



INFLUENCE OF MATERNAL AND CHILD HEALTHCARE UTILIZATION ON THE PREVALENCE OF MATERNAL AND CHILD UNDERWEIGHT: EVIDENCE FROM NATIONAL FAMILY HEALTH SURVEY, 2015-2016

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Abstract

Maternal healthcare services are essential for the well-being of both mothers and children. Numerous studies have established an association between demographic and behavioural factors. However, examining the impact of healthcare utilization on birth weight remains necessary. Maternal healthcare services are essential for the well-being of both mothers and children. Numerous studies have established an association between demographic and behavioural factors. However, examining the impact of healthcare utilization on birth weight remains necessary. This study aims to understand the relationship between healthcare services and their influence on the prevalence of underweight among mothers and children. Data used in the study are obtained from the Indian National Family Health Survey (2015-16). The tools for analysis included bivariate and multivariate analysis. In summary, our findings emphasize the critical role of ANC visits and the choice of childbirth location in



maternal and child nutrition. Proper utilization of antenatal care and institutional delivery can significantly reduce underweight conditions among mothers and children, highlighting the importance of comprehensive healthcare access and utilization during pregnancy and the postnatal period.

Key words: Underweight, predicted probabilities, nutrition, maternal underweight,

1. INTRODUCTION:

The integration of specialized prenatal care within public health services represents a relatively recent advancement in the field of modern obstetrics. It came into prominence in the late 1930s when officials in the United Kingdom of Great Britain and Northern Ireland decided to expand routine care to all expectant women, recognizing it as an essential part of maternity care (Zahr & Wardlaw, 2003). In 2002, the World Health Organization (WHO) introduced a transformative approach to antenatal care, advocating for a comprehensive package of at least four antenatal care visits, a concept termed focused antenatal care (FANC) (Carroli et al., 2001; WHO, 2002). This approach gained broad acceptance by many low and middle-income countries as a national policy and instructional protocol (Downe et al., 2016).

However, despite these advancements, recent data from 2015-16 reveals that only 84% of women in India aged 15-49 received four or more antenatal care visits during pregnancy, highlighting 4% increase from 2005-06. Maternal health care services play a pivotal role in enhancing maternal and child health outcomes. While some sociodemographic factors influence the propensity to seek care (Addai, 2000; Girma & Genebo, 2002), another critical determinant is the cultural background of women, their decision-making autonomy, and the accessibility of healthcare services, particularly in remote areas (Girma & Genebo, 2002).



Antenatal care has been widely acknowledged as essential for the well-being of both mothers and children throughout the twentieth century (Chuku, 2008). It encompasses various dimensions, including the timing of initiation, the number of visits, the spacing between visits, the content of each visit, the type of healthcare provider (e.g., doctors, ANMs/midwives/nurses, traditional practitioners), and the settings where care is delivered (e.g., hospitals, clinics, or homes).

Many studies have highlighted strong association between the utilization of prenatal care services and the incidence of low birth weight. Numerous studies consistently report that inadequate utilization of antenatal care, characterized by a lower number of visits (Gizaw & Gebremedhin, 2018; Khanal et al., 20014; Habib et al., 2018; Tang et al., 2017; Khanal et al., 2015), absence of iron and folic acid (IFA) (Gizaw & Gebremedhin, 2018; Khanal et al., 20014; Habib et al., 2018), and absence of de-worming tablet intake during pregnancy (Christian et al., 2004) is positively correlated with low birth weight. Adequate prenatal visits aid in the timely identification of pregnancy complications and facilitate parental care and immediate intervention during pregnancy (Azzaz et al., 2016; White et al., 2006). Proper consumption of IFA mitigates the risk of low birth weight by reducing maternal anaemia (Cogswell et al., 2006), while de-worming tablets during pregnancy reduce worm infections, thereby decreasing the proportion of low-birth-weight infants (Christian et al., 2004).

Infants born with low birth weight are more likely to remain underweight during their early childhood (WHO, 2009; Islam et al., 2013; Mishra et al., 2014). Even when mothers possess educational qualifications, a favourable household financial status, and extended birth intervals between pregnancies, childhood malnutrition continue to be a concern for infants with low birth weight (Rahman et al., 2016).



