



PREDICTING FACTORS OF POSTPARTUM ANEMIA AMONG POSTPARTUM  
MOTHERS AT NYANGABWE REFERRAL HOSPITAL, FRANCISTOWN,  
BOTSWANA

MALEBOGO QUEEN NTHUSANG

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF  
THE REQUIREMENTS FOR MASTER DEGREE OF NURSING SCIENCE  
(INTERNATIONAL PROGRAM)

IN MATERNITY NURSING AND MIDWIFERY PATHWAY

FACULTY OF NURSING

BURAPHA UNIVERSITY

2024

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PATHWAY; M.N.S. (MATERNITY NURSING AND MIDWIFERY  
PATHWAY)

KEYWORDS: BOTSWANA, HIV, IFA SUPPLEMENT, PICA, POSTPARTUM  
ANEMIA

MALEBOGO QUEEN NTHUSANG : PREDICTING FACTORS OF  
POSTPARTUM ANEMIA AMONG POSTPARTUM MOTHERS AT NYANGABWE  
REFERRAL HOSPITAL, FRANCISTOWN, BOTSWANA. ADVISORY  
COMMITTEE: PUNYARAT LAPVONGWATANA, Ph.D. TATIRAT  
TACHASUKSRI, Dr.P.H 2024.

Postpartum anemia (PPA) is a significant maternal health issue, affecting up to 50.0% of women in developed countries and 80.0% in developing countries.

Objective: This study aims to explore the prevalence and the predicting factors of PPA in postpartum mothers from Nyangabwe Referral Hospital, Francistown, Botswana.

The predicting factors indicated biological factors (HIV positive status), psychological factors (stress) and social factors (Dietary intake of food rich in iron, adherence to Iron Folic Acid (IFA) supplements, food taboos and pica).

Method: A cross-sectional study was conducted on 385 postpartum mothers with a convenience sampling technique during February to March 2024. The instruments used were a pre-tested researcher designed structured questionnaire and the Perceived Stress Scale (PSS). The PSS questionnaire had a Cronbach's alpha of 0.77. Descriptive analysis was done using means, frequency, and proportions. Chi-square test was used to determine the relationship between independent and dependent variables. Multivariable logistic regression analysis was performed to identify predictors of PPA.

Results: The overall prevalence of PPA was estimated at 51.4% (95% CI: 46.5 - 56.4). Mothers who had HIV-positive status (AOR=4.57, 95% CI: 2.41 - 8.67), poor adherence to IFA supplements (AOR=2.18, 95% CI: 1.29 - 3.68), and practiced PICA during pregnancy (AOR= 4.39, 95% CI: 2.67 - 7.23) could statistically predict PPA.

Conclusion: The prevalence of PPA was about a half the samples and HIV positive, poor adherence to IFA, and practice Pica were significant predicting factors

of PPA among women in Botswana. Suggesting interventions to reduce HIV infection in childbearing women, encouraging the importance of adhering to IFA supplements, and promoting nutritional health education to prevent pica practices during pregnancy and postpartum periods hence prevent consequences of PPA.



## ACKNOWLEDGEMENTS

Firstly, I express my gratitude to God for granting me perseverance, knowledge, and wisdom in completing this thesis. I acknowledge the support and encouragement from my major advisor, Assoc. Prof. Dr. Punyarat Lapvongwatana, co-advisor, Assoc. Prof. Dr. Tatirat Tachasuksri, proposal examination committee, and thesis examination committee members. I thank the Dean of the Faculty of Nursing, Assoc. Prof. Dr. Pornchai Jullamate, and Director of the Master of Nursing Science Program, Prof. Dr. Chintana Wacharasin, for allowing me to study in Thailand.

I gratefully, acknowledge the nursing faculty, the Graduate Office of Faculty of Nursing, international Affairs Staff, Ms. Rungnapa Yodchot and the library staff at Burapha University for their support, attention, motivation, and excellent teaching environment. I also thank the Thailand International Cooperation Agency (TICA) for scholarship support and the Ministry of Health in Botswana for permission and support during their study time in Thailand.

I also give thanks to the management, research team, matron, midwives, and support staff at Nyangabwe Referral Hospital, Francistown, Botswana, for allowing data collection and their help during the study. My appreciations also go to pregnant women who voluntarily participated in the study. Grateful acknowledgement is offered to all authors of original research instruments for the permissions to use and modified instruments. I am also very grateful to those people who helped me in the translation of the instruments.

Special gratitude to my husband Daniel Nthusang for his prayers, encouragement, and support throughout my study time in Thailand. Without him I could not have passed most of difficult time I went through and thank you Daniel for keeping up with an absent wife. I also express special thanks to my children, especially Michelle Daniel, for becoming a mother to her siblings when I was away in Thailand, my mother-in-law and my sisters for their love and encouragement. I also thank my friends and colleagues for their kindness, help, and support.

Lastly, I dedicate this work to my loving sister Precious Tebogo Boitumelo, who passed on during my study in Thailand, may your soul rest in eternal peace. This is for you, my love.

MALEBOGO QUEEN NTHUSANG

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# CHAPTER 1

## INTRODUCTION

### **Background and significance**

Anemia affects 500 million reproductive-age women in low- and middle-income countries (Bambo, Kebede, Sitotaw, Shiferaw, & Melku, 2023). Anemia occurs when red blood cells (RBCs) or hemoglobin (Hb) levels fall below the normal range (Bambo et al., 2023). It is defined by the World Health Organization (WHO) as levels below 12 g/dl in women, 11g/dl in pregnant women, 10 g/dl in postpartum mothers, and 13 g/dl in men of hemoglobin concentrations (Kofie et al., 2019; Mattar et al., 2019). No universal definition of postpartum anemia (PPA) exists, but researchers define it as anemia with hemoglobin values <10g/dl at 48 hours, <11 gm/dl at 1 week, and <12 gm/dl at 8 weeks postpartum (Abebaw, Gudayu, & Kelkay, 2020; Dündar, 2019; Fanta & Zelelow, 2020; Kofie et al., 2019; Mattar et al., 2019; Nkonwa et al., 2016; Wemakor, Ziyaaba, & Yiripuo, 2022; Yefet, Suleiman, Garmi, Hatokay, & Nachum, 2019).

PPA is linked to obstetric difficulties, poor economic growth, and dietary deficits. It can lead to various symptoms, including palpitations, dyspnea, fatigue, and decreased functional capacity (Bambo et al., 2023). If left untreated, it can negatively impact both the mother and child's wellbeing, including impaired quality of life, poor cognitive performance, emotional instability, and increased susceptibility to early postpartum depression. It also compromises mother-child interactions, reduces milk production, and increases morbidity and mortality rates among reproductive-age women (Bambo et al., 2023; Mattar et al., 2019; Moya, Phiri, Choko, Mwangi, & Phiri, 2022; Yefet et al., 2019).

PPA remains a significant public health issue in Botswana, accounting for 53.0% and 49.1% of all maternal complications in 2020 and 2021, respectively (MOH, 2023a). Francistown, the second-largest city in Botswana, has 17.2% of PPA cases, while Nyangabwe Referral Hospital (NRH) is the leading hospital with 14.4% of all cases (MOH, 2023a). However, there is no previous research on PPA in

Botswana, including Francistown, and no information suggests predictors of high PPA cases. The availability of studies on PPA in Botswana is unknown.

Studies show HIV is a significant risk factor for anemia during pregnancy, especially among African women. In Ethiopia, a multilevel multinomial analysis showed a higher prevalence of anemia in pregnant women (29.1%, 95% CI 24.9-33.7%) compared to non-pregnant women (23.2%, 95% CI 21.6-24.9%), (Kibret, Chojenta, D'Arcy, & Loxton, 2021). Anemia was found to be significantly correlated with HIV positive women ( $p < 0.001$ ) (Mozalyova, Samarina, & Rassokhin, 2022). The presence of HIV infection is an independent factor highly associated with anemia, with an AOR = 2.11; 95% CI 1.59 - 2.79 (Kibret et al., 2021). In Botswana, the HIV prevalence rate among pregnant women is 22.7%, making it a significant factor to be studied, (Kapoor et al., 2022).

Stress has been identified as a risk factor for anemia in some studies, with limited and inconsistent influence on iron concentrations in human populations (Lopresti, 2020; Toshi, 2023). Navy Seal trainees experienced a 44.0% decline in iron concentrations after 5 days of physical and psychological stress (Lopresti, 2020). Stress is also a common condition during postpartum periods, can be exacerbated by events like pregnancy, labor, and delivery (Juncker et al., 2022). It affects both the mother and newborn and affects the body's nutritional reserves, which are essential for enzyme activity, energy production, immune function, hormone synthesis, tissue growth and repair, and iron absorption (Lopresti, 2020). Understanding the potential negative effects of stress is crucial. A study by Lopresti (2020) found that over a five-day period, individuals experienced a 44.0% decrease in iron concentrations (Lopresti, 2020). Despite some studies linking stress to anemia, there is limited evidence about the relationship between stress and PPA in Botswana, hence necessitating further research.

Research shows that developing nations like Botswana experience a triple burden of malnutrition, including undernutrition and micronutrient deficiencies among pregnant and lactating women due to dietary practices like food taboos and pica (Abere & Azene, 2023). These practices, influenced by cultural and religious beliefs, contribute to inadequate dietary diversity during pregnancy, increasing the risk of PPA (Deshmukh, 2022). Women who do not follow recommended guidelines

on minimum dietary diversity were three times more likely to experience anemia, the AOR was found to be 2.96, with a 95.0% CI ranging from 1.67 to 5.25,  $p < 0.001$  (Wemakor et al., 2022). Furthermore, according to Adjei-Banuah et al., (2021), pregnant women in impoverished nations often begin their pregnancies with a preexisting iron deficiency, which worsens due to the heightened iron requirement of the developing fetus (Adjei-Banuah et al., 2021). This condition persists throughout the postpartum phase and can lead to PPA (Adjei-Banuah et al., 2021).

Iron folic acid (IFA) supplements can prevent anemia during pregnancy and postpartum, but 57.4% of postpartum mothers show inadequate adherence to the prescribed regimen. Suboptimal adherence increases the likelihood of developing PPA (Abebe, Kure, Yadeta, Roba, & Amante, 2022). In Botswana, 94.0% of women attend antenatal care services, and many are given IFA supplement for prophylaxis or treatment (Nkhwalume & Mashalla, 2019). Studying IFA supplement adherence could help identify the gap between IFA supplement and PPA.

Food taboos are specific foods and beverages that individuals avoid due to religious, cultural, or hygienic reasons (Ramulondi, de Wet, & Ntuli, 2021). These dietary prohibitions limit the intake of essential nutrients, and pregnant women who adhere to these practices are more likely to experience unfavorable pregnancy outcomes (Amare, Tura, Semahegn, & Teji Roba, 2022). Amare et al., (2022), study results showed that women with knowledge of food taboos are more likely to adhere to these practices AOR: 3.58, 95% CI: 1.89 - 6.83 (Amare et al., 2022). However, there is a lack of studies in Botswana that specifically examine predictors of PPA, so this study investigates the association between social and cultural dietary taboos and PPA.

Pica, a condition involving repetitive non-nutritive eating, insatiable hunger, and obsessive behavior, is linked to PPA (Konlan, Abdulai, Konlan, Amoah, & Doat, 2020). It is characterized by consuming non-nutritive substances for a minimum of one month, which is not culturally acceptable (Konlan et al., 2020). Non-food substances may hinder iron absorption by binding to iron within the gastrointestinal system, worsening iron insufficiency. The link between pica and vitamin insufficiency is unclear, but certain pica items may exacerbate iron shortages (Zaki, Fouly, & Elkafafi, 2021). The prevalence of pica ranges from 1.6% to 76.0%, with an estimated

34.0% with a 95% CI ranging from 28 to 41 during pregnancy (Sanjari, Soleimani, & Fakhraei, 2023). This study investigated the relationship between pica and PPA in Francistown, a region with high anemia rates among postpartum mothers.

Postpartum anemia (PPA) significantly impacts both mother and child, necessitating immediate diagnosis and treatment to prevent severe consequences (Bambo et al., 2023). Low iron levels during and after labor can cause tiredness, impaired cognition, and depression, altering the mother's emotional and cognitive changes (Moya et al., 2022). If iron stores are not supplemented soon after childbirth, anemia may linger throughout the reproductive cycle, especially in areas with high anemia rates and low-iron diets (Moya et al., 2022). PPA can cause maternal fatigue, and iron supplements or vitamins with hematological increases can significantly reduce fatigue scores. PPA is also linked to postpartum depression, decreased quality of life, severe hemorrhage, maternal shock, increased admission to the maternal intensive care unit, hysterectomy, antenatal and postnatal maternal sepsis, blood transfusion, poor wound healing, cardiac failure, and maternal death (OR 2.36; 95% CI 1.60–3.48), in a US study (Benson et al., 2022). It can also negatively impact mother-baby relationships, breastfeeding milk supply, and the optimal development and growth of infants exclusively breastfed (Rini & Dewi, 2019). PPA significantly impacts both the mother and infant, necessitating a robust family support system. This can include additional funds for formula, if milk production is insufficient, or lifestyle changes to accommodate postpartum anxiety-related quality of life, cognitive impairment, and emotional instability.

Despite the high rate of PPA and the profound impact of PPA on the mother, infant and family health, to date, studies on PPA in Botswana are limited or inexistence. This study aims to explore the predicting factors of PPA in postpartum mothers in Nyangabwe referral hospital, Francistown, Botswana. The study focuses on HIV, which has a high prevalence rate of 22.7% among pregnant mothers, and its statistically significant association with PPA (Kapoor et al., 2022). Other factors include stress, iron-rich diet, adherence to IFA supplements, food taboo, and pica. Understanding these variables will contribute to baseline scientific knowledge and help identify women at higher risk for PPA. This knowledge can help nurses minimize

or prevent PPA through health education and engaging family members as a support system.

### **Research Objectives**

The study will be conducted to:

1. To estimate the prevalence of PPA among postpartum mothers admitted in postpartum unit in NRH, Francistown, Botswana.
2. To examine which factors among HIV status, stress, and dietary intake of food rich in iron, adherence to IFA supplements, food taboos, and pica can predict PPA among postpartum mothers admitted in postpartum unit in NRH, Francistown, Botswana.

### **Research Hypotheses**

HIV positive status, stress, and dietary intake of food rich in iron, adherence to Iron Folic Acid (IFA) supplements, food taboos and pica factors could predict PPA among postpartum mothers admitted among postpartum unit in NRH, Francistown, Botswana.

### **Research Framework**

This study adopted the biopsychosocial (BPS) model as a theoretical framework. The model was developed by Engel in 1970, as an alternative to biomedical model that was used by the physicians. According to George Engel, (1977) it is not simply biological factors that are needed to understand a person's medical condition but psychological and social factors are also important factors that need to be considered (Ahmad, 2021). Taukeni, (2019) define BPS model as an interdisciplinary framework that examines the relationships of biological, psychological, and social components in relation to health phenomena. In addition, individual's perception of their symptoms and how they and their families respond to those symptoms they are experiencing is what the BPS model is focusing on (Taukeni, 2019).

According to the BPS model each component on its own is insufficient to lead definitively to illness or health but it is the deep interrelation of the three factors

that is biological, psychological and social factors that leads to a given outcome (Chingono, 2021). The BPS approach's basic tenet is that the patient's illness cannot be separated from his or her psychosocial factors, personality, and environment (Xiao et al., 2021). According to Xiao et al (2021), the BPS approach was discussed in other health disciplines and applied domains during the ensuing years, including medical traumatic stress, daily pain, and health psychology.

According to Xiao et al. (2021), the utilization of the Biopsychosocial (BPS) approach holds promise in enhancing clinical outcomes for chronic diseases and functional illnesses commonly encountered in primary care settings. This approach acknowledges that certain risk factors for diseases are psychosocial in nature rather than solely biomedical, and that certain non-pharmacological and non-surgical treatment methods can have a therapeutic impact (Xiao et al., 2021). Xiao et al (2021), further stated that BPS approach to healthcare can increase the efficacy of diagnosis and therapy, which raises patient satisfaction and reduces tensions between patients and clinicians. Therefore, the model was selected to be used to study the predictors of PPA. This model highlights the dynamic relationships among a variety of biological, psychological, and social factors that can modulate a postpartum mother's experience of PPA.

According to Abebaw et al, (2020), there are several factors that contribute to PPA, and all these factors cannot be generalized as the causes for all mothers who reside in and around Francistown (Abebaw et al., 2020). Based on this fact, in this study biological (HIV positive status), psychological (stress), and social (dietary intake of food rich in iron, adherence to IFA supplements, food taboos, and pica) factors will be followed to identify which factor predict PPA. Below is a conceptual framework (Figure 1), showing the above selected factors which from the literature review appeared to be cited by many researchers as being predictors of postpartum anemia.

