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Economic and Residential Differences in Nutritional Anemia Among Pregnant Women: Insights from Indonesia's National Health Insurance Data

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Abstract

Anemia in pregnant women remains a significant public health issue, increasing the risk of morbidity and mortality. This study aimed to examine the prevalence of nutritional anemia among pregnant women and its association with economic and residential factors. A cross-sectional design was used, analyzing 3,512 samples from the Health Social Security Administering Agency (HSSA) dataset based on ICD-10 codes D50-D53. Multinomial logistic regression was applied for data analysis. Iron deficiency anemia (unspecified) was the most common type (29.2%), with cases peaking in 2019 (18.5%) and lowest in 2016 (8.4%). Most cases occurred among recipients of central government premium assistance (45.2%), with the highest provincial prevalence in Central Java (15.6%). Nutritional anemia among pregnant women in Indonesia is closely related to economic status and residential disparities. Expanding insurance coverage, improving access to supplementation, and enhancing nutrition education are crucial strategies to address this issue.

Keywords: *Anemia Trends, Economic Factor, Iron Deficiency, The Health Social Security Administering Agency (HSSA), Residence.*

Introduction

In 2019, the World Health Organization (WHO) reported that anemia represented the most significant obstetric threat globally, with a prevalence of 40% among children under five and 37% among pregnant women. These figures were notably higher in regions such as West Africa, the Middle East, and Southeast Asia.(WHO, 2021) In Indonesia, the 2018 Basic Health Survey (Riskesdas) revealed that 48.9% of pregnant women were affected by anemia (Kemenkes RI, 2018), an increase from 37.1% in 2013, highlighting an alarming trend as the national rate surpassed the global average (Kemenkes RI, 2013). However, according to the 2023 Indonesian Health Survey (SKI), the prevalence of anemia among pregnant women declined to 27.7%, representing a 21.2% decrease from the 2018 data. The most significant reduction was observed in the 15–24 age group, with a drop from 84.6% to 14.5%, while the 25–34 age group, which constitutes the majority of pregnancies, experienced only a slight decrease from 33.7% to 31.4%.

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Indonesia's anemia control program includes the distribution of iron and folic acid (IFA) tablets, with a coverage rate of 92.2%. Nevertheless, adherence to the recommended consumption remains low at 44.2%, contributing significantly to the persistently high prevalence of anemia among pregnant women (Kemenkes RI, 2023; Sekartini et al., 2022).

Although the primary cause of anemia during pregnancy is iron deficiency, accounting for approximately half of all cases, there are several other potential causes (Helmyati et al., 2023; Hidayani, 2020; Irwan, D., & Kes, 2017; Nangi, M. G., Yanti, F., & Lestari, 2019; Sungkar et al., 2022). Anemia during pregnancy, particularly iron-deficiency anemia, remains a significant global health concern, with recent studies highlighting its association with various adverse maternal and fetal outcomes (Khattak et al., 2023). A 2025 meta-analysis reported that maternal anemia increases the risk of postpartum hemorrhage (RR 2.76), premature rupture of membranes (RR 1.94), preterm birth (RR 1.51), low birth weight (RR 1.40), cesarean delivery (RR 1.28), gestational hypertension (RR 1.33), and neonatal asphyxia (RR 1.21) (Wang et al., 2025). Similarly, a 2024 study found that third-trimester anemia correlates with higher rates of cesarean sections, preterm labor, placental abruption, and neonatal intensive care admissions (Ozyurt & Bulutlar, 2024). In Egypt, a 2025 systematic review revealed a 49% prevalence of anemia among pregnant women, with affected infants exhibiting significantly lower birth weights and Apgar scores. These findings underscore the critical need for early screening and iron supplementation during pregnancy to mitigate risks and enhance maternal and neonatal health outcomes (Azzam et al., 2025).

Economic factors, including income, can influence the physical and psychological well-being of pregnant women. It stands to reason that pregnant women of high socioeconomic status would exhibit optimal physical and psychological well-being, enabling by their capacity to meet both their own needs and those of their children postpartum, including nutrient-dense food and nutrition (Akmila et al., 2020). Furthermore, socioeconomic status exerts a significant influence on health behaviors. For instance, individuals from families with low socioeconomic status are more prone to refrain from vaccination against infectious diseases for themselves and their children. The political economy of a nation, influenced by ecological, climatic, and geographical factors, emerges as the first risk factor for anemia as it exerts a profound influence on education, income levels, cultural practices, and behavioral patterns. These factors, in turn, affect vulnerable groups, such as pregnant women and those with high parity, particularly in terms of their access to a diverse array of foods, sources of fortification, information about anemia, clean water and proper sanitation facilities, and health services. Inadequate access to these factors can result in suboptimal nutrient intake and absorption, which, in turn, can contribute to the development of anemia (Septiasari, 2019).

Geographical conditions of the place of residence of pregnant women have also been demonstrated to affect the occurrence of anemia. A significant proportion of pregnant women in Western Ethiopia live in rural areas, characterized by limited access to health facilities. This suggests a higher propensity for anemia among pregnant women residing in rural areas compared to those living in urban areas (Berhe et al., 2019; Eshete et al., 2022). This is primarily due to the influence of community norms regarding poor feeding practices and the limited access to healthcare facilities, which can collectively increase the risk of anemia during pregnancy. Furthermore, the limited awareness among pregnant women residing in rural areas regarding the causes of anemia and its prevention is a salient concern. Moreover, dietary restrictions, which are commonly practiced in these communities, have been identified as a contributing factor to the increased risk of anemia. Consequently, there is a compelling need for educational initiatives,

such as prenatal classes or regular antenatal care checkups, to disseminate information regarding anemia in pregnancy. These educational efforts should be complemented by the facilitation of access to healthcare facilities in remote areas (Oktaviana et al., 2022).