To enhance perinatal outcomes for mothers and babies, several strategies have been identified, including the presence of skilled attendants during delivery, proper management of complications, and effective post-operative care within the first 24 hours after birth (Timyan et al., 2018; Celik & Hotchkiss, 2000; Falkingham, 2003). Healthy mothers are better equipped to care for their children, allowing for extended periods of breastfeeding and adequate supplementary nutrition. In contrast, malnourished mothers struggle to provide sufficient breastfeeding due to their nutritional deficiencies.

Moreover, many studies have already established the relationship in various demographic and behavioural factors and also the health care utilisation with the prevalence of birth weight. Still there is a need to determine the role of risk factors such as health care services including ANC, institutional delivery and PNC. Prevalence of underweight was more frequently found to have the worst of the socioeconomic status and among those who have not to utilise the health care facilities during pregnancy to after birth. It is essential to identify how the prevalence of underweight among mother and child increase with a dimension of health care services — the present study attempt to understand the effect of maternal care utilisation on maternal and child underweight in India.

2. METHODS AND MATERIALS:

2.1 Data:

The data used in this study was collected from the National Family Health Survey (NFHS-4), conducted in India. NFHS-4 is a vital source for gathering detailed information on population dynamics, healthcare, and nutritional status at the national level, states level and union territories.



The Ministry of Health and Family Welfare (MoHFW), Government of India, played a central role in overseeing and coordinating all aspects of the NFHS-4 survey. The responsibility for the survey's management was entrusted to the International Institute for Population Sciences (IIPS) in Mumbai, as the nodal agency.

The successful execution of NFHS-4 was made possible through the generous financial support provided by multiple esteemed organizations, including the United States Agency for International Development (USAID), the United Kingdom Department for International Development (DFID), the Bill and Melinda Gates Foundation (BMGF), UNICEF, the MacArthur Foundation, and the Government of India.

2.2 Outcome variable:

In this analysis, we compute a composite variable of maternal and child underweight, as an outcome variable. A composite variable that provides four mutually exclusive categories were computed, including

- i) Both mother and child underweight
- ii) Mother underweight but child not underweight
- iii) Mother not underweight but child underweight
- iv) Both mother and child not underweight.

2.3 Independent variables:

This study incorporated several independent variables to assess maternal and child health outcomes. These variables encompassed antenatal care visits (Yes or No), institutional delivery (Yes or No), and postnatal care visits (Yes or No). Additionally, we constructed a composite variable that combined antenatal care (ANC), institutional



delivery, and postnatal care (PNC), resulting in eight distinct and mutually exclusive categories. These categories encompassed None (indicating the absence of all three healthcare components), ANC alone, institutional delivery alone, PNC alone, ANC and institutional delivery, ANC and PNC, institutional delivery and PNC, and finally, the utilization of all three healthcare components (ANC, institutional delivery, and PNC). This comprehensive approach allowed us to thoroughly evaluate the multifaceted aspects of maternal and child health by considering various combinations of healthcare services.

2.4 Methods:

In our study, we employed both descriptive analyses and multinomial logistic regression as analytical tools to investigate the relationships between the utilization of healthcare facilities and the outcome variable of interest. Specifically, multinomial logistic regression analysis was used to find associations between the dependent variables and a set of healthcare variables.

The findings from our analysis are presented in the form of predicted probabilities. These predicted probabilities are derived from the multinomial logistic regression. This analytical approach allows us to provide a comprehensive understanding of the associations between healthcare services and our outcome variables, offering valuable insights into the factors that influence the observed outcomes.

3. RESULT:

Table 1 reveals significant associations between maternal and child nutrition and the frequency of antenatal care (ANC) visits, that is No ANC visit, less than 4 ANC visits, and four or more ANC visits. It is evident that the percentage of both mothers



and children classified as underweight was notably higher (14.01%) among individuals who did not attend any ANC visits during pregnancy, in contrast to those who engaged in partial or complete antenatal care (12.55% and 10.3%, respectively). Furthermore, as the utilization of antenatal care increased, we observed a decrease in the proportion of cases where either the mother or the child was underweight. However, a distinct trend emerged when examining cases where neither the mother nor the child was underweight.