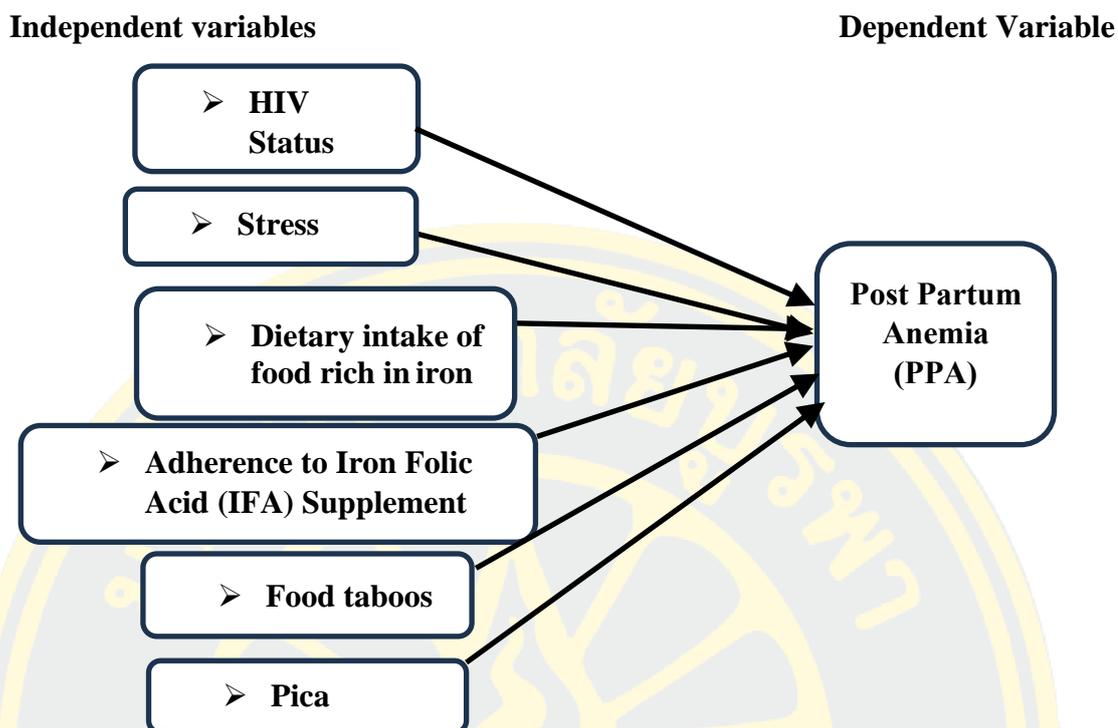


Figure 1 Conceptual Framework

### Scope of Study

The study focused on estimating the proportion of PPA and predicting factors of PPA among women admitted to Nyangabwe Referral Hospital postpartum unit Francistown, Botswana. The study includes mothers who are admitted to the postpartum unit of NRH following childbirth during the data collecting period which was February to March 2024. Additionally, mothers who delivered elsewhere but sought medical care at NRH within 48 hours of the postpartum period were also considered part of the source group.

### Operational Definitions

**Postpartum Anemia (PPA)** refers to a mother's hemoglobin level of  $< 10$  g/dL, within 48 hours of postpartum period. The value was recorded from the mother's Hb results of blood samples collected within 48 hours after delivery. Categorized as  $< 10$  g/dl and  $> 10$  g/dl.

**Human Immunodeficiency Virus (HIV) status** refers to a situation when a postpartum mother was tested for HIV during pregnancy using an HIV Rapid

Diagnostic Test (RDT) following the national testing protocol and the results come as reactive to HIV. The measurement will be HIV positive or negative (MOH, 2023b).

**Stress:** refers to a delivered mother's state of mental or emotional strain or tension caused by the numerous changes that occur throughout pregnancy, and feeling stressed is usual common. Stress was measured by Perceived Stress Scale (PSS) questionnaire (Cohen, Williamson, Spacapan, & Oskamp, 1988)

**Dietary intake of food rich in iron** refers to a 2-week recall of the meals consumed that are rich in iron, from 9 groups of food rich in iron, including consumption of food that promote iron absorption, and those that prevent absorption, and frequency of meals per day. The measurement of the variable will be conducted by the utilization of a questionnaire. The items included in the questionnaire will be derived from the criteria outlined in the manual titled "Assessing Nutrition-Related Knowledge, Attitudes, and Practices" published by the Food and Agriculture Organization (FAO) of the United Nations, (Macías & Glasauer, 2014)

**Adherence of IFA supplement:** refers to an intake of iron-folate supplements for at least 90 days (Abebe et al., 2022). In this study it will be measured by a number of days the postpartum mother has taken IFA supplement during pregnancy, < 90day being poor adherence and  $\geq 90$  day be good adherence (Abebe et al., 2022).

**Food taboos** refers to the avoidance of some particular foods with the belief to protect the health of pregnant women and their unborn children in many cultures. In this study It was measured using question adapted from a study done in Tanzania, (Gibore, Ngowi, Munyogwa, & Ali, 2021).

**Pica** refers to eats things which are not usually considered as food, for example termiteria mounds, clay soil, chalk and ice cubes. It was measured using question adapted from a study done in Tanzania, (Gibore et al., 2021).

## **CHAPTER 2**

### **LITERATURE REVIEW**

In this chapter, the researcher will review literature on concepts and factors predicting PPA among delivered mothers. The theoretical perspectives and research findings relevant to the study topic will be reviewed and summarized into five sections as follows:

1. Maternal Health in Botswana
2. Concepts of PPA
  - 2.1 Definition of PPA
  - 2.2 Consequences of PPA
3. Proportion of PPA worldwide and in Botswana
4. Theoretical Foundation of PPA
5. Predictors of PPA
6. Summary and gap of knowledge

#### **Maternal Health in Botswana**

Botswana has committed to attaining the aims of the Sustainable Development Goals (SDG), including ensuring that all people have access to sexual and reproductive health and rights and lowering the rate of maternal mortality to less than 70 per 100,000 live births by 2030. Botswana is among those nations that fell short of achieving Millennium Development Goals (MDGs) 5's goal to reduce Maternal Mortality Rate (MMR) by two thirds by 2015. The nation has one of the highest rates of maternal mortality among the nine upper middle-income nations in 2020 at 130.5 per 100,000 live births (MOH, 2022). Approximately, 19.0% of this maternal death are due to circulatory system which include PPA. In Botswana, nearly all women undergo Ante Natal Care (ANC) 95.0% and during these visits pregnant women are given a supply of iron folic acid supplements to take daily as a prophylaxis (MOH, 2016). This aligns with the World Health Organization's advice for any country where the prevalence rate of anemia among pregnant women exceeds

40.0% (Alkema et al., 2016). Despite that, records still show high prevalence rate of PPA 53.0% and 49.0% from DHIS data for 2020 and 2021, respectively. This indicates that there might be a gap between issuing of IFA supplements and a pregnant woman actually taking the dose, therefore this study aims to identify this gap and assist nurses with evidence-based report for them to implement measures that will reduce cases of PPA. Almost all deliveries are institutional deliveries in Botswana 99.8%, reported in 2020 by Statistics Botswana (Botswana, 2020). Every low-risk normal delivery is discharged after 24 hours and hemoglobin level is checked and documented before discharge. For caesarean section delivery they are discharged after 72 hours and hemoglobin level is checked 36 hours after delivery.

### **Concept of Postpartum anemia**

#### **Postpartum Anemia**

Maternal iron depletion due to pregnancy (Physiological anemia of pregnancy), exposure to pre-partum anemia, blood losses during and after delivery, iron use for breast milk production, lacerations/tears, and episiotomy predisposes a delivered mother to PPA, these include poor iron supplementation in the postpartum period (Tairo & Munyogwa, 2022; Wemakor et al., 2022). Consistent with literature, there is no consensus on the definition of PPA, in spite of that it can be inferred from the definition given by different researchers who differently defined it as, anemia occurring when the hemoglobin levels are below 10g/dl at 48 hours, below 11 gm/dl at 1 week, and below 12 gm/dl at 8 weeks during the postpartum period (Abebaw et al., 2020; DüNDAR, 2019; Fanta & Zelelow, 2020; Kofie et al., 2019; Mattar et al., 2019; Nkonwa et al., 2016; Wemakor et al., 2022; Yefet et al., 2019). In this study we will look at PPA of <10g/dl checked within 48 hours postpartum.

There is no doubt that PPA is a very significant health problem despite it been given the less needed recognition for interventions. Sultan et al. (2019) reiterates the under appreciation of the maternal health burden of PPA, this health condition (PPA) affects up to 50.0% of women in well-resourced countries and up to 80.0% of women in developing countries making it a major and global maternal health problem.

In agreement, studies suggest that developing countries have the highest PPA prevalence, and according to the literature review it is believed to be the major cause of maternal morbidity and mortality. Approximately 500,000 maternal deaths occur annually worldwide, with 20.0% attributed to postpartum hemorrhage and anemia, both of which are complications of childbirth (Dündar, 2019; Mattar et al., 2019; Selvaraj et al., 2019; Wemakor et al., 2022).

### **Consequences of PPA**

#### **Consequences of PPA on a postpartum mother**

The occurrence of somatic symptoms during PPA may enhance the vulnerability to the emergence of cognitive deficits and psychiatric disorders (Dündar, 2019). These physical symptoms experienced by the mother suffering from PPA most of the time include tiredness, breathlessness, palpitations, dizziness, and decreased physical endurance (Dündar, 2019). In the absence of proper diagnosis and management, PPA has the potential to give rise to various complications in both the short and long term. These complications encompass dyspnea, lethargy, dizziness, fatigue, reduced functional capacity, maternal infections due to altered immunity, syncope, diminished quality of life, impaired cognitive performance, emotional instability, heightened susceptibility to postpartum depression, impaired mother-child interactions, and increased mortality (Yefet et al., 2019). Postpartum mothers who have PPA are more likely to have poor wound healing, venous thromboembolism and endometritis (Selvaraj et al., 2019). Moreover, PPA may endure and influence the hemoglobin levels in a subsequent pregnancy (Yourkavitch et al., 2023).

Postpartum depression is linked to the modified emotions and cognitive functions caused by PPA (Moya et al., 2022). According to a systematic review carried out in Malawi, results showed that mothers with PPA were 1.66 times more likely to have symptoms of depression compared to women without anemia or with sufficient iron levels. These findings were statistically significant, with a heterogeneity estimate of  $I^2 = 67.0\%$  and  $p < 0.01$ , and a relative risk (RR) of 1.66 (95% CI: 1.28 - 2.15). According to a study in Ethiopia, further development of

complications in PPA could be avoided by early diagnosis and identification of risk factors which will help in managing signs and symptoms well on time(Abebew et al., 2020).

### **Consequences of PPA on the baby**

PPA according to the literature is also associated with decreased milk production, poorer functioning of mother-child interaction, delayed infant development (Mattar et al., 2019; Selvaraj et al., 2019). The correlation between PPA and an inadequate milk production is a substantial obstacle to the achievement of healthy breastfeeding and the overall well-being of both the mother and the newborn (Basrowi, Zulfiqqar, & Sitorus, 2024). The combination of decreased milk supply and low iron content in breast milk can lead to anemia in infants, a condition that is further exacerbated by premature cessation of breastfeeding (Lakew et al., 2024). Postpartum mothers who breastfeed and have PPA are also more prone to having infants who experience stunting (Basrowi et al., 2024). Iron shortage in newborn can result in enduring alterations in brain metabolism, neurotransmission, epigenetics, and myelination (Juul, Derman, & Auerbach, 2019). Iron is crucial for brain growth and development during fetal, neonatal, and childhood stages. Insufficient iron levels can negatively impact processes like myelination, neurotransmitter synthesis, and brain programming. In newborns with severe iron deficiency, restricted iron is directed towards red blood cells, deprived of iron in the brain, heart, and muscles (Juul et al., 2019). Neonates born to mothers with low iron levels in their blood are at a higher risk of developing iron insufficiency, which can lead to persistent cognitive and behavioral problems until the age of 19 (Juul et al., 2019). Babies with iron deficiency anemia (IDA) are at a higher risk for suboptimal cognitive, motor, social-emotional, and neurophysiologic development, resulting in poorer neurodevelopmental outcomes (Juul et al., 2019). A baby born to a mother with PPA may have compromised immune function, making them more vulnerable to morbidity and mortality (Lakew et al., 2024).

## **Proportion of PPA worldwide and in Botswana**

### **Proportion of PPA worldwide**

Primary pulmonary arterial hypertension (PPA) is a widespread issue globally, with a significant occurrence rate of 50.0% to 80.0% in developing nations and less than 30% in wealthy nations (Mremi et al., 2022). Extensive data on women of reproductive age and pregnant women indicate that anemia is a widespread issue globally. Moreover, the frequency of anemia in women after childbirth may be greater in low- and middle-income nations in comparison to high-income nations (WHO, 2016). PPA can be categorized according to its significance in public health. Prevalence rates of 4.9% and below are considered normal, while rates between 5% and 19.9% are categorized as mild. Rates between 20% and 39% are considered moderate, and rates of 40% and above are defined as severe (Agmassie, Alamneh, Ayicheh, Getahun, & Abneh, 2023). From the literature reviewed, different studies resulted in different prevalence's mainly because of using different cut-off hemoglobin levels, and different populations. In a study conducted in India, the prevalence of PPA was found to be 76.2 (Selvaraj et al., 2019). This prevalence was determined using a cut-off value of hemoglobin levels below 12g/dl, measured 6 weeks after childbirth (Selvaraj et al., 2019), this was the highest value from all reviewed studies. According to Fareed et al., (2024), the Indian National Family Health Survey has identified India as one of the nations with the greatest incidence of anemia globally (Fareed, Gupta, & Khatoon, 2024). The prevalence of PPA in pregnancy ranges from 50% - 70% in India (Fareed et al., 2024). The study is consistent with what was found in Asian countries, such as Pakistan, where in 2008 the prevalence of anemia among pregnant women was estimated at 90.5%; of these women, 75.0% had mild anemia and 14.8% had moderate anemia (Baig-Ansari et al., 2008). In Africa, a study done in Ghana reported a prevalence of 46.7% using a cut-off of hemoglobin <12g/dl and was done at 6 weeks also (Wemakor et al., 2022). Others done at 6 weeks postpartum were one in Tanzania had a prevalence of 34.2% used a cut-off of hemoglobin <11g/dl (Mremi, Rwenyagila, & Mlay, 2022), this was the highest compared to another study done in Tanzania with a prevalence of 21.6% with the same cut-off of <11g/dl (Tairo & Munyogwa, 2022).

Furthermore, another study carried out in Ethiopia, Africa resulted with a prevalence of 47.2% using a cut of 12g/dl at 6 weeks postpartum (Bambo et al., 2023). In addition, the differences in the PPA prevalence rate measured in different literature reviewed, may be explained by the differences in diagnostic procedures, populations studied, sociodemographic, obstetric, dietary, and biomedical factors (Wemakor et al., 2022). Despite the prevalence of PPA been considerably high as note in the above studies, and with its effects being significant in many places in the world, it has not received adequate attention as it should and it is mostly not diagnosed on time (Dündar, 2019; Tairo & Munyogwa, 2022).

### **Proportion of PPA in Botswana**

There are no studies to show evidence on PPA in Botswana despite it being a global maternal health problem. The 2020 data, from the DHIS information system used in the country, was reviewed to estimate the prevalence of PPA. The prevalence was predicted to be 53.0% when using a hemoglobin cut-off of <10g/dl within 1 week after childbirth (MOH, 2023a). The rate for Botswana is the second highest after Saudi Arabia which had a prevalence of 59.3% done within 1 week, with a cut-off value of <10g/dl (Mattar et al., 2019). Still using the same data found in the system the prevalence rate of PPA of postpartum mothers in Francistown was recorded at 17.2% of all the maternal complication cases which was leading city with high prevalence rate (MOH, 2023). No studies were accessed on prevalence of PPA in Francistown which this study is aiming to close that gap.

