) practices Antenatal check up in the first trimester, ( $A_3$ ) whose last birth was safeguarded against neonatal tetanus, ( $A_4$ ) exhausting iron folic acid for at least 100 days during their pregnancy, ( $A_5$ ) experiencing full antennal care, ( $A_6$ ) who had rolled due to which grabbed Mother and Child Protection (MCP) card.

Natal care: ( $A_7$ ) Percentage of mothers acquiring financial assistance under Janani Suraksha Yojana (JSY) for institutional delivery.

Postnatal Care Services: ( $A_8$ ) Percentage of mother who underwent postnatal care delivered by a doctor/nurse/LHV/ANM/midwife/other health personnel accessible within 2 days of delivery.

All the above eight indicators ( $A_1$  to  $A_8$ ) possess positive dimensions as greater the value of the indicators better is the performance in terms of practices of the maternal care.

It is to be noted that on 15 August 2015, five new districts Biswanath (carved out of Sonitpur), Charaideo (carved out of Sivasagar), Hojai (carved out of Nagaon), South Salmara Mankachar (carved out of Dhubri) and West Karbi Anglong (carved out of Karbi Anglong) were formed taking the total number of districts from 27 to 32. On 2016, one more district Majuli (carved out of the Northern parts of Jorhat) was announced taking the total districts from 32 to 33. As a result the researcher has cogitates total number of districts of Assam to be 27 in the study according to the data available during the year 2015 – 16 (NFHS-4) whereas during the year 2019 – 20 (NFHS – 5) the total number of districts of Assam is counted to be 33.

## Construction of the Composite Index

In order to provide an integrated and efficacious delineation of realism the construction of composite index is indispensable for exploring the district wise disparities on the basis of the indicators related to maternal health care. The composite index, expounded in the study as the mathematical combination of the six indicators, is conceded as suitable device for policy making on passing information regarding the practices of health care facilities. Here the Index of available Maternal Health Facilities (IMHF) is employed to quantify the maternal health facilities available in different districts. The symbols employed to compute the value of composite index pivoted on illumination of variables and subscripts below.

Let  $v_{ij}$  signifies the outcome of the  $i^{\text{th}}$  maternity indicator in the  $j^{\text{th}}$  district.

Where  $i = 1, 2, \dots, 8$  for the aforesaid eight maternal health care indicators,

$j = 1, 2, \dots, 27$  for the number of districts

Now, it is to be stated that the numerical values of various indicators  $v_{ij}$  obtained from the fourth round of NFHS are in percentages, so they are unit less and being in the same scale of reference normalizing or standardization of the data don't arise. In order to formulate the composite index based on the selected indicators, one must concede that all the maternal indicators are not of equal importance. Hence, in the study, the researcher adopted a weighted average according to the relative importance of the weights in the construction of index instead of using the simple average of the indicators. Here Shannon's Entropy, launched in information theory in the year 1948, and is used to evaluate the weights to be attached to the different parameters under study<sup>17</sup>. Entropy technique would facilitate to ascertain weights to be connected with the different indicators ( $A_1$  to  $A_6$ ) that would best reflect the status of maternal health care amongst the different districts.

According to this method, we explicate

$$G_i = -\sum_{j=1}^{27} \frac{g_{ij} \ln(g_{ij})}{\ln(27)} \text{ for } i = 1, 2, \dots, 8 \quad (1)$$

Where  $g_{ij} = \frac{v_{ij}}{\sum_{j=1}^{27} v_{ij}}$

Correspondingly, the weights to be assigned with the  $i^{\text{th}}$  parameter are computed as

$$\omega_i = \frac{1 - G_i}{8 - \sum_{i=1}^8 G_i}, \text{ Where } 0 \leq \omega_i \leq 1 \text{ and } \sum_{i=1}^8 \omega_i = 1 \quad (2)$$

Thus we accomplish the maternal health index as

$$(IMHF)_j = \sum_{i=1}^8 \omega_i g_{ij} \text{ for } j = 1, 2, \dots, 27 \quad (3)$$

Thus the scores of IMHF will indicate the status of pregnant women in terms of utilization of health care facilities. In case of each of the districts, we gain unique value of IMHF that ranges from 0 to 100, under the fourth and fifth rounds of NFHS respectively. It is apparent that the greater score of IMHF will exhibit sound status of maternal health care in the respective districts whereas; low score of IMHF will reflect the gloomy condition of health care of pregnant women.

