Sociodemographic factors associated with anemia among pregnant women in Indonesia: an analysis of data from the Health Social Security Administering Agency (HSSA)

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Abstract. The presence of anemia in pregnant women continues to be a significant public health issue, since it has the potential to raise the risk of morbidity and death. This study's purpose is to research the prevalence of anemia in pregnant women and to determine whether or not there is a link between the disease and characteristics such as home area, financial circumstances, and the year of visit. For the purpose of this research, a cross-sectional design and a quantitative-analytical technique were used. The data that correspond to nutritional anemia were analyzed using information obtained from the Health Social Security Administration (HSSA) dataset. There were 3,513 people that participated in the research, and the kind of data analysis that was used was called the Spearman Rank. It has been shown that the most common reason for anemia in pregnant women is a lack of iron in their bodies. On the island of Java, where the frequency of anemia is significant, the Cirebon Regency had the largest number of pregnant women who were affected by the condition. It was shown that there is a statistically significant link between the incidence of anemia among pregnant women and factors such as the location of residence (p-value <0.001), economic position (p-value <0.001), and the year of visit (p-value <0.001).

Keywords: anemia trends, economic factor, iron deficiency, National Health Insurance (NHI), residence.

1 Introduction

In 2019, the World Health Organization (WHO) reported that approximately 40% of children under 5 years of age and 37% of pregnant women worldwide are affected by anemia, thereby establishing it as the most significant obstetric threat in the contemporary global context. The prevalence of anemia is particularly pronounced in West African, Middle Eastern, and Southeast Asian regions[1]. The 2018 Indonesian Basic Health Survey revealed that 48.9% of pregnant women in Indonesia experience anemia, a figure that exceeds the global rate [2] This increase is alarming given that only 37.1% of pregnant women in Indonesia had anemia in 2013 [3].

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The 2023 Indonesian Health Survey (SKI) report indicated that the prevalence of anemia in pregnant women was 27.7%, marking a 21.2% decrease from the 48.9% recorded in the 2018 Indonesian Basic Health Survey. The most significant decrease in anemia prevalence was observed among pregnant women aged 15-24, with a decrease from 84.6% to 14.5%. However, the anemia prevalence among pregnant women aged 25-34, who constitute the majority of pregnancies, exhibited a modest decrease of only 2.3%, from 33.7% to 31.4%. Anemia control program in Indonesia include the provision of iron supplement tablets (TTD), with a coverage rate of 92.2%. However, the compliance rate to the recommended consumption of iron supplements among pregnant women is only 44.2%. This suboptimal compliance with iron supplementation guidelines contributes to the high prevalence of anemia among pregnant women [4,5].

Although the primary cause of anemia during pregnancy is iron deficiency, accounting for approximately half of all cases, there are several other potential causes. A comprehensive review of the extant literature reveals that pregnant women's risk factors for anemia can be mapped using the epidemiological triangle model. The epidemiological triangle, a basic concept of epidemiology, offers an overview of the relationship between the three main factors contributing to the onset of a disease and its associated complications. This model delineates an interaction between three factors: the host, the agent, and the environment. Host factors refer to all factors found in humans that can influence the onset or progression of a disease. Agents encompass certain substances whose presence or absence can trigger disease or modify its course. Environment factors represent extrinsic factors that facilitate disease occurrence [6–10].

Socioeconomic 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 [11]. 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 [12].

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 [13,14]. 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 [15].

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. The objective of this study was to identify trends and the prevalence of anemia, as well as to examine the relationship between place of residence, financial factors, and year of visit 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.

2 Methods

2.1 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 3,513. Subsequent to the implementation of weighting procedure, the total number of samples increased to76,505. The purpose of weighting is to obtain more representative, unbiased, and generalizable results that accurately reflect the national population and support effective health policy planning.

2.2 Outcome Variable

The outcome variable of this study was anemia in pregnant women, which can be categorized

as follows: 1) Iron deficiency anemia; 2) Vitamin B12 deficiency anemia; 3) Acid deficiency anemia; 4) Other nutritional deficiency anemia.

2.3 Exposure Variables

The exposure variable in this study was sociodemographic status, which consisted of two variables: place of residence and financial factors. The specific details encompasses the geographical location of residence, categorized into 34 provinces within Indonesia, as well as 515 regencies and cities within Indonesia. The financial 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.

2.4 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.

2.5 Data Analysis

The data were displayed in two stages of analysis: univariate and bivariate. Prior to the analysis, a data normality test was conducted using the Kolmogorov-Smirnov test. The results of all variables had a p-value less than 0.001, indicating that the data were not normally distributed. Consequently, nonparametric data analysis techniques were employed. Univariate data analysis employing percentages and bivariate data analysis are presented in the form of a cross table, while data testing was conducted using the Spearman's rank test with a 0.05 p-value and a 95% confidence interval (CI). The statistical computations for the analysis were executed using IBM SPSS Statistics 25.

2.6 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.