## **Theoretical Framework**

### **Biopsychosocial (BPS) Model**

George Engel, contend that when examining the origins of sickness, the BPS perspective is more suitable (Cardoso, 2023). The BPS perspective seeks to comprehend wellbeing by examining the relationships among biological, psychological, and social components. This paradigm states that none of these factors alone can definitively cause health or illness; rather, it is the profound interaction between all three factors that determines a certain result (Taukeni, 2019). The BPS

paradigm was proposed as a substitute for the prevailing biomedical approach for comprehending health and providing healthcare (Duberstein et al., 2021). The BPS model distinguishes itself through its focus on human needs, the social context of health and healthcare, and the interplay between a person's biological processes and the social and cultural systems they are a part of (Duberstein et al., 2021).

Applications of the BPS model, which place a strong emphasis on psychological and social factors, may hold the key to addressing health inequities that are pronounced and persistent in terms of maternal morbidity and mortality (Duberstein et al., 2021).

Based on two decades of reliable evidence from many research, which have shown a connection between the psychological well-being of expectant mothers and the behavioral and physical health of their children, it may be advantageous to use a BPS approach to perinatal health. This approach could have positive effects on the health of both the mother and child (Duberstein et al., 2021).

Therefore, a key clinical and public health goal is to pinpoint the causes and cut down on their prevalence. According to Duberstein et al., (2021), application of the BPS paradigm views the standard of prenatal and postpartum care as a health indicator impacted by social, psychological, and biological factors. Therefore, predicting factors will be discussed below as per the BPS factors.

### **Biological Factors**

The biological (bio-) component of the BPS model describes how the body reacts to sickness in a physiological manner (Taukeni, 2019). The paper explores how the biological make up of an individual impact on PPA. Several biological factors can raise the likelihood of PPA in mothers who have given birth (Abebaw et al., 2020). Some of these predicting factors include prepartum anemia, comorbid conditions i.e., HIV positive status, and postpartum hemorrhage. (Abebaw et al., 2020; Mattar et al., 2019; Selvaraj et al., 2019; Tairo & Munyogwa, 2022). From the above-mentioned biological factors comorbid condition that is HIV positive status will be chosen to determine the level and extent to which it influence PPA. HIV is one of the common

conditions among pregnant mothers in Botswana with the prevalence rate of 22.7% in 2019, (Kapoor et al., 2022).

### **Psychological Factors**

The psychological (-psycho-) is the components of mental and emotional well-being that have an impact on behavior (Megan, 2021). Finding a psychological basis for a specific illness is the goal of the BPS model's psychological compose (Taukeni, 2019). According to Meldawati, Fazraningtyas & Budi (2021) during pregnancy, a pregnant woman goes through physical and mental changes. Hence, in this study, stress will be studied to identify if it is a predictor of PPA.

### **Social Factors**

The Social factors refers to interpersonal elements like social interactions and community activities (Megan, 2021). The overall well-being of both individuals and society is impacted by a diverse range of social influences, alongside genetic predispositions, and personal lifestyle decisions. Approximately 40.0% of factors contributing to overall health can be linked to social variables, such as housing conditions, social relationships, financial status, and educational attainment (Health, 2023). A person's ability to have a meaningful social interactive largely affect how they also sustain health association with others (Litt, Zhao, Kraut, & Burke, 2020). In the current study we consider how a BPS model may be applied to PPA and consider how PPA is affected by an individual's social context. The Social factors that will be followed in this study are dietary intake of food rich in iron, adherence to IFA supplements, food taboos and pica these will be studied to determine whether there are predictors of PPA. Literature by different researchers have picked the above to have a significate association with PPA (Abebaw et al., 2020; Abebe et al., 2022; Amare et al., 2022; Bonglaisin et al., 2022; Chakrabarti & Chakrabarti, 2019; Wemakor et al., 2022).

## **Predictors of PPA according to the biopsychosocial model**

### **HIV Positive Status**

The literature cites the following concurrent infections as factors linked to PPA, helminth infestation, malaria infection, medical problems during pregnancy, HIV/AIDS, syphilis, and urinary tract infection. (Abebaw et al., 2020). According to Cao et al., (2022), adults with HIV were more likely to have anemia. The results of their study supported earlier research as it revealed a notable prevalence of anemia among individuals living with HIV, particularly pregnant women, with an estimated rate of AOR = 48.6% (95% CI: 41.6 -55.6). (Cao et al., 2022). Cao et al., (2022) stated that HIV alters the cytokine environment in the bone marrow, which has a variety of effects on hematopoietic progenitor cells. Kibret et al., (2021), also concur to this as they stated in their research that due to HIV's impact on the bone marrow and the drop in Hgb levels in the blood, HIV infection may also raise the risk of anemia. Anemia is the most prevalent hematologic abnormality among People Living With HIV (PLWHIV), (AOR = 2.11; 95 % CI 1.59 - 2.79), and it is linked to the course of the disease and a higher risk of patient mortality (Kibret et al., 2021). Therefore, recognizing the relationship between HIV positive status and presence of PPA is critical for offering appropriate assistance and intervention to pregnant women with HIV positive status to prevent PPA. The HIV status variable will be included in the Sociodemographic, Obstetric, Comorbidity, and Dietary practices Questionnaire (SOCDDQ) and be measured as positive and negative.

### **Stress**

Stress can be defined as a condition in which the state of homeostasis is jeopardized by stimuli that are either real or perceived (Lopresti, 2020). Kwak et al. (2022) asserts the journey of having a baby can be associated with mixed feelings and psychological adjustments. Every woman experiences stress in a unique way, but one of the main causes is hormonal shifts, which can alter her mood (Dimes, 2023). According to some research, stress can result in low levels of vitamins B12, C, magnesium, folate, and other nutrients (Api, 2022). This occurs when stress lowers the

level of stomach acid in our bodies, which might result in inadequate food absorption (Api, 2022). Some of these nutrients are essential for iron absorption, which can affect the current level of red blood cells (Api, 2022). Literature suggest that psychological stress have an association with iron availability, in addition maternal stress was found to causing iron deficiency (Shah et al., 2021). Research indicates that stress exposure has the potential to modify iron concentrations. Research in Australia suggests that the impact of stress on iron concentrations in human populations is constrained (Lopresti, 2020). The study findings revealed that over a period of 5 days characterized by physical and psychological stress, the individuals saw a significant fall of 44.0% in their iron concentrations (Lopresti, 2020). The mother's perception of stress will be measured by asking about her feelings and thoughts during the last month this will help to understand how this pregnancy affected her psychological being. This will be done using perceived stress scale questionnaire and measured as no stress and stress.

#### **Dietary intake of food rich in iron**

The nutritional status of women during pregnancy could have a significant impact on her health. The nutritional deficiency, especially regarding micronutrient, could adversely affect her hemoglobin level. Moreover, a study conducted in South Africa affirms that a nourishing diet is crucial during pregnancy, with an adequate intake of proteins, vitamins, and minerals to meet the nutritional needs of both the mother and the developing baby (Ramulondi et al., 2021). The characteristics that have been identified as being connected with anemia in women include having a sufficient diet (OR = 0.75, 95% CI (0.59 - 0.96)) (Tine & Adama, 2019). The most common causes of anemia are linked to insufficient intakes of iron, either in terms of amount or quality absorbed in assimilating dietary iron deficient foods or can be lessened by the use of inhibitors of mineral absorption. The type of iron in the diet affects how much iron the body can absorb. It's crucial to understand the elements that can increase or decrease iron absorption while consuming foods that contain it (Gomes et al., 1981). Noreen et al (2020) indicate that an expectant mother should ensure they have food rich in iron in their nutritious, well-balanced diet strong sources

of iron include liver, red meat, beans, lentils, tofu, fish, dried fruit, and dark leafy greens. Vitamin B12 and folic acid are both needed to meet the high physiological demand for iron during pregnancy. Noreen et al (2020) state that a pregnant women 600 mcg/day of iron.

Furthermore, Abebaw et al. (2020) listed the following dietary and micronutrient uptake factors, like taking hot drink (tea, coffee, or milk), when she has taken food rich in iron, meal frequency per day, as being related to PPA. In accordance with the literature, the consumption of pulses was statistically significantly associated with anemia in postpartum mother (Tairo & Munyogwa, 2022). Moreover, Wemakor et al., (2022), stated that, in a study that is similar to theirs, anemia among postpartum women in Tanzania was discovered to be connected with low dietary diversity score (DDS), and they discovered that anemia was more common in women with low dietary diversity.

In a study by Gibore et al., (2021), results showed that pregnant women who exhibited insufficient dietary variety scores were shown to have a higher likelihood of experiencing anemia in comparison to those who demonstrated enough dietary diversity scores (AOR: 1.16; 95% CI: 0.57 - 2.36; p-value < 0.05). The study found that pregnant women who did not consume tea or coffee with their meals had a lower likelihood of experiencing anemia compared to those who did consume tea or coffee with their meals AOR: 0.06; 95%, CI: 0.03 - 0.13; p < 0.001). Additionally, pregnant women who ate less than three meals per day were more likely to be anemic compared to those who ate three or more times per day (AOR: 2.92; 95% CI: 1.60 - 5.84; p < 0.0001) (Gibore et al., 2021). Dietary intake of food rich in iron will be evaluated using the 2 weeks recall method of food eating in the past 2 weeks. The variable will be measured using a dietary diversity score for iron (DDSI) adapted from the guidelines for assessing nutrition-related knowledge, attitudes and practices manual of the Food and Agriculture Organization of the United Nations by Macias and Glasauer, 2014).

### **Adherence to IFA supplements**

Poor adherence of IFA supplement intake during pregnancy is associated with PPA. IFA supplement is well known to effectively prevent and treat IDA and is, therefore, recommended by the WHO as part of standard prenatal care. Four studies reviewed, had results showing that poor adherence to IFA supplementation and inadequate iron-folate supplementation have been significantly associated with PPA (Abebaw et al., 2020; Abebe et al., 2022; Wemakor et al., 2022; Yefet et al., 2019).

According to the literature risks of developing PPA are high in women with no iron-folate supplementation during their recent pregnancy (Abebe et al., 2022).

Additionally In a cross-sectional study that was carried out in two private hospitals of Karachi, revealed that inadequate iron intake showed significant association with PPA. Inadequate hematinic iron and folic acid supplements during pregnancy is a cause of PPA (Rabia, Jalil, Feroze, & Iqbal, 2018). According to Rabia et al., (2018) the results of their study showed that there is a significant link between insufficient iron consumption and PPA. Specifically, 48.9% of the group exhibited this association, with a p-value of 0.001 and an odds ratio of 0.083.

In addition, it was shown that women who did not get iron-folate supplementation during their present pregnancy had a significantly higher likelihood of being anemic compared to those who had a history of iron-folate supplementation during their most recent pregnancy (AOR: 3.27; 95% CI: 1.31-8.15), (Abebe et al., 2022). According to studies, taking at least 90 iron-fortified tablet supplements that is one tablet a day, can prevent maternal anemia by up to 70.0% throughout pregnancy (Abebe et al., 2022). This variable will be measured by the number of tablets the delivered mother managed to take during this pregnancy period this will be according to reviewed literature, good adherence been  $\geq 90$  days, poor adherence  $< 90$  days (Abebaw et al., 2020; Abebe et al., 2022).

### **Food taboo**

Food taboos are specific food items or beverages that individuals avoid due to religious or cultural factors (Tela, Gebremariam, & Beyene, 2020). Pregnant women often face challenges in obtaining nutritious meals due to these dietary restrictions, particularly in low- and middle-income countries. Research shows that women worldwide face these restrictions during pregnancy and postpartum due to cultural customs and beliefs (Ramulondi et al., 2021). Food taboos primarily contribute to maternal and fetal malnutrition during pregnancy, leading to the development of anemia. Food taboos are often imposed on pregnant women to prevent adverse effects on their offspring. These taboos are believed to protect the unborn baby from certain abnormalities and diseases, as well as delay labor (Ramulondi et al., 2021). In some parts of Africa, protein-rich foods like meat, fish, eggs, and legumes are typically denied to pregnant women. A study in the Eastern Cape, South Africa, found that pregnant women in the Kat River Valley followed food taboos for oranges, naartjies, chicken, potatoes, fish, and wild animals (Chakona & Shackleton, 2019). In Botswana, many pregnant women prohibit meat, salty foods, eggs, and bread, while in South Africa, eggs and yellow fruits are the major taboo foods.

Pregnancy increases the need for nutrients, and restricting certain foods can have detrimental effects on the mother, such as iron deficiency anemia (Deshmukh, 2022). Deshmukh, (2022), stated that influential pressure pregnant women to avoid animal-based meals like milk and curd, which are rich in good quality proteins.

A study by Abere & Azene (2023) found that 27.5% (95% CI 23.2–31.8) of pregnant women exhibited dietary taboos. Pregnant women exhibited various restrictions, including avoiding meat, eggs, honey, milk, fruit, and cereals. The study showed that 80 individuals (22.5%) refrained from consuming meat, while 76 individuals (21.4%) avoided eggs (Abere & Azene, 2023). Despite the nutritional value of these foods, many women abstain from consuming them during pregnancy, leading to malnutrition conditions like anemia. A significant proportion of those who abstain from food during pregnancy, equivalent to 21.8% of the sample, reported difficulties during the delivery process. The study highlights the importance of addressing dietary taboos in the healthcare system to ensure the health and well-being

of pregnant women (Abere & Azene, 2023). The measurement for this variable in this study was determined by history of avoiding intake of food because of cultural beliefs or religious reasons during this pregnancy with a yes and no answer adapted from a study by Gibore et al. (2016).

### **Pica**

Pica is a common craving and purposive ingestion of non-food items, particularly among children and pregnant women (Ahmed, Al-Nafeesah, AlEed, & Adam, 2023). It includes geophagia, which involves compulsive consumption of dirt or earth-based substances such as termitaria mounds, clay, or chalk. It can also be defined as persistent intake of non-nutritive substances for at least a month that is inappropriate for a developmental stage (Konlan et al., 2020). The name "pica" comes from the Latin word "magpie," a bird known for its peculiar feeding habits (Konlan et al., 2020).

According to Young & Cox, (2023), the frequency of pica varies by health condition, diagnostic criteria, and among nations and ethnic groups. The mean frequency of pica during pregnancy was substantially greater in Africa 45.0% than in either North/South America 23.0% or Eurasia 18.0% in a meta-analysis examining the worldwide prevalence of pica throughout pregnancy and the postpartum period (Young & Cox, 2023). Studies, however, often overestimate the true occurrence since patients may not disclose pica because they feel ashamed or fear reprimand and because doctors frequently forget to inquire about this behavior from patients (Young & Cox, 2023).

Data from in vitro experiments indicate that clays can bind iron (Young & Cox, 2023). This is also in agreement with the study by Bonglaisin et al., (2022) who stated that results from a variety of contexts and studies suggest that the practice of geophagy may affect the body's iron levels. The composition of the geophagic material will chelate non-haem iron in the gut, causing complexes that cannot be broken down (Bonglaisin et al., 2022). According to Miao et al., (2015) the presence of pica was found to be associated with significantly higher odds of anemia (OR: 2.35, 95%, CI: 1.94–2.85, p-value < 0.001), as well as lower concentrations of

hemoglobin (0.65 g/dl, 95%, CI: 0.83–0.48 g/dl, p-value < 0.001), hematocrit (1.15%, 95%, CI: 1.61 – 0.70, p-value < 0.001), and zinc (34.3 µg/dl, 95% CI:59.58 - 9.02 µg/dl, p-value = 0.008). The statistical significance remained evident even after the removal of outliers, as well as in subgroup analyses based on pica type and life stage. To summarize, the points discussed above indicate that the evidence presented suggests a strong connection between Pica and an increased vulnerability to anemia, as well as lower levels of hemoglobin (Hb), hematocrit (Hct), and plasma zinc (Zn). (Miao, Young, & Golden, 2015).

The phenomenon has been linked to religious observance, cultural traditions, and periods of food scarcity. Pica is hypothesized to arise from shortages in micronutrients, cultural factors, and gastrointestinal disturbances. History of having craved for non-food items for a period of one month during this pregnancy will be the measurement of this variable by a yes and no to pica adapted from a study by Gibore et al, (2023).

### **Summary and gaps of knowledge**

In conclusion, many studies are available on factors predicting PPA in other countries, and nil was identified having been done in Botswana. This is a gap that has been identified because Botswana is characterized by high maternal mortality, which can be associated to high prevalence of PPA. It was identified that there is statistical significance between HIV, stress, poor consumption of food rich in iron, non-adherence to IFA supplements, food taboo, and pica to PPA, but no studies on these factors done in Botswana were accessible. Hence, there is need for a study to explore on their association with PPA in Botswana. In addition, Francistown is the second largest city in Botswana yet health studies in that area are limited there is need for future studies to assess the impact of socioeconomic states of Francistown in relation to PPA. Moreover, based on the literature analysis, it has been determined that PPA is a result of biological variables, including prepartum anemia and postpartum hemorrhage (Abebe et al., 2022; Dündar, 2019; Mattar et al., 2019; Wemakor et al., 2022). Therefore, in this study more emphasis will be placed on studying social

factors that reflect dietary issues for pregnant women which can lead to PPA. Doing this will assist in future with early detection of predictors and guide in the implementation of primary preventive measures.



## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

This chapter introduces the research design, population, and sampling procedures, and setting. In addition, the chapter provide research instruments, /measurements, how humans were protected in the study. Furthermore, the chapter provides data collection techniques and how data was analysed.

#### **Research design**

A cross sectional study design was used to study whether HIV positive status, stress, and dietary intake of food rich in iron, adherence to IFA supplements, food taboos, and pica have an association with PPA among delivered mothers admitted at NRH postpartum ward in Francistown, Botswana.

The study was conducted in postpartum ward of Nyangabwe Referral Hospital in the city of Francistown. The hospital is a referral hospital with 12 inpatient wards and 542 total bed capacity, and outpatient unit. Postpartum ward has 54 bed capacity, it admits all who delivered in the hospital and those who delivered in other places and were referred in for further management. On arrival in postpartum ward the mother and baby are done puerperal check-up and then admitted in the ward. Those with vaginal delivery and low risk are checked after every 12 hours. High risk and cesarean sections deliveries are checked 4 hourly. After 24 hours blood is collected from normal deliveries and low risk mothers to check hemoglobin levels and those with levels in normal range that is above 10 g/dl, were discharged home. The baby also receives birth immunizations before discharge. For those who delivered by cesarean section blood was collected after 36 hours and be discharged after 72 hours for all with everything within normal readings. Services in postpartum ward are offered 24 hours.

## **Population and Sample**

### **Population**

All postnatal mothers who gave birth in NRH and mothers who gave birth somewhere else and were referred and admitted at the hospital within 48 hours of the postpartum period were considered as the target population.

### **Sample**

The samples were selected from the postpartum mother who were admitted in NRH postpartum ward during data collection time and meeting the following criteria.

### **Inclusion Criteria**

#### **All those who:**

1. Age  $\geq$  18 years.
2. Are able to communicate in English and Setswana.
3. Agree to participate in this study and sign a consent form.
4. Have no history of with sickle cell anemia, aplastic anemia, and hemolytic anemia

### **Exclusion Criteria**

1. Critically ill that is bed ridden and unable to communicate.
2. Are victims of rape.

## **Sampling**

### **Sample Size**

The calculation of the sample size was determined using the method for a single population proportion, taking into consideration the following assumptions: The proportion of 50% was determined based on the absence of accessible documents pertaining to prior investigations. A confidence level of 95% and a margin of error of 5% were employed in the calculation. Consequently, the resulting sample size was determined to be 385.

### **Cochran Formula (Cochran, 1977)**

If the population proportion is estimated

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

$$n = \frac{(0.5)(1-0.5)(1.96)^2}{(0.05)^2} = 385$$

$n$  = sample size

$p$  = the population proportion ( $p = 0.5$ )

$e$  = acceptable sampling error ( $e = 0.05$ )

$z$  =  $z$  value at reliability level or significance level.

- Reliability level 95% or significance level 0.05;  $z = 1.96$ .

### **Sampling Technique**

The NRH was selected for the study area in the postpartum wards.

Convenience sampling technique was used, this involves interviewing all available postpartum mothers who met the inclusion criteria on the day of data collection and were willing to participate in the study. On each data collection day, the researcher approached all mothers on day 2 (48 hours) post-delivery, brief them on the purpose, and objectives of the study, and then request for consent to participate in the study and permission to go through her medical records. Obstetric records of those who gave consent and agreed to take part in the study was screened for inclusion criteria and those who meet the criteria were requested to sign an informed consent. The interview was started when the mother was comfortable and ready. They were interviewed either in Setswana or English depending on which language the participant was comfortable with. Interviews took 30 to 45 minutes. The number of deliveries per day was around 12 cases and the total sample of this study is 385 postpartum women. These continued every day until the sample size was reached.

## **Research Instruments/Measurements**

The data were collected using a pre-tested structured and interviewer-administered questionnaire adapted and customized from different kinds of literature.

### **The first part: Sociodemographic, Obstetric, Comorbidity and Dietary Practices Questionnaire (SOCDDQ)- 3 parts.**

Socio-demographic questionnaire had three parts. The socio-demographic data made the first part and included age, marital status, education level, family income and maternal residence. The second part was made up of questions assessing the obstetric and comorbidity characteristics including postpartum hemoglobin level, mode of delivery, postpartum blood loss, gestation at initial ANC visit, gestation at delivery, weight of the baby at birth, prepartum hemoglobin level, number of ANC visits, gravidity, parity, number of abortions, number of living children, gravidity interval, and HIV status.

Postpartum anemia was defined as a mother's hemoglobin level of  $< 10$  g/dL, within 48 hours of postpartum period. The value was recorded from the mother's Hb results of blood samples collected within 48 hours after delivery. Categorized as  $<10$  g/dl and  $>10$  g/dl in a socio-demographic questionnaire under the second part.

Human Immunodeficiency Virus (HIV) status was defined as a record of positive or negative to HIV test results extracted from the women's obstetric card. The measurement was HIV positive or negative and it was assessed using a socio-demographic questionnaire.

The third part assessed the dietary practices characteristics which included dietary intake of food rich in iron, adherence to IFA supplements, food taboo and pica.

Dietary intake of food rich in iron was defined as a 2-week recall of the meals consumed that are rich in iron, from 9 groups of food rich in iron. For each food group, the women ate from, they got a score of "1" (irrespective of the number of foods eaten), otherwise a score of "0". The scores were added up to give the dietary diversity score (range 0 – 9) for each woman. The score of  $\leq 5$  was recorded as inadequate and the score of  $> 5$  was recorded as adequate, the dietary diversity scale questionnaire by Macías & Glasauer (Macías & Glasauer, 2014) was used for this variable. The items used to measure this variable were derived from the manual titled

"Assessing Nutrition-Related Knowledge, Attitudes, and Practices" published by the Food and Agriculture Organization (FAO) of the United Nations (Macías & Glasauer, 2014). The tool's reliability was confirmed with a Kuder–Richardson 20 = .75 from a sample of 385.

Adherence of IFA supplements was defined as good adherence if the mother took IFA supplementation for  $\geq 90$  days. It was assessed through number of days the woman took IFA supplement during pregnancy question in the socio-demographic questionnaire, adapted from a study by Abebe and others (Abebe et al., 2022). The measurement was good adherence for number of days equal or more than 90 and poor adherence for days less than 90.

Food taboo was yes for those with a history of avoiding food rich in iron during this pregnancy. It was assessed through a yes and no answer to a question of history of avoiding food rich in iron during pregnancy through a socio-demographic questionnaire. The question was adapted from a study by Gibore and others (Gibore et al., 2021).

Pica which was defined as yes to history of eating things which are not usually considered as food, for example clay soil, chalk, and termitaria mounds. It was measured by yes to a report of practicing pica for a month or more and no to those who have practiced pica for less than 1 month or never. The question was incorporated in a socio-demographic questionnaire, having been adapted from the study by Gibore and others (Gibore et al., 2021)

### **The second part: Perceived Stress Scale (PSS) Questionnaire**

**Stress:** it refers to a postpartum mother's state of mental or emotional strain or tension caused by the numerous changes that occur throughout pregnancy, and feeling stressed is usual common (Dimes, 2023). Stress was measured by Perceived Stress Scale questionnaire developed by Cohen et al., (1988). PSS-10 measures stress using 10 items. The original 14-element PSS-14 is simplified into PSS-10. PSS-4 is a brief variant with four elements. PSS-10 has better validity and dependability than the prior two PSS versions. A 5-point Likert scale from "never" to "very often" rates how unexpected, unmanaged, and overwhelmed respondents' lives are in the PSS-10. Each

response is assigned a value ranging from 0 to 4, with the overall PSS score calculated as the sum of the 10 items' scores, with four reverse-coded items. The highest score is 40, and higher scores indicate more stress. There is no single cut-off point that corresponds to high or low stress (Chen et al., 2021). According to Chen et al., (2021)'s validity study, exploratory component analysis found a two-factor structure for PSS-10, with Cronbach's alpha values of 0.865 and 0.796, indicating strong internal consistency.

- ▶ Scores of 0-13 indicates low stress.
- ▶ Scores between 14-26 indicate moderate stress.
- ▶ Scores of 27-40 indicate considerable considered high perceived stress.

In this study stress will be categorized as no stress for scores 0-13 and for scores  $\geq 14$  as stress.

### **Translation of Instruments**

The original questionnaires are in English, they were translated to Setswana language following steps recommended guidelines by WHO (WHO, 2023).

**Initial Translation:** Was performed by translator with excellent command of the language to translate from English and with the language to translate into Setswana as mother tongue. It was someone who is familiar with health concepts and terms which is essential for translation.

**Back translation:** Two bilingual translators who are familiar with health concepts and terms and are proficient in both languages were then independently back-translated the instruments from Setswana version into English. They had not come across the original English version.

**Harmonization:** To guarantee that the meaning of the original text is made clear, and that the translation is satisfactory, a group discussion was undertaken with the 1<sup>st</sup> translators, the 2 back-translators, and 2 midwives who are experts in the subject field. To produce a final translation, all discrepancies were settled.

## **Quality testing of the instruments**

### **Validity**

Questionnaires were tested prior main data collection among 30 participants from the same health facility of study. To ensure validity of the research instruments, the panel of three experts were asked to evaluate the content validity, language suitability and criteria for scoring of the entire questionnaire. The item- level content validity index score (CVI) of three experts for DDS and PSS was .80 and 0.83 respectively. Modifications were done based on the result of the pretest before the final task of data collection.

### **A Pilot Test**

### **Reliability**

The internal consistency reliability of two questionnaires was tested in a pilot study with 30 participants, using the same inclusion and exclusion in the same hospital of study, participants used in the pilot did not participant in the main study. For the instrument to limit the measurement errors the tool must be both reliable and valid. It is said to be reliable if it is able to measure what it was designed for, and that was tested with the pilot study (Gray, Grove, & Sutherland, 2017) which showed positive results. The internal consistency reliability was tested by Cronbach's alpha coefficients (Gray et al., 2017) for the PSS questionnaire and the factor variable exhibits acceptable reliability estimates of 0.77 which is greater than the recommended level of 0.7. The DDS tool's reliability was confirmed with a Kuder–Richardson 20 =.75 from a sample of 385.

### **Protection of human subject**

The proposal and the instruments were submitted to the Institutional Review Board (IRB), (G-HS113/2566), Burapha University, and Botswana, Ministry of Health, Health Policy Research and Development department (HPRDD), Health Research Division (HPRD:6/14/1) for approval of this study. Permission to conduct the study in the facility was also sourced from the hospital management through the hospital research team including the postnatal unit manager. After that, the eligible participants were invited to take part in the study. The researcher clearly explained the

purpose and procedures of the study to the participants. Also, the researcher informed them about their anonymity, freedom to withdraw from the study at any time.

All participants signed the consent form prior to data collection. The consent form indicated that participant was completely volunteering to take part in the study. In cases where the participants were not feeling well during the interview, the researcher stopped the interview and then assisted the participant to be reviewed by the medical doctor. Anonymity and confidentiality of the participants was maintained, participants names were not used to identify collected data, instead codes were used. All completed forms were placed into an envelope, kept in a secure place to maintain confidentiality. All data files will be saved by only the researcher via secured password. The data would be destroyed after one year of publication of the study.

#### **Training of research assistant**

One research assistant was engaged in this research. The research assistant was trained on the purpose and objective of the study. The training included training on the instruments to be used, and research ethics with more emphases on informed consent and confidentiality. Pilot study was also used to train research assistant on the use of the instruments of the study.

#### **Data collection**

The researcher and the research assistant introduced themselves to the manager and staff of postpartum ward, by presenting identity cards and permission letter from the hospital management. They then asked for two working areas in the unit. After been granted permission to see participants, participants were approached individually by the either the research or the assistant, who introduced the purpose of the study, its objective and confidentiality issues using a participants information sheet. Rapport was created and those willing to participate signed the consent form and they were taken to a private room and were interviewed. Two interviews would run concurrently in two different rooms. Questionnaires were used to collect data from respondents. All the data that was collected was later stored in a sealed envelope by the researcher for data protection purposes. The questionnaires took 30 to 45

minutes of the respondent's time and all interviews were conducted from 10.30 hours to 16.30 hours. The number of participants interviewed per day was around 12 cases and these continued every day until the sample size of 385 postpartum women was reached. The researcher then entered the data collected by paper-based tools into a software computer program for subsequent data analysis.

### **Data analysis**

The collected data were coded, cleaned, and entered into Statistical Package for Social Sciences (SPSS) version 26 software, license number 001483 (Faculty of Nursing, Burapha University) for further analysis. Descriptive statistics including mean with standard deviation and frequency with percentage were used to summarize socio demographic and obstetric characteristics of the participants and study factors. To compare prevalence of PPA according to respondents' biological, psychological and social characteristics, bivariable analyses (i.e., chi-square test for independence) was conducted. Thereafter, multivariable logistic regression analyses with a 95% Confidence Interval (CI) was used to explain the predicted odds of PPA. The statistical significance was declared at a p-value less than 0.05.

## CHAPTER 4

### RESULTS

This chapter analyzed data collected from mothers admitted at NRH postpartum ward in Francistown, Botswana. Continuous variables are expressed mean  $\pm$  standard deviation (SD). Categorical variables were summarized using proportions. In the bivariate analysis, chi-square test was used to test for association between PPA and predictor variables. All statistical tests were performed at 5% significance level (95% confidence level) and summarized data were presented in tables. A multivariable logistic regression model was fitted to the anemia data to explain the predicted odds of postpartum anemia. The results of this study are presented as follows.

#### **Part 1 Characteristics of the samples**

##### **1. Socio-demographic characteristics of the samples**

A total of 385 postpartum women were recruited in this study. Their mean age was 28.1 years with a SD of  $\pm 7.1$  years. Two-thirds (68.3%) of the participants aged between 20 and 35 years and PPA was more prevalent (62.5%) among younger mothers aged 18-19 years than compared to their counterparts. One-third (37.4%) of mothers had primary education. In terms of occupation, one-third (33.3%) of them were housewives and only 2.6% were still attending school. About half (53.0%) of the mothers resided in rural areas. Concerning family monthly income, more than half 88.6% of the participants had family monthly income of less than BWP6, 000. (Table 1)

Table 1 Socio-demographic characteristics of the sample (n=385)

Variables	*Non-PPA n=187 n (%)	**PPA n=198 n (%)	Total n (%)
Age (years), (Mean = 28.1, SD = 7.1, Min =18, Max = 46)			
18-19 years	15 (37.5)	25 (62.5)	40 (10.4)
20 – 35 years	130 (49.4)	133 (50.6)	263 (68.3)
36 years and above	42 (51.2)	40 (48.8)	83 (21.3)
Marital Status			
Single	163 (46.8)	185 (53.2)	348 (90.4)
Married	24 (66.7)	12 (33.3)	36 (9.3)
Divorced	0 (0.0)	1 (100.0)	1 (0.3)
Education attained			
No formal education	0 (0.0)	5 (100.0)	5 (1.3)
Primary	7 (35.0)	13 (65.0)	20 (5.2)
Junior Secondary	55 (43.0)	73 (57.0)	128 (33.2)
Senior Secondary	72 (50.0)	72 (50.0)	144 (37.4)
Tertiary	53 (60.2)	35 (39.8)	88 (22.9)
Occupation			
Housewife	58 (45.3)	70 (54.7)	128 (33.3)
Self-employed	52 (47.3)	58 (52.7)	110 (28.6)
Private	42 (54.5)	35 (52.73)	77 (20.0)
Government	30 (50.0)	30 (50.0)	60 (15.5)
Student	5 (50.0)	5 (50.0)	10 (2.6)
Residence			
Rural	108 (53.0)	96 (47.0)	204 (53.0)
Urban	79 (43.7)	102 (56.3)	181 (47.0)
Family monthly income (in BWP), (Mean = 2805.5, SD = 3767.8, Min =200, Max = 30,000)			
0-6000	162 (47.5)	179 (52.5)	341 (88.6)
>6000	25 (56.8)	19 (43.2)	44 (11.4)

\*Non PPA  $\geq 10\text{g/dl}$ , \*\*PPA  $< 10\text{g/dl}$

Regarding the obstetrical history on the mothers, a half (56.4%) had completed  $\geq 8$  antenatal care (ANC) visits during their pregnancy and about 3 quarters of them (71.7%) had spontaneous vaginal delivery. Nearly a half (52.7%) of the mothers were multigravida, and 50.3% were multiparous. Of the multigravida (multigravida and grand multigravida), 58.4% had an inter-pregnancy interval of two years or more. Nearly half (51.1%) of the mothers had prepartum anemia (Table 2).