**Kolmogorov Smirnov test:** In order to test the probability distribution of IMHF, the researcher contemplates Kolmogorov-Smirnov (K-S) test statistics to be pertinent to scrutinize whether the random sample under consideration is picked out

from a population having specified cumulative distribution function  $G_0(x)$  on the grounds that the values of the index are continuous in nature. Consequently, the null hypothesis and alternative hypothesis are set up as

$$H_0 : G(x) = G_0(x) \text{ vs. } H_1 : G(x) \neq G_0(x)$$

Assuming the null hypothesis to be true, the K-S test statistic is defined by

$$D_n = \max |G_n(x) - G_0(x)|$$

Kolmogorov Smirnov enunciates that empirical distribution function  $G_n(x)$  tends to the true distribution function  $G_0(x)$  under null hypothesis. The smaller the value of  $D_n$  greater is the probability to accept the null hypothesis. On the contrary, the high value of  $D_n$  will lead to the violation of the null hypothesis. Thus if the calculated value of  $D_n$  for a given sample size exceeds the significant value  $D_{\alpha, n}$  for a given level of significance  $\alpha$  (say) then one should reject the null hypothesis.

Once the probability distribution of IMHF is finalized, the researcher aims to obtain three real numbers  $\gamma_1, \gamma_2$  and  $\gamma_3 \in [0, 100]$  to segregate the values of IMHF into four mutually disjoint linear intervals  $[0, \gamma_1], [\gamma_1, \gamma_2], [\gamma_2, \gamma_3]$  and  $[\gamma_3, 100]$  attached with the same probability weight of 25%. These groups are employed to portray the classification of the status of maternity care of the districts of Assam as far as NFHS-4 is concerned. The district will be categorized as the possession of: i. Very Poor Level of Maternal Health Care Facility if  $IMHF \in [0, \gamma_1]$ , ii. Poor Level of Maternal Health Care Facility if  $IMHF \in [\gamma_1, \gamma_2]$  iii. Good Level of Maternal Health Care Facility if  $IMHF \in [\gamma_2, \gamma_3]$  iv. Very good Level of Maternal Health Care Facility  $IMHF \in [\gamma_3, 100]$

### Calculation and result

The weights  $\omega_i$  ( $i = 1, 2, \dots, 8$ ) of the attributes exhibited in Table-1 can be evaluated by using equation (2).

**Table 1:** Weights cognate with the stipulated indicators exerted in the composite index

Indicators	$A_1$	$A_2$	$A_3$	$A_4$	$A_5$	$A_6$	$A_7$	$A_8$
Weights ( $\omega_i$ )	0.1203057	0.0589315	0.00752312	0.1931076	0.43187208	0.0009196	0.0632531	0.1240874

After calculating the weights analogous to various indicators, the researcher intends to compute composite indices on the basis of the district-wise authenticated values of designated maternal care indicators for 27 districts by making use of the expression (3). To delineate the current maternal health services across Assam, the districts are graded in accordance with the corresponding score of IMHF. As already postulated higher the grade of the composite index better is the performance with respect to practices of the health care facilities in the district ergo the district with a lower score of IMHF will gain the lower rank and reflects the more wretched condition of the mothers with regard to maternal health care in the respective district. The values of composite index IMHF along with whereabouts of the districts are organized below in Table-2:

**Table-2:** District-wise rank elicited from IMHF values.

Districts	NFHS-4	
	IMHF	Rank
Dhubri	16.57445	1
Karimganj	23.10406	2
Hailakandi	26.51791	3
Barpeta	27.00294	4
KarbiAnglong	27.15249	5
Cachar	28.86111	6
Darrang	28.89142	7
Kamrup(R)	28.95997	8
Bongaigoan	29.29149	9
Chirang	29.52385	10
Udalguri	31.96668	11
Kokrajjar	32.63484	12
DimaHasao	32.80131	13
Nagaon	33.39918	14
Goalpara	34.16775	15
Nalbari	35.0123	16
Sonitpur	36.09813	17
Morigoan	37.72653	18
Dhemaji	40.49897	19
Tinsukia	40.66283	20
Baksa	40.81504	21
Kamrup (M)	42.95526	22
Lakhimpur	45.50644	23
Golaghat	47.56111	24
Sivasagar	48.38006	25
Dibrugarh	53.61906	26
Jorhat	62.02284	27

In view of the fact that all the IMHF values are perceived to be positive (i.e. IMHF > 0) one anticipated distribution of the index to be assigned may be the two parameter gamma distribution. The probability function of the distribution is given by

$$g(x) = \frac{1}{\lambda^\delta \Gamma \delta} \left(\frac{x}{\lambda}\right)^{\delta-1} e^{-\frac{x}{\lambda}}, \delta > 0, \lambda > 0; 0 < x < \infty. \quad (4)$$

$$\text{Where } \Gamma \delta = \int_0^\infty e^{-x} x^{\delta-1} dx \quad (5)$$

It is to be noted that the estimated values of the two parameters known as scale ( $\lambda$ ) and shape ( $\delta$ ) respectively are obtained by employing the method of Maximum Likelihood Estimation (MLE)<sup>18</sup>. The estimators are

$$\hat{\lambda} = \frac{\sigma^2}{M} \text{ and } \hat{\delta} = \left(\frac{\bar{M}}{\sigma}\right)^2$$

Where  $\bar{M}$  and  $\sigma^2$  stand for the average and variance of the 27 IMHF values.

Thus the IMHF values presented in Table-2 produces the estimated values of  $\hat{\lambda}$  and  $\hat{\delta}$  under the assumption of two parameter gamma distribution as:

$$\hat{\lambda} = 2.761335 \text{ and } \hat{\delta} = 12.89913$$

The K-S test is then computed to scrutinize whether the IMHF values fit the two parameter gamma distribution based on the parameters already calculated from data available. The numerical value of the test statistic is given by

$$D_n = \max |G_n(x) - G_0(x)| = 0.10604$$

Which is observed to be insignificant at 5% level of significance due to corresponding  $p$  value of 0,6912. Thus it can be concluded there exist sufficient evidence for the IMHF values to follow the two-parameter gamma distribution as defined in (4). In order to validate the application of two parameter gamma distribution, the researcher again opts for the graphical delineation of K-S test (Figure-1).

From the graph, it is ascertained that the Empirical Distribution Function (EDF) is not only very nearer to CDF but also lying in the neighborhood of the bounds and as a deduction authenticates the fit of empirical data to the theoretical distribution.

Recognized the probability distribution of the index IMHF to be two parameters Gamma distribution the values of the unknown constants are calculated to be  $\gamma_1 = 28.545$ ,  $\gamma_2 = 34.725$  and  $\gamma_3 = 41.746$ .

On the basis of the thus obtained estimated values of  $\gamma_1$ ,  $\gamma_2$  and  $\gamma_3$ , the four stages of maternal health care facilities are formed so that echelon of the 27 districts as per NFHS-4 with respect to practices of maternal health care can be evaluated.

