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RELEVANCE OF MATERNAL FACTOR ON LOW BIRTH WEIGHT IN FULL-TERM NEONATES AT NAKIVALE HEALTH CENTER III, ISINGIRO DISTRICT.A CROSS-SECTIONAL STUDY.

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ABSTRACT

Background
Low birth weight (LBW) among neonates constitutes a significant global public health challenge with implications for immediate and long-term maternal and child health outcomes. This study investigated the relevance of maternal demographic factors on LBW neonates: specifically focusing on the association of maternal age, residential category status, and the relationship between gravidity and parity, and health status with low birth weight in full-term neonates at Nakivale Health Center III, Isingiro district.

Methodology
The study adopted a descriptive cross-sectional research design conducted among 98 mothers. The data was collected from the maternal register and analyzed using descriptive, exploratory, and logistic regression analysis.

Results
The average age of mothers was approximately 25.37 years, A logistic regression model fitted to explore the simultaneous influence of multiple maternal demographic factors on the likelihood of LBWs recorded Age = 0.779, Gravidity = 0.997, Parity:p = 0.997, Nulliparity: (Yes vs. No): p = 1.000. The null model's null deviance was 93.4760 with 97 degrees of freedom, all participants were recorded with an HIV-negative status and the average weight of babies was 2.247 Kg, with a range from 1.5 to 2.4 Kg.

Conclusion
The study offered valuable insights into the factors potentially influencing LBW at Nakivale Health Center III. While maternal age, residential category, gravidity, and parity were explored, only maternal age showed no significant association with LBW

Recommendation
To improve the accuracy and depth of our findings, health centers should prioritize complete and comprehensive data collection, especially concerning maternal health statuses.
Culturally sensitive interventions focusing on socioeconomic inequalities, timely access to antenatal and prenatal care, and health education promotion will be crucial in reducing LBW incidence and improving maternal and child health outcomes.

Keywords: *Maternal Factors, Full-term babies, Low birth weight, Nakivale Health Center III*
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BACKGROUND

Maternal and child health is a critical component of public health, with a profound impact on the well-being of communities and societies. The issue of low birth weight (LBW) among neonates has gained increasing attention due to its association with adverse health outcomes in both the short and long term (la et al., 2009). LBW, defined as a birth weight of less than 2,500 grams, poses significant challenges to neonatal health and development, making it a global public health concern (Thappa et al., 2022).

Globally, LBW remains a prevalent issue, with approximately 15% of all births recorded as LBW (Thappa, 2022). In regional contexts, statistics vary, reflecting diverse maternal health profiles. For instance, in Sub-Saharan Africa, the LBW rate is reported to be around 13%,

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highlighting the regional disparities in neonatal health (Tessema et al., 2021). Within the specific context of Uganda, the country's LBW prevalence stands at 11.5%, indicating a significant public health challenge (Louis et al., 2016). In Nakivale Health Center III, LBW is at 8.1% devastating almost as high as the country's burden.

The phenomenon of LBW is multi-factorial, with various maternal demographic factors playing pivotal roles. One of the key factors under investigation is maternal age. Previous studies have indicated a correlation between advanced maternal age and an increased risk of LBW (Goisis et al., 2017). Understanding this association is crucial for developing targeted interventions to mitigate the risks associated with LBW in neonates.

Gravidity and parity, representing the number of pregnancies and live births, respectively, might play a crucial role in determining birth outcomes. Studies suggest that primiparous women may be at an increased risk of delivering LBW neonates (Lin et al., 2021). This emphasizes the need to explore the relationships between gravidity, parity, and LBW in the specific setting of Nakivale Health Center III.

The residential category, particularly the distinction between national and refugee status, might be another determinant of neonatal health. Disparities in healthcare access and socioeconomic conditions between national and refugee populations may contribute to variations in birth weight outcomes (Gieles et al., 2019). Investigating this aspect within the specific context of Nakivale Health Center III is essential for tailoring interventions

The health status of the mother, encompassing factors such as HIV and AIDS status, hypertension (HTN), and diabetes mellitus (DM), has been identified as a significant contributor to adverse birth outcomes (Fentie et al., 2022a; Fentie et al., 2022b). Understanding how these health conditions influence the occurrence of LBW in neonates is vital for informing comprehensive maternal healthcare programs.