Table 2 Obstetric characteristics of the sample (n=385)

Variables	*Non-PPA n=187 n (%)	**PPA n=198 n (%)	Total n (%)
Method of delivery			
Cesarean Section	57 (52.3)	52 (47.7)	109 (28.3)
Spontaneous Vaginal Delivery	130 (47.1)	146 (52.9)	276 (71.7)
Postpartum hemorrhage			
Yes	4 (44.4)	5 (55.6)	9 (2.3)
No	183 (48.7)	193 (51.3)	376 (96.7)
Pregnancy interval			
First pregnancy	66 (50.0)	66 (50.0)	132 (34.3)
< 2 years	11 (32.3)	17 (60.7)	28 (7.3)
≥ 2 years	110 (48.9)	115 (51.1)	225 (58.4)
ANC visits during last pregnancy			
No visits	3 (42.86)	4 (57.1)	7 (1.8)
< 8 visits	65 (40.4)	96 (59.6)	161 (41.8)
8 or more visits	119 (54.8)	98 (45.2)	217 (56.4)
Gravity			
Primigravida	66 (50.0)	66 (50.0)	132 (34.3)
Multigravida	99 (48.8)	104 (51.2)	203 (52.7)
Grand Multigravida	22 (44.0)	28 (56.0)	50 (13.0)
Parity			
Primiparous	79 (52.0)	73 (48.0)	152 (39.5)
Multiparous	88 (45.6)	105 (54.4)	193 (50.1)
Grand Multipara	20 (50.0)	20 (50.0)	40 (10.4)
Prepartum anemia***			
Yes	50 (27.9)	129 (72.1)	179 (51.1)
No	124 (72.5)	47 (27.5)	171 (48.9)

\*Non PPA ≥10g/dl, \*\*PPA <10g/dl, \*\*\*Missing data of Hb in 13 cases of non-PPA and 22 cases of

PPA, \*Missing data of Hb. First pregnancy: pregnant for the first time in her life time;

< 2 years: Years between the last pregnancy and the current pregnancy was less than 2 years and;

≥ 2 years: years between the last pregnancy and the current pregnancy was more than 2 years.

## Part 2 Description of the study variable

### Biological, psychological and social characteristics of the samples

Table 3 summarizes the biological, psychological and social characteristics of the respondents. Majority (80.3%) of the mothers were HIV-negative while (19.7%) were HIV-positive. In terms of adherence of IFA supplements during pregnancy, about 3 quarters of mothers (70.1%) had good adherence. In terms of dietary intake of food rich in iron, (62.6%) of the participants had inadequate intake of

food rich in iron. Moreover, almost a half of the mothers (46.5%) practiced PICA during pregnancy and of those who practiced PICA during pregnancy, (43.0%) of them were in their second trimester. Two-thirds (69.4%) of the mothers possessed knowledge of food taboos (Table A7) and 43.9% of them practice food taboos (Table 3).

Table 3 Biological, psychological and social characteristics of the sample (n=385)

Variables	*Non-PPA (n= 187) n (%)	**PPA (n=198) n (%)	Total n (%)
HIV status			
Negative	171 (55.3)	138 (44.7)	309 (80.3)
Positive	16 (21.0)	60 (79.0)	76 (19.7)
Adherence of IFA supplements			
Poor adherence	33 (28.7)	82 (71.3)	115 (29.9)
Good adherence	154 (57.0)	116 (43.0)	270 (70.1)
Stress			
No stress	43 (60.6)	28 (39.4)	71 (18.4)
Stress	144 (45.9)	170 (54.1)	310 (81.6)
Dietary intake of food rich in iron			
Inadequate	108 (44.8)	133 (55.2)	241 (62.6)
Adequate	79 (54.9)	65 (45.1)	144 (37.4)
Food taboos			
Yes	65 (38.5)	104 (61.5)	169 (43.9)
No	122 (56.5)	94 (43.5)	216 (56.1)
PICA			
Yes	48 (26.8)	131 (73.2)	179 (46.5)
No	139 (67.5)	67 (32.5)	206 (53.5)

\*Non PPA  $\geq 10\text{g/dl}$ , \*\*PPA  $< 10\text{g/dl}$ ,

### Part 3 Presentation of results answering research objectives

#### Prevalence of Postpartum anemia (PPA)

Table 4 shows the prevalence of PPA of admitted mothers. The overall prevalence of PPA was estimated at 51.4%, 95% CI: (46.5% - 56.4%).

Table 4 Prevalence of PPA of the sample and their corresponding 95% CI and SE

Proportion	Standard Error (SE)	95% Confidence Interval (CI)	
		Lower Bound	Upper Bound
0.514	0.03	0.464	0.564

#### Bivariate analysis

The chi-square test for independent variables was conducted to assess the prevalence of PPA according to biological, psychological and social characteristics of the mothers. With respect to social characteristics, the results show that prevalence of PPA was statistically significant by adherence of IFA supplements during pregnancy, food taboo practice and pica practice. The prevalence of PPA was not statistically significant statistical association by dietary intake of food rich in iron during pregnancy ( $p > 0.05$ ). About biological and psychological characteristics, prevalence of anemia was also statistically significant by HIV status, and stress perceived during pregnancy.

The prevalence of anemia was statistically significantly higher among HIV-positive mothers (79.0%) and mothers who reported stress during pregnancy (54.1%). About the adherence of IFA supplements during pregnancy, prevalence of anemia was higher among respondents who had poor IFA adherence (71.3%). Furthermore, the prevalence of anemia was higher among respondents who practice food taboos (39.5%), and mothers who reported craving and purposive ingestion of non-food items (73.2%) (Table 5).

Table 5 Relationship between PPA and biological, psychological and social characteristics among delivered mothers, (n=385)

Variables	Non-PPA (n=187) n (%)	PPA (n=198) n (%)	Chi-Square	p-value
HIV status			28.707	0.000***
Negative	171 (55.3)	138 (44.7)		
Positive	16 (21.0)	60 (79.0)		
Adherence of IFA supplements			25.933	0.000***
Poor adherence	33 (28.7)	82 (71.3)		
Good adherence	154 (57.0)	116 (43.0)		
Stress			5.002	0.025*
No stress	43 (60.6)	28 (39.4)		
Stress	144 (45.9)	170 (54.1)		
Dietary intake of food rich in iron			3.643	0.056
Inadequate	108 (44.8)	133 (55.2)		
Adequate	79 (54.9)	65 (45.1)		
Food taboos			12.325	0.000***
Yes	65 (38.5)	104 (61.5)		
No	122 (56.5)	94 (43.5)		
PICA			63.389	0.000***
Yes	48 (26.8)	131 (73.2)		
No	139 (67.5)	67 (32.5)		

Note: \*\*\* $p < 0.001$ , \*\* $p < 0.01$  and \* $p < 0.05$ . PICA: craving and purposive ingestion of non-food items. IFA: iron and folic acid.

### Multivariable logistic regression

Multivariate logistic regression was conducted for all variables with  $p$ -value of  $\leq 0.05$  at the chi-square test to identify factors independently associated with anaemia. Dietary intake of food rich in iron sufficiency during pregnancy was not good predictors of PPA hence this factor was omitted when conducting the multivariate logistic regression.

In multivariable logistic regression, adherence of IFA supplements during pregnancy, mother's HIV status and pica practice were significantly associated with PPA. The odds of PPA were 4.57 times higher among HIV-positive mothers (AOR=4.57, 95% CI: (2.41 - 8.67) compared with HIV-negative mothers. PPA was more common among women who did practice PICA during pregnancy (AOR=4.39,

95% CI: (2.67 - 7.23) compared with their counterparts. Moreover, mothers who had poor adherence to iron and folic acid supplements during pregnancy were more likely to have PPA (AOR=2.18, 95% CI: (1.29 - 3.68) compared to those who had good IFA adherence (Table 6).

Table 6 Predictors of PPA among delivered mothers (n=385)

Variables	B	SE	Wald	df	p-value	Exp (B)	95% CI
HIV status							
Negative	1.00						
Positive	1.52	0.33	4.65	5	0.000	4.57	2.41-8.67
Adherence of IFA supplements							
Good adherence	1.00						
Poor adherence	0.78	0.26	2.91	5	0.004	2.18	1.29-3.68
Stress							
No stress	1.00						
Stress	0.31	0.42	1.00	5	0.318	1.36	0.74-2.51
Food taboo							
No	1.00						
Yes	0.15	0.25	0.61	5	0.544	1.16	0.71-1.90
PICA							
No	1.00						
Yes	1.48	0.25	5.81	5	0.000	4.39	2.67-7.23
Pseudo R <sup>2</sup> =0.20, Log likelihood = -215.96							

## CHAPTER 5

### DISCUSSION AND CONCLUSION

This chapter presents the summary of the findings, discussion about the study findings, limitations of study, and implications of the study results. In addition, recommendations for future research are also discussed.

#### **Summary of the study findings**

The objective of this study was to ascertain the prevalence of PPA, and examine which factors among biological (HIV positive status), psychological (stress), and social (dietary intake of food rich in iron, adherence to IFA supplements, food taboos, and pica) can predict PPA among delivered mothers admitted at NRH postpartum unit in Francistown, Botswana. A total of 385 postpartum women were recruited in this study. Data was collected using pre-tested research instrument, namely, Socio-demographic, Obstetric, Comorbidity and Dietary practices Questionnaire (SOCDDQ), and Perceived Stress Scale (PSS) Questionnaire.

Findings of the study revealed that the sample consisted of two-thirds (68.3%) of the participants aged between 20 and 35 years, (Mean = 28.1, SD = 7.1, Min = 18, Max = 46), and one-third (37.4%) had primary education. Most of the mothers were single (90.4%). One-third (33.3%) of mother were housewives and 88.6% of the participants had family monthly income of less than BWP6,000. A half (56.4%) had completed 8 or more ANC visits during their pregnancy and about 3 quarters of them (71.7%) had spontaneous vaginal delivery. Nearly a half (52.7%) of the mothers were multigravida, and 50.3% were multiparous.

Majority (80.3%) of the mothers admitted at NRH were HIV-negative, and about 3 quarters of mothers (70.1%) had good adherence of IFA supplements during pregnancy. In terms of dietary intake of food rich in iron, 62.6% of the participants had inadequate intake of food rich in iron. Moreover, almost a half of the mothers (46.5%) practiced PICA during pregnancy.

The overall prevalence of PPA among mothers admitted at NRH was estimated at 51.4% and it was more common (62.5%) among younger mothers aged 18-19 years. The chi-square test of association revealed that prevalence of PPA was statistically significantly higher among HIV-positive mothers (79.0%) and mothers who reported stress during pregnancy (54.1%). Furthermore, the prevalence of PPA was higher among mothers who practice food taboos (39.5%), mothers who reported craving and purposive ingestion of non-food items (73.2%), and those who had poor IFA adherence (71.3%).

The results from multivariable logistic regression indicated that the odds of PPA were 4.57 times higher among HIV-positive mothers (AOR=4.57, 95% CI: (2.41 - 8.67) compared with HIV-negative mothers. PPA was more common among women who did practice PICA during pregnancy (AOR=4.39, 95% CI: (2.67 - 7.23) compared with their counterparts. In addition, mothers who had poor adherence to IFA supplements during pregnancy had a higher likelihood of experiencing PPA (AOR = 2.18, 95% CI: 1.29 - 3.68) compared to those with good adherence to IFA supplements.

## **Discussion of the findings**

The findings of this study were discussed based on two research purposes. The first discussion was about prevalence of PPA among women in Francistown, Botswana. The second discussion was about predictors of PPA among women in Botswana.

### **1. Prevalence of PPA among women in Botswana**

In this study, the overall prevalence of PPA among mothers admitted at NRH in Francistown, was estimated at 51.4%. This study highlighted that PPA is a significant public health problem in Botswana. PPA is a common problem throughout the world, with a high prevalence rate ranging from 50.0% to 80% in developing countries and this include Botswana (Mremi et al., 2022). The present discovery is analogous to earlier investigations carried out in African nations, such as Senegal,

where the percentage stands at 55.2% (Tine et al., 2018) and more than the studies conducted in Ethiopia at 47.2% (Bambo et al., 2023) and in Ghana at 46.7% (Wemakor et al., 2022). Nevertheless, the present incidence is lower than the percentage recorded in a study conducted in Saudi Arabia (59.3%) (Mattar et al., 2019) and India (65%) (Selvaraj et al., 2019). The disparity in findings could perhaps be ascribed to variations in the demographics of the participants and the criteria employed to define anemia in the present study compared to the previous investigations. Unlike the current study, the former studies were conducted among postpartum mothers using hemoglobin cut-off points and different timeline, Selvaraj et al; (2019) used HB level of <12 g/dl at 6 weeks postpartum (Selvaraj et al., 2019) and Bambo et al; (2023) used <11 g/dl at 24 hours postpartum (Bambo et al., 2023), to define PPA. The changes in prevalence seen can be related to the increased risk of anemia in the present research population compared to that of the prior studies.

The high prevalence of PPA observed in this study might be linked with the low socio-economic classes of the participants which might had an impact on their nutritional status. In the current study, two-thirds (88.6%) of the participants had family monthly income of less than BWP 6,000.00 which is less than recommended average national household income of BWP 6,027.00 to live a decent life (Botswana, 2019). Women from disadvantaged socio-economic backgrounds tend to have limited access to education and frequently face financial limitations (Tine et al., 2018). Consequently, they are prone to experience food insecurity, which in turn hinders pregnant women from consuming sufficient, high-quality, and nourishing food, so increasing their susceptibility to developing anemia (Tine & Adama, 2019).

## **2. Predictors of PPA among women in Botswana**

### **HIV status:**

In this study, mothers' HIV positive status was found to be a risk factor of PPA. The prevalence of PPA was found to increase in mothers who are diagnosed with HIV. The odds of PPA were 4.57 times higher among HIV-positive mothers compared with HIV-negative mothers. The prevalence of PPA was statistically significantly higher among HIV-positive mothers (79.0%). Our findings confirmed the previously

published information that anemia was widespread among all demographic groups of individuals with HIV (Cao et al., 2022; Goodman, 2022). Likely this is so because according to Cao et al., (2022), Individuals with HIV infection frequently experience recurrent bacterial, viral, and fungal infections, which play a significant role in the development of anemia. Furthermore, several of these diseases are associated with aberrant production of blood cells (Cao et al., 2022). Moreover, the empirical evidence suggest that HIV invades and infects the cells of the bone marrow stroma yet, it is still uncertain to what degree hematopoietic progenitors are vulnerable to HIV infection (Cao et al., 2022). Kibret et al., (2021) also concur to this, stating in their research that HIV's effect on the bone marrow and the decrease in hemoglobin levels in the blood may increase the risk of anemia (Kibret et al., 2021). The current finding aligns with the theoretical aspects of BPS that various biological variables, including prepartum anemia, comorbidities such as HIV, and postpartum hemorrhage, can heighten the probability of PPA in postpartum mothers (Abebaw et al., 2020; Mattar et al., 2019; Selvaraj et al., 2019; Tairo & Munyogwa, 2022).

### **Stress**

The current study noted that stress was statistically significantly associated with anemia during postpartum (Although it did not show statistical significance in the multivariate logistic regression analysis). The prevalence of PPA was found to increase in mothers who reported stress during pregnancy and delivery. The high perceived stress level might be explained by the fact that nearly a half (47.8%) of mothers often felt nervous and “stressed” during pregnancy. Moreover, (47.2%) of mothers often felt difficulties were piling up so high that they could not overcome them. This finding was expected as stress is a commonly seen phenomenon during the postpartum period, intensified by stressful events, such as the process of labor and delivery (Juncker et al., 2022). Kwak et al., (2022) asserts the journey of having a baby can be associated with mixed feelings and psychological adjustments. This could exacerbate the preexisting physiological stress experienced during pregnancy, potentially leading to the inhibition of erythropoiesis in the bone marrow (Lopresti, 2020). Stress has been linked deficiencies in vitamins B12, C, magnesium, folate, and

other nutrients (Api, 2022). In the BPS model stress can lead to elevated levels of cortisol and other stress hormones, which may interfere with the body's ability to absorb and utilize nutrients, including iron. This disruption can exacerbate or contribute to anemia during pregnancy which was the results of this study. However, despite this significant association found in this study, stress did not predict PPA. While stress can influence factors like diet and absorption mechanism, it does not directly cause anemia. For stress to lead to anemia, it would need to trigger a series of specific behavior or physiological changes, which do not occur universally across all individuals experiencing stress.