The Health Social Security Administering Agency (HSSA) is an institution that organizes a health insurance program in Indonesia, commonly known as the National Health Insurance (NHI). The HSSA has a number of datasets, which are derived from the memberships of individuals insured under the national health insurance program it administers, as well as from primary healthcare facilities where the individuals are registered. These datasets enables analysis of various health concerns, including anemia in pregnant women. The HSSA dataset collection is regarded as the most extensive source of health data in Indonesia, catering to the research and academic communities. The contextual sample data provided are increasingly diverse, including contextual diabetes mellitus (DM), tuberculosis (TB), and maternal and child health (MCH). The cohort data from participants and services from 2015 to 2022 are also available. The HSSA dataset is designed to provide up-to-date estimates of key demographic and health indicators for HSSA members in Indonesia. For example, one study that utilizes data HSSA, which explores the views and experiences of key stakeholders regarding the implementation and impact of Indonesia's National Health Insurance system (Susanti et al., 2021). The objective of this study was to identify prevalence of anemia, as well as to examine the relationship between economics factor and the incidence of anemia among pregnant women who are beneficiaries of the national health insurance program administered by the Health Social Security Administering Agency (HSSA) in Indonesia.

Materials and Methods

Study Design and Data Source

This study employed a cross-sectional methodology and is quantitatively analytical. The corresponding author and the Indonesian Health Social Security Administering Agency have formally authorized the public to access the datasets utilized for model building and validation in this study. The dataset under consideration encompasses approximately 2.6 million cases reported from 34 Indonesian provinces. The data source used in this study is a sample of the HSSA dataset from primary health facilities, specifically maternal and child health (MCH) polyclinics, from 2015 to 2022.

The 10th Revision of the International Classification of Diseases (ICD10) was used to code the diagnoses in the dataset. The study employed an approach of ICD10 code-based data preprocessing to get to these definitions. The inclusion of each visit from a subject with a code was made in the case groupings D50-53 (nutritional anaemias) by filtering the data, specifically limiting the data to only pregnant women. The sampling method entailed the combination of the denominator of participant data and service data. This process was executed in stages (complex samples) through the implementation of statistical procedures. Subsequently, weighting procedure was employed to obtain a representative sample. The implementation of weighting entailed the entry of the weight variable (PSTV15) into the designated weight field, followed by the selection of the analytic weight option. This procedure automatically calculates the normalization weight, ensuring that the number of samples matches the actual number of samples. The total sample of anemia in pregnant women was 3,512. Subsequent to the implementation of weighting procedure, the total number of samples increased to76,505.

Outcome Variable

The outcome variable of this study was nutritional anemia in pregnant women, within the category of nutritional anemia according to ICD-10 codes D50–D53, a total of 20 diagnoses are listed in the table 1.

No	Diagnosis
1	Dietary folate deficiency anaemia
2	Drug-induced folate deficiency anaemia
3	Folate deficiency anaemia
4	Folate deficiency anaemia, unspecified
5	Iron deficiency anaemia
6	Iron deficiency anaemia secondary to blood loss (chronic)
7	Iron deficiency anaemia, unspecified
8	Nutritional anaemia, unspecified
9	Other dietary vitamin B12 deficiency anaemia
10	Other folate deficiency anaemias
11	Other iron deficiency anaemias
12	Other megaloblastic anaemias, not elsewhere classified
13	Other nutritional anaemias
14	Other specified nutritional anaemias
15	Other vitamin B12 deficiency anaemias
16	Protein deficiency anaemia
17	Scorbutic anaemia
18	Sideropenic dysphagia
19	Transcobalamin II deficiency
20	Vitamin B12 deficiency anaemia
21	Vitamin B12 deficiency anaemia due to intrinsic factor deficiency
22	Vitamin B12 deficiency anaemia due to selective vitamin B12 malabsorption with proteinuria
23	Vitamin B12 deficiency anaemia, unspecified

Table 1. Nutritional Anemia Diagnosed In Pregnant Women

Exposure Variables

The exposure variable in this study was the economic factor was examined through the lens of the primary health facility membership segment, which was further delineated into th following categories: 1) Non-workers; 2) Beneficiaries of premium assistance from the state budget; 3) Beneficiaries of premium assistance from the regional budget; 4) Non-wage recipient workers; and 5) Wage recipient workers.

Control Variables

The control variable in this study was the year of visit, defined as the year in which pregnant women who are members of the national health insurance program managed by the Health Social Security Administering Agency participants visited a primary health facility and were diagnosed with anemia. The other variables was place of residence. The specific details encompasses the geographical location of residence, categorized into 34 provinces within Indonesia.

