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Mapping anemia burden in Abuja: Insights from facility-based data

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Abstract

Background: Anemia is a significant public health issue in Nigeria, particularly among pregnant women. Despite its prevalence, localized data on anemia burden in the Federal Capital Territory (FCT), Abuja, remains sparse.

Objective: This study aimed to map the burden of anemia among pregnant women attending antenatal care clinics in selected health facilities across Abuja.

Methods: A cross-sectional study was conducted among 2,233 pregnant women attending antenatal care services in selected health facilities. Hemoglobin levels were assessed, and anemia prevalence was determined.

Results: The overall anemia prevalence was 30.9% (95% CI: 29.1-32.9%). Anemia was more frequent among women aged 21-30 years and those in their second trimester. The study found no significant association between anemia status and facility type.

Conclusion: The findings highlight the need for integrated, multisectoral strategies to reduce anemia burden among pregnant women in Abuja. Recommended actions include community-based nutrition education programs, improved access to iron-rich foods and micronutrient supplements, and strengthened policy support for maternal health initiatives.

Implications: This study provides critical insights for policymakers, healthcare providers, and stakeholders to develop targeted interventions and improve maternal health outcomes in Abuja and similar urbanizing regions.

Keywords: Anemia; Maternal health; Federal Capital Territory; Abuja

1. Introduction

Anemia, a condition marked by a deficiency in red blood cells or hemoglobin concentration, remains a significant global public health issue, particularly in low- and middle-income countries where access to healthcare and adequate nutrition is limited [1]. In Nigeria, the burden of anemia is high, affecting 71% of children under five, 47.3% of non-pregnant women aged 15 to 49, and 57.5% of pregnant women [2]. These figures reflect a combination of nutritional deficiencies and the impact of infectious diseases and socio-economic disparities.

Among women of reproductive age, anemia contributes to poor maternal and neonatal outcomes, including increased risk of maternal mortality, preterm delivery, and low birth weight [3,4]. The underlying causes are multifactorial,

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including inadequate intake or absorption of essential nutrients such as iron, folate, and vitamin B12, as well as parasitic infections such as malaria and hookworm that further deplete hemoglobin levels [5,6].

In the Federal Capital Territory (FCT), Abuja, variations in socioeconomic status, education, and access to health services create a complex landscape for addressing maternal anemia. While national surveys have documented anemia prevalence broadly, localized data remain sparse—particularly those derived from health facility settings. This lack of granular, spatially relevant data limits the ability of policymakers and public health stakeholders to implement targeted interventions.

Facility-based studies have begun to shed light on this issue. For example, a cross-sectional study in primary health facilities in Gwagwalada Area Council reported anemia prevalence as high as 58.7% among children under five, with higher risk among children aged 2–3 years [7]. Another study in Gwarinpa General Hospital linked malaria infection to significantly lower hemoglobin levels among outpatients [8]. Despite such findings, there has been limited research examining the burden of anemia specifically among pregnant women attending antenatal care (ANC) clinics in Abuja—a group particularly vulnerable to the adverse effects of anemia.

1.1. Statement of the Problem

Anemia during pregnancy, especially iron-deficiency anemia which remains a leading cause of maternal morbidity and mortality in Nigeria [1]. It is associated with a range of complications, including premature delivery, low birth weight, and impaired cognitive development in infants. Yet, despite growing recognition of these risks, comprehensive, up-to-date data on the burden and distribution of anemia among pregnant women in the FCT is scarce.

Existing facility-based studies have largely focused on children or general outpatient populations, offering only fragmented insights into maternal anemia. This gap hinders effective public health planning, limits the precision of interventions, and leaves many pregnant women at risk of underdiagnosis and undertreatment.

1.2. Purpose of the Study

This study was conducted to map the burden of anemia among pregnant women attending antenatal care clinics across Abuja, using facility-based data. By generating updated, localized evidence on anemia prevalence and its associated factors, the research addresses a critical gap in the maternal health literature for the FCT.