Table 1: Percentage distribution of maternal and child underweight by antenatal care services, India NFHS, 2015-16

Independent variables	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight	Total no of Cases
Antenatal Care					
ANC Visit					
No	14.01	26.47	12.92	46.60	28322
Less than 4	12.55	23.76	13.34	50.36	58257
4 and more	10.30	22.18	11.92	55.60	137610
Natal Care					
Institutional delivery					
No	16.55	28.15	14.17	41.13	53894
Yes	10.71	22.68	12.72	53.89	170295
Postnatal Care					
PNC visit					
No	13.80	25.45	13.88	46.87	66963
Yes	9.72	21.51	12.26	56.50	100409



The study also examined the impact of other healthcare factors on underweight, including the place of childbirth and postnatal care visits. Notably, approximately 10.71% of mothers who gave birth in a hospital or other healthcare institution had both mother and child classified as underweight. This percentage was notably higher among those who did not opt for institutional delivery. Similar patterns were observed in cases where the mother was not underweight, but the child was, and vice versa. Conversely, the percentage of cases where neither the mother nor the child was underweight was higher among those who had utilized institutional delivery services. This trend also extended to the analysis of postnatal care visits.

In addition to antenatal care visits, institutional delivery and post-natal care visits, a factor may influence maternal and child health status. These include the use of supplementary food, health care and nutritional education. Regarding these, the services provided by the Integrated Child Development Services (ICDS) are associated with maternal and child nutritional status. From Table 2, it was found that when people used ICDS services, more mothers and children were underweight, about 13.14% of them. This was more than those who did not use ICDS services. Interestingly, even more mothers and children who got extra food from ICDS were underweight, but this did not show a statistically significant result. Also, about 13.24% of mothers and children were underweight if they got healthcare from ICDS. This was higher than those who did not get healthcare from ICDS.

**Table 2:** Percentage distribution of maternal and child underweight by Anganwadi/ICDS services, India NFHS, 2015-16

Independent variables	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight	Total no of Cases
Received Anganwadi/ICDS services					
No	9.63	23.40	11.36	55.61	78566
Yes	13.14	24.04	13.92	48.92	145509
Supplementary food					
No	12.50	22.06	13.06	52.38	1123
Yes	13.34	24.09	14.04	48.53	115013
Health care					
No	14.40	26.07	13.82	45.71	13551
Yes	13.24	23.64	13.95	49.18	94612
Nutrition education					
No	12.06	24.69	12.81	50.44	11399
Yes	13.47	24.04	14.09	48.40	112773

Table 3 shows a comprehensive overview of the maternal and child health status concerning various combinations of healthcare services. Notably, the percentage of both mothers and children classified as underweight was notably higher (17.60%) among individuals who had not received any of the specified healthcare services. In contrast, for those who had availed themselves of antenatal care (ANC) and natal care, the percentages were comparatively lower at 15.76% and 14.12% respectively. The proportion of cases where both mothers and children were underweight decreased progressively with an increasing number of healthcare services utilized, reaching its lowest point at 9.26% among those who had utilized all three services (ANC, natal



care, and PNC). These trends also extended to cases where the mother was not underweight, but the child was underweight, as well as situations where the mother was underweight but the child was not underweight. Utilizing multiple healthcare services consistently improved health outcomes in these scenarios as well.

Furthermore, our analysis highlighted the effect of the place of residence on maternal and child underweight. In urban areas, approximately 11.74% of mothers and children who had not utilized any healthcare services were underweight. However, for those who accessed natal care, PNC visits, both ANC and natal care, or all three services, the percentages were notably lower at 8.76%, 11.52%, 5.83%, and 5.26%, respectively. These patterns were consistent across all four categories of underweight in urban areas. This highlights the significant impact of healthcare service utilization, particularly when multiple services are combined, on improving the nutritional status of both mothers and children, regardless of their place of residence.