Despite existing global literature providing insights into LBW patterns and determinants, there is a notable gap regarding the specific factors influencing LBW in Nakivale Health Center III which hinders the development of targeted interventions and evidence-based policies to address LBW in this setting.

Addressing LBW is crucial for both immediate and long-term health outcomes due to its association with increased mortality risk, developmental delays, and a higher likelihood of chronic health conditions later in life (Bianchi and Restrepo, 2022). Consequently, understanding and mitigating factors contributing to LBW in Nakivale Health Center III have far-reaching implications for the overall health and well-being of the community.

Considering the gap, in identifying the specific maternal factors associated with LBW, the research aims to provide actionable insights for healthcare practitioners, policymakers, and community stakeholders to develop targeted interventions and improve neonatal health outcomes in Nakivale and surrounding communities. This study investigated the relevance of maternal factors on low birth weight in full-term neonates at Nakivale Health Center III, Isingiro district.

METHODOLOGY

Research Design

The selection of an appropriate research design is paramount to the validity and reliability of the study, a descriptive cross-sectional research design was deemed most suitable. This design facilitates the collection of data at a single point in time, allowing for a snapshot analysis of maternal demographics and LBW prevalence. The descriptive aspect enabled the exploration of the relationships between maternal age, gravidity, parity, health status, gestational age, and LBW.

The choice of a cross-sectional design aligned with the study's objective to capture a comprehensive overview of the current status of maternal factors and LBW at Nakivale Health Center III. This design also facilitated the examination of multiple variables simultaneously, providing a holistic understanding of the interplay between various demographic factors and LBW outcomes. Additionally, the cross-sectional design allowed for the identification of patterns and associations without necessitating a lengthy and resource-intensive longitudinal study. Given the time constraints of the research, a cross-sectional approach provided an efficient means to gather relevant data within the specified time frame. While acknowledging the advantages of a cross-sectional design, it was essential to recognize its inherent limitations, primarily the inability to establish causation due to the absence of temporal sequencing. Nevertheless, the chosen design aligned with the exploratory nature of the research, aiming to unveil associations and trends that will inform subsequent in-depth investigations. This study aimed to assess the

Target Population

The population comprised both national and refugee mothers, reflecting the diverse demographics of the healthcare facility. Nakivale Health Center III serves as the primary maternal healthcare facility in the region, making the captured experiences representative of the broader population it serves.

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Inclusion criteria

- The study strictly only included data collected from the HMIS MCH 006: INTEGRATED MATERNITY REGISTER at Nakivale Health Center III, Isingiro district.
- The study targeted mothers who delivered full-term neonates at Nakivale Health Center III within the past six months. This inclusion criterion ensured recent childbirth experiences, minimizing recall bias.

Exclusion criteria

- Babies born prematurely were not included in this study.
- Births that had not been recorded in the specific integrated maternity register.

Sample Size Determination

The sample size for this study was determined using the Kish-Leslie formula for cross-sectional studies:
Given that Nakivale Health Center III serves as the primary maternal healthcare facility for the region and the population size (N) of mothers who delivered full-term neonates within the past six months is estimated to be 500. To ensure a representative sample, a stratified sampling approach was employed, considering the unique characteristics of national and refugee subgroups. The sample size was determined based on the prevalence of low birth weight at Nakivale Health Center III, anticipated response rates, and the desired precision level. This approach enabled meaningful comparisons between demographic factors and low birth weight outcomes within the distinct subgroups that were established and the calculation calculated as follows:

$$N = Z^2P(1 - P)/D^2$$

n=required sample size
z=standard error of mean which corresponds to 95% confidence level (standard value of 1.96)
p=known prevalence; P?
d=margin of error as 5% (standard value of 0.05)
n= (1.96x1.96) (P?) (1-P?) / (0.05x0.05)

Establishing the sample size of this study

n= (1.96x1.96) (0.08) (1-0.08) / (0.05x0.05)
n= (3.8416) (0.08) (0.92)/ (0.0025)
n= 0.28274176/ 0.0025
n= 113

Considering that the prevalence of low birth weight in Nakivale Health Center III is 8%, the sample size of the study was 113 mothers who met the inclusion criteria for participation to adequately ensure a robust and feasible data collection process. However, due to various factors such as accessibility to participants, data collection challenges, and time constraints, the actual sample size obtained was 98 mothers. While this was slightly lower than the initially targeted sample size, it still provided a robust dataset for analysis. Despite the slight deviation from the original target, the sample size of 98 remained sufficiently large to detect significant associations and trends in the data, ensuring the study's findings were both reliable and generalizable to the broader population.