**Table-3:** Codification of maternal health facilities through IMHF.

Stages of maternal health care	Values of IMHF
Very poor level of MHC facility	Less than 28.545
Poor level of MHC facility	Between 28.545 to 34.725
Good level of MHC facility	Between 34.725 to 41.746
Very good level of MHC facility	Greater then 41.746

Consequently, depending upon the obtained score of IMHF, the arrangement of districts under different stages of maternal health care are displayed below in Table-4.

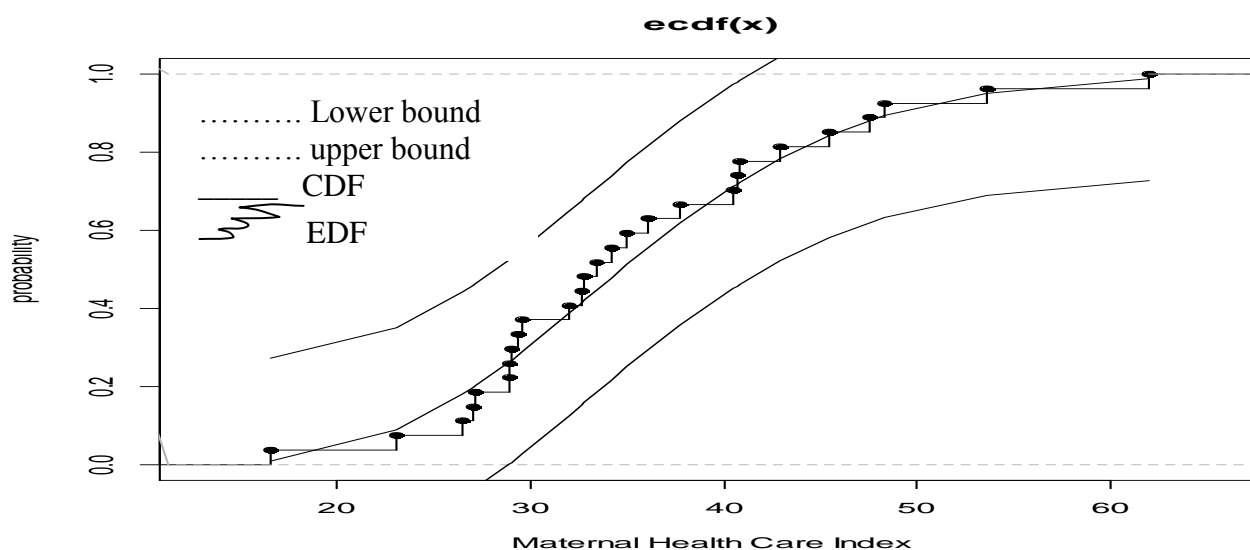
The results in Table-4 portrays that Women belonging to districts Dhubri, Karimganj, Hailakandi, Barpetta, Karbi Anglong were using very low maternal health services. It is to be mentioned that excluding Cachar the entire Barak valley region comprising the districts Cachar, Hailakandi and Karimganj, is exhibiting the very depressing maternal care scenarios. In a study conducted by Deka and Sarmah based on NFHS-5 data explore that mothers of the districts Cachar, Dhubri, Darrang, Bongaigaon, South Salmara Mancachar, Karimganj are enjoying very poor level of maternal care<sup>20</sup>. Thus it is revealed that though status of pregnant women in the districts Cachar, Darrang and Bongaigaon are in the second stage of maternal care (Poor level) as per NFHS-4 but are the most deprived districts according to NFHS-5 data in terms of maternal care<sup>20</sup>. Though at state level Government of Assam has initiated several policies and programmes to eliminate the issue of sparse utilization of maternal care but the question arises as to whether National Health Mission (NHM), a great endeavor of the Government of India has played an instrumental role to

strengthen the maternal health services among in the districts. On the other hand, Hailakandi, Barpetta and Karbi Anglong are in the first stage of maternal health care (Very poor) in the current study (NFHS-4) but are in the second stage of health care as per the study based on NFHS-5<sup>20</sup>. Surprisingly the districts Dhubri (Old Dhubri + South Salmara Mankachar) and Karimganj are continuously having dismal pictures as far as the maternal health situation is concerned and experiencing the very poor level of maternal health care (First stage) according to studies based on both NFHS-4 and NFHS-5.