### **Dietary intake of food rich in iron**

The study found out that two-thirds (62.6%) of mothers had inadequate dietary intake of food rich in iron during pregnancy. The inadequate dietary intake of food rich in iron could be explained by low socio-economic status observed in this study leading to poor eating practice/diet. 55.2% of mothers who had inadequate dietary intake of food rich in iron had PPA. Despite this finding inadequate dietary intake of food rich in iron was not statistically significant to PPA unlike in a study by Gibore et al., (2021) which revealed that pregnant women with insufficient dietary diversity scores had a greater probability of developing anemia compared to their counterparts. The adjusted odds ratio (AOR) is 1.16 with a 95% confidence interval (CI) ranging from 0.57 to 2.36. The p-value is less than 0.05. (Gibore et al., 2021). The present study observed a statistically significant association between the consumption of iron-absorbing foods and postpartum anemia in the bivariate analysis. The prevalence of PPA was found to be less common among mothers who reported taking food that enhances absorption of iron like orange, mango and green apple. Majority (70.4%) of mothers reported taking food that enhances absorption of iron. The results were expected as most common causes of anemia are linked to insufficient intakes of iron, either in terms of amount or quality absorbed in assimilating dietary iron deficient foods or can be lessened by the use of inhibitors of mineral absorption like coffee, tea and coke.

The current study confirmed this as the prevalence of PPA was higher among women who ate food that inhibit consumption of iron (54.3%). The study found

out that overwhelming majority (82.3%) drunk beverages that inhibit absorption of iron such as tea (Five Roses & Joko tea), coffee, and coke. In support, it has been shown that drinking tea with a meal can decrease iron absorption by  $\geq 50\%$  and that can increase the chances of iron deficiency (Gibore et al., 2021). Gibore et al., (2021) found that pregnant women who consumed fewer than three meals daily had a higher likelihood of experiencing anemia in comparison to those who consumed three or more meals each day. This finding is applicable to this study, as the incidence of PPA was significantly greater among mothers who consumed fewer than three meals per day. This discovery suggests that a higher frequency of daily meals may enhance dietary sufficiency, as the need for nutrients increases during pregnancy.

#### **Adherence to IFA supplements**

The likelihood of PPA was 2.18 times higher in postpartum mothers who did not adhere well to iron and folic acid (IFA) supplements. The study found out that prevalence of PPA was higher among respondents who had poor IFA adherence (71.3%). This finding was in agreement with the studies carried out in Ethiopia at 57.4%, AOR: 3.27; 95% CI: (1.31- 8.15) (Abebe et al., 2022) and at 72.7%, AOR = 2.52; 95% CI (1.06 - 6.04) (Abebaw et al., 2020). One probable explanation could be the depletion of stored maternal iron, as the physiological demands for iron during pregnancy and childbirth are significant. Consequently, failing to adhere to the correct sequence of taking IFA supplements may lead to a decrease in iron reserves and result in anemia, even in cases of modest blood loss after childbirth. Research indicates that consuming a minimum of 90 iron-fortified tablet supplements, taken once daily, can reduce the occurrence of maternal anemia by up to 70.0% during pregnancy (Abebe et al., 2022). The BPS model suggest that poor adherence to taking IFA during pregnancy which could be associated with cultural attitudes towards pregnancy for example a woman preferring to take traditional remedies over taking IFA supplements or lack of awareness on the importance of IFA during pregnancy. These social factors can influence the decision or the ability of pregnant women to take iron supplements, which in turn can result with PPA.

**Food taboo:** In terms of food taboo practice, the current study noted that prevalence of PPA was statistically higher among mothers who practiced food taboo.

This could be explained the fact that in Botswana, many pregnant women tend to avoid meat, salty foods and bread which are high in protein are also excellent sources of calcium, iron, vitamin, and B-complex. In support, the current study found out that of women who practiced food taboo during pregnancy, two-thirds (60.1%) avoided eggs while 8.3% avoided liver and it was mainly due to cultural beliefs (98.8%). This finding is line with study done in Ethiopia (Teshome MS, Meskel DH, & B., 2020), which revealed that pregnant women who adhered to cultural beliefs and experienced food restriction during pregnancy were 3.9 times more prone to developing anemia compared to pregnant women who did not restrict their food intake. Research has shown that women from various regions worldwide face dietary restrictions during pregnancy and the postpartum period due to cultural customs and beliefs (Ramulondi et al., 2021). A study by Ramulondi et al., (2021) in South Africa revealed that eggs and yellow fruits are the primary taboo foods during pregnancy in their research area. In contrast, in Botswana, many pregnant women avoid meat, salty foods, and bread.

In the BPS model, food taboo as a social factor can significantly influence the risk of PPA. Even when pregnant women are educated about the importance of certain food e.g., food rich in iron, they may be reluctant to break taboos due to fear of social judgment or cultural consequences, this was reflected by this study. Although, food taboo was significantly associated with PPA, in this study it did not predict PPA. Reasons could be because of the potential for nutrient compensation, health interventions, and individual differences in adherence to these taboos. These factors can mitigate the risk of anemia, making food taboo an inconsistent predictor of PPA.

**PICA:** Craving of non-food substances (such as termiteria mounds or clay) in pregnant women was associated with anemia in this study. The prevalence of this dietary habit among women was substantial, with 46.5% reporting it. This is consistent with a study conducted in Ghana, where 47.5% of pregnant women reported experiencing similar non-food desires. (Sanjari et al., 2023). PPA was more common among women who did practice pica during pregnancy compared to their counterparts. In the current study, the most common non-food substance consumed by

admitted mothers were termiteria mounds (96.7%), clay (2.8%), and chalk (0.5%). This finding is consistent with the meta-analysis study done by Miao and colleagues in which they conclude that presence of pica was found to be associated with significantly higher odds of anemia (Miao et al., 2015). It is crucial to educate pregnant women about the risks associated with consuming non-food substances like soil and termiteria moulds. These chemicals can increase the likelihood of intestinal worms and other illnesses, which can lead to the development of anemia or other undesirable results. According to BPS model lack of education or low health literacy which is a social factor in the model, can lead to misunderstandings about the dangers of pica. If a pregnant woman is unaware of the risk associated with consuming non-food substances, she may continue the practice, especially if it is common in her community which is same as reported in this study.

### **Strength and Limitations**

This study aims to contribute to the existing but limited body of knowledge on the prevalence and impact of anemia during the postpartum period in Botswana. One significant advantage of this study is that it offers essential initial data on the frequency of anemia among hospitalized moms in this specific context, using point-of-care testing among the participants of the study. The PPA was calculated using primary data collected by a skilled technician during the survey. Nevertheless, this investigation was subject to certain constraints. The research was a cross-sectional study carried out in a single healthcare facility. This may restrict the ability to apply the findings to all women in Botswana. Furthermore, the socio-demographic variables and other factors evaluated in the study were based on self-reported data provided by the participants, which could potentially introduce information bias.

### **Implications to nursing**

Monitoring postnatal health is crucial to ensure the welfare of both the mother and the newborn. Finding of this study demonstrated that positive HIV status, pica practice, and poor adherence to IFA are significant factors determining high level

of PPA among women in Francistown, Botswana. Implications of study results are as follows:

### **Nursing practice**

Having a standard postnatal guideline is crucial in ensuring that healthcare providers can offer appropriate treatment and closely monitor postnatal women. Therefore, the study results will help nurses and other health care providers to understand the factors that are strongly related to PPA. Thus, nurses and nurse-midwives can apply this knowledge to create educational programs for pregnant women in Botswana so as to prevent occurrence of PPA. Moreover, midwives and health care providers can apply the study findings to improve care during prenatal period by providing counseling on how to prevent HIV infection, nutritional education on how to avoid practicing pica and encourage good adherence to IFA. It will also enhance the quality of care for pregnant women and reduce maternal and child morbidity and mortality in Botswana.

### **Nursing education**

It is necessary to teach nursing and midwifery students about PPA and its prevalence and risk factors as well as prevention and intervention strategies of PPA. Therefore, knowledge gained from this study can be incorporated in teaching nursing students to understand factors predicting PPA.

### **Nursing administration and health policy**

It will suggest policy makers to formulate appropriate policies that might be a guideline for local and national level to incorporate screening PPA to detect and treat PPA early including preventive measure for PPA. To address the problem of insufficient consumption of iron-rich food and IFA supplements, it is essential to enhance the enforcement of the WHO recommendation. This guideline advises the ongoing use of oral iron and folic acid supplementation for a duration of 3 months after childbirth. This would reduce the rate of PPA and its consequences, and improve maternal and child health.

**Recommendations for future research**

Further research is crucial to gather evidence that will aid in the development of cost-effective solutions for this issue. Additionally, it is necessary to undertake a study combining other facilities in order to identify other factors that can predict PPA, thus allowing for generalization of the results. This would facilitate the strategic development of healthcare services, resulting in a decrease in maternal morbidity and mortality rates, and ultimately enhancing the overall welfare of mothers.



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**APPENDICES**



**Appendix A**

IRB approval and data collection letters

สำเนา

ที่ IRB3-015/2567

## เอกสารรับรองผลการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา

คณะกรรมการพิจารณาจริยธรรมการวิจัยในมนุษย์ มหาวิทยาลัยบูรพา ได้พิจารณาโครงการวิจัย

รหัสโครงการวิจัย : G-HS113/2566  
 โครงการวิจัยเรื่อง : Predicting factors of postpartum anemia among delivered mothers at Nyangabwe Referral Hospital, Francistown, Botswana  
 หัวหน้าโครงการวิจัย : MRS.MALEBOGO QUEEN NTHUSANG  
 หน่วยงานที่สังกัด : คณะพยาบาลศาสตร์  
 อาจารย์ที่ปรึกษาโครงการหลัก (สารนิพนธ์/ งานนิพนธ์/ วิทยานิพนธ์/ คุษฎีนิพนธ์) : รองศาสตราจารย์ ดร.ปัญญารัตน์ ลาภวงค์วัฒนา  
 หน่วยงานที่สังกัด : คณะพยาบาลศาสตร์  
 อาจารย์ที่ปรึกษาโครงการร่วม (สารนิพนธ์/ งานนิพนธ์/ วิทยานิพนธ์/ คุษฎีนิพนธ์) : รองศาสตราจารย์ ดร.ตติรัตน์ เตชะศักดิ์ศรี  
 หน่วยงานที่สังกัด : คณะพยาบาลศาสตร์  
 วิธีพิจารณา :  Exemption Determination  Expedited Reviews  Full Board

BUU Ethics Committee for Human Research has considered the following research protocol according to the ethical principles of human research in which the researchers respect human's right and honor, do not violate right and safety, and do no harms to the research participants.

Therefore, the research protocol is approved (See attached)

1. Form of Human Research Protocol Submission Version 2: 22 January 2024
2. Research Protocol Version 1: 13 September 2023
3. Participant Information Sheet Version 2: 22 January 2024
4. Informed Consent Form Version 2: 22 January 2024
5. Research Instruments Version 1: 13 September 2023
6. Others (if any) Version :-

วันที่รับรอง : วันที่ 5 เดือน กุมภาพันธ์ พ.ศ. 2567 วันที่หมดอายุ : วันที่ 5 เดือน กุมภาพันธ์ พ.ศ. 2568

สำเนา

ลงนาม *Assistant. Professor Ramorn Yampratoom*

*(Assistant. Professor Ramorn Yampratoom)*

Chair of The Burapha University Institutional Review Board Panel 3 (Clinic / Health Science  
/ Science and Technology)

\*\* หมายเหตุ การรับรองนี้มีรายละเอียดตามที่ระบุไว้ด้านหลังเอกสารรับรอง \*\*





MHESI 8137/272

Graduate School, Burapha University  
169 Longhaad Bangsaen Rd.  
Saensuk, Muang, Chonburi  
Thailand, 20131

February 14<sup>th</sup>, 2024

To Minister of Health & Wellness, Ministry of Health & Wellness, Republic of Botswana

Enclosure: 1. Certificate ethics document of Burapha University  
2. Research Instruments (Try out)

On behalf of the Graduate School, Burapha University, I would like to request permission for Mrs. Malebogo Queen Nthusang to collect data for testing the reliability of the research instruments.

Mrs. Malebogo Queen Nthusang, ID 65910024, a graduate student of the Master of Nursing Science program (International Program) in Maternity Nursing and Midwifery Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Predicting Factors of Postpartum Anemia Among Delivered Mothers at Nyangabwe Referral Hospital, Francistown, Botswana" under supervision of Assoc. Prof. Dr. Punyarat Lapvongwatana as the principle advisor. She proposes to collect data from 30 postpartum mothers in post-natal unit at Nyangabwe Referral Hospital.

The data collection will be carried out from February 19 - 29, 2024. In this regard, you can contact Mrs. Malebogo Queen Nthusang via mobile phone +267-7741-0440 or +66-98-515-8241 or E-mail: 65910024@go.buu.ac.th

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

มีณฑนา รุ่งสียะภาส

(Assist. Prof. Dr. Montana Rungsiyopas)  
Vice-Dean for Academic Affairs  
Acting of Dean of Graduate School, Burapha University

Graduate School Office  
Tel: +66 3810 2700 ext. 705, 707  
E-mail: [grd.buu@go.buu.ac.th](mailto:grd.buu@go.buu.ac.th)  
<http://grd.buu.ac.th>





Graduate

School, Burapha University

169 Longhaad Bangsaen Rd.

Saensuk, Muang,

Chonburi

Thailand,

20131

February 14<sup>th</sup>, 2024

To Minister of Health & Wellness, Ministry of Health & Wellness, Republic of Botswana

Enclosure: 1. Certificate ethics document of Burapha University  
2. Research Instruments

On behalf of the Graduate School, Burapha University, I would like to request permission for Mrs. Malebogo Queen Nthusang to collect data for conducting research.

Mrs. Malebogo Queen Nthusang, ID 65910024, a graduate student of the Master of Nursing Science program (International Program) in Maternity Nursing and Midwifery Pathway, Faculty of Nursing, Burapha University, Thailand, was approved her thesis proposal entitled: "Predicting Factors of Postpartum Anemia Among Delivered Mothers at Nyangabwe Referral Hospital, Francistown, Botswana" under supervision of Assoc. Prof. Dr. Punyarat Lapvongwatana as the principle advisor. She proposes to collect data from 385 postpartum mothers in post-natal unit at Nyangabwe Referral Hospital. The data collection will be carried out from March 1, 2024 to April 30, 2024. In this regard, you can contact Mrs. Malebogo Queen Nthusang via mobile phone +267-7741-0440 or +66-98-515-8241 or E-mail: 65910024@go.buu.ac.th

Please do not hesitate to contact me if you need further relevant queries.

Sincerely yours,

ผัณฑนา รังสียะภาด

(Assist. Prof. Dr. Montana Rungsiyopas)

Vice-Dean for Academic Affairs

Acting of Dean of Graduate School, Burapha University

Graduate School Office



TELEPHONE: 363 2500  
 FAX: 317 0155  
 TELEGRAMS: RABONGAKA  
 TELEX: 2818 CARE BD



Republic of Botswana

MINISTRY OF HEALTH  
 PRIVATE BAG 0038  
 GABORONE

REFERENCE NO: HPRD: 6/14/1

21<sup>st</sup> February 2024

Health Research and Development Division

Notification of IRB Review: **New application**

Malebogo Queen Nthusang  
 P O Box 10208  
 Botshabelo

Dear Malebogo Queen Nthusang

**PROTOCOL TITLE: PREDICTING FACTORS OF POSTPARTUM ANEMIA  
 AMONG DELIVERED MOTHERS AT NYANGABWE REFERRAL HOSPITAL,  
 FRANCISTOWN, BOTSWANA**

**Review Type:** Expedited  
**Review Date:** 19<sup>th</sup> February 2024  
**Approval Date:** 21<sup>st</sup> February 2024  
**Effective Date:** 21<sup>st</sup> February 2024  
**Expiration Date:** 20<sup>th</sup> February 2025  
**Risk Determination:** Minimal risk

Thank you for submitting new application for the above referenced protocol.  
**Permission is hereby granted to conduct the study.**

This permit does not however give you authority to collect data from the selected sites without prior approval from the management. Consent from the identified individuals should be obtained where applicable.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the Health Research and Development Division in the Ministry of Health for consideration and approval.

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research, Ministry of Health within 3 months of completion of the study. Copies should also be submitted to all other relevant authorities.

