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Unveiling The Burden of Anaemia: Socio-Demographic and Obstetric Determinants Among Pregnant Women in Mehsana District, Gujarat

Nitin A Lodha[1], Hitesh L Bhabhor[2], Ullas H Bhabhor[3], Jayna D Devalia[4*], Jatin D Chhaya[5]

[1]Department of Community Medicine, Nootan Medical College and Research Centre, Visnagar, India
[2,5]Department of Community Medicine, GMERS Medical College, Navsari, India
[3]Department of Microbiology, Government Medical College, Bhavnagar, India
[4]Department of Physiology, GMERS Medical College, Valsad, India

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***Corresponding author**:
Dr. Jayna Devalia
(Email: jaynadevalia@gmail.com)

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ABSTRACT

Background: Anemia is a leading contributor to maternal mortality in India. Early identification and timely intervention during pregnancy can help prevent adverse health outcomes. This study aimed to estimate the prevalence of anaemia among pregnant women and identify associated socio-demographic and obstetric factors.

Methodology: A cross-sectional observational study was conducted among pregnant women. Based on a reported prevalence of 62.6% from NFHS-5 data, a sample size of 239 was calculated. For simplicity and completeness, a total of 250 samples were included in the study. Participants were selected using systematic random sampling, and data were collected using a pretested proforma from Obstretic and Gynecology OPD. Descriptive statistics were applied to determine the prevalence and severity of anaemia, and statistical tests were conducted to assess associations.

Results: The prevalence of anaemia among pregnant women was 78.8%. Moderate anaemia was observed in 66.5% of cases, mild anaemia in 28.9%, and severe anaemia in 4.6%. Significant associations were found between anaemia and factors such as education level, locality, social class, husband's education, pregnancy interval, and complications in previous pregnancies.

Conclusions: A high prevalence of anaemia was observed among pregnant women, with multiple contributing factors identified. Comprehensive interventions, including counselling, screening, and health education, are recommended to address and reduce the high burden of anaemia in this population.

Keywords: Anaemia, Determinants, Pregnancy, Prevalence

INTRODUCTION

Anaemia, characterized by a decreased concentration of haemoglobin, is one of the most prevalent nutritional deficiency disorders globally, affecting over a quarter of the world's population. It remains a significant public health problem impacting all age groups, with the highest prevalence observed among children under five and pregnant women.[1] Among pregnant women, anaemia is especially common, with a prevalence of 14% in devel-

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oped countries, 51% in developing countries, and between 65% to 75% in India. This condition is a major contributor to maternal mortality in India, responsible for about 80% of the anaemia-related maternal deaths in Southeast Asia.[2]

Anaemia contributes to maternal deaths caused by complications such as hemorrhage, septicemia, and eclampsia, and in severe cases, it can lead to cardiac arrest. Anaemic women are also more vulnerable to communicable diseases like tuberculosis (TB) and malaria, which carry further risks for adverse pregnancy outcomes.[3] Additionally, iron deficiency anaemia in pregnant women is associated with preterm delivery, low birth weight, and increased perinatal and neonatal mortality. The impact of anaemia is exacerbated by a cycle of malnutrition, multiple pregnancies, and socio-economic challenges. Women experiencing anaemia during pregnancy often attempt multiple pregnancies to increase the chances of child survival, which can further strain maternal health and contribute to poor maternal and infant outcomes.[4-6]

Various cultural practices and socio-economic factors intensify the prevalence and severity of anaemia in pregnant women, particularly in rural India. Customs such as open-air defecation, eating last in the family, walking barefoot, early marriage, and teenage pregnancy contribute to higher rates of anaemia. These factors, combined with poverty, illiteracy, and unemployment, worsen the condition in affected populations.[7] Despite the fact that anaemia in pregnancy is largely preventable and treatable if identified early, it continues to be a leading cause of morbidity and mortality in India.[8] Socio-demographic barriers present significant challenges to prevention and treatment efforts, underscoring the need for a better understanding of these factors to effectively address anaemia in pregnancy.[9]

Anaemia during pregnancy poses serious risks, leading to maternal and fetal complications such as low birth weight, infant mortality, and increased maternal mortality. Early identification of anaemia, especially in the first trimester, followed by timely preventive or therapeutic interventions, could significantly reduce these adverse outcomes. Routine anaemia screening for pregnant women is therefore recommended.[10]

In this context, the present study aims to estimate the prevalence of anaemia among pregnant women and to identify the socio-demographic and obstetric determinants associated with this condition. The findings of this study can help formulate targeted, multi-faceted strategies to control anaemia in pregnancy. Additionally, the study aims to raise awareness among pregnant women, encouraging them to adopt healthier behaviors and lifestyles to mitigate the risk of anaemia.