In the study, it is found that the block of districts Cachar, Darrang, Kamrup (R), Bongaigaon, Chirang, Udalguri, Kokrajhar, Dima Hasao, Nagaon and Goalpara are enjoying poor level of health services (second stage). Geomorphological hurdles in the districts or heterogeneous distribution of facilities within the state give rise to deprivation in maternal care.

**Table-4:** Classification of districts in the light of IMHF.

Stages of maternal health care	Districts of Assam
Very poor level of Maternal care facility	Dhubri, Karimganj, Hailakandi, Barpetta, Karbi Anglong
Poor level of Maternal care facility	Cachar, Darrang, Kamrup (R), Bongaigaon, Chirang, Udalguri, Kokrajhar, Dima Hasao, Nagaon, Goalpara
Good level of Maternal care facility	Nalbari, Sonitpur, Morigaon, Dhemaji, Tinsukia, Baksa,
Very good level of Maternal care facility	Kamrup(M), Lakhimpur, Golaghat, Sivsagar, Dibrugarh, Jorhat



**Figure-1:** Graphical representation of K – S test based on MHCI values calculated for different districts of Assam<sup>19</sup>.

It should be noted in Table-4 that six contiguous districts experiencing good maternal care (third stage) are in progressive track compared to first two blocks of districts. On the other hand, the six least deprived districts of Assam as far as maternal care is concerned get classified into very good maternal care.

Since we have identified that maternal care of mothers of the five districts falling under the stage of very poor level of maternal care to be lamentable therefore a discussion of data sets were compared with each other (NFHS-4 and NFHS-5) for various maternal health indicators in these districts so that such areas should be focused by the government to formulate some region oriented development policies and schemes.

**Discussion:** The paramount goal of the study is to appraise different districts of Assam from the perspective of utilization of maternal health care facilities in the light of the data furnished by NFHS-4 so that a stratum of most deprived districts can be ascertained. From the Table-4, it is apparent that mothers of five contiguous districts are in wretched condition and far away from modern health facilities. It is noticeable that the progress in the maternal health indicators pondered in the study is of utmost importance for upgrading the maternal health status of the endangered mothers. Antenatal Care (ANC), acts as a solacing platform to strengthen the understanding of maternity care, is the structured supervision of mothers throughout the childbearing periods to keep track of progress of flourishing of the foetus in order to ascertain the well-being of the mother and the child. Antenatal services not only render medical care to women but also include suggestion on consumption of proper diet and provision of iron and folic acid tablets and immunization with 2 doses of Tetanus Toxoid (TT) during the span of Child bearing to promote good health<sup>21</sup>. Through antenatal checkup mothers are persuaded by health professionals for institutional delivery. Another study in Indian context concludes that the utilization of ANC services is exalted among the mothers of Southern states of India as compared to that of other states<sup>22</sup>.

Government of India recommends a minimum of 4 obligatory ANC visits throughout the pregnancy for optimal maternal care. It is observed in Appendix I that while considering the indicator of at least 4 ANC visits, all the districts excluding Barpeta of the most deprived group in terms of maternal care revealed a sluggish increment of proportion of pregnant women from NFHS-4 to NFHS-5. Though Barpeta recorded the highest position out of five contiguous districts as per the survey NFHS-4 but there is a decline of proportion of mothers in Barpeta from 47.5% (NFHS-4) to 43.6% (NFHS - 5) with regard to the aforesaid indicator. Karbi Anglong shows a fairly significant jump in the percentage of mothers with regard to access of a minimum of 4 ANC from 38.1% (NFHS-4) to 63.9% (NFHS-5). In a study by Baruah et al. revealed that more than 50% (about 57.98%) of women availed full range of ANC (3 or more visit) visits while less than 50% (about 42.02%) of registered women had 1-3 visits<sup>23</sup>.