Data Analysis

Data analysis was conducted using univariate and bivariate approaches. Since the data were in discrete form, a non-parametric test was applied, namely multinomial logistic regression. Prior to the analysis, model fit and likelihood ratio tests were performed. The model fitting information showed a significant improvement of the full model over the intercept-only model (χ^2 = 31,440.04, df = 132, $p < 0.001$), indicating that the included predictors contribute significantly to the classification of anaemia types, which indicated that the model was a good fit for the data. Based on the Nagelkerke R^2 value of 0.343, it can be interpreted that the independent variable, economic factors, influenced nutritional anemia in pregnant women by 34%. The statistical computations for the analysis were executed using IBM SPSS Statistics 25. The hypothesis of this study is that there is a relationship between economic factors and the occurrence of nutritional anemia among pregnant women enrolled in the National Health Insurance (BPJS Kesehatan) in Indonesia.

Ethical Approval

This study has received ethical approval from the Health Research Ethics Committee of Universitas Muhammadiyah Prof. Dr. Hamka with the approval number KEPK-NK/02/06/2025/03317.

Results

Anemia Etiology Classification

In the case of anemia in pregnant women, the most prevalent etiology was Iron deficiency anaemia (unspecified), accounting for 29.2%, Iron deficiency anaemia (26.7%), other iron deficiency anaemias (10.1%) and Iron deficiency anaemia secondary to blood loss (chronic), accounting for (9.7%).

No	Diagnosis	Total	Percentage (%)
1	Dietary folate deficiency anaemia	182.83	0.2
2	Drug-induced folate deficiency anaemia	36.18	0.0
3	Folate deficiency anaemia	500.78	0.7
4	Folate deficiency anaemia, unspecified	646.56	0.8
5	Iron deficiency anaemia	20445.60	26.7
6	Iron deficiency anaemia secondary to blood loss (chronic)	7439.68	9.7
7	Iron deficiency anaemia, unspecified	22369.09	29.2
8	Nutritional anaemia, unspecified	3646.81	4.8
9	Other dietary vitamin B12 deficiency anaemia	128.52	0.2
10	Other folate deficiency anaemias	18.67	0.0
11	Other iron deficiency anaemias	7725.04	10.1
12	Other megaloblastic anaemias, not elsewhere classified	212.77	0.3
13	Other nutritional anaemias	3434.99	4.5
14	Other specified nutritional anaemias	558.20	0.7
15	Other vitamin B12 deficiency anaemias	339.53	0.4

16	Protein deficiency anaemia	1224.46	1.6
17	Scorbutic anaemia	132.71	0.2
18	Sideropenic dysphagia	376.16	0.5
19	Transcobalamin II deficiency	32.27	0.0
20	Vitamin B12 deficiency anaemia	4171.68	5.5
21	Vitamin B12 deficiency anaemia due to intrinsic factor deficiency	959.04	1.3
22	Vitamin B12 deficiency anaemia due to selective vitamin B12 malabsorption with proteinuria	153.00	0.2
23	Vitamin B12 deficiency anaemia, unspecified	1770.66	2.3

Table 2. Anemia Etiology Classification (n=76,505)

Anemia Trends

The highest number of anemia cases was recorded in 2019, with 14,191 cases (18.5%), while the lowest number was recorded in 2016, with 6,409 (8.4%), and in 2015, with 6,989 cases (9.1%). In 2017, the numbr of cases increased to 9,679 (12.7%), and it increased further in 2018 to 11,681 (15.3%), reaching a peak in 2019. In 2020, it decreased to 8,125 (10.6%), subsequently increasing to 9,773 (12.8%) in 2021. Finally, it increased slightly in 2022 to 9,659 (12.6%), as illustrated in Figure 1.

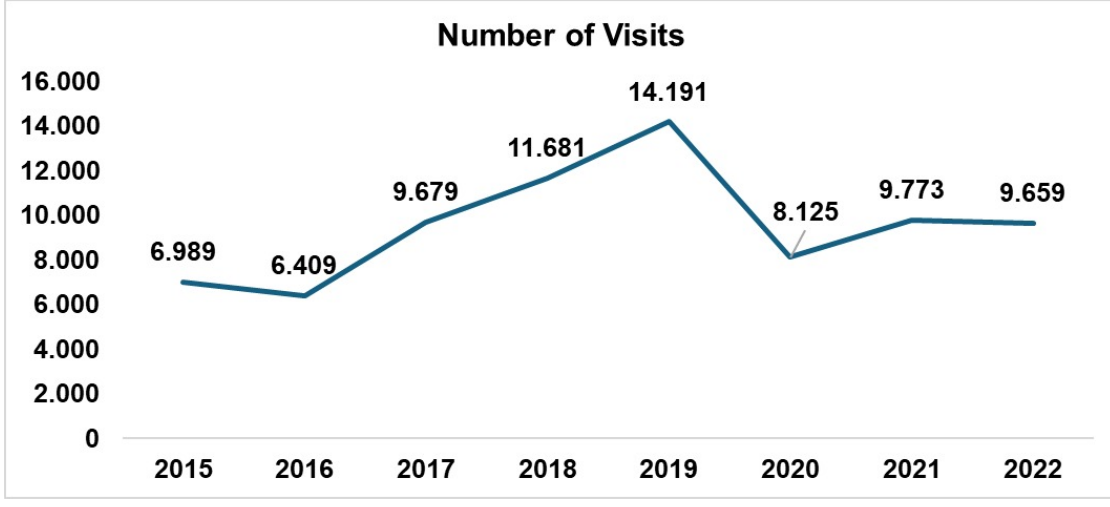

Figure 1. Trends Of Anemia in Pregnant Women From 2015 To 2022

Membership Segments

The majority of anemic pregnant woman patients were beneficiaries of premium assistance, with 34,571 (45.2%) receiving assistance from the government budget and 10,831 (14.2%) receiving assistance from the regional budget. The second largest category was wage recipient workers, which accounted for 24,708 cases (32.3%), followed by non-wage recipient workers, which accounted for 6,207 cases (8.1%). The smallest category was non-workers, which accounted for only 189 cases (0.2%).