The study was conducted to estimate the prevalence of anaemia among pregnant women attending a tertiary care hospital and also to identify and analyze the socio-demographic and obstetric determinants associated with anaemia in this population.

MATERIALS AND METHODS

Study Design: A cross-sectional observational study was conducted among pregnant women attending antenatal check-ups at a tertiary care hospital during the study period.

Sample Size and Sampling Technique: According to NFHS-5 data, the prevalence of anaemia among pregnant women aged 15–49 years in Gujarat is 62.6%.[11] Based on this prevalence, with a 95% confidence interval and a precision of 10%, the required sample size was calculated to be approximately 239; to simplify, a total of 250 participants were included. The study was carried out over three months, from June to August 2021. A systematic random sampling technique was employed to select pregnant women attending the Obstetric OPD for antenatal check-ups.

Inclusion and Exclusion Criteria: Inclusion criteria: All pregnant women visiting the antenatal clinic at the tertiary care hospital during the study period were included at regular interval.

Exclusion criteria: Pregnant women who were severely ill, unwilling to participate, or taking therapeutic doses of iron and folic acid were excluded from the study.

Data collection: Data were collected through an oral questionnaire administered using a pre-designed and pre-tested semi-structured proforma. Participants were informed about the study's purpose and potential benefits to help them make an informed decision regarding their participation. They were also told that participation was entirely voluntary, and they retained the right to withdraw from the study or discontinue the interview at any point.

Data were gathered on various independent variables, including socio-demographic factors, literacy, and the number of antenatal visits. Reproductive details such as gravidity, age at first pregnancy, and birth interval were also recorded. Additionally, participants were asked whether they had taken iron-folic acid tablets during the current pregnancy. The haemoglobin level for each participant was obtained from the "Mamta Card" or other documented health records.

Anaemia Classification: Anaemia was defined as a hemoglobin level of less than 11 mg/dl. The classification of anaemia severity, following the guidelines of the Indian Council of Medical Research, was as follows:[12] a) Mild anaemia: Haemoglobin 10.0–10.9 mg/dl; b) Moderate anaemia: Haemoglobin 7.0–10.0 mg/dl; c) Severe anaemia: Haemoglobin less than 7 mg/dl; and d) Very severe anaemia: Haemoglobin less than 4 mg/dl

Data Analysis: The data were analyzed using MS Excel and Epi Info software. Descriptive statistics, expressed as percentages, were used to present the prevalence and severity of anaemia. To assess the association between anaemia and its etiological factors, Chi-square tests, Z-tests, and odds ratios were applied. A p-value of ≤ 0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Institutional Ethical Committee. Written informed consent was obtained from all participants before data collection, and they were assured of the confidentiality and privacy of their records.

Approval of Institutional Ethical Committee was sought before the start of the study (Approval letter Number: GMERS/MCG/IECHR/Approval/2967/2021)

RESULTS

A total of 250 pregnant women were enrolled in the study. The age distribution of the participants revealed that 45.2% were in the 15–24 years age group, 49.6% were in the 25–34 years age group, and 5.2% were aged over 34 years. The mean age of the participants was 25.08 ± 4.17 years. The majority of the pregnant women were Hindu (81.6%), while 18.4% were Muslim. Regarding educational status, 18% of participants were illiterate, 71.2% had education up to primary school, 8.4% had education up to secondary school, and only 2.4% were graduates or above. The majority of the participants resided in rural areas (84%), and 69.2% of them lived in joint families. In terms of socio-economic status, most participants belonged to class IV (63.6%). Additionally, 92.4% of the women were housewives. Regarding their body mass index (BMI), 44.4% of the women had a normal BMI, 31.6% were overweight, 6.8% were obese, and 17.2% were underweight (Table 1).

