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Original Research Article

Predictors of immediate postpartum anemia among singleton postpartum women, Dire Dawas, Ethiopia: hospital based cross sectional study

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ABSTRACT

Background: Immediate postpartum anemia is a condition where hemoglobin concentrations are lower than normal, which complicates maternal lives, including death. But so far, studies across Ethiopia have been inconsistent and lacking in the study area. Therefore, this study was aimed at assessing the magnitude and predictors of immediate postpartum anemia among singleton postpartum women which could help in interventions.
Methods: A cross-sectional study was conducted in May 2022 in the public hospitals in Dire Dawa, Ethiopia. Participants were selected using a systematic random sampling technique. Data were collected using a structured questionnaire and medical card review, entered into EPI DATA (version 3.1) and analyzed using statistical package for the social sciences (SPSS) (version 22). A p value of 0.05 or less at multivariate with 95% confidence intervals was considered statistically significant.
Results: Of 476 participants, 26.9% had immediate postpartum anemia and significantly associated with lack of formal education (AOR=3.01, 95% CI: 1.12–8.08), unemployment (AOR=2.72, 95% CI: 1.02–7.21), number of ANC visits (AOR=2.40, 95% CI: 1.32–4.30), instrumental delivery (AOR=3.70, 95% CI: 1.952–6.86), pre-delivery anemia (AOR=2.96, 95% CI: 1.48–5.91), gastro-intestinal parasites (AOR=3.23, 95% CI: 1.37–7.59), low dietary diversity (AOR=3.10, 95% CI: 1.65–5.79), and no iron supplementation during pregnancy (AOR=2.69, 95% CI:1.10–6.58).
Conclusions: Almost one in four singleton postpartum women had immediate postpartum anemia. Findings indicate a public health problem and interventions need on risk factors.

Keywords: Immediate postpartum anemia, Singleton postpartum-women, Postpartum

INTRODUCTION

According to the World Health Organization and other studies, anemia is defined as a condition in which hemoglobin concentration and/or red blood cell (RBC) numbers are lower than normal and insufficient to meet an individual's physiological needs.[1-3]

Anemia can exist wherever there is its risk factors regardless of age and sex but common in pregnant women and children.[4,5] Blood loss and loss of excess fluid from body tissues after delivery different in amount among individuals, which have a major effect on maternal hemoglobin (Hgb) concentration.[6,7] As a result, postpartum anemia (PPA) lacks a single consensus definition, but clinically, depending on the duration of postpartum period, PPA can be defined as Hgb <10 g/dl, Hgb <11 g/dl and Hgb <12 g/dl cut-off values within the first 24-48 hours, at 1 week and 6 weeks of postpartum duration respectively.[8-10] Immediate PPA should be considered if Hgb concentration is <10 g/dl and severe if Hgb <7 g/dl and it can be confirmed by measurement of Hgb concentration within the first 24-48 hours of postpartum period.[11] However, there is considerable

variation in the exact concentration that defines anemia and the time after birth at which it should be measured.[6,12,13]

Anemia is common during postpartum period characterized by having multifactorial origin.[14,15] Although most maternal and infant deaths occur during this time, it is among neglected period for the provision of quality of maternal care, especially in low resource setting countries.[15-18]

Globally, anemia including PPA affects one third of world's population and over 800 million women and children.[19-21] Moreover, severe PPA can increase maternal mortality by three folds during postpartum period.[22] Anemia in post-delivery women has complications, decreases work productivity, increases risks of postpartum hemorrhage (PPH) renal failure, disseminated intravascular coagulation and maternal death.[5,22-24] In Ethiopia, the most reported indirect causes of maternal death was anemia (10.39%).[25] Besides, consequences of postpartum anemia is associated with an impaired quality of life, reduced cognitive abilities, emotional instability, and depression which negatively affect mother-infant bonding.[6]

Despite World Health Organization (WHO) global nutrition target 2 reduction of anemia by 50% among women of reproductive age by 2025, none of the countries were on the track of the target particularly in Africa including Ethiopia.[26] Hence, the burden of anemia including PPA remains persistently high in many regions of the world.[27] Thus, an increase focus on identifying magnitude and contributing factors of anemia. is needed to know area of intervention.