No	Economic factor	Total	Percentage (%)
1	Non-workers	188.59	0.2
2	Beneficiary of central government contribution assistance	34570.66	45.2
3	Beneficiary of regional government contribution assistance	10831.01	14.2
4	Non-wage workers	6207.11	8.1
5	Wage workers	24707.87	32.3

Table 3. Economic Factor

Distribution Anemia Based on the Province of Residence

A total of 34 provinces in Indonesia were included in the study. The three provinces with the highest distribution of pregnant women with anemia were Central Java (11,901 cases, 15.6%), East Java (11,115, 14.5%), and Jakarta (9,591, (12.5%). Concurrently, the three provinces exhibiting the lowest distribution were West Papua with (146 cases, 0.2%), Gorontalo (133 cases, 0.2%), and North Sulawesi (19 cases, almost zero percentage).

No	Province	Frequency	Percentage %)
1	Aceh	2.513	3.3
2	North Sumatra	2.062	2.7
3	West Sumatra	1.228	1.6
4	Riau	1.134	1.5
5	Jambi	534	0.7
6	South Sumatra	934	1.2
7	Bengkulu	693	0.9
8	Lampung	888	1.2
9	Bangka Belitung Islands	194	0.3
10	Riau islands	123	0.2
11	Jakarta	9.591	12.5
12	West Java	9.404	12.3
13	Central Java	11.901	15.6
14	Special Region of Yogyakarta	1.886	2.5
15	East Java	11.115	14.5
16	Banten	2.055	2.7
17	Bali	156	0.2
18	West Nusa Tenggara	1.752	2.3
19	East Nusa Tenggara	1.703	2.2
20	West Kalimantan	2.975	3.9
21	Central Kalimantan	1.275	1.7
22	South Kalimantan	1.142	1.5
23	East Kalimantan	498	0.7
24	North Kalimantan	2.264	3.0
25	North Sulawesi	19	0.0

26	Central Sulawesi	1.488	1.9
27	South Sulawesi	3.872	5.1
28	Southeast Sulawesi	839	1.1
29	Gorontalo	133	0.2
30	West Sulawesi	1.140	1.5
31	Moluccas	352	0.5
32	North Moluccas	170	0.2
33	West Papua	146	0.2
34	Papua	328	0.4

Table 4. Distribution Of Anemia in Pregnant Women Based on Province of Residence (N=76,505)

The Relationship Between economics factor, year of visit, residence and anemia

The results of the data analysis revealed that the nutritional anaemia diagnoses among pregnant women were significantly associated with health insurance participant status. Compared to wage workers (reference category), participants classified as recipients of central government contribution assistance exhibited significantly lower odds of being diagnosed with several types of nutritional anaemia. For instance: folate deficiency anaemia, the odds ratio (OR) was 0.285 (95% CI: 0.175–0.464, $p < 0.001$), unspecified folate deficiency anaemia, OR = 0.193 (95% CI: 0.121–0.309, $p < 0.001$), other nutritional anaemias, OR = 0.164 (95% CI: 0.105–0.257, $p < 0.001$), vitamin B12 deficiency anaemia, OR = 0.113 (95% CI: 0.071–0.179, $p < 0.001$), Iron deficiency anaemia, OR = 0.202 (95% CI: 0.130–0.314, $p < 0.001$), Iron deficiency anaemia secondary to blood loss (chronic), OR = 0.315 (95% CI: 0.202–0.490, $p < 0.001$), Iron deficiency anaemia, unspecified, OR = 0.302 (95% CI: 0.195–0.470, $p < 0.001$), Nutritional anaemia, unspecified, OR = 0.265 (95% CI: 0.169–0.414, $p < 0.001$), other iron deficiency anaemias, OR = 0.247 (95% CI: 0.159–0.385, $p < 0.001$), other megaloblastic anaemias (not elsewhere classified), OR = 0.03 (95% CI: 0.016–0.054, $p < 0.001$), other specified nutritional anaemias OR = 0.110 (95% CI: 0.067–0.180, $p < 0.001$), other vitamin B12 deficiency anaemias, OR = 0.065 (95% CI: 0.039–0.107, $p < 0.001$), scorbutic anaemia, OR = 0.104 (95% CI: 0.056–0.192, $p < 0.001$), sideropenic dysphagia, OR = 0.109 (95% CI: 0.066–0.178, $p < 0.001$), vitamin B12 deficiency anaemia due to intrinsic factor deficiency, OR = 0.043 (95% CI: 0.028–0.068, $p < 0.001$), vitamin B12 deficiency anaemia due to selective vitamin B12 malabsorption with proteinuria, OR = 0.048 (95% CI: 0.026–0.087, $p < 0.001$), vitamin B12 deficiency anaemia (unspecified), OR = 0.045 (95% CI: 0.028–0.071, $p < 0.001$).