The specific objectives of the study were to:

- Determine the prevalence of anemia among pregnant women attending ANC services in selected health facilities across Abuja.
- Identify key contributing factors such as nutritional status, malaria infection, socioeconomic status, and healthcare access.
- Highlight spatial patterns of anemia burden, using facility-level data to inform targeted intervention planning.
- Provide evidence to support improved allocation of maternal health resources and design of context-specific public health interventions.

By leveraging routine clinical data from health facilities, this study provides actionable insights for policymakers, health planners, and clinicians working to reduce the burden of maternal anemia in Abuja and similar urbanizing regions.

2. Literature review

2.1. Introduction

Anemia, defined by a reduction in red blood cell count or hemoglobin concentration, compromises the oxygen-carrying capacity of the blood, resulting in fatigue, weakness, and increased susceptibility to disease [1]. According to the World Health Organization (WHO), anemia is present when hemoglobin levels fall below 13 g/dL in men and 12 g/dL in non-pregnant women [9]. Globally, anemia affects over 1.6 billion people, with the highest burden seen among women of reproductive age and young children [1]. In sub-Saharan Africa including Nigeria, this condition is primarily driven by poor nutritional intake, parasitic infections, and widespread infectious disease [3,10].

The 2018 Nigeria Demographic and Health Survey (NDHS) reported that 58% of women aged 15–49 and 68% of children under five were anemic [11]. Among pregnant women, anemia is of particular concern due to the increased physiological demands of pregnancy and commonly pre-existing deficiencies [2]. These figures underscore a critical public health issue with implications for maternal and child survival.

2.2. Anemia Epidemiology in Nigeria

Nigeria is one of the countries most affected by anemia globally [12]. As reported by Azinge et al. [2], anemia affects 71% of children under five, 47.3% of non-pregnant women, and 57.5% of pregnant women. Nationally, the 2021 National Food Consumption and Micronutrient Survey (NFCMS) estimated the prevalence of iron deficiency anemia in pregnant women at 26.1% [13].

According to the same survey, 32% of pregnant women aged 15–49 were anemic overall, with higher rates in rural areas (37%) compared to urban areas (21%). Moderate anemia was observed in 9% of women, while severe anemia, though less common, affected 0.5% [13]. These patterns reflect significant urban–rural disparities and suggest that underlying determinants vary by location, requiring tailored responses.

Although these statistics offer a national overview, they do not sufficiently capture localized burdens, particularly in rapidly urbanizing areas such as Abuja. The lack of facility-based, geographically specific data has limited the effectiveness of interventions aimed at reducing maternal anemia.

2.3. Anemia Burden in the Federal Capital Territory (FCT), Abuja

Within the North-Central geopolitical zone, where the Federal Capital Territory (FCT) is situated, anemia prevalence remains high. The NFCMS reports a regional prevalence of 59% [13]. Yet, despite Abuja's status as the capital city—with relatively better infrastructure compared to many states—disparities persist across its six Area Councils. Rural and peri-urban areas tend to exhibit higher anemia rates due to limited healthcare access, food insecurity, and poor sanitation [12].

Government interventions such as routine iron supplementation and intermittent preventive treatment of malaria (IPTp) during pregnancy are in place but have shown inconsistent implementation across health facilities in the FCT [18]. Furthermore, there is limited data on how well these programs are integrated into antenatal care services, particularly in public primary health centers, which serve the majority of low-income residents.

Few studies have directly assessed anemia prevalence through facility-based ANC data in Abuja. Available research primarily focuses on children or general outpatient populations. For example, a study in primary healthcare clinics in Gwagwalada Area Council found a 58.7% anemia prevalence among children under five, with the highest rates among those aged 2–3 years [7]. Another study in Gwarinpa General Hospital demonstrated significantly lower hemoglobin levels among malaria-positive patients, underscoring the link between parasitic infections and anemia [8]. However, similar localized data on pregnant women have been lacking - until now.