In Ethiopia few studies conducted on postpartum anemia in different interval of time within 42 days after delivery but they are community-based studies. However, maternity ward is an important window of opportunity for anemia diagnosis and medical intervention for postpartum women.[28] Thus, facility-based study of magnitude and associated factors of IPPA in early postpartum period is crucial for correctly identification of associated factors on time, to provide appropriate intervention and anemia prevention before further complications occur and for success of anemia control program. However, little information is available about IPPA in the study area. Therefore, this study was aimed at assessing the magnitude and predictors of immediate postpartum anemia among singleton postpartum women which could help in interventions.

METHODS

Study setting and design

A facility-based, cross-sectional study was conducted from 01 May to 30 May 2022 in two public hospitals in Dire Dawa Administration, eastern Ethiopia, which is located 515 kilometers from Addis Ababa, the capital city of Ethiopia. According to 2020 population projections, 506,000 people live in Dire Dawa Administration (68% estimated to be urban inhabitants) and have 38 rural and 9 urban kebeles (smallest administrative units). This administration has six hospitals, including public and 4 private.[29]

Study subjects and exclusion criteria

We included all singleton postpartum women who were admitted at maternity ward within the first 48 hours of delivery. However, women who were delivered by cesarean hysterectomy or laparotomy after uterine rupture, women who were critically ill, known anemia before conception, who had blood transfusion both during intrapartum and postpartum period were excluded to reduce over estimation of IPPA.

Sample size and sampling procedure

The sample size was determined using a single population proportion formula considering the following assumptions: standard normal distribution (z=1.96), 95% level of significance, 4% margin of error (to obtain the maximum sample), prevalence=24.3% and 10% non-response rate and the final sample size became 486.[17] A systematic random sampling technique was used to get all 476 study participants. The K^{th} interval for both selected hospitals was ≈2 (633/486=1.3≈2). Two public hospitals (Dilchora referral (DRH) and Sabiyan general (SGH)) were included based on their high number of maternity ward admission services and sample size was proportionately allocated to each after taking consideration of monthly maternity admission average from health management and information system (HMIS) report of each hospital (Figure 1).

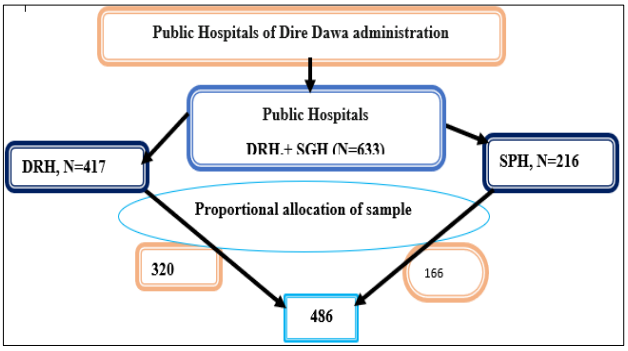

Figure 1: Diagram presentation of sample size allocation for the study in the Dire Dawa administration, Ethiopia, 2022.

DRH=Dilchora referral hospital, SGH=Sabian general hospital

Data collection tools and procedures

Data were collected using a pre-tested structured questionnaire adapted and modified from different studies to suit local context.[15,17] The questionnaire was translated

from English into local languages (Afaan Oromo and Amharic). It was then translated back into English to maintain consistency. The questionnaire contained four main parts, socio-demographic, obstetrics, and dietary-nutrition and comorbid illness characteristics. Data were collected through face-to-face interviews and medical card review with eight trained diploma Nurses and Midwives, and two supervisors checked and monitored the data collection process daily.

Food insecurity status was measured using the household food insecurity access scale (HFIAS) recommended by food and nutrition technical assistance to stratify individuals as food secure and food insecure. It consists of nine occurrence questions that represent a generally increasing level of severity of food insecurity (access), and nine "frequency-of occurrence" questions that were asked as a follow-up to each occurrence question to determine how often the condition occurred. It is valid and reliable in Ethiopia as measured by Cronbach's alpha value of 0.85 for both rural and urban samples.

Dietary diversity developed as a proxy indicator to reflect the micronutrient adequacy of women's diets. Ten food groups or foods recommended by USAID-FANTA to classify individuals or households as lower or higher dietary diversity if at least consumed five and less than five of ten food groups. Dietary diversity can act as an alternative indicator of food security. Research has shown that a more diversified diet is associated with improved hemoglobin concentrations.