The prevalence of anaemia among the pregnant women was found to be 78.8%. Among these women, the majority (66.5%) had moderate anaemia, 28.9% had mild anaemia, and 4.6% were classified as severely anaemic (Table 2).

The association between anaemia and various socio-demographic factors was examined in the study (Table 3).

The prevalence of anaemia was highest in the 25-34 years age group, with 50.3% of women in this group being anaemic. This was followed by 44.1% in the 15-24 years age group and 5.6% in the >34 years age group. However, statistical analysis showed no significant association between anaemia and age (χ^2 = 0.564, P = 0.754). Anaemia was slightly more prevalent among Hindu women (82.7%) than Muslim women (17.3%), but the difference was not statistically significant (χ^2 = 0.487, P = 0.485). A significant association was found between anaemia and the level of education (χ^2 = 9.18, P = 0.027). Anaemia was most prevalent among illiterate women (18.3%), followed by those with primary education (71.1%). Among those with secondary or higher education, the prevalence of anaemia was lower, with 9.6% in secondary education and 1.0% among graduates and above.

A significant difference in anaemia prevalence was found between rural and urban women (χ^2 = 14.49, P = 0.0001). A higher proportion of rural women (88.8%) were anaemic compared to 11.2% in the urban population. No significant association was found between anaemia and family type (χ^2 = 0.896, P = 0.343), though a higher proportion of anaemic women were in joint family (64.5%).

Table 1: Socio-demographic and Lifestyle Characteristics of Study Participants (N=250)

Variable	Women (%)
Age Group (years)	
15–24	113 (45.2)
25–34	124 (49.6)
>34	13 (5.2)
Religion	
Hindu	204 (81.6)
Muslim	46 (18.4)
Education Level	
Illiterate	45 (18)
Up to Primary	178 (71.2)
Up to Secondary	21 (8.4)
Graduate and above	6 (2.4)
Locality	
Rural	210 (84)
Urban	40 (16)
Type of Family	
Joint Family	173 (69.2)
Nuclear	77 (30.8)
Socio-Economic Class	
Class I	9 (3.6)
Class II	10 (4)
Class III	32 (12.8)
Class IV	159 (63.6)
Class V	40 (16)
Occupation	
Housewife	231 (92.4)
Working	19 (7.6)
Type of Diet	
Vegetarian	196 (78.4)
Mixed	54 (21.6)
Body Mass Index (BMI, Kg/m²)	
Underweight (<18.5)	43 (17.2)
Normal (18.5–24.9)	111 (44.4)
Overweight/pre-obese (25–29.9)	79 (31.6)
Obese (≥30)	17 (6.8)

Table 2. Prevalence and Severity of Anaemia among Pregnant Women (N=250)

Category	Women (%)
Anaemia Status	
Yes	197 (78.8)
No	53 (21.2)
Severity of Anaemia	
Mild	57 (28.9)
Moderate	131 (66.5)
Severe	9 (4.6)
Total	250 (100)

A significant association was found between anaemia and social class (χ^2 = 13.067, P = 0.011). The highest prevalence of anaemia was observed in women belonging to social class IV (67.0%), followed by those in class V (16.7%). In contrast, women in higher social classes (I and II) had lower prevalence rates of anaemia. Anaemia prevalence was significantly associated with the education level of the husband (χ^2 = 4.31, P = 0.0379). Women whose husbands had lower educational levels (illiterate or up to primary school) had higher rates of anaemia compared to those whose husbands had secondary or higher education.

There was no statistically significant association between the type of diet (vegetarian or mixed) and anaemia (χ^2 = 4.31, P = 0.127), though a slightly higher proportion of anaemic women were vegetarians (80.7%). There was no significant relationship between anaemia and BMI (χ^2 = 2.865, P = 0.412). Anaemia was present in 18.8% of underweight women, 44.7% of women with normal weight, 29.4% of overweight/pre-obese women, and 7.1% of obese women.

The association between obstetric determinants and anaemia in pregnant women was assessed in this study (Table 4). Among the different parity groups, anaemia was most prevalent in women with gravida 2 (49.2%), followed by primi gravida (32%) and women with more than two pregnancies (18.8%). However, no statistically significant association was observed between parity and the prevalence of anaemia (χ^2 = 2.504, p = 0.286). It was found to be a significant factor (p < 0.0001) associated with anaemia. The women who had a pregnancy interval of three years or less were more to be an anaemic (82.8%), compared to a woman with a pregnancy interval greater than three years (17,2%). This suggests that shorter pregnancy intervals are more likely to be associated with anaemia.