2.4. Determinants of Anemia in Nigeria

2.4.1. Nutritional Deficiencies

Iron deficiency is the most common cause of anemia in Nigeria, driven by poor dietary diversity and limited intake of iron-rich foods such as meat, legumes, and leafy vegetables [2,19]. Other micronutrient deficiencies, particularly folate and vitamin B12, also contribute to poor hemoglobin synthesis [20]. Dietary inhibitors such as phytates that's common in cereal-based diets further reduce iron absorption [21].

2.4.2. Parasitic Infections

Parasitic infections, particularly malaria and helminthiasis, are strongly associated with anemia in Nigeria [22,23]. Malaria induces hemolysis and suppresses red blood cell production, while hookworm leads to chronic gastrointestinal blood loss. The combination of parasitic infection and malnutrition amplifies anemia risk, especially among children and pregnant women [24].

2.4.3. Chronic Diseases

Chronic illnesses such as HIV/AIDS, tuberculosis, and kidney disease also impair hemoglobin production and increase anemia risk [25,26]. These conditions are particularly concerning among vulnerable populations with already limited access to healthcare.

2.4.4. Socioeconomic and Behavioral Factors

Poverty, food insecurity, and limited education restrict access to adequate nutrition and healthcare services [27]. Rural communities face greater infrastructural challenges and often lack access to fortified foods or antenatal supplements [28]. In some areas, cultural practices also restrict the consumption of nutritious foods among pregnant women due to food taboos or traditional beliefs [29,30]. Intra-household food distribution patterns may favor adult men, placing women and children at nutritional disadvantage [31].

2.4.5. Maternal Education

Low levels of maternal education are associated with poor health-seeking behavior and limited knowledge of nutrition, further increasing the risk of anemia in both women and children.

2.5. Vulnerable Populations

2.5.1. Pregnant Women

Pregnant women are especially vulnerable to anemia due to increased physiological demands for iron and other nutrients. Without adequate dietary intake or supplementation, anemia during pregnancy can lead to maternal complications, including low birth weight, premature delivery, and increased mortality risk [2,6].

2.5.2. Children Under Five

Children are at high risk due to rapid growth, poor complementary feeding practices, and exposure to parasitic infections. Weaning onto nutritionally inadequate diets compounds the problem [32].

2.5.3. Current Interventions and Gaps

Several national strategies are in place to reduce anemia prevalence in Nigeria. These include:

- Micronutrient Supplementation: Provision of iron and folic acid to pregnant women through ANC services.
- Food Fortification: Fortifying staple foods with essential vitamins and minerals [34].
- Health Education Campaigns: Focused on nutrition, malaria prevention, and early ANC attendance [35].
- Policy Frameworks: The National Strategic Plan on Anemia Control guides multisectoral efforts to address anemia among women and children [36].

Despite these initiatives, coverage and effectiveness remain inconsistent—particularly at the sub-national level. Challenges include inadequate supply chains, lack of health worker training, poor integration of services, and insufficient monitoring and evaluation mechanisms.

2.6. Relevance of Facility-Based Data and Spatial Mapping

There is a critical need for high-resolution, facility-level data to inform interventions and policymaking. While national surveys offer broad insights, they often obscure local disparities and programmatic gaps. By utilizing facility-based ANC data across multiple Area Councils in Abuja, the present study fills a major gap in the literature.

It provides spatially disaggregated insights into the prevalence and determinants of anemia among pregnant women, identifying potential hotspots and informing more targeted maternal health strategies.

Here's a refined version of your Theoretical Frameworks and Research Gaps sections, modified to fit seamlessly into the Literature Review of your manuscript titled:

2.7. Theoretical Frameworks

To better understand the multifaceted nature of anemia among pregnant women in the Federal Capital Territory (FCT), this study draws on two complementary theoretical frameworks: the Social Determinants of Health (SDH) and the Health Belief Model (HBM).