Hemoglobin concentration was determined by using automated blood analyzer Cell-Dyne1800 (Abbot Laboratories Diagnostic Division, USA) by laboratory technologist. MUAC was measured via tape measures on non-dominant hand and the result was interpreted to the UNICEF and WHO recommendation cutoff point less than 23 cm as undernourished and 23 cm or more as well nourished.

Operational definitions

Postnatal period

Time from the birth of the baby and extends up to six weeks (42 days) after birth.

Immediate postpartum anemia

Immediate postpartum anemia is usually clinically defined by hemoglobin <10 gm/dl within the first 48 hours of postpartum.

Food insecurity

Food insecurity is a lack of consistent access to sufficient amount, healthy, nutritious and culturally appropriate food for every person in a household due to lack of money and other resources to live an active, healthy life. It is measured by household food insecurity access scale (HFIAS) based on nine occurrence questions which developed by NATA and validated in Ethiopia. It categorized as food secure if the women scored two or less affirmative (yes) answers and, and food insecure if the women scored more than two affirmative (yes) answers.

Dietary diversity

Dietary diversity is the number of different foods and food groups consumed over a given reference period. This does not include food group consumed outside the home. It can be classified as: high food diversity if the women consumed five or more food groups out of ten food groups within 24 hours, and low food diversity if women consumed less than five food groups out of ten food groups within 24 hours.

Upper arm circumference

It was measured to the nearest 0.1 cm using flexible and non-stretchable measuring tapes following the standard procedures. Pregnant women were considered under-nourished when their upper arm circumference (MUAC) value is less than 23.0 cm and those with MUAC ≥23 cm were considered well nourished).

Data quality control

Two days of training were provided to all data collectors and supervisors. We conducted a pretest on 5% of the sample size out of the selected hospitals (Hiwot Fana Specialized University hospital, not included in the final sample) before the actual data collection. Based on the findings of the pretest, we made minor modifications to the questionnaire. The data collection process was closely supervised, and the completeness of each questionnaire was checked by the investigators and supervisors daily. During data cleaning, a logical checking technique was used to identify the errors. Finally, double data entry was performed to verify the consistency of the data.

Data management and analysis

The data were coded and entered into Epi Data (version 3.1) and exported to the statistical package for social sciences (SPSS) (version 22) statistical software for analysis. A univariate analysis was used to describe the frequency distribution variables. We coded the outcome variables as "1" for having IPPA, whereas "0" for not having IPP. The association between the outcome and independent variables was analyzed using a logistic regression model. Covariates with a p value ≤0.25 were retained and entered into the multivariable logistic regression analysis using a forward step-wise approach. A multicollinearity test was performed to determine the linear correlation among the independent variables using the variance inflation factor (>10) and standard error (>2). The goodness-of-fit test was performed using the Hosmer–Lemeshow test (>0.05). Adjusted odds ratio (AOR) with

95% CI using a p value <0.05 was considered a statistically significant associated with outcome variable (IPPA).

RESULTS

Socio-demographic characteristics

A total of 476 singleton postpartum women were included, yielding a response rate of 97.94%. The age of respondents was ranged from 18 to 40 (mean=28.4 years, SD±6.3 years). Majority of the study participants were urban resident (79.4%), merchant (47.3%) and married (92.4%) (Table 1).

Dietary and micronutrient uptake

More than three-fourth (89.1%) of study participants were not under nutrition (MUAC ≥23 cm) but only one-fourth (25%) had high dietary diversity. Around three-fourth (75% and 78.4%) had IFA supplementation during their recent pregnancy and less than three times per day consumption of coffee or/and tea respectively (Table 2).

Table 2: Dietary and micronutrient uptake characteristics of singleton postpartum women, Dire Dawa, Ethiopia, 2022 (n=476).

Variables	Frequency	Percentage (%)
Under nutrition (cm)		
MUAC <23	52	10.9
MUAC ≥23	424	89.1
Dietary diversity		
Low	357	75.0
High	119	25.0
Meal frequency (times per day)		
<3	117	24.6
≥3	359	75.4
Food insecurity		
Yes	38	8
No	438	92
IFA supplementation		
No	119	25
Yes	357	75
Coffee or/and tea intake (cups per day)		
>3	103	21.6
≤3	373	78.4

Obstetrics characteristics

Majority (80.3%) of the participants were multiparous women, had delivery at hospital (89.7%) and had no history of C/S delivery (85.5%) (Table 3).