Anaemia was more prevalent in women in their third trimester (56.3%), followed by those in their second trimester (24.4%) and first trimester (19.3%). However, the association between trimester and anaemia was not statistically significant separately (χ^2 = 4.113, p = 0.1279).

Table 3: Association of Socio-demographic Factors with Anaemia in Pregnant Women (N=250)

Socio-Demographic Profile	Anaemia (n = 197) (%)	No Anaemia (n = 53) (%)	Total (N = 250)	Statistical Significance
Age Group (years)				χ^2 = 0.564, P = 0.754
15–24	87 (44.1)	26 (49.0)	113 (45.2)	
25–34	99 (50.3)	25 (47.2)	124 (49.6)	
>34	11 (5.6)	2 (3.8)	13 (5.2)	
Religion				χ^2 = 0.487, P = 0.485
Hindu	163 (82.7)	41 (77.4)	204 (81.6)	
Muslim	34 (17.3)	12 (22.6)	46 (18.4)	
Education Level				χ^2 = 9.18, P = 0.027
Illiterate	36 (18.3)	9 (17.0)	45 (18.0)	
Up to Primary	140 (71.1)	38 (71.7)	178 (71.2)	
Up to Secondary	19 (9.6)	2 (3.8)	21 (8.4)	
Graduate and above	2 (1.0)	4 (7.5)	6 (2.4)	
Locality				χ^2 = 14.49, P = 0.0001
Rural	175 (88.8)	35 (66.0)	210 (84.0)	
Urban	22 (11.2)	18 (34.0)	40 (16.0)	
Type of Family				χ^2 = 0.896, P = 0.343
Joint Family	113 (64.5)	40 (75.5)	173 (69.2)	
Nuclear	64 (32.5)	13 (24.5)	77 (30.8)	
Social Class				χ^2 = 13.067, P = 0.011
I	4 (2.0)	5 (9.4)	9 (3.6)	
II	5 (2.5)	5 (9.4)	10 (4.0)	
III	25 (12.7)	7 (13.2)	32 (12.8)	
IV	132 (67.0)	27 (50.9)	159 (63.6)	
V	31 (16.7)	9 (17.0)	40 (16.0)	
Husband's Education				χ^2 = 4.31, P = 0.0379
Illiterate	12 (6.1)	2 (3.8)	14 (5.6)	
Up to Primary	121 (61.4)	29 (50.7)	150 (60.0)	
Up to Secondary	60 (30.5)	16 (30.2)	76 (30.4)	
Graduate and above	4 (2.0)	6 (11.3)	10 (4.0)	
Type of Diet				χ^2 = 4.31, P = 0.127
Vegetarian	159 (80.7)	37 (69.8)	196 (78.4)	
Mixed	38 (19.3)	16 (30.2)	54 (21.6)	
BMI (kg/m²)				χ^2 = 2.865, P = 0.412
Underweight	37 (18.8)	6 (11.3)	43 (17.2)	
Normal	88 (44.7)	23 (43.4)	111 (44.4)	
Overweight/pre-obese	58 (29.4)	21 (39.6)	79 (31.6)	
Obese	14 (7.1)	3 (5.7)	17 (6.8)	

Table 4: Obstetric Determinants Associated with Anaemia in Pregnant Women (N = 250)