2.7.1. Social Determinants of Health (SDH)

The SDH framework, developed by the World Health Organization, emphasizes that health outcomes are significantly influenced by the social and structural conditions in which individuals are born, live, work, and age. These include factors such as education, income, employment, housing, gender, food security, and access to healthcare. In the context of anemia in the FCT, this framework provides a lens through which to understand how socioeconomic disparities, urban-rural divides, and access to maternal health services contribute to the uneven distribution of anemia prevalence across different communities. Facility-based data, when spatially disaggregated, can help visualize how these social gradients manifest in health outcomes such as anemia.

2.7.2. Health Belief Model (HBM)

The Health Belief Model is a psychological framework that explains health behaviors through individual perceptions of illness and the benefits or barriers to taking action. Applied to maternal anemia, the HBM helps to interpret health-seeking behaviors such as compliance with iron supplementation, attendance at antenatal care (ANC), and adherence to dietary recommendations. In Abuja, where cultural beliefs, knowledge gaps, and systemic barriers influence maternal practices, the HBM can shed light on why some pregnant women may not engage with available preventive services—even when access exists. Factors such as perceived severity of anemia, perceived benefits of treatment, perceived barriers (e.g., cost or side effects of iron tablets), and cues to action (e.g., health education during ANC) are particularly relevant in shaping behavioral responses.

Together, the SDH and HBM frameworks provide a comprehensive basis for analyzing both the structural drivers and individual-level behaviors that influence anemia outcomes in the FCT.

2.7.3. Research Gaps in Anemia Data and Interventions

While extensive national and regional data exist on anemia in Nigeria, key gaps persist—especially concerning localized data collection and use for program design in the FCT. These gaps include:

Lack of Disaggregated, Community-Level Data

National surveys like the NDHS and NFCMS offer broad estimates but often fail to capture community-specific variations within Abuja's diverse Area Councils. This limits the ability to identify anemia hotspots and tailor interventions at the ward or facility level.

Limited Use of Facility-Based Data

Although health facilities regularly collect hemoglobin and related data during ANC visits, these datasets are often underutilized for surveillance, program planning, or resource allocation. There is a missed opportunity to leverage routine facility records for real-time monitoring of maternal anemia trends.

2.7.4. Insufficient Spatial Analysis of Anemia

There is limited application of geospatial mapping techniques to visualize the burden of anemia across different parts of the FCT. Without spatially disaggregated data, programs may fail to reach high-burden areas, especially in peri-urban and underserved rural zones.

2.7.5. Behavioral Insights Are Underexplored

Few studies have examined how health beliefs, knowledge, and social norms affect the uptake of anemia-prevention behaviors such as dietary modification, supplement adherence, or ANC attendance. This behavioral dimension is essential for understanding why anemia persists despite ongoing interventions.

2.8. Fragmented Program Coverage

Government-led initiatives such as iron-folic acid supplementation, food fortification, and malaria prevention during pregnancy often suffer from uneven implementation. Coverage gaps across health facilities and Area Councils are rarely documented in a systematic way, limiting efforts to improve equity in service delivery.

- By addressing these gaps, the present study contributes to the evidence base by utilizing facility-based ANC data across multiple locations within Abuja to:
- Determine the prevalence and geographical distribution of anemia among pregnant women;
- Explore socio-demographic and clinical factors contributing to the burden;

- Provide actionable insights for localized, data-driven interventions.

This approach aligns with national goals to strengthen maternal health systems and offers a replicable model for other urbanizing regions in Nigeria.

3. Methodology

3.1. Background of the Study Area

The Federal Capital Territory (FCT), Abuja, serves as the capital of Nigeria and is centrally located within the country. Established in 1976 and officially designated as the seat of government in 1991, Abuja was selected for its neutrality, accessibility, and suitability for planned urban development. The FCT comprises six Area Councils: Abaji, Bwari, Gwagwalada, Kuje, Kwali, and the Abuja Municipal Area Council (AMAC), each characterized by distinct demographic, socioeconomic, and healthcare profiles.