Sampling Procedure

Although the initial plan aimed for stratified sampling based on residential status to ensure a balanced representation of both national and refugee populations, practical challenges arose during data collection. These challenges led to an uneven distribution of participants, with a disproportionately smaller number from the national population. To address this imbalance and still achieve meaningful insights into the maternal factors influencing low birth weight, we opted for purposive sampling. This intentional selection method allowed us to focus on participants most relevant to the study's objectives, ensuring a comprehensive understanding of the maternal demographic factors affecting neonatal outcomes. While stratified sampling offers a structured approach to sample selection, adaptation to purposive sampling was essential to navigating the constraints encountered during the study, thereby maintaining the validity and relevance of the findings.

Data Collection

The data collection for this study primarily involved a retrospective review of maternal and neonatal health records available at Nakivale Health Center III. This approach was chosen to efficiently gather comprehensive information on maternal demographic factors and birth outcomes, specifically low birth weight (LBW) in full-term neonates.

Data Collection Instrument

The main data collection instrument was a structured data extraction form designed to capture relevant information from maternal and neonatal health records. The form included fields for maternal age, residential category (national/refugee), gravidity, parity, the health status of the mother (HIV status, hypertension, diabetes mellitus), and birth weight. The instrument was pre-tested to ensure clarity, relevance, and completeness.

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Administration of Instruments

The data extraction form was administered systematically by trained research assistants with experience in health record review. The review process was conducted at Nakivale Health Center III, ensuring access to accurate and up-to-date records. Research assistants adhered to standardized procedures to maintain consistency and reliability in data extraction.

As the study focused on retrospective record review, no direct interaction with mothers was anticipated. The review process was conducted in a manner that upholds confidentiality and privacy, with all collected data anonymized and securely stored.

Data Analysis Procedure

The data analysis for this study employed both descriptive and inferential statistical methods to comprehensively examine the relationships between maternal demographic factors and low birth weight (LBW) in full-term neonates. Descriptive statistics, including mean, median, standard deviation, and frequency distributions, were calculated for maternal age, gravidity, parity, health status of the mother, gestational age, and birth weight. These measures will provide a clear overview of the central tendencies and variability of the variables under investigation. Inferential analysis focused on exploring associations and identifying potential predictors of LBW. T-tests were applied for continuous variables. Furthermore, logistic regression analysis was employed to assess the simultaneous influence of multiple maternal demographic factors on the likelihood of LBW. Odds ratios and 95% confidence intervals were calculated to quantify the strength and direction of associations. All statistical analyses were performed using statistical software (R Studio), and statistical significance was set at $p < 0.05$. The findings were presented in graphical formats to facilitate clear interpretation and support the study objectives. To ensure the accuracy and reliability of the data, a random sample of records was independently reviewed by a second research assistant. Inter-rater reliability was assessed, and any discrepancies were resolved through consensus or consultation with a third reviewer. Additionally, data validation checks and range checks were implemented during data entry to identify and rectify any errors.

Validity and Reliability of Research Instruments

Validity

Effectiveness in capturing key maternal demographic factors related to low birth weight (LBW). The data extraction instrument was assessed to confirm its accurate measurement of maternal age, residential category, gravidity, parity, health status, gestational age, and birth weight, aligning with the study's conceptual framework.

Reliability

Ensuring that the questions on the data extraction form consistently measured the same aspects without relying on complex statistical measures. A second researcher independently reviewed a sample of records, and any differences in their assessments were resolved through discussion or consultation with a third reviewer.

For continuous variables like maternal age and gestational age, the study evaluated the consistency of measurements by applying the data extraction form to a subset of records after a specific time interval.

RESULTS

Age: The average age was approximately 25.37 years, ranging from 15 to 42 years which indicated a relatively young population, with the majority (57.1%) of participants being 25 years or younger.

National Status:10 nationals (10.2%) and 88 refugees (89.8%) indicating a predominance of refugees is reflective of the study setting in a refugee settlement.

Gravidity: Average gravidity of 3.469, ranging from 1 to 11, median gravidity was 3, with 25% of the participants having a gravidity of 2 or less, and 25% having a gravidity of 5 or more, indicating significant variability.