Obstetric Determinants	Anaemia (n = 197) (%)	No Anaemia (n = 53)	Total (N = 250)	Statistical Significance
Parity				$\chi^2 = 2.504$, P = 0.286
Primi gravid	63 (32.0)	22 (41.5)	85 (34.0)	
Gravida 2	97 (49.2)	25 (47.2)	122 (48.8)	
Gravida >2	37 (18.8)	6 (11.3)	43 (17.2)	
Pregnancy Interval (n = 165)				$\chi^2 = 37.936$, P < 0.0001
≤3 years	111 (82.8)	8 (25.8)	119 (72.1)	
>3 years	23 (17.2)	23 (74.2)	46 (27.9)	
Duration of Pregnancy				$\chi^2 = 4.113$, P = 0.1279
First Trimester	38 (19.3)	7 (13.2)	45 (18.0)	
Second Trimester	48 (24.4)	8 (15.1)	56 (22.4)	
Third Trimester	111 (56.3)	38 (71.7)	149 (59.6)	
Types of Previous Delivery				$\chi^2 = 0.04$, P = 0.841
Normal	121 (90.3)	27 (87.1)	148 (89.7)	
Caesarean	13 (9.7)	4 (12.9)	17 (10.3)	
Complications in Previous Pregnancy				$\chi^2 = 9.07$, P = 0.0026
No	21 (15.7)	13 (41.9)	34 (20.6)	
Yes	113 (84.3)	18 (58.1)	131 (79.4)	

Table 5: Logistic Regression Analysis of Independent Risk Factors Associated with Anaemia in Pregnant Women (N=250)

Determinant Factors	No Anaemia (n=53) (%)	Anaemia (n=197) (%)	Odds Ratio (OR)	95% Confidence Interval (CI)	P Value
Age					
>35 years	51 (96.23)	186 (94.42)	0.663	0.142–3.08	0.600
<35 years	2 (3.77)	11 (5.58)	Ref		
Locality					
Rural	35 (66.04)	175 (88.83)	1.8094	0.910–3.589	0.0897
Urban	18 (33.96)	22 (11.17)	Ref		
Education					
Illiterate	9 (16.98)	36 (18.27)	1.093	0.489–2.44	0.827
Literate	44 (83.02)	161 (81.73)	Ref		
Working Status					
Housewife	47 (88.68)	184 (93.4)	1.806	0.652–5.00	0.2552
Working	6 (11.32)	13 (6.6)	Ref		
Family Type					
Joint Family	40 (75.47)	133 (67.51)	0.675	0.337–1.350	0.267
Nuclear Family	13 (24.53)	64 (32.49)	Ref		
Parity					
Primi	22 (41.51)	63 (31.98)	0.662	0.355–1.235	0.195
Multipara	31 (58.49)	134 (68.02)	Ref		
Duration of Pregnancy					
1st and 2nd Trimester	15 (28.3)	86 (43.65)	1.962	1.013–3.80	0.045
3rd Trimester	38 (71.7)	111 (56.35)	Ref		
Pregnancy Interval					
≤3 years	8 (15.09)	111 (56.35)	13.875	5.522–34.86	<0.0001
>3 years	23 (43.4)	23 (11.68)	Ref		
Types of Previous Delivery					
Normal	27 (50.94)	121 (61.42)	1.378	0.417–4.559	0.598
Caesarean	4 (7.55)	13 (6.6)	Ref		

The type of delivery (normal versus caesarean) did not show a significant association with anaemia ($\chi^2 = 0.04$, p = 0.841). Lastly, a significant association was observed between complications in previous pregnancies and anaemia (p = 0.0026). Women who had complications in previous pregnancies were less likely to be anaemic (15.7%) compared to those without any complications (84.3%).

Logistic regression analysis identified significant associations between anaemia and certain obstetric factors. A shorter pregnancy interval (≤3 years) was strongly

associated with increased odds of anaemia (OR: 13.875, p < 0.0001). The analysis also showed that women in the first and second trimesters had higher odds of anaemia compared to those in the third trimester (OR: 1.962, p = 0.045). Other factors, such as age, education, working status, family type, parity, and previous delivery type, were not significantly associated with anaemia.

DISCUSSION

Anaemia is one of the most prevalent nutritional deficiencies globally, with the World Health Organization (WHO) estimating its prevalence at 14% in developed countries, 51% in developing countries, and a significantly higher rate of 65-75% in India.[13] In the present study, the prevalence of anaemia among antenatal women was found to be 78.8%, with 28.9% of women having mild anaemia, 66.5% moderate anaemia, and 4.6% severe anaemia. This finding is consistent with previous research, such as Dutta et al.'s study, which reported a similarly high prevalence of 82.17%.[7] However, Siddalingappa et al. reported a lower prevalence of 62.4%, which contrasts with the present study's findings.[14] In line with our results, Khan et al. found a prevalence of 84.9% in their study, with 32.3% of cases being mild, 46.6% moderate, and 6% severe.[9] The variations in prevalence rates across different studies can be attributed to factors such as geographical differences, socio-economic conditions, dietary patterns, healthcare access, and regional variations in maternal nutrition.

