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🌐 Assessment of Iron Deficiency and Iron Deficiency Anemia Using Red Blood Cell Indices: A Retrospective study Protocol

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We use this protocol and it's working

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Abstract

Abstract

This protocol describes a retrospective study designed to assess the prevalence, associated factors, and geographical variation of iron deficiency and iron deficiency anemia among children under five years and pregnant women seeking healthcare services at Sebbi Hospital, Uganda. The study will utilize data from August 2021 to August 2024, extracted from the Health Management Information System (HMIS) and Streamline Patient Database.

Objectives

1. To estimate the prevalence of iron deficiency and iron deficiency anemia among children and pregnant women.
2. To identify factors associated with these conditions in the study population.
3. To examine geographical variations in prevalence across residential areas served by the hospital

Materials

Sources of data

1. Health Management Information System (HMIS) register books for pregnant women
2. Streamline Patient Management Database

Data Management Tools

1. Microsoft® Excel® for data extraction, cleaning, and organization.
2. R software version 4.4.1 for data analysis

Methods

1 Inclusion Criteria

- 1.1 Pregnant women aged 15–49 years who attended antenatal care (ANC) at Sebbi Hospital between August 1, 2021, and August 1, 2024, and had a complete blood count (CBC) performed on their first visit to the hospital
- 1.2 Children aged 6–59 months who received healthcare services at Sebbi Hospital and had a CBC test performed during the same period

2 Exclusion Criteria

- 2.1 Pregnant women who attended ANC from Sebbi Hospital and didn't do a CBC test on the first time they visited the hospital
- 2.2 Non-pregnant women and those outside the 15–49 age range
- 2.3 Children younger than 6 months or older than 59 months and those without a CBC test result

Preparing the sampling frame for Children aged 6 - 59 months

- 3 We will use the reports window in Streamline, and search for, "Patient visits" as the report category, 0 - 5 years as the custom age group, "All" for Gender, "All" for Inpatient/Outpatient, "All" for Patient Category, "All" for patient registration fields, and "1/08/2021 to 1/8/2024" as the search period.
- 4 For Children who will be older than five years by 1st August 2024 but were eligible for the study during the study period, we will search using "Patient visits" as the report category,
 - 4.1 We will use 6 - 8 years as the custom age group, "All" for Gender, "All" for Inpatient/Outpatient, "All" for Patient Category, "All" for Patient registration fields, and "1/08/2021 to 1/8/2024" as the search period,
 - 4.2 We will use 6 - 7 years as the custom age group, "All" for Gender, "All" for Inpatient/Outpatient, "All" for Patient Category, "All" for Patient registration fields, and "1/08/2022 to 1/8/2024" as the search period;

- 4.3 We will search 6 years as the custom age group, "All" for Gender, "All" for Inpatient/Outpatient, "All" for Patient Category, "All" for Patient registration fields, and "1/08/2023 to 1/8/2024" as the search period
- 5 We will use the hyperlinked service number of children generated from the search to access the list of children, identified by name, patient number, and gender.
- 6 An excel list with unique patient numbers using Microsoft excel will be created
- 7 Duplicates will be removed.
- 8 Using patient numbers, we will check if a CBC has ever been done or not.
- 9 For participants with a CBC done, we will indicate "Yes" against each participant, and for those without a CBC, we will indicate "No".
- 10 We will use the patient numbers of participants who had a CBC done to obtain their date of birth.
- 11 We will use the date of birth to calculate the age of the participant at the time when the CBC was done.
- 12 From the list we will remove any child without a CBC done, younger than 6 months and those older than 59 months. The remainder will form the sampling frame of children.

Preparing the sampling frame for Pregnant women

- 13 From the HMIS register books, we will search for pregnant women who obtained Antenatal care services for the first time at Sebbi Hospital and had a CBC done.
- 14 We will write the names of these women on a data collection sheet including their age, date of first antenatal visit, and gestation age.
- 15 Using the names and dates of their first antenatal visit, we will search for the patient numbers that will be used throughout the study period and for data collection.
- 16 This will form the sampling frame for pregnant women.

Determining Sample size

- 17 The sample size will be calculated using the Scalex SP calculator for determining the sample size of prevalence studies (Naing et al., 2022). The estimated prevalence of IDA in children is 34% (Muriuki et al., 2020), while the prevalence is estimated to be 9.3% among pregnant women (Baingana et al., 2014). We will apply the precision of 2% for children and 2.08% for pregnant women

Sampling from the Sampling Frames

- 18 We will generate a column of random numbers using Microsoft Excel for the data frames of both pregnant women and children.
- 19 We will Sort all columns in ascending order using the column of random numbers.
- 20 We will select the first number of participants that make up the sample size calculated.

Data Collection

- 21 We will use patient numbers to look up data for the participants.
- 22 This data will include Patient demographic characteristics such as sex, residence, age, gestation age, and red cell indices such as Red blood cell count (RBC), Hemoglobin (Hb), Mean Cell Volume (MCV), Mean Corpuscular Hemoglobin (MCH), and Red cell Distribution Width (RDW).

Definition of terms

- 23 **Mentzer Index**
- 23.1 The corrected Mentzer index will be determined using the formula: MCV/RBC
- 24 **Anemia and Severity of anemia**



24.1 We will define anemia and severity of anemia based on hemoglobin levels specific to age groups and pregnancy trimester, following the World Health Organization cutoff values.

25 Iron Deficiency

25.1 Iron deficiency will be defined by lower mean corpuscular volume (MCV), lower mean corpuscular hemoglobin (MCH), and high RDW. This will be determined by applying the following cutoff values: MCH < 27 pg, MCV < 80fl, and RDW > 16%

26 Iron Deficiency Anemia

26.1 Iron deficiency anemia will be defined using a corrected Mentzer index, which will be determined by a Mentzer index > 13, an MCH < 27.0 pg and low HB (HB < 10.5g/dl for children 6 – 23 months, HB < 11.0 g/dl for children 24 – 59 months, First trimester HB < 11.0 g/dl, Second trimester HB < 10.5 g/dl, and third trimester HB < 11.0 g/dl).

27 Sensitivity testing

27.1 Sensitivity testing will be performed by comparing the corrected Mentzer Index with an alternative index that classifies IDA based on hemoglobin (HB) thresholds for children and pregnant women, along with criteria for iron deficiency.

Data validation

28 Cross-check 10% of the dataset for consistency in red blood cell indices and demographic details

Data analysis

29 Descriptive Statistics

29.1 We will summarize demographic and clinical characteristics for children and pregnant women, including age, sex, residence, gestational age, and red blood cell indices

29.2 We will test for normality of the data on age and gestation period



29.3 We will use means and standard deviations (SD) for normally distributed data, and medians with ranges for non-normal data

29.4 We will visualize red blood cell parameter distributions using box plots with error bars

30 **Prevalence estimation**

30.1 We will calculate the prevalence of ID and IDA as proportions with 95% confidence intervals (CI) stratified by age group, sex, trimester and residence area

30.2 We will perform sensitivity testing by comparing the corrected Mentzer Index with an alternative index. In this case we will use an index that classified IDA based on hemoglobin (HB) thresholds for children and pregnant women, along with criteria for iron deficiency

31 **Inferential statistics**

31.1 We will perform chi-square tests to evaluate associations:

- Age groups (6–23 months, 24–59 months for children; trimester for pregnant women).
- Sex
- Residence area

31.2 We will calculate odds ratios (OR) with 95% CI to quantify the risk of ID and IDA by age group, sex,



Protocol references

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