Parity: The average parity was 3.194, with values ranging from 1 to 11. The median parity was 3, with 25% of participants having a parity of 2 or less, and 25% having a parity of 5 or more.

LBW: On average, participants experienced 0.2653 LBW, with values ranging from 0 to 3. Notably, 19.4% of the participants had at least one LBW.

Weight of Baby (Kgs): The average weight of babies was 2.247 Kg, with a range from 1.5 to 2.4 Kg. The majority (61.2%) of babies weighed between 2.0 and 2.4 Kg, with 38.8% being classified as low birth weight (less than 2.5 Kg).

Nulliparity: 67 (68.4%) were categorized as multiparous and 31 (31.6%) as nulliparous.

HIV Status: All participants were recorded with an HIV-negative status, indicating a zero prevalence and influence of HIV among the study group.

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Diabetes Mellitus Status and Hypertension Status: Participants had an 'Unknown' Diabetes Mellitus and hypertension status, reflecting the absence of data on this health condition among the study group.

EXPLORATORY DATA ANALYSIS

National Status

Figure 1: showing the participant's National Status.

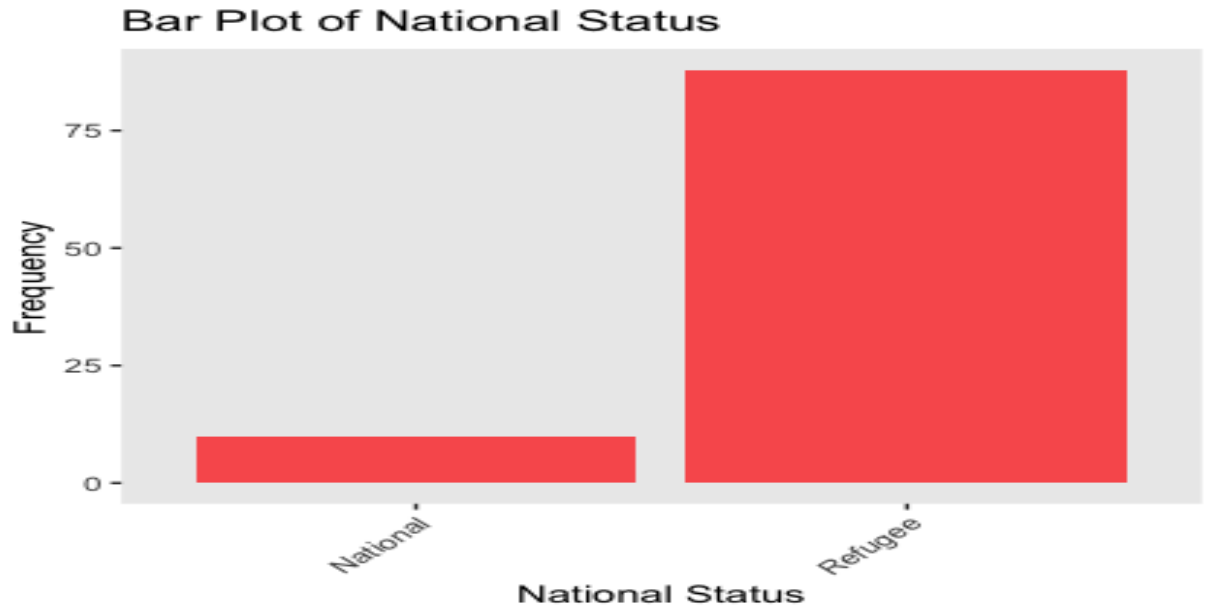

Figure 1: illustrates the distribution of national status among the study participants. It clearly shows a predominance of refugees compared to nationals in the study area.

Nationals: 10 participants (10.2%)

Refugees: 88 participants (89.8%)

Gravidity

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Figure 2: Showing gravidity of the study participants