Across the FCT, there are 559 primary healthcare facilities and 90 secondary healthcare centers, underscoring the region's investment in public health infrastructure [39]. Bwari Area Council houses 87 Primary Health Centers (PHCs), including 23 public and 64 private facilities, along with two secondary healthcare institutions: Bwari General Hospital and Sumit Hospital. In Gwagwalada Area Council, there are 78 PHCs (30 public, 48 private), supported by additional secondary-level services.

This study focused on mapping the anemia burden using facility-based data from Bwari and Gwagwalada Area Councils. These councils were purposively selected due to their representation of both rural and semi-urban populations, differences in healthcare access, and diversity in maternal health indicators. From an initial pool of 22 PHCs in Gwagwalada, 18 met the inclusion criteria. In Bwari, 20 PHCs were selected based on service availability and data completeness. This stratified sampling ensured representativeness across facility types and geographic contexts within the FCT.

3.2. Health Facility Overview

The selected facilities provide maternal healthcare services including antenatal care (ANC), anemia screening, iron and folic acid supplementation, and nutrition education. For this study, 38 healthcare facilities were included: 35 Primary Health Centers (PHCs) and 3 secondary hospitals (Zuba General Hospital, Kubwa General Hospital, and Bwari General Hospital). These facilities were chosen based on their active ANC programs and consistent recording of hematological data, making them suitable sources for facility-based mapping of anemia prevalence among pregnant women.

3.3. Study Population

The study population consisted of pregnant women attending ANC at the selected 38 healthcare facilities in Gwagwalada and Bwari Area Councils. These facilities serve diverse communities across urban and semi-urban settings, capturing a broad cross-section of the maternal population in the FCT.

3.4. Inclusion Criteria

Participants were eligible for inclusion if they:

- Had a confirmed pregnancy at the time of data collection;
- Were enrolled in antenatal care at one of the 38 selected facilities;
- Had completed hematological screening, particularly hemoglobin testing;
- Provided informed consent;
- Were between 15 and 49 years of age.

3.5. Exclusion Criteria

Exclusion criteria included:

- Non-pregnancy at the time of data collection;
- Incomplete medical records, especially missing hemoglobin values;
- Pre-existing hematological disorders (e.g., sickle cell disease, leukemia);
- Declined participation or withheld informed consent;

- Recent blood transfusion or iron therapy, which could influence hemoglobin levels.

3.6. Study Design

This research employed a cross-sectional descriptive design to map the prevalence and distribution of anemia among pregnant women in selected healthcare facilities. The design was appropriate for identifying facility-based patterns and associations at a specific point in time, supporting data-driven public health insights.

3.7. Study Approach

A mixed-methods approach was adopted to provide a comprehensive assessment of anemia burden and its underlying drivers:

- Quantitative data: Collected from hematological screening records (hemoglobin levels) to classify anemia prevalence and severity.
- Qualitative data: Derived from patient medical records, facility profiles, and contextual information on nutrition counseling and healthcare access.
- This integrated approach allowed for both measurement and contextualization of maternal anemia, aligning with the study's goal of mapping the burden through facility-level insights in Bwari and Gwagwalada.

3.8. Sample Size Determination

The minimum sample size was calculated using the Cochran formula for populations over 10,000:

$$n = \frac{z^2 \mathrm{p}(1 - \mathrm{p})}{d^2}$$

Where:

Z = 1.96 (standard normal deviate for 95% confidence)

p = 0.5 (assumed prevalence for maximum sample size)

q = 1 - p = 0.5

d = 0.05 (desired margin of error)

Substituting into the formula:

$$n = \frac{(1.96)^2 \text{x } 0.5 \text{ x } (0.5)}{(0.05)^2}$$

$$n = \frac{38416 \text{ x } 0.25\ )}{0.0025} = \underline{0.9604}$$

n = 384.16. Rounding up to the nearest whole number we get 384

To account for potential non-response or loss to follow-up, the sample size was increased by 10%:

384+(10% of 384)=384+38.4=422.4

Thus, the final target sample size was 422 participants.