In contrast, the non-wage worker group demonstrated a significantly higher likelihood of being diagnosed with some forms of nutritional anaemia: for folate deficiency anaemia, OR = 9.976 (95% CI: 1.602–62.113, $p = 0.014$), for other nutritional anaemias, OR = 6.848 (95% CI: 1.121–41.821, $p = 0.037$), for other specified nutritional anaemias, OR = 13.043 (95% CI: 2.114–80.465, $p = 0.006$) and for Scorbutic anaemia, OR = 18.929 (95% CI: 2.973–120.54, $p = 0.002$).

Non-workers were also strongly associated with certain anaemia diagnoses, with notably high odds observed for iron deficiency anaemia (OR = 6,431,575, 95% CI: 3,552,941–11,642,513, $p < 0.001$), though interpretation is limited due to extremely large effect size, possibly indicating sparse data. These results suggest that nutritional anaemia types are unequally distributed across participant segments in the national health insurance program, with wage workers and PBI recipients showing relatively lower odds, while non-wage workers and non-workers tend to have higher vulnerability.

The year of visit was significantly associated with several nutritional anaemia diagnoses. For example, the odds of being diagnosed with folate deficiency anaemia increased over time (OR = 1.925, 95% CI: 1.753–2.114, $p < 0.001$), suggesting a rising trend in detection or incidence across the study period. Similarly, for other nutritional anaemias, the odds increased with year (OR = 1.774, 95% CI: 1.637–1.923, $p < 0.001$), possibly reflecting either improved diagnosis or worsening underlying nutritional conditions over time.

Province of residence was significantly associated with the likelihood of several nutritional anaemia diagnoses. The odds of folate deficiency anaemia and vitamin B12 deficiency anaemia were inversely associated with province-level variables (OR < 1), suggesting that geographic location, potentially reflecting disparities in access to health services, socioeconomic status, or regional nutrition policies may influence diagnosis patterns.

Both year of visit and province of residence were found to be significant confounding variables in the multinomial regression model. The increasing odds of nutritional anaemia diagnoses over time suggest a rising public health concern, potentially due to improved surveillance or worsening dietary patterns. Additionally, regional disparities as indicated by the inverse association with province highlight the importance of geographically tailored health policies and resource allocation.

Anemia diagnosis	Non-workers		Beneficiary of central government contribution assistance		Beneficiary of regional government contribution assistance		Non-wage workers		Wage workers		Province of Residence		Year of visit	
	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)
Dietary folate deficiency anaemia														
Drug-induced	0.999	-	0.981	-	1.000	-	0.999	-	-	-	0.007*	0.966	<0.001*	3.002

folate deficiency anaemia												(0.942-0.991)		(2.228-3.940)
Folate deficiency anaemia	1.000	-	<0.001*	0.285 (0.175-0.464)	0.708	-	0.014*	9.976 (1.602-62.113)	-	-	0.002*	0.986 (0.977-0.995)	<0.001*	1.925 (1.753-2.114)
Folate deficiency anaemia, unspecified	1.000	-	<0.001*	0.193 (0.121-0.309)	<0.001*	0.116 (0.041-0.329)	0.08	5.105 (0.823-31.671)	-	-	<0.001*	0.984 (0.975-0.992)	<0.001*	1.187 (1.087-1.296)
Iron deficiency anaemia	<0.001*	6,431,575 (3,552,941-11,642,513)	<0.001*	0.202 (0.130-0.314)	0,782	-	0,088	-	-	-	0.002*	0.998 (0.980-0.995)	<0.001*	1.967 (1.817-2.128)
Iron deficiency anaemia secondary to blood loss (chronic)	<0.001*	7,458,877 (4,186,440-13,289,297)	<0.001*	0.315 (0.202-0.490)	0.392	1.442 (0.623-3.336)	0.138	-	-	-	<0.001*	0.976 (0.968-0.984)	0.122	0.939 (0.868-1.017)

Iron deficiency anaemia, unspecified	0.999	-	<0.001*	0.302 (0.195-0.470)	0.057	2.254 (0.977-5.199)	0.077	-	-	-	<0.001*	0.981 (0.973-0.988)	<0.001*	1.215 (1.123-1.314
Nutritional anaemia, unspecified	<0.001*	17,959,324 (10,152,134-31,770,396)	<0.001*	0.265 (0.169-0.414)	0.358	-	0.081	5.020 (0.821-30.695)	-	-	<0.001*	0.979 (0.971-0.986)	0.002*	1.134 (1.046-1.228)
Other dietary vitamin B12 deficiency anaemia	0.997	-	0.962	-	0.999	-	0.998	-	-	-	0.154	-	<0.001*	0.418 (0.344-0.509)
Other folate deficiency anaemias	0.999	-	1.000	-	0.978	-	-	-	-	-	0.002*	0.581 (0.409-0.826)	0.001*	1.640 (1.216-2.212)
Other iron deficiency anaemias	<0.001*	2,927,335 (1,496,918-5,724,625)	<0.001*	0.247 (0.159-0.385)	0.484	-	0.106	4.438 (0.727-27.079)	-	-	<0.001*	0.978 (0.970-0.986)	0.880	-