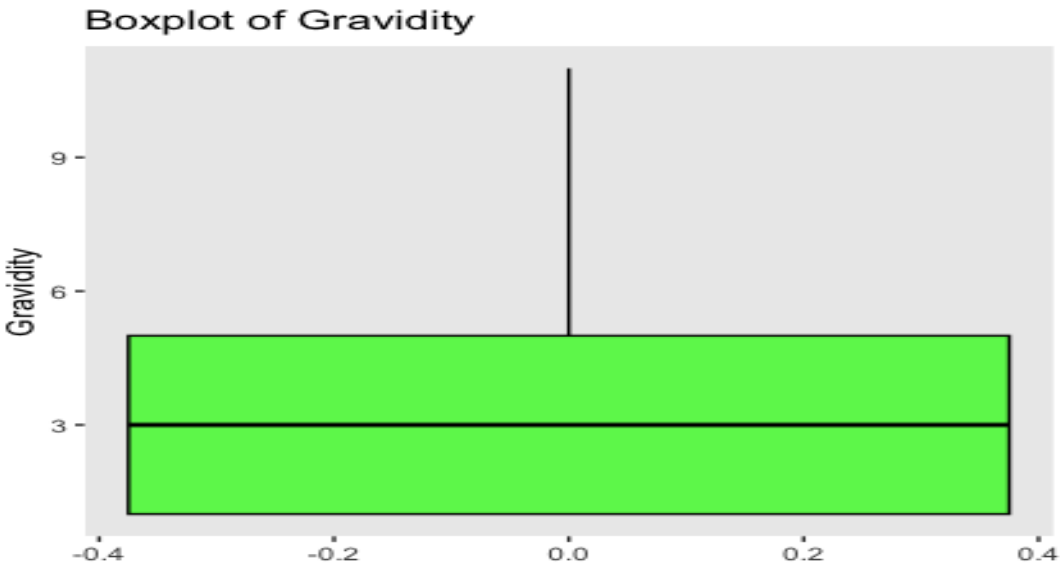
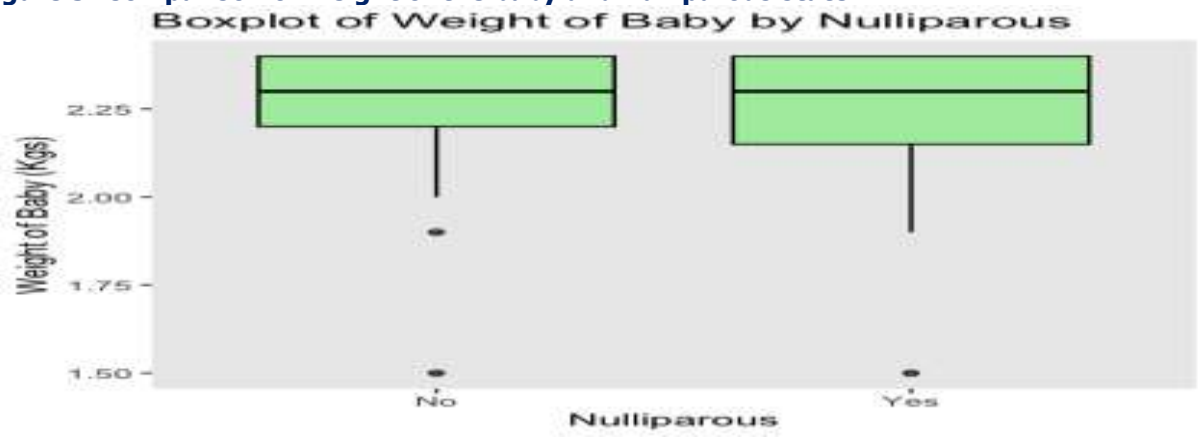


Figure 2: presents the distribution of gravidity among the study participants. The plot reveals variability in the number of pregnancies, with some participants having higher gravidity than others.
Median Gravidity: 3
Interquartile Range (IQR): 2 to 5

Comparison of Weight of Baby by Nulliparous State

Figure 3: Comparison of weight of the baby and nulliparous state



I

Figure 3: compares the weight of babies between nulliparous and multiparous participants. The plot suggests no significant difference in baby weights between the two groups.

Nulliparous: Mean weight = 2.245 Kgs, Median weight = 2.3 Kgs
Multiparous: Mean weight = 2.248 Kgs, Median weight = 2.25 Kgs

Age

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Figure 4 shows the maternal age.