Table 3: Percentage distribution of maternal and child underweight by a combination of antenatal, natal and postnatal care services, India NFHS, 2015-16

Independent variables	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight	Total No of Cases
Total					
None	17.60	29.38	14.36	38.65	13,288
ANC only	15.76	26.66	14.15	43.43	20,617
Natal only	14.12	26.95	14.06	44.87	7,270
PNC only	20.84	28.48	12.59	38.09	346
ANC & Natal	10.86	22.63	13.46	53.05	25,788
ANC & PNC	16.11	23.88	15.35	44.66	2,199
Natal & PNC	12.97	26.55	13.90	46.59	7,418
ANC, Natal & PNC	9.26	21.01	12.05	57.68	90,446



Urban					
None	11.74	31.09	9.97	47.20	1,286
ANC only	11.74	27.48	10.59	50.20	3,047
Natal only	8.76	26.72	10.26	54.26	1,253
PNC only	11.52	34.11	17.52	36.84	51
ANC & Natal	5.83	22.64	10.44	61.10	6,869
ANC & PNC	15.4	23.45	10.52	50.63	464
Natal & PNC	7.67	23.22	11.09	58.02	1,404
ANC, Natal & PNC	5.26	20.16	8.16	66.42	27,631
Rural					
None	18.33	29.17	14.91	37.59	12,002
ANC only	16.57	26.49	14.86	42.08	17,570
Natal only	15.36	27.00	14.94	42.69	6,017
PNC only	22.39	27.54	11.77	38.29	295
ANC & Natal	13.06	22.62	14.78	49.54	18,919
ANC & PNC	16.30	24.00	16.67	43.04	1,735
Natal & PNC	14.43	27.47	14.67	43.44	6,014
ANC, Natal & PNC	11.42	21.47	14.16	52.95	62,815

Table 4 provides valuable insights into the prevalence of maternal and child underweight status in the context of different healthcare service combinations in Empowered Action Group (EAG) states and non-EAG states across India. Among those who did not receive any healthcare services, the overall prevalence of underweight conditions for both mothers and children was 18.99% in EAG states, while it was slightly lower at 16.26% in non-EAG states.

Our analysis revealed a statistically significant association between the combination of healthcare variables and the nutritional status of both mothers and children, irrespective of whether they resided in EAG or non-EAG states in India. Notably, the utilization of healthcare services exhibited a significant negative correlation with underweight conditions among both mothers and children, as well as



either the mother or the children. In simpler terms, those who accessed healthcare services were less likely to be underweight.

Conversely, the same healthcare variable displayed a positive association with being not underweight, meaning that mothers and children who utilized healthcare services were more likely to fall into the category of not underweight. These associations were observed consistently across both EAG and non-EAG states in India.

Table 4: Percentage distribution of maternal and child nutrition by a combination of ANC, Institutional Delivery and PNC services for EAG and Non-EAG states of India.

Independent variables	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight	Total No of Cases
EAG states					
None	18.99	29.7	15.05	36.26	4,470
ANC	17.28	27.2	15.04	40.48	6,188
Natal	15.15	27.78	14.67	42.4	2,512
PNC	29.72	23.27	14.58	32.43	113
ANC & Natal	12.54	22.43	15.18	49.84	6,647
ANC & PNC	16.24	22.18	16.81	44.77	842
Natal & PNC	14.58	28.52	14.25	42.64	2,820
ANC, Natal & PNC	11.03	21.45	13.47	54.05	20,785
Non-EAG states					
None	16.26	29.19	13.73	40.82	8,628
ANC	14.34	26.36	13.51	45.79	13,430
Natal	13.42	26.45	13.62	46.51	4,633
PNC	14.8	31.93	11.17	42.1	221
ANC & Natal	10.03	22.82	12.55	54.6	17,549
ANC & PNC	15.8	25.47	13.89	44.84	1,135
Natal & PNC	11.84	25.3	13.63	49.23	4,334
ANC, Natal & PNC	8.56	21.06	11.47	58.92	59,939



Table 5 provides a comprehensive overview of maternal and child underweight prevalence in 22 major states across India, focusing on the utilization of antenatal care (ANC) visits. The findings reveal distinct variations in underweight rates among different states. Notably, Jharkhand stands out with the highest prevalence of underweight for both mothers and children, reaching 24.17% among those who did not receive ANC care. Chhattisgarh follows closely with a prevalence of 20.77%, while Madhya Pradesh records an underweight prevalence of 17.29% in the same category.