Comorbid illnesses

Around 15.1% study participants had clinically confirmed gastrointestinal parasites during the recent pregnancy. From these, *Trichuris trichiura* and *Schistosoma mansoni* were the commonest ones (Figure 2).

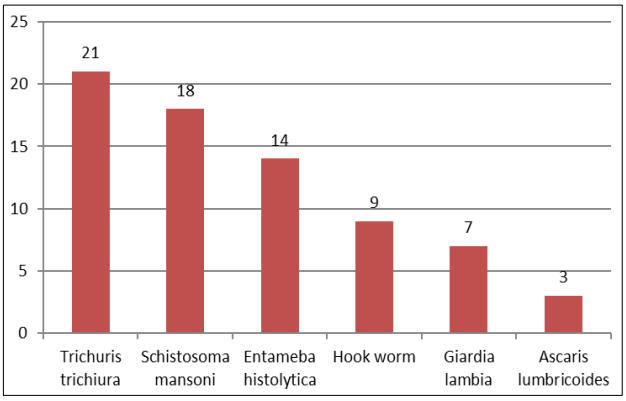

Figure 2: Clinically confirmed GIT parasites during pregnancy among singleton postpartum women, Dire Dawa, Ethiopia, 2022 (frequency=72, valid percent=15.1%).

Chronic illnesses

Around 5.3% and 2.5% had chronic illnesses, gastritis and chronic hypertension respectively (Table 4).

Table 4: List of clinically confirmed chronic illnesses during pregnancy among singleton postpartum women, Dire Dawa, Ethiopia, 2022 frequency, valid percent=12.4%).

Types of chronic illnesses	Frequency (n=59)	Percentage (%)
Gastritis	25	5.3
Chronic hypertension	12	2.5
TB	10	2.1
HIV	7	1.5
More than one chronic illness	5	1.1

Magnitude of immediate singleton postpartum anemia

The overall magnitude of immediate singleton postpartum anemia (IPPA) was 26.9% (95% CI: 22.9-31.1%). From this 44 (34.4%), 65 (50.8%) and 19 (14.8%) were sever, moderate and mild anemia respectively.

Factors associated with immediate postpartum anemia

In the multivariable logistic regression analysis women's level of education, occupation, number of ANC visits, mode of delivery, dietary diversity, IFA supplementation during recent pregnancy, GIT parasites and pre-delivery anemia were significantly associated with IPPA (Table 5).

In this study, educational status of the postpartum women was independent factor significantly associated with IPPA. The odds of IPPA were higher among postpartum women

who had no formal education (AOR=3.01, 95% CI: 1.12-8.08) and unemployed once (AOR= 2.72, 95% CI: 1.02-7.21). Likewise, the higher likelihood of IPPA was noticed among postpartum women who had <4 ANC visits (AOR=2.40, 95% CI: 1.32-4.30), instrumental assisted vaginal delivery (IAVD) (AOR=3.70, 95% CI: 1.952-6.86), pre-delivery anemia (AOR=2.96, 95% CI: 1.48-5.91) and GIT parasites (AOR=3.23, 95% CI: 1.37-7.59). Furthermore, postpartum women who had low dietary diversity (AOR=3.10, 95% CI: 1.65-5.79) and had no IFA supplementation (AOR=2.69, 95% CI: 1.10-6.58) during their recent pregnancy were almost three times more likely to develop IPPA compared to their counterparts (Table 5).

Table 5: Bivariable and multivariable binary logistic regression analysis outputs of factors associated with IPPA among singleton postpartum women, Dire Dawa, Ethiopia, 2022.