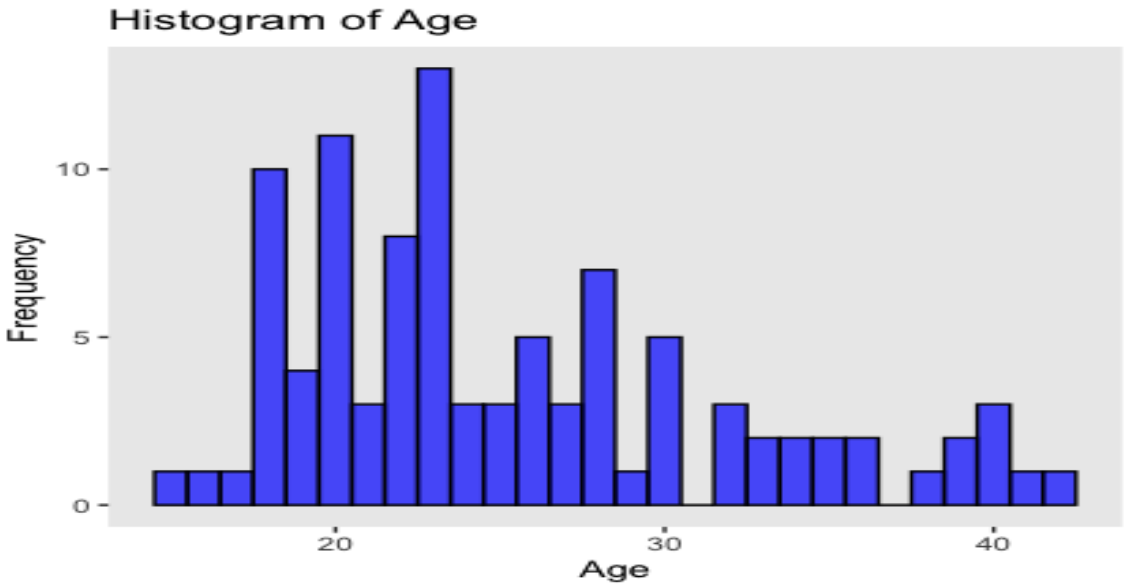

Figure 4: displays the distribution of age among the study participants. It indicates a relatively young population, with the majority of participants falling within the younger age groups.

Mean Age: 25.37 years
Median Age: 24 years
Age range: 15 to 42 years

Comparison of Weight of Baby by National Status

Figure 5: showing the Weight of the Baby by National Status.

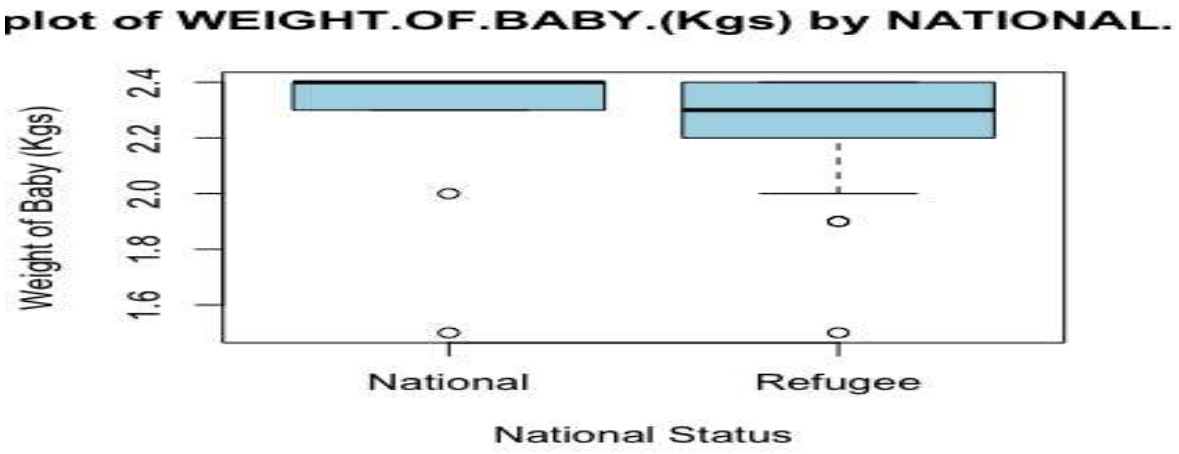

Figure 5: compares the weight of babies between nationals and refugees. It shows no significant difference in baby weights between the two nationalities.