In terms of age distribution, the current study revealed that the majority of anaemic women (49.6%) were in the 25-34 years age group, which is considered the primary reproductive age group. This aligns with findings by Khan et al., who observed a higher prevalence of anaemia in pregnant women over 25 years of age. Similarly, Abiselvi et al. reported that 48.5% of anaemic women were aged 15-24 years. The higher prevalence in the 25-34 age group in our study could be due to factors such as repeated pregnancies, insufficient dietary intake, and cumulative iron deficiency, all of which contribute to the development of anaemia.[9,15]

The prevalence of anaemia was notably higher among study participants with lower levels of education. Specifically, 18% of pregnant women were illiterate, 71.2% had only primary-level education, 8.4% had reached secondary education, and only 2.4% were graduates or above. These findings are in line with previous studies, including those by Siddalingappa et al. and Dutta et al., which also reported a significant association between low education levels and anaemia prevalence.[7,14] Similar trends were noted by Kaul et al. and Rai et al., indicating that pregnant women with limited education may lack awareness about the importance of regular antenatal care (ANC) check-ups and available health services, which may contribute to higher anaemia rates.[10,16]

In addition to women's education, the education level of their husbands also showed a statistically significant relationship with anaemia prevalence. This suggests that spousal support and awareness about maternal health can play an important role in reducing anaemia risk among pregnant women.

Socioeconomic status was another significant factor associated with anaemia. The majority of participants in this study were from lower socioeconomic backgrounds, with 63.6% in class IV status, and 92.4% were housewives. Although Balkrishna et al. also observed a high number of housewives among their study population, the participants were primarily from higher socioeconomic classes (I and II).[1] Lower socioeconomic status may impact dietary quality and healthcare access, making it an important risk factor for anaemia. This association is consistent with findings from Kaul et al. and Rai et al., where lower socioeconomic status correlated with a higher prevalence of anaemia.[10,16]

This study found a significantly higher prevalence of anaemia among rural participants (88.8%) compared to urban counterparts. Similar findings were reported by Mangla et al., Agarwal K et al., and Rajaratnam et al., who also noted a high prevalence of anaemia among rural populations, with rates reaching 91% and 69.3%, respectively.[17,18,19] Contributing factors in rural areas may include limited autonomy regarding marriage and reproductive decisions, limited access to healthcare, and greater challenges in obtaining a nutritious diet.

Obstetric determinants revealed that while anaemia prevalence did not significantly vary by parity, it was slightly higher among primigravida women (34%) compared to those with higher parity.[17] Most participants (59.6%) were in their third trimester, though anaemia rates were actually more pronounced in the first and second trimesters, consistent with studies by Abiselvi et al. and Kumar et al.[15,20]

Among women who had experienced previous pregnancies, a significant association was found between short pregnancy intervals (≤ 3 years) and anaemia, with 82.8% of this group being anaemic. These findings align with Suryanarayana et al., who also reported high anaemia rates among women with intervals of less than two years.[21] Complications in previous pregnancies were also significantly linked to anaemia prevalence. Addressing these challenges may require targeted health education programs for adolescent girls and women on literacy, antenatal care, healthcare service utilization, and the importance of family spacing.

CONCLUSION AND RECOMMENDATIONS

In conclusion, despite existing programs, anaemia prevalence remains high among pregnant women, highlighting a need for intensified efforts in prevention and control. Early detection and treatment are essential to reduce pregnancy complications, and healthcare providers should investigate the underlying causes of anaemia in pregnant women, beyond standard iron and folate supplementation. Key measures include routine anaemia

screening, iron supplementation, targeted food fortification, and efficient implementation of anaemia-control programs. Given the association of anaemia with factors such as literacy, socioeconomic status, pregnancy spacing, and previous pregnancy complications, interventions should focus on these high-risk groups. Community-based initiatives, including health education on reproductive health and anemia screening, alongside ante-natal counselling by trained health workers, are critical. Additionally, integrating these risk factors into the National Health Policy as key indicators could improve long-term outcomes.

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