#### **Continuing Review**

In order to continue work on this study (including data analysis) beyond the expiry date, submit a Continuing Review Form for Approval at least three (3) months prior to the protocol's expiration date. The Continuing Review Form can be obtained from the Health Research Division Office (HRDD), Office No. 7A.7 or Ministry of Health

website: [www.moh.gov.bw](http://www.moh.gov.bw) or can be requested via e-mail from HRDD office, e-mail address [hhealthresearch@govbots.onmicrosoft.com](mailto:hhealthresearch@govbots.onmicrosoft.com). As a courtesy, the HRDD will send you a reminder email about eight (8) weeks before the lapse date, but failure to receive it does not affect your responsibility to submit a timely Continuing Report form.

### Amendments

During the approval period, if you propose any change to the protocol such as its funding source, recruiting materials, or consent documents, you must seek HRDC approval before implementing it. Please summarize the proposed change and the rationale for it in the amendment form available from the Health Research Division Office (HRDD), Office No. 7A 7 or Ministry of Health website: [www.moh.gov.bw](http://www.moh.gov.bw) or can be requested via e-mail from HRDD Office, e-mail address: [hhealthresearch@govbots.onmicrosoft.com](mailto:hhealthresearch@govbots.onmicrosoft.com). In addition submit a copy of an updated version of your original protocol application showing all proposed changes in bold or "track changes".

### Reporting

Other events which must be reported promptly in writing to the HRDC include:

- Suspension or termination of the protocol by you or the grantor
- Unexpected problems involving risk to subjects or others
- Adverse events, including unanticipated or anticipated but severe physical harm to subjects.

If you have any questions please do not hesitate to contact Mr Abia Sebaka +267-3632754 at [asebaka@gov.bw](mailto:asebaka@gov.bw) and Mr. K. Motlhanka at [kmmotlhanka@gov.bw](mailto:kmmotlhanka@gov.bw), Tel +267-3632751.

Thank you for your cooperation and your commitment to the protection of human participants in research.

Yours Sincerely

  
Mr. Kgomo Motlhanka  
**for /PERMANENT SECRETARY**



Vision: A Healthy Nation by 2023.

Values: Botho, Equity, Timeliness, Customer Focus, Teamwork, Accountability.



NYANGABGWE HOSPITAL  
PRIVATE BAG 127  
FRANCISTOWN



TEL: (267) 2411000  
FAX: (267) 2416706

Researcher: MALEBOGO QUEEN NTHUSANG

BURAPHA UNIVERSITY

**STUDY TITLE:** "PREDICTING FACTORS OF POSTPARTUM ANEMIA AMONG DELIVERED MOTHERS AT NYANGABGWE HOSPITAL, FRANCISTOWN BOTSWANA"

Application Type: NEW APPLICATION

Site: Nyangabgwe referral Hospital

Date of approval: 29 February 2024

Expiration date: 29 February 2025

The institutional review Board (Research & Ethics Committee) for Human Subjects Research for Nyangabgwe Hospital is pleased to inform you that your request to conduct a research study has been approved.

- You will not change any aspect of your research without permission from the Nyangabgwe Hospital IRB. The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal must be submitted to the research and to the Research and ethics board for consideration and approval
- You need to report any unforeseen circumstance including the termination of the study.
- You must allow Nyangabgwe hospital IRB access to the study at any time for purposes of auditing.
- **At the end of the study you should give Nyangabgwe Hospital IRB a hard copy and soft copy of your report.**
- The permit does not however give you authority to collect data from the selected sites without prior approval from management and relevant heads of departments. Consent from the identified individuals should be obtained at all times.

Wishing you success in your study.

Yours sincerely

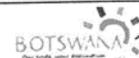
For: Chairperson Nyangabgwe Hospital IRB Committee

Dr Maitseo Nwako-Mohamadi



*Vision: A Model of Excellence in Quality Health Services.*

*Values: Botho, Equity, Timeliness, Customer Focus, Teamwork, Accountability*





**Appendix B**  
Questionnaires (English and Setswana versions)

## English Version Questionnaire

**Title of the study: Predicting factors of postpartum anemia among delivered mothers at Nyangabwe Referral Hospital, Francistown, Botswana.**

### INTRODUCTION

Date of interview.....

Name of interviewer.....

Questionnaire number.....

Name of the Hospital.....

Ward .....

**Your honest responses on the following questionnaire will greatly assist in the attempt to identify factors that contribute to the occurrence of anemia after delivery and hence improve recognition and management of anemia during childbirth period.**

#### Section 1: Sociodemographic information of the participants.

1. Age in years.....

2. Marital status

Single       Married       Widow       Divorced

3. Education Level

No formal       Primary       Junior Secondary

Senior Secondary       Tertiary education

4. What is your family's income per monthly? \_\_\_\_\_

5. Where did you stay for most of your pregnancy time in the past 3 months?

\_\_\_\_\_

6. Occupation status:

Self-employed       Government       Private       Housewife       Student

## Section 2: Obstetric and Comorbid Characteristics

- a) Hemoglobin level taken within 48 hours from time of deliver.  
**Hb \_\_\_\_\_ g/dl**
- b) Method of delivery. \_\_\_\_\_
- c) The amount of blood loss within 24 hours after delivery. \_\_\_\_\_ **mls**
- d) Gestation at initial ANC visit \_\_\_\_\_ Weeks
- e) Gestation at delivery \_\_\_\_\_ Weeks
- f) Weight of the baby at birth \_\_\_\_\_ grams
- g) Hemoglobin level taken during pregnancy, all available records:
- 1. 1st trimester Hb-----g/dl**
  - 2. 2nd trimester Hb-----g/dl**
  - 3. 3rd trimester Hb-----g/dl**
- h) Number of ANC visits \_\_\_\_\_
- i) Number of pregnancies (Gravity) \_\_\_\_\_
- j) How many times have you given birth to a live birth or still birth with gestation of 24 weeks or more (Parity) \_\_\_\_\_
- k) Number of abortions \_\_\_\_\_
- l) Number of living children \_\_\_\_\_
- m) How many years from the last pregnancy? \_\_\_\_\_
- n) HIV status that is less than 4 weeks old at time of delivery. \_\_\_\_\_

## Section 3: Dietary Practices Characteristics

### 3.a) Dietary intake food rich in iron

- 1) In the past 2 weeks did you eat any of the food that promote absorption of iron or drink juice made from them? Those are as follows:
- Yes     No
- Orange     Lemon     Naartjie     Green Apple     Mango.
- 2) In the past 2 weeks have you drunk the following beverages that prevent absorption of iron:
- Yes     No
- Coffee     Cocoa     Five Roses     Joko Tea
- Coke     Energy drink

3) Frequency of meals per day \_\_\_\_\_ times

**4) Dietary Diversity Scale- Food consumption based on 2 weeks dietary recall.**

What food did you consume in the last past 2 weeks. <b>Food group</b>	If a participant reported eating at least one of the foods listed in a particular group, the participant will be scored 1 for that food group and 0 for all NO's in a group
1. <b>Organ meat</b> (Liver, Kidney, Heart)	
2. <b>Flesh meat</b> (Beef, Pork, Lamb, Goat, Chicken)	
3. <b>Insects</b> (Mopane worm, Other specify...)	
4. <b>Seafood</b> (Fresh fish, Dried fish, Canned fish, Shrimps)	
5. <b>Vegetables</b> (Potatoes, Leafy greens vegetables, Broccoli, Tomatoes, White Mushrooms, avocado)	
6. <b>Legumes</b> (Nuts, Beans, Lentils, Peas)	
7. <b>Fruits</b> (Mulberries, Prunes, Black Olives)	
8. <b>Whole grain</b> (Oats, Wheat, Iron fortified - Maluto)	
9. <b>Sweets</b> (Black strap molasses, Dark chocolate)	
Total scores	

**3.b) Adherence to IFA supplements**

1. Did you take IFA tablet during pregnancy?
  - a) Yes, why? \_\_\_\_\_
  - b) No, why? \_\_\_\_\_
2. Gestation when IFA tablets started. \_\_\_\_\_ Weeks
3. During this pregnancy how many days in total did you take the IFA tablets? \_\_\_\_\_ days
4. Did you receive any counselling from nurse on IFA tablets? \_\_\_\_\_
5. What are the benefits of taking IFA tablets?  
\_\_\_\_\_
6. What are the side effects of IFA tablets?  
\_\_\_\_\_
7. Which side effects did you experience when taking IFA tablets?  
\_\_\_\_\_
8. What did you do when you experienced the above side effects?  
\_\_\_\_\_
9. What are the consequences of not taking IFA tablets?  
\_\_\_\_\_  
\_\_\_\_\_

### 3.c) Food taboo

1. Have you heard about food taboo? \_\_\_\_\_
2. If yes, where did you get information? \_\_\_\_\_
3. Who do you know that have ever practiced food taboo? \_\_\_\_\_
4. Did you practice food taboo during pregnancy? \_\_\_\_\_
5. If yes, why?  
\_\_\_\_\_
6. If no, why?  
\_\_\_\_\_
7. Which food in particular did you avoid?  
\_\_\_\_\_
8. Why did you avoid that particular food?  
\_\_\_\_\_  
\_\_\_\_\_
9. What are the medical effects of practicing food taboo on food rich in iron?  
\_\_\_\_\_  
\_\_\_\_\_
10. Have you ever avoided receiving counselling on avoiding food taboo on food rich in iron? \_\_\_\_\_
11. You were counselled by who? \_\_\_\_\_

### 3.d) Pica

1. During this pregnancy have you ever taken the whole month craving and eating one of the following items?  Yes  No  
 **Termiteria mounds**  **Clay**  **Chalk**
2. From whom did you learn about practicing pica? \_\_\_\_\_
3. What do you think lead you to crave those items?  
\_\_\_\_\_  
\_\_\_\_\_
4. In your own opinion is practicing pica harmful in pregnancy?  
 Yes  No  Do not know.
5. What do you think are the effects of practicing pica?  
\_\_\_\_\_  
\_\_\_\_\_
6. Which trimester did you practice pica?  
\_\_\_\_\_
7. In relation to pica and food consumption when do you practice pica?  
 Before  During  After meals?

8. What are the effects of not practicing pica?

---

---

---

9. Have you ever received education on effects of pica practice on pregnancy?

---

10. Who taught you on effects? \_\_\_\_\_

11. Have you ever received education against practicing pica?

---

12. Who taught you against? \_\_\_\_\_

13. Have you practiced pica when you were not pregnant?  Yes  No

14. If yes, Why?

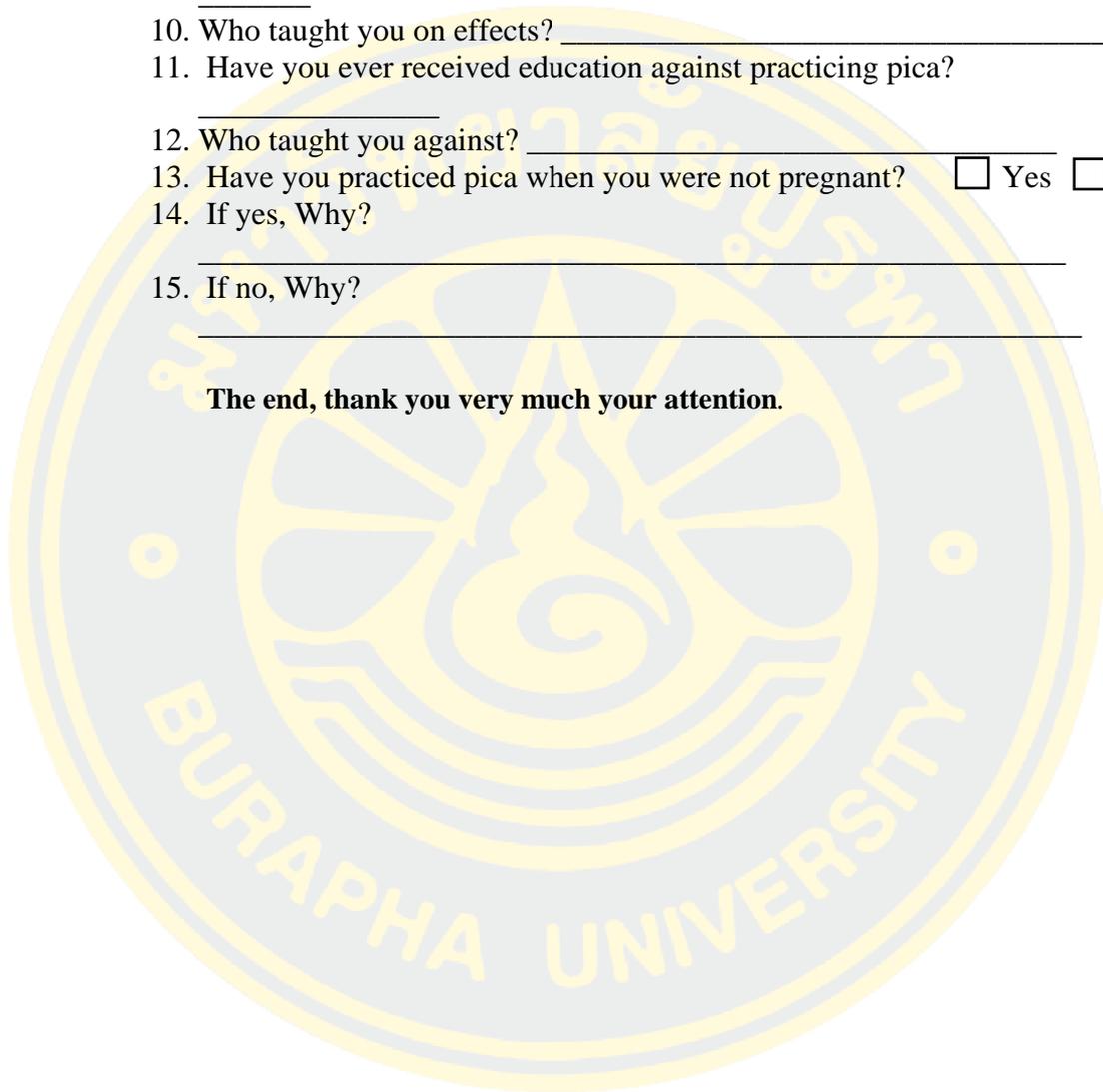
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15. If no, Why?

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**The end, thank you very much your attention.**



### Potsolotso ka puo ya Setswana

Setlhogo sa patlisiso: Tse di ka bakang go ya tlase ga madi a mmele morago ga belegi, mo go bomme ba ba belegeng ko sepatleleng se segolwane sa Nyangabwe Referral Hospital, mo Francistown, Botswana.

#### KE TLA PELE

Tsatsi la potsoloso.....

Leina la mmatlisisi.....

Nomoro ya potsoloso.....

Leina la sepatlela.....

Ko o robaditsweng teng .....

Go araba dipotso ka nnete ga gago gotla thusa thata go bona tse di ka bakang madi a ko tlase mo batsetsing le go itepatepanya le seemo sa go nna jalo morago ga pelegi.

Le gato sa ntlha: Go kaega ga mo tsaya karolo.

1. Dingwaga.....

2. Seemo sa Lenyalo

Ga ke a nyalwa  Ke nyetswe  Motlholagadi  Re

kgaogane

3. Di thutego tsa gago

Ga ke a tsena sekolo  Thuto tse di potlana  Thuto tse di fa gare  Thuto tse di kgolwane  Thuto tsa ithutelo ditiro

4. Letseno la madi ka kgwedi mo lwapeng ke bo kae?

\_\_\_\_\_

5. Mo kgweding tse tharo tse di fitileng o ntse o nna kae?

\_\_\_\_\_

6. Seemo sa pereko:

- Kea ipereka       Ke bereka goromente       Ke bereka ba  
ba ikemetseng ka nosi       Ke bereka tsa mo lwapeng       Ke tsena  
sekolo

**Le gato la bobedi: Tsa pelegi le makoa a mangwe**

1. Selekanyo sa bokete ja madi a gago a a kadilweng mo di oureng tse di masome mane le boferabobedi o sena go belega.

**Hb** \_\_\_\_\_ **g/dl**

2. Mohuta wa pelegi: \_\_\_\_\_

3. Selekanyo sa madi a a go latlhegetseng mo di oureng tse di masome mabedi le bone o sena go belega. \_\_\_\_\_ **mls**

4. Dibeke tsa gago ole moimana nako ya ntlha oya go ikwa disetsa boimana

\_\_\_\_\_ (Dibeke)

5. Dibeke tsa gago tsa boimana ka nako ya pelegi \_\_\_\_\_ (dibeke)

6. Sekale sa ngwana fa a tsholwa \_\_\_\_\_ grams

7. Selekanyo sa bokete ja madi nako tsotlhe tsa boimana:

- **Kgedi tse tharo tsa ntlha Hb**-----**g/dl**
- **Kgwedi ya bone goya ko go borataro Hb**-----**g/dl**
- **Kgwedi ya bosupa go ya ko go ya bofera bongwe ya bofelo Hb**----**g/dl**

8. O ile tshidilo ya boimana ga kae? \_\_\_\_\_

9. O imile ga kae? \_\_\_\_\_

10. O imile ga kae boimana jo bo fetlang dibeke tse masome mabedi le bone o felela o tshola ngwana yo o tshelang kana yo osa tsheleng?