Variables	IPPA		COR (95% CI)	AOR (95% CI)
	Yes (%)	No (%)		
Current residence				
Rural	17 (13.3)	81 (23.3)	1.98 (1.12-3.50)*	0.95 (0.25-3.55)
Urban	111 (86.7)	267 (76.7)	1	1
Level of education (women's)				
No formal education	13 (10.2)	62 (17.8)	2.20 (1.052-4.60)*	3.01 (1.12-8.08)*
Primary school (1-8th)	17 (13.3)	48 (13.8)	1.30 (0.65-2.36)	1.70 (0.70-4.1)
Secondary (9-10th)	35 (27.3)	100 (28.7)	1.32 (0.74-2.35)	1.38 (0.64-2.98)
Preparatory (11-12th) and diploma	33 (25.8)	73 (21.0)	1.02 (0.56-1.85)	0.92 (0.41-2.08)
Degree and above	30 (23.4)	65 (18.7)	1	1
Occupation (women's)				
Unemployed	17 (13.3)	63 (18.1)	2.22 (1.06-4.65)*	2.72 (1.02-7.21)*
Merchant	58 (45.3)	167 (48)	1.73 (0.96-3.11)	1.66 (0.74-3.74)
Private employee	29 (22.7)	78 (22.4)	1.61 (0.83-3.13)	1.42 (0.56-3.61)
Public employee	24 (18.8)	40 (11.5)	1	1
ANC follow up				
No	19 (14.8)	96 (27.6)	2.18 (1.27-3.75)**	1.15 (0.32-4.10)
Yes	109 (85.2)	252 (72.4)	1	1
Number of ANC visits (times)				
<4	76 (59.4)	168 (72.1)	1.77 (1.12-2.78)	2.40 (1.32-4.30)**
4 and above	52 (40.6)	65 (27.9)	1	1
Dietary diversity				
Low	84 (65.6)	273 (78.4)	1.91 (1.22-2.98)	3.10 (1.65-5.79)***
High	44 (34.4)	75 (21.6)	1	1
Meal frequency per day (times per day)				
<3	19 (14.8)	98 (28.2)	2.25 (1.31-3.86)**	1.993 (0.57-6.93)
≥3	109 (85.2)	250 (71.8)	1	1
IFA supplementation				
No	13 (10.2)	106 (30.5)	3.87 (2.10-7.18)***	2.69 (1.10-6.58)*
Yes	115 (89.8)	242 (69.5)	1	1
Mode of delivery				
IAVD	28 (21.9)	152 (43.7)	2.46 (1.50-4.03)***	3.70 (1.952-6.86)***
c/s	32 (25)	46 (13.2)	0.65 (0.38-1.11)	0.59 (0.27-1.27)
SVD	68 (53.1)	150 (43.1)	1	1
GIT parasites				
Yes	10 (7.8)	62 (17.8)	2.56 (1.27-5.16)**	3.23 (1.37-7.59)**
No	118 (92.2)	286 (82.2)	1	1
Pre-delivery anemia (g/dl)				
Yes (<11)	27 (21.1)	163 (54.5)	4.48 (2.77-7.26)***	2.96 (1.48-5.91)**
No (≥11)	101 (78.9)	136 (45.5)	1	1
Lacerations (birth canal and perineal)				
Yes	12 (9.4)	70 (20.1)	2.43 (1.27-4.66) **	3.87 (0.88-17.11)
No	116 (90.6)	278 (79.9)	1	1

Significant at *p≤0.05, **p≤0.01, ***p=0.000, 1=reference

DISCUSSION

This study was conducted to assess the magnitude and factors associated with immediate postpartum anemia among postpartum women admitted to maternity ward at public hospitals in Dire Dawa administration, eastern Ethiopia. In this study, immediate postpartum anemia (IPPA) was considered based on World health organization definition of hemoglobin level of postpartum women <10gm/dl within the first 48 hours of post-delivery partum.[10,30]

Based on this, we found the overall magnitude of IPPA was 26.9% (95% CI: 22.9-31.1%). This finding was in line with a study conducted in Spain (29%), Uganda (30 %), and Costal Karnataka (26.5%).[31-33] This was also in line with studies conducted in Ethiopia, Debre Markos (24.3%), Mekelle (24.2%), and Jimma (28.7%).[17,34,35] This consistency might be related to the fact that all of the study participants in these studies were same population (singleton postpartum women), almost all were in similar physiological state (post-delivery period), related time frame (within 24 hours or 48 hours) and singleton pregnancy rather than twins or more. Likewise, some socio-demographic characteristics of study participants were highly related like marital status (majority were married) and majority were urban dwellers. Besides, related to the obstetrics characteristics of the study participants, majority was multiparous.