The Practices of attending antenatal checkup in the first trimester has an efficacious influence on the health of mother. The data in Appendix I infers that according to NFHS-4 approximately 64.3 percent of the mothers reported receiving ANC in Barpeta during the first trimester was leading out of the five districts but declined to 62.2% in NFHS-5. Though there is an increasing trend of the other four districts Dhubri, Karimganj, Hailakandi and Karbi Anglong but Dhubri is witnessing repeatedly the lowest percentage of mothers utilizing antenatal check up in the first trimester according to the surveys NFHS-4 and NFHS-5. A study conducted in Madhya Pradesh opined an association between use of ANC and factors like women's education, household's standard of living, caste and religion<sup>24</sup>.

Regarding the percentage of pregnant women whose last birth was protected against neonatal tetanus, Dhubri performed a magnificent job by strengthening its share from 71.4% (NFHS - 4) up to 97% (NFHS-5) crossing the share of state accomplishment (94.5%; NFHS-5) and is surprisingly higher than that of other four districts. Both the districts Barpeta and Karbi Anglong are able to increase while Karimganj and Hailakandi show a negative trend of protection of mothers against tetanus according to NFHS- 5 when compared with that of NFHS - 4.

The present study also observed a significant discrepancy in the consumption of hundred IFA tablets or an adequate amount of syrup in the state. Coverage of all pregnant women with prophylactic dose of IFA Tablets or an adequate amount of syrup to pregnant women once daily for 100 days is one of the interventions for maternal anemia prevention. In a study done by Shindhaye et al. reported that majority of the women (86.2%) rolled for ANC received Iron and folic acid tablet during the antenatal period<sup>25</sup>. From NFHS-4 data displayed in Appendix 1, it is crystal clear that in all the districts coverage of consumption of Iron and Folic Acid (IFA) are much lower and it was perceived that the beneficiaries groups are still lacking to experience it.

However, as per the NFHS-5 (2019-20), the scenario of the health care of mothers with regard to consumption of IFA at district level has revamped to some extent in the block of five districts (Appendix I). Dhubri managed to increase the consumption more than three times from 13% in NFHS - 4 to 47.6 % in NFHS - 5. Further Barpeta district is able to boost the consumption in percentage change by more than 30% from NFHS 4 to NFHS 5. In a study conducted in Uttar Pradesh exhibited that though about 71.9% pregnant women received 100 IFA tablets but only 78.7% women consumed 100 IFA and concluded IFA consumption had statistically significant relationship with their age, education, husbands education, socio-economic status, type of family and family as a determinant of maternal and child health<sup>26</sup>.

Government of India delineates full ANC as a package of minimum four antenatal visits, at least one Tetanus Toxoid (TT) injection and provision of IFA tablets or syrup for 100 or more days for care of the pregnant women. The data presented in Appendix 1 portrays unacceptably a lower utilization of full ANC in all the five districts as majority of young mothers did not enjoy the conglomeration of full ANC during 2015–2016. The egregious proportion of mothers experiencing full ANC was found to be disheartening in the stratum of five districts. With 11.6% practice of full ANC, Karbi Anglong was leading while with a practice of 5.2% Karimganj was at the bottom out of the stratum of five districts whereas the state level coverage stood at 18.1%. A study highlighted the regional variation where utilization of full ANC was higher among the mothers of southern states of India as compared to other states<sup>6</sup>.