- Sampling Technique
- Health Facility Selection

A purposive sampling technique was used to select facilities in Bwari and Gwagwalada Area Councils. Selection criteria included:

- Presence of active ANC services;

- Availability of both primary and secondary healthcare centers;

3.9. Accessibility for research purposes;

Variation in population demographics across service areas.

In Gwagwalada, 22 PHCs were initially reviewed; 18 were selected based on operational readiness and record completeness. In Bwari, 20 PHCs were similarly chosen. This ensured a geographically and functionally diverse sample of health facilities contributing to the mapping of anemia prevalence.

3.10. Participant Sélection

A stratified sampling approach was adopted to select pregnant women within the chosen facilities. Stratification was based on:

- Pregnancy trimester**;**
- Maternal age group**.**

Eligible women were screened using inclusion and exclusion criteria. Women with hematological conditions, recent transfusions, or incomplete data were excluded to minimize bias. This combined sampling strategy enhanced the representativeness and reliability of the data collected for mapping anemia burden across facility levels.

3.11. Data Collection Tools

Validated tools were employed to ensure data quality, consistency, and comparability:

Pregnancy and Nutrition Questionnaire (PNQ) – Developed by the International Federation of Gynecology and Obstetrics (FIGO), this tool assesses maternal nutrition, dietary patterns, and related health practices [40].

Anemia Knowledge Questionnaire (AKQ) – Developed by Kanna et al., this instrument evaluates participants' knowledge of anemia causes, symptoms, and prevention strategies [41].

3.12. Data Collection Method

To effectively map the burden of anemia among pregnant women in the Federal Capital Territory (FCT), a mixed-methods approach was adopted. This integrated both quantitative and qualitative data collection techniques to ensure a robust, facility-based understanding of anemia prevalence and its associated factors.

3.13. Data Collection Procedures

3.13.1. Hematological Assessment

Hemoglobin levels were assessed using standard laboratory protocols consistent with World Health Organization (WHO) guidelines. Blood samples were collected by trained phlebotomists and laboratory scientists using aseptic techniques to ensure accuracy and minimize contamination.

3.13.2. Structured Questionnaires

Participants completed structured interviews using validated tools:

- Pregnancy and Nutrition Questionnaire (PNQ)
- Anemia Knowledge Questionnaire (AKQ)

Facility-based patient records were reviewed to extract relevant data, including:

- Previous hemoglobin test results, history of antenatal visits and diagnosed cases of anemia

This retrospective review allowed for triangulation of reported data and provided insight into health system practices related to anemia screening and treatment.

- Key Informant Interviews

- Semi-structured interviews were conducted with healthcare personnel including:
- ANC focal persons
- Facility managers
- Participant Recruitment and Support

ANC focal persons assisted in identifying eligible participants in line with the study's inclusion criteria. Facility officers provided administrative support and facilitated access to patient records.

Pre-testing of data collection instruments was conducted in a comparable facility to evaluate tool clarity, consistency, and usability. Necessary adjustments were made based on pre-test results to improve data quality.

3.14. Packed Cell Volume (PCV) – Hematocrit Measurement

3.14.1. Principle

The Packed Cell Volume (PCV), or hematocrit, reflects the volume percentage of red blood cells in a blood sample and is used to estimate hemoglobin concentration using the approximation:

$Hb \approx PCV \div 3$

Specimen Collection

Capillary blood was collected using a sterile finger prick method.

3.14.2. Procedure

- The puncture site (usually the middle finger) was disinfected with 70% alcohol.
- A sterile lancet was used to draw blood, wiping away the first drop.
- Blood was drawn into heparinized capillary tubes by capillary action, up to two-thirds full.
- One end of each tube was sealed with plasticine.
- Tubes were centrifuged at 1,200 rpm for 5 minutes using a micro-hematocrit centrifuge.
- PCV values were read with a hematocrit reader, measuring the ratio of red cell column to total blood volume.
- This method provided a rapid, low-cost hematological assessment, ideal for facility-based studies in resource-constrained settings.