However, the finding of this study was lower than studies conducted in Pakistan (49.7%), China (32.7%), Turkey (45.1%), and Enugu, Nigeria (72.8%).[15,36-38] The possible explanation for this variation might be due to the use of different hemoglobin concentration cut-off points to define postpartum anemia (for instance some studies use a cut of value of hemoglobin less than 11 g/dl a or <12 g/dl and some others including this study used a cut-off point <10 g/dl). Additionally, possible explanation for this variation might be due the differences in sample size and time of screening postpartum anemia and this study was excluded diagnosed pre-conception anemia, uterine rupture and laparotomy to minimize over estimation of postpartum anemia.

Moreover, this finding was higher than studies conducted in California (7.3%), Germany (22%), and Kenya (16.4%).[13,39,40] This inconsistency might be differences in study times, and some socio-demographic characteristics like age, educational level and residence area. The variation also might be high coverage of ANC follow up and supplementation of IFA tablets during pregnancy which is crucial in preventing anemia and directly impacts on IPPA. Besides, such inconsistency could be due to difference in sample size, study times and use of different time frame for PPA. For instance, the above studies were used study periods which was far from immediate postpartum close to 6 weeks of postpartum period but this study used a time frame from immediately after child birth up to 48 hrs. As the period of postpartum period extends physiologic changes during pregnancy returned to normal and the women will have recover from anemia and this highly creates variation in magnitude of PPA. Due to lack of consensus on the definition of postpartum anemia, scholars use different HGB cut-off points. For instance, Nawagi <11 g/dl at 24 hours, Rubio-Alvarez et al <11 g/dl, Brichs et al were used Hgb <11 g/dl, Dundar and Cakmak were used Hgb <11 g/dl at 6 hrs. Rakesh et al were used Hgb <12 g/dl at 6 weeks as cut-off points in contrast to this study (Hgb <10 g/dl at 48 hours) to define IPPA. Other factors might be study settings, geographical differences, dietary practices (dietary diversity or/and meal frequency, amount and access), health seeking behaviors (like prevention, detection and treatment of malaria and other parasites) of the community of different area of the world.

Strengths

The study focused on one of the leading causes of maternal death in obstetrics, which is an important topic in obstetrics. The data collectors were local language speakers and knew the local norms and times at which participants were comfortable; this was very helpful to probe the actual information and reduce the non-response rate. Data collection was done by interview complemented with review of medical cards, which allowed for variables commonly missed in documentation or referring to the documents for getting clinical data difficult to obtain through interview. The study used a diverse sample (included participants from rural and urban areas, both public hospitals with a high postpartum women's admission rate), which increases the external validity of the study. The findings of the study could have implications for social, research, and practice; implications for the following.

Implications for social

The study findings imply the need for continuous awareness for pregnant women, considering their education level, about the need to check for and treat gastro-intestinal parasites. It also implies the need for community awareness to increase dietary diversity and iron supplementation during pregnancy.

Implications for research

The study implies the need for future research to identify whether meal frequency per day is associated with IPPA or not. Another recommendation for further research is to conduct research on the influence of residence area on the occurrence of IPPA because, at the binary level, this study showed an association with IPPA, but this needs further study.

Implications for practice (health professionals and health care managers)

According to the study's findings, health facilities require counseling of pregnant women about nutritional diversity

during ANC visits, checking and treating predelivery anemia, and taking precautions during instrumental deliveries. Since the number of ANC visits, instrumental delivery, and pre-delivery anemia were found to be associated with IPPA.

Limitations

The study was institutional-based, and therefore it may be difficult to generalize the results to the general population. Since the study participants came from different geographical areas with different altitudes, it was difficult to make an adjustment for hemoglobin. In addition, since the study design was cross-sectional, a causal relationship could not be established. Some sort of social desirability bias was expected in this study. But efforts were made to manage them through training of data collectors on how to approach participants, interviewing postpartum women privately, close supervision of data collectors on how to approach respondents, explaining the purpose of the study to participants well, and reviewing supplementary medical cards.

CONCLUSION

Almost one in four postpartum women had immediate postpartum anemia; this indicates a high public health problem as per the WHO cut-off value**.** Women's educational status, occupation, dietary diversity, IFA supplementation during pregnancy, number of ANC visits, mode of delivery, pre-delivery anemia, and presence of gastro-intestinal parasites showed a significant association with immediate postpartum anemia. This finding may help improve the ability of health professionals to intervene against IPPA via the identification of risk factors for immediate postpartum anemia during the prenatal, intranatal, and postnatal periods.

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