Other megaloblastic anaemias, not elsewhere classified	1.000	-	<0.001*	0.030 (0.016-0.054)	0.970	-	0.097	4.748 (0.755-29.867)	-	-	<0.001*	0.959 (0.947-0.970)	<0.001*	1.451 (1.306-1.611)
Other nutritional anaemias	0.999	-	<0.001*	0.164 (0.105-0.257)	0.019*	0.363 (0.156-0.847)	0.037*	6.848 (1.121-41.821)	-	-	0.818	-	<0.001*	1.774 (1.637-1.923)
Other specified nutritional anaemias	1.000	-	<0.001*	0.110 (0.067-0.180)	0.412	-	0.006*	13.043 (2.114-80.465)	-	-	<0.001*	0.954 (0.945-0.963)	0.434	-
Other vitamin B12 deficiency anaemias	1.000	-	<0.001*	0.065 (0.039-0.107)	0.963	-	0.934	-	-	-	0.151	-	0.053	-
Protein deficiency anaemia	0.266	-	0.125	-	0.436	-	2.558	-	-	-	<0.001*	0.978 (0.970-0.	0.513	-

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Scorbutic anaemia	1.000	-	<0.001*	0.104 (0.056-0.192)	0.976	-	0.002*	18.929 (2.973-120.54)	-	-	<0.001*	0, 967 (0.954-0.979)	<0.001*	0.678 (0.591-0.777)
Sideropenic dysphagia	1.000	-	<0.001*	0.109 (0.066-0.178)	0.960	-	0.106	-	-	-	<0.001*	0.941 (0.931-0.951)	0.593	-
Transcobalamin II deficiency	1.000	-	0.975	-	0.988	-	0.992	-	-	-	0.708	-	0.087	-
Vitamin B12 deficiency anaemia	0.999	-	<0.001*	0.113 (0.071-0.179)	0.462	-	0.680	-	-	-	<0.001*	0.982 (0.975-0.991)	0.609	-
Vitamin B12 deficiency anaemia due to intrinsic factor deficiency	1.000	-	<0.001*	0.043 (0.028-0.068)	0.009	0.326 (0.141-0.757)	0.747	-	-	-	<0.001*	0.982 (0.975-0.991)	0.609	-

Vitamin B12 deficiency anaemia due to selective vitamin B12 malabsorption with proteinuria	1.000	-	<0.001*	0.048 (0.026-0.087)	0.993	-	0.983	-	-	-	<0.001*	0.977 (0.966-0.988)	0.677	-
Vitamin B12 deficiency anaemia, unspecified	-	-	<0.001*	0.045 (0.028-0.071)	0.141	-	0.229	-	-	-	0.516	-	0.677	-

Table 5. Correlation Between Residence, Economic Factor, Year Of Visit And Anemia (N=76,505)

Note:

The reference category is: Dietary folate deficiency anaemia.

*) Significancy value at 0.05

Discussion

Anemia is a condition characterized by abnormally low hemoglobin or red blood cell level in the blood (WHO, 2021). Hemoglobin, a principal protein, serves as a carrier of oxygen to the tissues and carbon dioxide from the tissues to the lungs. Anemia can result from a deficiency or decreased production of red blood cells, thereby reducing the blood's capacity to transport oxygen to tissues. The resulting symptoms may include fatigue, tiredness, dizziness, and shortness of breath (Ramadhan et al., 2023).

Signs and symptoms associated with anemia in pregnant women include weakness, fatigue, lethargy, tiredness, and inattentiveness. Additional symptoms include pale skin, usually obvious in the face, the eyelids, tongue, and lips; lightheadedness; and a hemoglobin level less than 11 gr/dl (Kemenkes, 2020). The negative impacts of anemia in pregnant women are multifaceted, including but not limited to decreased immune function, increased risk of infection, and diminished quality of life, which can lead to complications such as miscarriage, hemorrhaging with the potential for mortality, preterm birth, low birth weight (LBW), and maternal and infant

mortality (Gustanela & Pratomo, 2022).

The present study was conducted with the objective of ascertaining the prevalence of anemia in pregnant women, with a particular focus on the underlying cause, place of residence, financial factors, and the year of visit. The findings revealed a statistically significant correlation between anemia in pregnant women, their place of residence, financial factors, and the year of visit. This correlation was observed among pregnant women who were members of the national health insurance program administered by the Health Social Security Administering Agency in Indonesia. The subsequent sections provide a more detailed explanation of the findings.

Anemia Trends

The present study found that cases of anemia in pregnant women in Indonesia increased from 2015 to a peak in 2019 and began to decline again, though not significantly until 2022. According to the findings of previous studies, the prevalence of anemia in pregnant women has exhibited fluctuations and even a marginal decline, while remaining at relatively high levels (Abdullahi et al., 2023; Pobee et al., 2021; Yalew et al., 2020). The composition of the population is a factor that may exert a dual influence, both positive and negative. Characteristic differences account for approximately one out of every twelve variations in anemia. This observation suggests that shifts in the population composition between survey periods are a significant contributing factor to these variations in anemia. This assertion is further substantiated by studies conducted in Ghana (Ampiah et al., 2019).

Temporal trends indicated that the odds of being diagnosed with most forms of nutritional anaemia have increased significantly over time. This may reflect both improved screening coverage and increased awareness among healthcare providers, as well as potentially worsening dietary quality or persistent micronutrient deficiencies in the population (Black et al., 2013). These findings align with reports from the WHO that anaemia in women of reproductive age remains a major global challenge, with rising prevalence in some low- and middle-income countries despite existing nutrition programs (Coutinho et al., 2020).