3.15. Data Analysis

Collected data were analyzed using both descriptive and inferential statistical techniques to identify trends and associations relevant to anemia burden in the FCT.

3.16. Descriptive Analysis

Frequencies, percentages, and means were used to summarize:

- Demographic characteristics
- Anemia prevalence
- Distribution across facilities
- Inferential Analysis

Chi-square tests examined associations between categorical variables (e.g., anemia status vs. trimester or age group).

Logistic regression identified significant predictors of anemia, adjusting for potential confounders.

All analyses were performed using appropriate statistical software. The level of statistical significance was set at $p < 0.05$.

3.17. Ethical Considerations

This study adhered to established ethical guidelines and was approved by the Federal Capital Territory Health Research Ethics Committee (FCT-HREC).

3.18. Informed Consent

All participants received detailed information about the study's objectives, procedures, risks, and benefits. Written informed consent was obtained from each participant. All physical and digital data were securely stored and accessible only to authorized research personnel.

3.19. Minimization of Risk

The study posed minimal risk. Blood sample collection was conducted by certified personnel using sterile equipment. Participants identified with severe anemia were referred immediately for appropriate medical care.

3.20. Community and Institutional Approvals

In addition to ethical clearance:

- Administrative approvals were secured from all participating health facilities.
- Engagement meetings were held with community leaders and facility managers to ensure alignment with local norms and gain stakeholder buy-in.

3.21. Dissemination of Results

A multi-tiered dissemination strategy was developed to share findings with relevant stakeholders and promote actionable change based on study outcomes.

- Community-Level Dissemination
- Community meetings and health talks will be organized at selected PHCs and community centers using local languages.
- Sessions will involve pregnant women, caregivers, and traditional leaders.
- Visual tools (posters, charts, infographics) will aid in communication.
- Community Health Workers (CHWs) will be engaged to ensure follow-up actions and culturally sensitive messaging.
- Healthcare Professionals
- Findings will be shared via workshops and training sessions with frontline providers (nurses, midwives, doctors).
- Key findings

3.22. Educational content

Resources for healthcare providers and pregnant women

4. Results

4.1. Screening Coverage and Facility Distribution

A total of 2,233 pregnant women were screened for anemia across selected healthcare facilities in two Area Councils of the Federal Capital Territory (FCT), Abuja. Of these:

- 629 (28.1%) were from Gwagwalada Area Council
- 1,604 (71.8%) were from Bwari Area Council
- In terms of facility type:
- 1,653 women (74%) were screened at Primary Health Care (PHC) facilities
- 580 women (26%) were screened at Secondary Health Care facilities
- Overall Anemia Prevalence

Among the 2,233 participants screened, 692 women (30.9%) were found to be anemic, with a 95% Confidence Interval (CI) of 29.1% to 32.9% (Figure 1). This prevalence rate places maternal anemia in Abuja within the moderate public health concern category, as defined by WHO guidelines.

Characteristics of the Analyzed Subsample (n = 422)

From the total screened population, a subsample of 422 women was selected for more detailed analysis based on pre-defined inclusion criteria. The sample size was calculated using Cochran's formula, with an initial estimate of 384. A 10% adjustment for non-response increased the final sample size to 422.

4.2. Age Distribution

As shown in Table 1:

- 255 participants (60.4%) were aged 21–30 years, the largest age group
- The mean age across the sample was 27 years
- Adolescent pregnancies (women <20 years) accounted for 11% of the sample
- Gestational Age and Trimester Distribution

According to Table 2:

- 394 women (93.4%) were in early gestation (<28 weeks)
- 19 women (4.5%) were between 28 and 31 weeks
- 8 women (1.9%) were between 32 and 36 weeks
- 1 participant (0.2%) was between 37 and 41 weeks

When categorized by trimester:

- 359 participants (85.1%) were in their second trimester
- Anemia Prevalence by Demographic and Clinical Characteristics
- Among the analyzed subsample (n = 422), anemia was more frequently observed in:
- Women aged 21–30 years
- Women with gestational age <28 weeks
- Women in their second trimester

However, none of these associations reached statistical significance:

Age group vs. anemia: $\chi^2 = 5.572$, $p = 0.782$

Gestational age vs. anemia: $\chi^2 = 2.451$, $p = 0.982$

Trimester vs. anemia: $\chi^2 = 3.661$, $p = 0.72$

Table 1 Age Distribution of Pregnant Women (n = 422)

Age Group (Years)	Frequency	Percentage (%)
< 20	46	10.9
21–30	255	60.4
31–40	105	24.9
> 40	16	3.8
Total	422	100

Table 2 Gestational Age Distribution

Gestational Age (Weeks)	Frequency	Percentage (%)
< 28	394	93.4
28–31	19	4.5
32–36	8	1.9

37–41	1	0.2
Total	422	100

Table 3 Distribution by Trimester

Trimester	Frequency	Percentage (%)
First	62	14.7
Second	359	85.1
Third	1	0.2
Total	422	100

5. Discussion

This study provides critical facility-based insights into the geographic and demographic distribution of anemia in Abuja, helping to map the burden and identify priority intervention areas.

5.1. Participant Profile and Engagement with ANC

Most participants were young women, with an average age of 27.5 years. The 21–30 age group accounted for the majority of both participants (60.4%) and anemia cases, though the association between age and anemia was not statistically significant. The 11% adolescent pregnancy rate highlights a vulnerable subgroup requiring targeted reproductive health and nutrition education interventions.

Nearly 93.4% of women were in early pregnancy (<28 weeks), with 85.1% in their second trimester. This reflects early engagement with ANC services, enabling timely detection of anemia. The second trimester showed a higher prevalence of anemia, consistent with studies linking increased physiological demand and plasma volume expansion during mid-pregnancy to heightened anemia risk.

5.2. Burden and Severity of Anemia

The overall anemia prevalence of 30.9% classifies the condition as a moderate public health concern, according to WHO criteria. Among anemic participants:

- 79.23% had mild anemia
- 20.00% had moderate anemia
- 0.77% had severe anemia

These figures mirror prevalence rates observed in Mararaba Gurku (Nasarawa State) and Warri, but are notably lower than those reported in Uyo (54.5%) and Kaduna (62%) [42,43]. These regional differences likely reflect variability in socioeconomic status, dietary patterns, healthcare access, and maternal education.

5.3. Facility-Based Insights and Service Delivery

Although anemia was more frequently observed among women attending primary healthcare centers, statistical analysis found no significant relationship between facility type and anemia status. This suggests comparable service delivery standards, such as routine hemoglobin screening and iron supplementation, across both primary and secondary facilities. This is consistent with previous findings from Kaduna, which also noted standardized ANC protocols at PHC level.

5.4. Trimester-Specific Patterns

Anemia prevalence tended to increase in later trimesters, aligning with trends reported in Lagos and Port Harcourt. This underscores the need for continued nutritional support and supplement adherence throughout the pregnancy lifecycle—not only in early gestation.

5.5. Comparative and International Context

In comparison to international data, the anemia prevalence in this study (30.9%) was higher than in The Gambia (21.6%) [Reference Needed]. These differences may stem from structural factors such as:

- Household income
- Women's decision-making power
- Maternal health literacy
- Access to nutritious foods and prenatal supplements

6. Conclusion and Implications for Public Health Programming

These findings underscore the urgent need for integrated, multisectoral strategies to reduce the anemia burden among pregnant women in Abuja. Recommended actions include:

- Community-based nutrition education programs
- Improved access to iron-rich foods and micronutrient supplements
- Strengthened policy and programmatic support for maternal health initiatives

This baseline phase lays the foundation for assessing the effectiveness of targeted interventions—especially nutrition education—in improving micronutrient adherence and reducing anemia-related complications in the FCT.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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