3 Results

3.1 Anemia Etiology Classification

In the case of anemia in pregnant women, the most prevalent etiology was iron deficiency, accounting for76.3% of the total cases (n=58,356). This was followed by vitamin B12 deficiency, which accounted for 9.9% of cases (n=7,556), and folate deficiency, which accounted for 1.8% of cases (n=1,385). The remaining 9,210 cases (12%) were attributable to other nutritional deficiencies.

3.2 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.

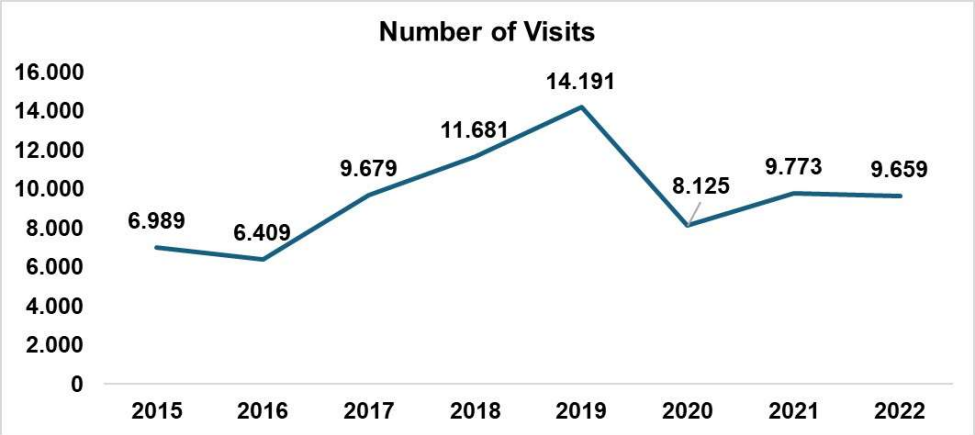

Fig. 1. Trends of anemia in pregnant women from 2015 to 2022

3.3 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%).

3.4 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).

Table 1. Distribution of anemia in pregnant women based on province of residence (n=3,513)

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

3.5 Distribution of Anemia Based on the Regency or the City of Residence

The results of the data analysis demonstrated that the five regencies or cities with the highest prevalence of anemia in pregnant women among the 515 regencies or cities of residence were Cirebon (4,850 cases, 6.3%), West Jakarta (3,120 cases, 4.1%), East Jakarta (2,253 cases, 2.9%), Malinau (2,184 cases, 2.9%), and North Jakarta (1,984 cases, 2.6%).

3.6 The Relationship Between the Variables Under Study

As illustrated in Table 2, all independent variables, namely province of residence, regency/city of residence, financial factors, and year of visit, were found to have a correlation with the incidence of anemia in pregnant women with a p-value of less than 0.001 are. The correlation coefficient value (r) for the province residence was 0.143, indicating a very weak correlation with anemia in pregnant women, with a positive direction. The correlation coefficient value (r) for the regency/city of residence was 0.132, signifying a very weak correlation with anemia in pregnant women, with a positive direction. The correlation coefficient value (r) for financial factors was 0.133, indicating a very weak correlation with anemia in pregnant women with a positive direction. The correlation coefficient value (r) for the year of visit was -0.014, signifying a very weak correlation with anemia in pregnant women, with a negative direction. Consequently, it can be concluded that place of residence, financial factors, and year of visit have an effect on the incidence of anemia in pregnant women.

Table 2. Correlation between place of residence, financial factors, and year of visit and anemia (n=3,513)

	Anemia in Pregnant Women	
Independent Variable	**p-value**	**Correlation Coefficient (r)**
Province of residence	<0.001	0.143
Regency/city of residence	<0.001	0.132
Financial factor	<0.001	0.133

Year of visit	<0.001	-0.014

4 Discussions

Anemia is a condition characterized by abnormally low hemoglobin or red blood cell level in the blood.[1] 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 [16].

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 [17]. 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 [18].

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.

4.1 Anemia Trends in Pregnant Women

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 [19–21] 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 [22].

4.2 Etiology of Anemia in Pregnant Women

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 [23].

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 [23].

4.3 Correlation Between Place of Residence and Anemia in Pregnant Women

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. Cirebon Regency and the three administrative cities of Jakarta exhibited the highest prevalence of anemia in pregnant women, 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.

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 [24] A body of research, both domestic and international, has identified a correlation between sociodemographic factors and the prevalence of anemia in pregnant mothers [15,18,25–28]

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 [29].

4.4 Correlation Between Financial Factors and Anemia in Pregnant Women

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 [30].

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 [31]. 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 [32] 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 [33]

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 [34] 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 [35]

4.5 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. Therefore, further research based on a nationwide health survey is necessary to enhance the representativeness of the findings.

5 Conclusion

Anemia cases among pregnant women in Indonesia demonstrated an overall increasing trend between 2015 and 2022, with notable regional disparities, highest in Java and lowest in the eastern regions. The condition is largely linked to iron deficiency and influenced by residence, financial factors, and year of visit. These findings underscore the need for more equitable distribution of primary health facilities and targeted strategies beyond Java. Future research should incorporate nationally representative data, such as large-scale health surveys, to strengthen evidence and inform more comprehensive interventions.

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