Nationals: Mean weight = 2.26 Kgs, Median weight = 2.3 Kgs

Refugees: Mean weight = 2.24 Kgs, Median weight = 2.25 Kgs

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Logistic Regression Analysis

A logistic regression model was fitted to explore the simultaneous influence of multiple maternal demographic factors on the likelihood of LBW. The model included age, national status, gravidity, parity, and nulliparous state as predictors.
The logistic regression model did not identify any statistically significant predictors for LBW:

Age: p = 0.779
National Status (Refugee vs. National): p = 0.998
Gravidity: p = 0.997
Parity: p = 0.997
Nulliparous (Yes vs. No): p = 1.000

The null model's null deviance was 93.4760 with 97 degrees of freedom, while the residual deviance was 6.0693 with 92 degrees of freedom. The Akaike Information Criterion (AIC) for the model was 18.069.

DISCUSSION OF RESULTS

Association Between Maternal Age and Low Birth Weight

The relationship between maternal age and the occurrence of low birth weight (LBW) has been a subject of considerable interest in maternal and child health research. In this study conducted at Nakivale Health Center III, Isingiro district, the researcher sought to elucidate this association specifically within the context of full-term neonates.

The findings, somewhat unexpectedly, did not show a significant association between maternal age and LBW. This result stands in contrast to several previous studies that have reported varying degrees of correlation between advanced maternal age and LBW (Goisis et al., 2017; Aradhya et al., 2022). Globally, Gibbs et al. (2012) found a U-shaped relationship, with both adolescent and advanced maternal age associated with increased LBW risk. Similarly, national studies in Uganda highlighted significant LBW risks among teenage mothers (Zheng et al., 2023; Bhutta et al., 2010), and research by Schminkey (2017) emphasized the impact of advanced maternal age.

One potential explanation for our discrepant findings could be the unique socio-economic and healthcare context of Nakivale Health Center III, which might differ significantly from the settings of other studies. It's also worth noting that while maternal age is an important factor in neonatal health outcomes, its role as a standalone determinant of LBW may be less pronounced than previously thought. Earlier studies have proposed various ways in which the age of the mother could affect birth weight, including physiological changes in maternal health with age, increased prevalence of chronic health conditions, and alterations in placental function (Cooke and Davidge, 2019; Admon et al., 2017). This study, however, suggests that in this particular setting, other factors might be overshadowing the influence of maternal age on LBW.

The absence of a significant association between maternal age and LBW in our study underscores the importance of context-specific research. While maternal age remains a relevant consideration in neonatal health, it might not be a primary determinant of LBW in all settings.

Impact of Residential Category on Low Birth Weight

Understanding the disparities in health outcomes between different population groups is essential for targeted interventions and policy-making. In this study conducted at Nakivale Health Center III, Isingiro district, the researcher sought to explore the impact of the residential category, distinguishing between nationals and refugees, on the occurrence of low birth weight (LBW) in full-term neonates. The data revealed a stark contrast in the representation of nationals (n=10) and refugees (n=88) within the sample, as depicted in the bar plot. This disparity in numbers could potentially reflect broader socioeconomic and health system challenges faced by refugee populations, including limited access to quality healthcare, nutritional deficiencies, and exposure to stressful environments (Daynes., 2016; Finney-Lamb & Smith, 2022). These findings align with global studies showing heightened vulnerabilities in refugee populations (Restrepo-Méndez et al., 2014; Abubakari, Kynast-Wolf & Jahn, 2015).

Despite the pronounced difference in sample sizes between the two groups, the analysis did not find a direct correlation between the residential category and the occurrence of LBW. This finding suggests that while the residential category may influence other aspects of maternal and neonatal health, it might not be a significant determinant of LBW in this particular context. Other national studies, such as Kiwanuka et al. (2008), have emphasized considering socio-economic factors within each residential category to understand LBW patterns comprehensively.

Several factors could contribute to the absence of a clear association between the residential category and LBW in this study. It is possible that other variables, such as maternal health status, prenatal care access, and overall living conditions, play a more substantial role in influencing LBW outcomes than the residential category alone. Additionally, the relatively small sample size of nationals in the study

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might have limited the statistical power to detect significant differences between the groups.

Relationship Between Gravidity, Parity, Health Status, and Low Birth Weight

Understanding the intricate relationship between maternal health indicators and neonatal outcomes is crucial for identifying risk factors and designing effective interventions to improve birth outcomes. In this section, we explore the relationship between gravidity, parity, health status, and the occurrence of low birth weight (LBW) in full-term neonates at Nakivale Health Center III, Isingiro district.