Table 5: Percentage distribution of maternal and child nutrition by antenatal care visit in states of India

States	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight
Andhra Pradesh				
No ANC Visit	10.31	21.66	17.15	50.88
ANC Visit	9.62	21.51	11.15	57.71
Assam				
No ANC Visit	12.76	22.48	15.24	49.51
ANC Visit	10.16	17.79	16.73	55.31
Bihar				
No ANC Visit	16.87	29.85	14.74	38.54
ANC Visit	14.68	25.17	14.98	45.16
Chhattisgarh				
No ANC Visit	20.77	25.02	20.85	33.36
ANC Visit	12.23	24.38	13.91	49.48
Gujarat				
No ANC Visit	15.98	24.15	16.46	43.41
ANC Visit	13.35	23.34	14.17	49.14
Haryana				
No ANC Visit	8.05	27.21	11.10	53.64



ANC Visit	6.00	21.97	9.08	62.96
Himachal Pradesh				
No ANC Visit	7.36	16.13	14.10	62.42
ANC Visit	4.52	15.37	10.01	70.11
Jammu and Kashmir				
No ANC Visit	2.63	17.23	7.74	72.41
ANC Visit	3.08	12.12	7.84	76.95
Jharkhand				
No ANC Visit	24.17	29.71	15.53	30.59
ANC Visit	17.84	26.1	17.03	39.03
Karnataka				
No ANC Visit	8.11	26.65	14.61	50.64
ANC Visit	9.49	24.41	11.85	54.25
Kerala				
No ANC Visit	0	4.10	28.04	67.87
ANC Visit	2.06	14.19	5.92	77.82
Madhya Pradesh				
No ANC Visit	17.29	28.39	14.50	39.82
ANC Visit	14.88	25.27	15.05	44.80
Maharashtra				
No ANC Visit	12.55	28.46	13.54	45.44
ANC Visit	11.85	22.33	14.47	51.35
Delhi				
No ANC Visit	11.83	32.31	4.99	50.87
ANC Visit	3.51	22.82	5.63	68.05
Odisha				
No ANC Visit	16.13	23.00	14.53	46.34
ANC Visit	12.89	20.62	13.98	52.51
Punjab				
No ANC Visit	2.23	16.10	11.43	70.24
ANC Visit	2.90	18.16	8.09	70.85
Rajasthan				
No ANC Visit	16.08	25.27	16.12	42.53



ANC Visit	12.32	22.04	14.53	51.11
Tamil Nadu				
No ANC Visit	5.11	18.06	8.07	68.76
ANC Visit	4.83	18.43	9.08	67.66
Uttar Pradesh				
No ANC Visit	15.37	29.95	13.34	41.34
ANC Visit	10.22	25.89	11.17	52.72
Uttarakhand				
No ANC Visit	7.16	24.01	12.49	56.35
ANC Visit	5.29	18.62	10.28	65.81
West Bengal				
No ANC Visit	15.38	22.08	14.54	48.00
ANC Visit	10.20	19.27	12.64	57.89
Telangana				
No ANC Visit	14.05	23.01	24.71	38.22
ANC Visit	14.05	23.01	24.71	38.22

In contrast, the state of Kerala presents a noteworthy exception, as none of the cases in this region exhibited underweight for either mothers or children among those who did not avail themselves of ANC care. These findings explain the regional disparities in maternal and child underweight prevalence concerning ANC utilization across the 22 major states of India. The clear differences highlight the significance of ANC services in addressing underweight conditions, particularly in states like Jharkhand, Chhattisgarh, and Madhya Pradesh, where the rates are notably higher while highlighting Kerala as a positive outlier in this context.