The launching of Mother and Child Protection (MCP) card is an endeavor to monitor the status of maternal health more meticulously. The MCP card, serves as a tool of excellent resource for transferring knowledge of health education regarding pregnancy and child care to mothers including cognizance of danger signs, institutional delivery, benefit schemes, and family planning to accredit families to make decisions for care of women and children. Assessment of this component is one of the attempts by NFHS-4 which brings out the acquiescence of care and maintenance of record. It is exhilarating that the percentage shares of the MCP card holders in the districts Dhubri (94.6), Karimganj (97.7), Hailakandi (96.6), Barpeta (96.4), Karbi Anglong (95.5) are very high in NFHS-4 (2015-16) in reference to this particular attribute and reported persistent growth in NFHS-5 (2019-20). A study in Karnataka conducted to appraise the degree of comprehension about the maternal health care among mothers in acquisition of MCP card observed a poor maternal awareness among the rural dwellers<sup>27</sup>.

Janani Suraksha Yojana (JSY) a cash transfer programme aimed at promoting institutional delivery and post-natal care to reduce MMR and child mortality rates (CMR) as high degree of cognizance regarding benefit schemes among the beneficiaries can shepherd to splendid utilization of schemes. NFHS-4 data disclosed in Appendix I confirms that Hailakandi (77%) and Karimganj (75.8%) are faring well in access to Janani Suraksha Yojana (JSY) benefits to the pregnant mothers than the other three districts. It is very obvious that pregnant women of the district Dhubri (48.3%) face discrimination in access to JSY though much above the national average (36.4%). Moderate coverage of percentage shares of JSY across the eligible beneficiaries of Karbi Anglong (65.6) and Barpeta (66.7) are being reported from NFHS-4 (2015–16). In a study by Mishra et. al. exposed that caste among social groups persuaded the mothers in the access to JSY. The study emphasized on the healthcare training leverage of ASHA and Anganwadi workers to be recruited from the same community in order to ascertain the right beneficiaries of JSY and to mitigate the influence of dominant caste groups<sup>28</sup>.

Postnatal care empowered the pregnant women for perception of emergencies in the immediate postnatal period. The lion's share of the complications of the postpartum period arises due to paucity of reliable health information and home deliveries which can lead to maternal death occur during the first 48 hours. The importance of postnatal check-ups practices immediately after the delivery arises due to births that eventuate in non-institutional settings. Concerning percentage share of mothers experiencing postnatal care served by a doctor/ nurse/ LHV/ ANM/ midwife/ other health personnel accessible within 2 days of delivery (A<sub>8</sub>), Dhubri district (22.1%) remained as the most disadvantaged region in the block of five districts whereas 62.4% of Indian mothers received PNC within 48 hours of delivery as far as NFHS-4 is concerned. However, it is clearly visible from the figure of Appendix I that the widespread persistent discrepancies in case of proportion of mothers receiving PNC within 2 days of delivery in all five districts have increased substantially as reported by NFHS-5 compared to NFHS-4. One significant observation is that the proportion of mothers utilizing the PNC increased from 22.1% in NFHS-4 to more than two times (48.4%) in NFHS-5 in Dhubri but still the lowest turn up out of the five districts in NFHS-5 is a matter of great concern.

## Conclusion

The utilization of maternal health care services of the pregnant women, the key to combat the maternal mortalities, remained unjustifiably meager and heterogeneous among different strata in Assam between 2015-16 and 2019-20. It is obvious from the study of NFHS-4 that there is a desideratum for not only to revamp the existing lamentable coverage but also the level of full ANC services in Assam. A study conducted in Assam analyzed the association of utilization of ANC with maternal age, educational status, occupational status, religion, caste, place of delivery, mode of delivery and parity<sup>29</sup>.

Educated women have the potentiality to acquire health care inputs and consciousness of the adverse effect of not experiencing maternity care services that may guide them to take right decisions for their health. A study on rural Indian women reported that mothers with higher education, one of the cogent determinants of ANC utilization, had the chances of practicing the same three times than that of uneducated women<sup>6</sup>.