Etiology of Anemia

The etiology of anemia in pregnant women has been predominantly attributed to iron (Fe) deficiency, followed by vitamin B12 deficiency, folic acid deficiency, and other nutritional deficiencies. Low nutrient intake, inadequate nutrient absorption, and increased nutrient demand or loss are the main causes of the disparities that define the majority of developing nations. Dietary deficits are frequently associated with cost, preparation, and eating habits. A significant number of food taboos are observed among pregnant mothers, many of which are followed during pregnancy (Maradze et al., 2020).

Anemia in pregnant women in developing countries is a complex health problem, and it is not exclusively caused by iron deficiency. While iron deficiency is often associated with anemia, it is rarely an isolated condition. Instead, it is influenced by other factors, including vitamin A and B-12 deficiencies, as well as the presence of acute or chronic inflammation. The presence of underlying diseases, such as HIV and malaria, contributes significantly to the anemia observed in this population. Therefore, the provision of iron supplementation alone is insufficient to ensure optimal outcomes. A more comprehensive approach, entailing the elucidation of the mechanisms of underlying inflammation, the treatment of underlying diseases, and the improvement of adherence to antenatal iron supplementation, is imperative to optimize the effectiveness of interventions and enhance maternal health outcomes (Maradze et al., 2020).

Place of Residence and Anemia

The data indicate significant variation in the distribution of places of residence and anemia prevalence among provinces and regions in Indonesia. Central Java exhibited the highest prevalence, with 15.6% of the population affected, followed by East Java (14.5%) and Jakarta (12.5%). Conversely, West Papua and Gorontalo demonstrated the lowest prevalence, contributing only 0.2% of cases, while North Sulawesi reported an extremely low count of 19 cases. Among the 515 regencies and cities that were analyzed, the highest prevalence was observed in Cirebon (6.3%), followed by West Jakarta (4.1%), East Jakarta (2.9%), Malinau (2.9%), and North Jakarta (2.6%).

Central Java, East Java, and Jakarta are the most populous provinces, while West Papua, Gorontalo, and North Sulawesi have the smallest populations, signaling a need for targeted health interventions in these regions. Additionally, the number of primary health facilities located outside of Java Island is typically lower due to the comparatively lower population density compared to Java Island. Consequently, the number of primary health facilities will adjust to the specific population size and density of each area. In light of the findings from this analysis, it is imperative to formulate a comprehensive strategy that is both effective and efficient in reducing anemia cases among pregnant women, extending beyond the confines of Java Island.

Provincial-level variation also significantly influenced anaemia diagnosis outcomes. The inverse associations between province of residence and various types of anaemia may reflect unequal distribution of health resources, geographical barriers to care, or variations in local policy implementation (Nasution et al., 2023). Region-specific interventions, such as fortified food distribution, local supplementation programs, and community nutrition education, may be essential to address these disparities effectively.

A number of factors have been identified as possible causes of anemia in pregnant women, including inadequate nutrition in food, infectious diseases that elevate the risk of anemia, occupation, educational attainment, sociodemographic status, and geographical location.(Susilo et al., 2021) A body of research, both domestic and international, has identified a correlation between sociodemographic factors and the prevalence of anemia in pregnant mothers (Campbell et al., 2024; Faghir-Ganji et al., 2023; Gustanela & Pratomo, 2022; Harahap & Lubis, 2021; Loechl et al., 2023; Oktaviana et al., 2022).

Geographical variances in anemia prevalence among nations may result from variations in the prevalence of infectious diseases, cultural perspectives on food consumption during pregnancy, and access to medical resources. For instance, the resurgence of malaria in East Africa, attributable in part to climate change, has contributed to the exacerbation of anemia prevalence in this region (Liyew et al., 2021).

Economic factor and Anemia

This study demonstrates that health insurance participant status is significantly associated with the likelihood of nutritional anaemia diagnoses among pregnant women. Specifically, individuals classified as recipients of contribution assistance from the central government showed consistently lower odds across a wide range of nutritional anaemia subtypes compared to wage workers. These findings suggest that government-sponsored insurance coverage may serve a protective function, likely due to facilitated access to maternal health and nutrition services. Prior research supports that subsidized health coverage enhances access to preventive and curative health services, particularly for low-income populations (Tangcharoensathien et al.,

2015).

In contrast, non-wage workers and non-workers were significantly more likely to be diagnosed with various forms of nutritional anaemia, such as folate deficiency anaemia, scorbutic anaemia, and other micronutrient-related types. These groups may experience irregular income, limited awareness, and fewer touchpoints with the formal healthcare system, resulting in lower nutritional intake and reduced healthcare utilization (Coutinho et al., 2020). The particularly high odds observed among non-workers for iron deficiency anaemia, although statistically significant, should be interpreted with caution due to the extreme value, which may indicate sparse data or model instability (Shrimpton & Rokx, 2013).

A statistically substantial contribution to the increase in anemia cases was attributed to the rise in the proportion of women in low-income households. This finding is comparable to the results of a study conducted in India. This finding underscores the notion that the economic development of a nation is associated with a reduced risk of anemia, a crucial consideration in future research and policy initiatives (Nguyen et al., 2018).