Table 6 presents the estimated predicted probabilities for each of the four categories, taking into account several independent healthcare variables, including the use of intestinal parasitic drugs, iron and folic acid (IFA) tablets, tetanus toxoid (TT)



injections, mode of delivery, delivery assistance, Anganwadi/Integrated Child Development Services (ICDS) healthcare, nutrition education, and supplementary food. These probabilities were adjusted to understand better the relationships between healthcare services and maternal and child underweight.

Table 6: Predicted probability of maternal and child underweight according to correlates

Independent variables	Both mother and child underweight	Mother not underweight but child underweight	Mother underweight but child not underweight	Both mother and child not underweight
Intestinal parasitic drug				
No	0.129	0.232	0.136	0.503
Yes	0.125	0.244	0.132	0.499
IFA				
No	0.136	0.256	0.135	0.473
Yes	0.126	0.231	0.136	0.507
TT injection				
No	0.122	0.234	0.127	0.517
Yes	0.128	0.235	0.136	0.501
Mode of delivery				
Vaginal	0.136	0.239	0.141	0.483
Caesarean	0.073	0.209	0.103	0.615
Delivery assistance				
None	0.183	0.222	0.124	0.471
doctor	0.107	0.223	0.133	0.537
Nurse/Mid-wife/ANM	0.124	0.235	0.136	0.505
Traditional	0.159	0.246	0.140	0.455
other	0.145	0.250	0.132	0.473
Anganwadi/ICDS health care				
No	0.123	0.236	0.133	0.508
yes	0.129	0.234	0.136	0.501



Nutrition Education				
No	0.092	0.211	0.116	0.581
Yes	0.132	0.237	0.137	0.494
supplementary food				
No	0.115	0.205	0.137	0.543
Yes	0.128	0.235	0.136	0.502
Health care services				
None	0.150	0.261	0.142	0.447
ANC	0.139	0.252	0.131	0.478
Natal	0.166	0.264	0.139	0.431
PNC	0.118	0.329	0.153	0.400
ANC & Natal	0.134	0.237	0.142	0.487
ANC & PNC	0.135	0.236	0.167	0.462
Natal & PNC	0.150	0.281	0.132	0.436
ANC, NC, & PNC	0.119	0.225	0.134	0.523

In general, the analysis revealed that the predicted probability of both the mother and child not being underweight was consistently higher across all types of combinations of healthcare services when compared to the remaining three categories. Specifically, mothers who utilized a combination of three types of healthcare services during pregnancy up to two days after delivery were found to be less likely to have both themselves and their children classified as underweight when compared to those who did not access any of these healthcare services. This difference is evident in the predicted probabilities, with a probability of 0.119 for the former group instead of 0.150 for the latter.

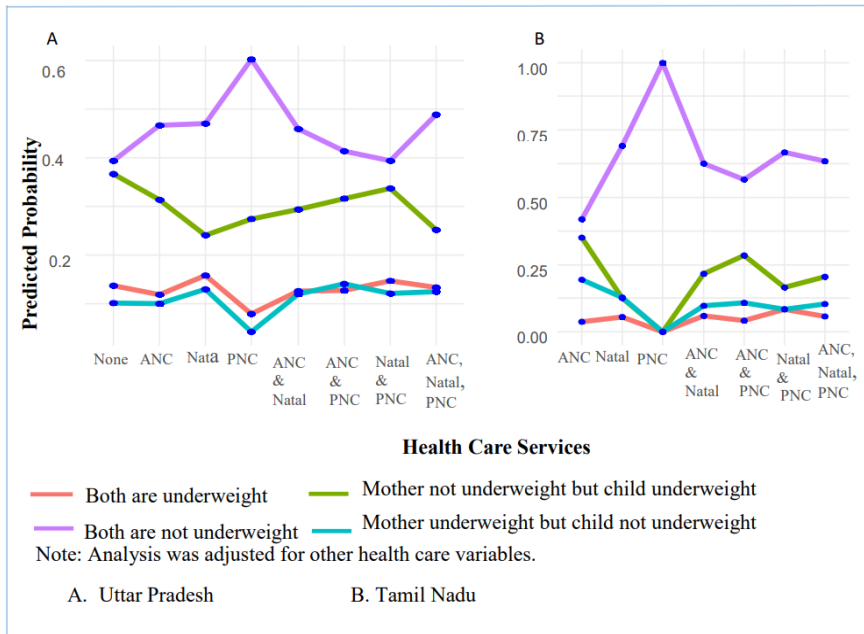


Figure 1: Predicted probability for health care services for the prevalence of maternal and child underweight in two states of India.