Utilization of antenatal services was efficacious both for accessing institutional delivery and postnatal care. Another study exhibited religious affiliation of woman and caste as potent determinants of the inequalities in the utilization of postnatal care<sup>30</sup>. In a study it is noticed that the Muslim women belonging to Southern States were ahead in terms of utilization of maternal healthcare services than that of northern states and concluded the instrumental role of NHM schemes in strengthening the practices of maternal health services among Muslims<sup>31</sup>.

Another study by Sing et al., highlighted that educational status, maternal age, mass media exposure, three and more birth order, residence etc. strengthened the discrepancy largely among the Muslim woman belonging to scheduled caste/ scheduled tribe in the utilization of Skilled birth attendance (SBA) and full ANC. The study also investigated that education, media exposure and wealth status was the paramount determinants that limited the practices of maternal health services among the Muslim populations. A study conducted in rural Uttar Pradesh found a positive association between mass-media exposure and the utilization of maternal health care services during pregnancy and post-delivery hence endeavors to provide health related counseling using different media including television and radio<sup>32</sup>. In the study, the researchers highlighted that women exposed to mass media, may gain a better concept of maternal health complications and the importance of ANC and skilled birth attendance during delivery. According to the study by Ponna et. al. wide-ranging regional discrepancy of inadequate maternal health services perceived across Andhra Pradesh was due to meager consciousness of mothers regarding health schemes, financial constraints, and lack of awareness of households of incentives for institutional delivery<sup>33</sup>.

Health interventions should be delineated to get stuck into obstacles such as introduction of persuasive training of ASHA worker to cultivate and inspire mothers about neonate and maternal care. The concern for encouraging the pregnant mothers to avail government healthcare facilities has been reflected in concerted attempts of the Indian Government adopted through various incentive-based schemes under the roof of National Rural Health Mission (NRHM-2005)/National Health Mission (NHM - 2013). Due to Paucity of infrastructure, non-attendance of doctors/health providers, low levels of competence, scantiness of medicines, rareness of information and inadequacy of co-ordination at different levels of the Mission, women have been struggling with higher hardships in ingress to the enjoyment of these schemes. Though various schemes, that inspire the pregnant women of lugubrious groups in practicing health care, like JSY, JSSK were launched by central Govt. within the framework of NRHM to upgrade the maternity care but health policy measures need to be effectuated to habitually keep track of its accessibility, availability and acceptability of ongoing programs, especially in the stratum of districts having very poor maternal health facilities.

**Appendix I:** Veritable values of the maternal health care indicators of mothers during NFHS-4 and NFHS-5 in the districts falling under the category of very poor level of maternal health care.

Districts	A <sub>1</sub>		A <sub>2</sub>		A <sub>3</sub>		A <sub>4</sub>	
	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
Dhubri	26	37.6*	36.3	43.9	71.4	97.0	13	47.6
Karimganj	37.1	42.2	47.3	54.8	96.9	94.2	18.2	39.9
Hailakandi	34.5	43.1	49.6	77.6	96.6	96.2	24.3	29
Barpeta	47.5	43.6	64.3	62.2	86.8	94.9	18.6	49.4
Karbi Anglong	38.1	63.9	47.4	64.8	87.2	90.9	25.1	35.3

**Appendix-I:** Veritable values of the maternal health care indicators of mothers during NFHS-4 and NFHS-5 in the districts falling under the category of very poor level of maternal health care.

Districts	A <sub>5</sub>		A <sub>6</sub>		A <sub>7</sub>		A <sub>8</sub>	
	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5	NFHS-4	NFHS-5
Dhubri	5.5	NA	94.6	98.2	48.3	NA	22.1	48.4
Karimganj	5.2	NA	97.7	99.5	75.8	NA	36.1	63.9
Hailakandi	9.7	NA	96.6	100	77	NA	39.3	68.8
Barpeta	10.2	NA	96.4	99.1	66.7	NA	36.6	70.5
Karbi Anglong	11.6	NA	95.5	96.4	65.6	NA	40.5	56.9



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