Socioeconomic status has been demonstrated to exert an influence on anemia, given its correlation with family income and purchasing power. An increase in income leads to enhancement in a family's capacity to meet their nutritional requirements, while a decrease in income impedes this capacity. A study demonstrated that poverty rates influence the prevalence of anemia in pregnant women (Oktaviani, 2018). This study's findings are strengthened by the established role of financial constraints in influencing the prevalence of anemia among pregnant women. Specifically, pregnant women with limited financial resources often experience reduced nutritional intake, increased susceptibility to infections, and inadequate anemia prevention behaviors (Darmawati, 2019). Furthermore, malaria, malnutrition, and anemia are more prevalent in low- and middle-income countries. The present study found that families with high incomes have a 1% lower risk of anemia than families with low incomes (Sinawangwulan et al., 2018).

The dietary habits of pregnant women are also influenced by their economic status. In households with a high number of individuals, financial limitations may result in an inequitable distribution of food resources. In such scenarios, the pregnant individual may face a deficiency in essential nutrients, which can increase the risk of anemia. This assertion is corroborated by the findings of a study conducted by Bansal et al., which demonstrated that anemia is more prevalent among individuals from low socioeconomic classes. These individuals are more likely to have limited educational attainment and to encounter financial difficulties. This phenomenon is further substantiated by the observation that women with limited financial resources often consume diets deficient in essential nutrients such as vitamins, animal protein, and micronutrients (Bansal et al., 2020). A study conducted at a tertiary care hospital in Rawalpindi revealed that 92 percent (182) of pregnant women with anemia were below the poverty line. This finding suggests that poverty persists as a major contributing factor to anemia in pregnant women (Khalid et al., 2017).

Together, these findings highlight the structural inequities embedded in socioeconomic status, health insurance access, and geographic location, all of which can modulate health outcomes in vulnerable populations like pregnant women.

Strength and Limitation

A notable strength of the present study is its utilization of national big data, a methodological

approach that has been demonstrated to yield accurate results. Nevertheless, given that the study was conducted only on members of the national insurance program administered by the Health Social Security Administering Agency, the findings may not be entirely representative of the Indonesian population as a whole, As a result, it is possible that mild cases of anemia remain unrecorded or undiagnosed, and the economic factor variable does not accurately reflect the economic condition of the research subjects. The quality of secondary data is constrained by its limited capacity to encompass a broader scope of variables.

Conclusions

The analysis of national health insurance data revealed that participant status plays a pivotal role in anaemia prevalence: pregnant women receiving contribution assistance from the central government consistently exhibited lower odds of various forms of nutritional anaemia, whereas those in informal employment (non-wage workers) or with no employment status (non-workers) were disproportionately affected. Temporal trends showed a notable rise in anaemia diagnoses over time, suggesting either increased detection due to better screening practices or a real escalation in underlying nutritional deficiencies. Additionally, geographic disparities in anaemia prevalence, particularly across provinces, point to uneven distribution of health services, infrastructure, and nutrition programs, with Java-based provinces reporting the highest burden.

The etiology of anaemia among pregnant women in this population is multifactorial, with iron deficiency being the most prevalent cause, often accompanied by folate and vitamin B12 deficiencies. These nutritional gaps are compounded by low dietary diversity, cultural taboos, and limited access to supplementation programs. The data further indicate that economic hardship and low-income status significantly increase anaemia risk, underscoring the importance of addressing poverty, health literacy, and equitable healthcare access in national strategies. Despite the strengths of using large-scale national data, the findings are limited by potential underreporting and the representativeness of only insured populations. Furthermore, the classification of economic status through insurance segmentation may not fully capture the nuanced socioeconomic realities of pregnant women in diverse Indonesian settings. Ultimately, these findings highlight the structural inequities that shape maternal health outcomes and call for integrated, region-specific, and socially inclusive interventions to reduce the burden of anaemia and improve maternal well-being.

To reduce the burden of nutritional anaemia among pregnant women in Indonesia, it is essential to strengthen inclusive and region-specific maternal nutrition programs that prioritize vulnerable groups such as non-wage workers and non-workers. Efforts should focus on expanding access to subsidized health insurance, integrating routine anaemia screening and supplementation into antenatal care, and addressing geographic disparities through equitable resource distribution. Public education campaigns targeting dietary practices and cultural taboos during pregnancy are also crucial to improve health literacy and adherence to nutritional interventions.

Declarations

Ethical Approval and Consent to Participate

This study has received ethical approval from the Health Research Ethics Committee of Universitas Muhammadiyah Prof. Dr. Hamka with the approval number KEPK-NK/02/06/2025/03317

Consent for Publication

Not applicable

Availability of Data and Materials

The author cannot have the data, because it is owned by a third party. Other authors may request data from the Health Social Security Administering Agency website https://data.bpjs-kesehatan.go.id/bpjs-portal/action/landingPage.cbi after fulfilling the requirements requested by the organization.

Competing Interests

All authors disclose no competing interests.

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Authors' Contributions

HK and TE developed the proposal, analyzed the data, and interpreted the results. MS and ADL were significant contributors in conducting the study, interpreting the data, and writing the manuscript. HK and TE were substantial contributors to conducting the research and writing the manuscript. RWB is contributed to review the manuscript. All authors read and approved the final manuscript.

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