Gravidity refers to the number of times a woman has been pregnant, while parity denotes the number of times a woman has given birth to full-term babies at a gestation period of not less than 24 weeks (Mendis, 2023). Analysis revealed varying degrees of gravidity and parity among the study participants. The boxplot of gravidity showcased a wide range of values, indicating diverse pregnancy histories among the mothers in the sample. Similarly, the boxplot of parity highlighted the variability in the number of births experienced by the participants.

Interestingly, the logistic regression model did not find a significant association between gravidity, parity, and the likelihood of LBW. This finding suggests that while these maternal factors play a role in neonatal health, they might not be primary determinants of LBW in the study population at Nakivale HC III. This aligns with findings from global studies, where Hinkle et al. (2013) noted increased LBW risks among primiparous women, but the protective effect of previous pregnancies varied across populations. In Uganda, Agaba & Bater (2020) found elevated LBW risks among primigravida mothers regardless of parity.

Health status indicators, including diabetes mellitus status, and hypertension status, were also considered in the analysis. Notably, the majority of participants had unknown health statuses across these categories, limiting the researcher's ability to draw conclusive associations between these health conditions and LBW.

The absence of a clear relationship between gravidity, parity, and LBW in our study highlights the complexity of factors influencing neonatal health outcomes. It underscores the importance of considering a broader range of maternal health indicators and socio-economic determinants in understanding LBW disparities.

CONCLUSIONS

The study offered valuable insights into the factors potentially influencing LBW at Nakivale Health Center III. While maternal age, residential category, gravidity, and parity were explored, only maternal age showed no significant association with LBW

LIMITATIONS OF THE STUDY

While every effort was made to conduct a thorough and meaningful investigation, it was important to acknowledge several limitations that may impact the study's findings and generalizability.

The study relied on the retrospective review of maternal and neonatal health records, which was subject to incomplete or inconsistent documentation. The accuracy of recorded information was contingent on the quality and completeness of historical records, and any gaps limited the comprehensiveness of the analysis.

The findings of this study might have primarily applied to the specific context of Nakivale Health Center III and may not be readily generalizable to other healthcare settings or populations. The unique demographic composition of Nakivale, including a significant refugee population, influenced the external validity of the results.

As the study involved a retrospective review of records, there was potential for recall bias, particularly concerning maternal health history and behaviors during pregnancy. Mothers might not have accurately recalled certain details, leading to underreporting or misreporting of relevant information.

The study focused on maternal demographic factors available in health records. While efforts were made to extract comprehensive information, certain potentially influential variables might not have been captured, limiting the depth of the analysis.

The cross-sectional design inherently limited the ability to establish causation. The study captured a snapshot of maternal demographics and birth outcomes, but causal relationships could not be definitively inferred. Longitudinal studies would be required for a more in-depth understanding of temporal associations.

Given the diverse population served by Nakivale Health Center III, language and cultural factors posed challenges in accurately interpreting certain aspects of health records. Translation and cultural discrepancies impacted the validity of the extracted data.

The study offered valuable insights into the factors potentially influencing LBW at Nakivale Health Center III. While maternal age, residential category, gravidity, and parity were explored, only maternal age showed no significant association with LBW. The residential category's impact on LBW remains inconclusive due to the limited representation of national cases in our sample. Health

statuses like diabetes mellitus and hypertension require further investigation with improved data collection methods.

RECOMMENDATIONS

Enhanced Data Collection: To improve the accuracy and depth of our findings, health centers should prioritize complete and comprehensive data collection, especially concerning maternal health statuses.
Further Research: Future studies could expand the sample size to include a more diverse population, ensuring a better representation of both national and refugee categories.
Health Awareness: Implementing educational programs to increase awareness about maternal health and its impact on neonatal outcomes can be beneficial.
Regular Health Check-ups: Encourage regular health check-ups for pregnant women to monitor potential risk factors and ensure timely interventions.

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Faculty of Agricultural Sciences, Uganda Christian University: For providing the necessary resources and a conducive environment for academic pursuits.
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LIST OF ABBREVIATIONS

LBW:	Low Birth Weight
MCH:	Maternal and Child Health
HMIS:	Health Management Information System
HIV:	Human Immunodeficiency Virus
HTN:	Hypertension
DM:	Diabetes Mellitus

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CONFLICT OF INTEREST.

The author declares no conflict of interest.

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Iran Ayesigye is a student with a bachelor's degree in human nutrition and clinical dietetics from Uganda Christian University.
Judah Turumanya is a research supervisor at Uganda Christian University.

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