The predicted probabilities for four distinct outcomes while accounting for various healthcare variables, specifically within the contexts of two Indian states, namely Uttar Pradesh and Tamil Nadu. These estimated probabilities are visually represented in Figure 1.

In a broader context, it was observed that the predicted probability of a mother being underweight but the child not being underweight for each combination of healthcare services was consistently lower than the probability of both the mother and child being underweight. Furthermore, this probability was lower than that of the mother not being underweight in the case of Uttar Pradesh.



Interestingly, the data showed a distinct pattern in the economically prosperous state of Tamil Nadu. Here, the predicted probability of both the mother and child being underweight for each combination of healthcare services was lower than that of the other three outcomes.

Notably, the probability of each outcome was lowest among individuals who had received all three healthcare services, followed by those who had yet to receive any of the healthcare services. These findings highlight the complex relationship between healthcare service utilization and maternal and child underweight status, highlighting the variations between states with differing economic profiles, such as Uttar Pradesh and Tamil Nadu.

4. DISCUSSION:

In our study, we observed notable associations between the utilization of maternal healthcare services and maternal and child underweight prevalence, as supported by various research findings (Addai, 2000; Gizaw & Gebremedhin, 2018; Khanal et al., 2015).

Specifically, we found that the percentage of both mothers and children classified as underweight was higher (14.01%) among those who had chosen to skip antenatal care (ANC) visits during pregnancy, in contrast to those who had availed themselves of partial and comprehensive antenatal care (12.55% and 10.3%, respectively). This aligns with previous studies that have highlighted the positive impact of ANC on maternal and child health (Chuku, 2008; Khanal et al., 2015).



The study also revealed that various other healthcare factors were associated with underweight, including the place of childbirth and postnatal care visits (Azzaz et al., 2016; Timyan et al., 2018).

For instance, we observed that 10.71% of mothers who had experienced institutional deliveries had both themselves and their children categorized as underweight. This proportion was even higher among those who chose deliveries outside healthcare institutions. These findings highlight the significance of facility-based deliveries in promoting maternal and child health (Girma & Genebo, 2002).

Furthermore, the study identified that poor utilization of healthcare services, such as a reduced number of ANC visits, limited consumption of iron and folic acid (IFA), as well as the absence of institutional deliveries and postnatal care, were all associated with adverse maternal and child health outcomes (Gizaw & Gebremedhin, 2018; Khanal et al., 2015; Cogswell et al., 2006).

Notably, the majority (17.6%) of mothers and children who had not utilized any healthcare services were classified as underweight. However, we observed a decline in the proportion of underweight cases with an increasing level of engagement with healthcare services. These findings emphasize the critical role of healthcare utilization in mitigating underweight conditions (Christian et al., 2004).

Our research also revealed regional disparities, with a higher prevalence of underweight mothers and children (18.33%) in rural areas among those without healthcare services. Additionally, a comparison between Empowered Action Group (EAG) and non-EAG states showed slightly higher underweight rates in EAG states (18.99%) compared to non-EAG states (16.29%). This disparity, though minor,



highlights the need for targeted interventions in EAG states to improve maternal and child health outcomes (Rahman et al., 2016).

Furthermore, this study highlighted significant variations in maternal and child health outcomes across different Indian states, particularly concerning the utilization of antenatal care services (Falkingham, 2003). These findings highlight the importance of adapting healthcare interventions to specific regional contexts and healthcare service utilization patterns (Celik & Hotchkiss, 2000).

Surprisingly, we found that more mothers and children were underweight when they used ICDS services compared to those who did not. Also, it was interesting to see that when people got extra food from ICDS, there were still more underweight cases, but this difference was not big enough to be considered significant. We also noticed that when both mothers and children were underweight, it was more common among those who got healthcare from ICDS. However, this difference was not very big when we compared it to those who did not get healthcare from ICDS.

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