\_\_\_\_\_

11. O senyegetswe ke boimana ga kae? \_\_\_\_\_

12. Bana ba gago ba ba tshelang ba? \_\_\_\_\_

13. Go dingwaga tse kae go tswa mo boimaneng jwa gago jwa bofelo?  
\_\_\_\_\_

14. Seemo sa gago sa mogare wa HIV beke dile nne pele ga o belega ke sefe? \_\_\_\_\_

**Le gato laboraro: Dijo le mokgwa wa go ja**

1. a) **Go ja dijo tse di nang le kota ee agang madi a mmele.**

1. Mo dibekeng tse pedi tse di fitileng a o kile wa ja kgotsa wa nwa sengwe sa dijo tse di latelang tse di thusang mmele go aga madi a mmele?

Ee  Nnyaa

Ke tse di latelang:

Namone  Surinamune  Naraki  Apole e tala

**Mango.**

2. Mo dibekeng tse pedi tse di fitileng o kile wa nwa sengwe se se kganelang mmele go amogela kota ee agang madi a mmele?

Ee  Nnyaa

Kofi  Tee ya Cocoa  Tee ya Five Roses

Tee ya Joko  Seno tsididi sa Coke  Seno sa Energy drink

3. O ja ga kae mo letsatsing \_\_\_\_\_

4. Sekale sa dijo ka go farologana- Dijo tse o gakologelwang o di ja mo dibekeng tse pedi tse di fetileng.

O jele dijo dife mo bekeng tse pedi tse di fetileng? <b>Mofuta wa dijo</b>	Fa motsaya karolo a kaya fa a jele ngwe ya dijo mo ngweng ya dithopha tse di filweng, o tla tshwara bongwe (1) go lebagana le setlhopha seo sa dijo. Fa go sena go tla kwalwa lefela (0).
1. <b>Nama tsa mo teng</b> (sebete, philo, pelo)	
2. <b>Nama</b> (kgomo, kolobe, nku, podi, koko)	
3. <b>Diboko</b> (phane)	

4. <b>Ditswa metsing</b> (tlhapi e metsi, tlhapi e omisitsweng, tlhapi ya sebagabiki)	
5. <b>Merogo</b> (ditapole, merogo e metala(chomolia, sepeneche, reipi), borokholi, Tamati, mabowa, avokhado)	
6. Manoko, Dinawa, ditloo, letlhodi)	
7. <b>Maungo</b> (mmurubele, Purune, Olives tse dinthu)	
8. <b>Dijo tsa ditlhaka: Korong, Habore, Maluto.</b>	
9. <b>Dinekere jaaka</b> Molasese o montsho, tšhokoletse e ntsho	
Maduo ka kakaretso	

### 3.b) Dipilisi tse di fang mmele kotla ya go aga madi mo mmele (IFA)

1. Aa o ne wa nwa pilisi ya IFA fa o le moimana? \_\_\_\_\_  
 a) Fa karabo ele ee, neela mabaka \_\_\_\_\_  
 b) Fa karabo ele nnyaa, neela mabaka \_\_\_\_\_
2. One ole boimana jwa dibeke tse kae fa o simolola dipilisi tsa IFA? \_\_\_\_\_
3. Nako ya boimana, o tsere malatsi a le kae o dirisa dipilisi tsa IFA \_\_\_\_\_ Days
4. O kile wa bona tshidilo maikutlo mo mooking ka go tsaya pilisi ya IFA? \_\_\_\_\_
5. Di pilisi tsa IFA di ka solofela motho molemo wa eng?  
 \_\_\_\_\_  
 \_\_\_\_\_
6. Ditlamorago tsa pilisi ya IFA ke eng?  
 \_\_\_\_\_
7. O itemogetse ditlamorago dife fa o dirisa pilisi tsa IFA? \_\_\_\_\_  
 \_\_\_\_\_
8. O dirile eng ka ditlamorago tseo? \_\_\_\_\_  
 \_\_\_\_\_
9. Ditlamorago tsa go tlhoka go nwa dipilisi tsa ya IFA fa o imile ke eng?  
 \_\_\_\_\_

### 3.c) Meila ya dijo fa o le moimana

1. O kile wa utlwa ka meila ya dijo? \_\_\_\_\_
2. Fa karabo ele ee, o utlule kae? \_\_\_\_\_
3. Ke mang yo o mo itseng yo o obamelang meila ya dijo fa a le moimana?  
 \_\_\_\_\_

4. A a go nale dijo tse o neng o sa di je fa o le moimana?  
\_\_\_\_\_

5. Fa karabo ele ee, fa mabaka?  
\_\_\_\_\_

6. Fa karabo ele nnya, fa mabaka?  
\_\_\_\_\_

7. Ke dife dijo tse oneng o sa di je fa o le moimana?  
\_\_\_\_\_  
\_\_\_\_\_

8. Ke eng o ne o sa je dijo tseo? \_\_\_\_\_  
\_\_\_\_\_

9. Ke ditlamorago dife tse di ka diragalelang motho yo o nang le moila wa go ja dijo tse di nang le kotla e e thusang mmele go aga madi?  
\_\_\_\_\_

10. A o kile wa seka wa batla go tsaya kgakololo ya tshedilo maikutlo/bokaidi ka go sa nna le meila ya dijo tse di nang le kotla ee thusang mmele go aga madi? \_\_\_\_\_

11. One o gakololwa/sedilwa maikutlo ke mang? \_\_\_\_\_

### 3.d) Keletso ya dilo tse disa jiweng

1. Nako ya boimana o kile wa eletsa go ja tse di latelang? Ee Nnyaa  
 seolo  mmopa  choko

2. O ithutile mo go mang go ja dilo tse e seng dijo? \_\_\_\_\_

3. Ke eng se o bonang se gweta keletso ya go ja dilo tse di sa jiweng?  
\_\_\_\_\_

4. Go ya ka wena, go ja dilo tse disa jiweng tse a go ka nna le diphatsa mo boimanang?  
Ee Nnyaa  Ga ke itse.

5. O bona borai jwa go eletsa go ja dilo tse di sa jiweng e le eng?  
\_\_\_\_\_

6. Ke mo dikgweding dife tse o jeleng sengwe se se sa jiweng? \_\_\_\_\_  
\_\_\_\_\_

7. Bapisa le nako ya go ja, nako e o neng oo ja sengwe se se sa jiweng ke efe?  
Pele ga dijo  Nako ya dijo  Morago ga dijo

8. O ne diragalelwa ke eng fa o sa ja dilo tse e seng dijo tseo?  
\_\_\_\_\_

9. O kile wa rutlwa ka ditlamorago tsa go ja dilo tse di sa jiweng ka boimana?  
\_\_\_\_\_

10. O rutilwe ke mang ka ditla morago?  
\_\_\_\_\_

11. O kile wa amogela dithuto kgatlhanong le mokgwa wa go ja dilo tse di sa jiweng? \_\_\_\_\_

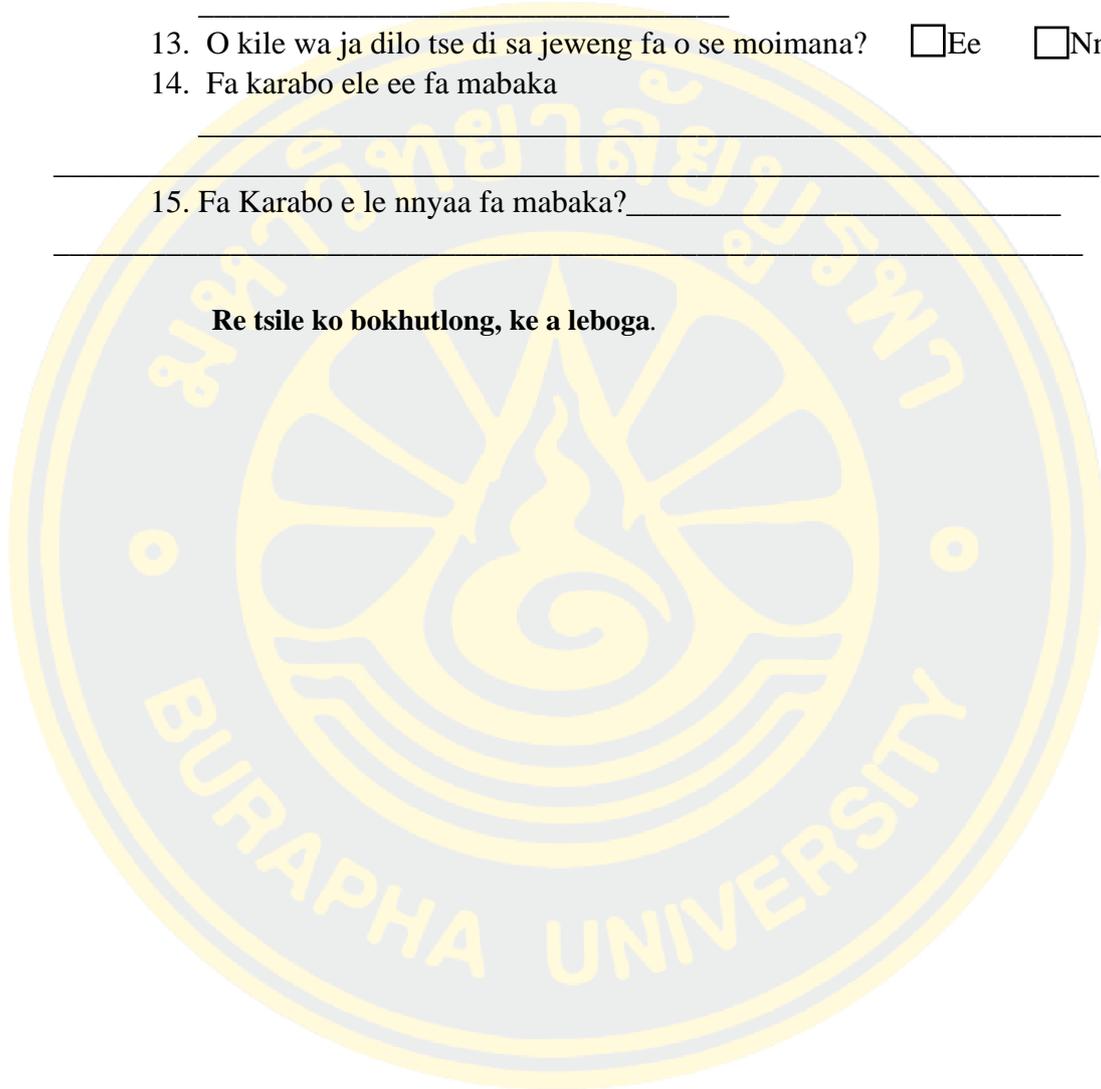
12. Ke mang yo o go rutileng kgatlhanong?  
\_\_\_\_\_

13. O kile wa ja dilo tse di sa jeweng fa o se moimana? Ee Nnyaa

14. Fa karabo ele ee fa mabaka  
\_\_\_\_\_  
\_\_\_\_\_

15. Fa Karabo e le nnyaa fa mabaka? \_\_\_\_\_  
\_\_\_\_\_

**Re tsile ko bokhutlong, ke a leboga.**



### Perceived Stress Scale - 10 items (PSS-10)<sup>®</sup>

#### INSTRUCTIONS:

The questions in this scale ask you about your feelings and thoughts during **THE LAST MONTH**. In each case, please indicate your response by placing an "X" over the circle representing **HOW OFTEN** you felt or thought a certain way.

	Never 0	Almost Never 1	Sometimes 2	Fairly Often 3	Very Often 4
1. In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>				
2. In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>				
3. In the last month, how often have you felt nervous and "stressed"?	<input type="radio"/>				
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>				
5. In the last month, how often have you felt that things were going your way?	<input type="radio"/>				
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="radio"/>				
7. In the last month, how often have you been able to control irritations in your life?	<input type="radio"/>				
8. In the last month, how often have you felt that you were on top of things?	<input type="radio"/>				
9. In the last month, how often have you been angered because of things that were outside your control?	<input type="radio"/>				
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>				

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PSS-10 – United States/English  
PSS-10\_AJ2.0\_eng-USori.doc

## Perceived Stress Scale - 10 items (PSS-10)<sup>®</sup>

### KAELA TIRISO:

Dipotso mo sekaleng se di botsa ka maikutlo a gago le megopolo mo KGWEDING E E FETILENG. Mo lebakeng lengwe le lengwe, o tla botswa gore o ikutwile jang kgotsa dikakanyo tse o di akantseng ka tsela nngwe. Supa ka go baya sefapano "X" go lebagana le karabo ya gago.

	Ga go ise go diragale	Ga se gantsi	Nako dingwe	Gantsi nyana	Gantsintsi
	0	1	2	3	4
1. Mo kgweding e fetileng, o ikutwile ga kae gore o kgopisegile ka ntlha ya sengwe se se diragetseng o sa solofela?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Mo kgweding e fetileng, o ikutwile ga kae gore ga o kgone go laola dilo tse di botlhokwa mo botshelong ja gago?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Mo kgweding e fetileng, o ikutwile ga kae gore o tshogile kgotsa o "tshwenyegile"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Mo kgweding e fetileng, o ikutwile ga kae gore ona le bokgoni ja go emelana le mathata a gago?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Mo kgweding e fetileng, o ikutwile ga kae gore dilo di tsamaya ka fa o batlang ka teng?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Mo kgweding e fetileng, o ikutwile ga kae o sa kgone go emelana le dilo tsotlhe tse o neng o tshwanetse go di dira?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Mo kgweding e fetileng, o ikutwile ga kae, o kgona go laola tse di go feretlhang mo botshelong ja gago?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Mo kgweding e fetileng, o ikutwile ga kae, o nale taolo mo dilong tsotlhe?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Mo kgweding e fetileng, o ikutwile ga kae o shakgetse ntateng ya dilo tse di diragetseng tse o sa kgoneng go di laola?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Mo kgweding e fetileng, o ikutwile ga kae gore mathata a thataganela pele mo o sa kgoneng go a fenyaa?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Appendix C**  
Patient Information and Consent Form



## Participant Information Sheet

Research protocol code: .....

Research Title: Predicting factors of postpartum anemia among delivered mothers at Nyangabwe Referral Hospital, Francistown, Botswana.

Dear.....

My name's Malebogo Queen Nthusang, a student studying Master of Nursing science at the Faculty of Nursing in Burapha University, Thailand. My study entitled, "Predicting factors of postpartum anemia among delivered mothers at Nyangabwe Referral Hospital, Francistown, Botswana".

The objective of this study is to estimate the prevalence of postpartum anemia and examine which factors can predict postpartum anemia among delivered mothers admitted in postpartum unit in NRH, Francistown, Botswana. *All postnatal mothers who gave birth in Nyangabwe Referral Hospital and mothers who gave birth somewhere else and were referred and admitted at the hospital within 48 hours of the postpartum period* in the months of February and March 2024, will be approached to participate in the study until a sample of 385 is reached.

This study will be a survey study. If you agree to participate in the study, you will be asked questions about demographic and socio-economic characteristics, adherence to iron and folic acid, knowledge on causes and consequences of anemia, dietary practices and use of ANC services, and your perception of your state to stress. It will take about 30 to 45 minutes to complete the questionnaires.

This study may or may not benefit you immediately. However, the information you provide will help increase the understanding on factors causing anemia among pregnant and postpartum women. Knowledge of these predicting factors of anemia during postpartum will help investigate and manage anemia early and therefore reduce the burden of disease on the mother and her baby. If you are interested in knowing the results of the study at the end of the study you are free to indicate that, and they will be communicated to you after completion.

*There will be no compensation, since the study will be a facility-based study using inpatient participants, meaning there will be no expenses that you are going to incur during the study period.*

*Participation in this study is wholly voluntary. You may decline to participate or withdraw your consent at any point during the study. If you withdraw, your care will not be affected in any way. You have a right to ask any question or clarifications at any time during the study. The information that you will provide cannot be identified with you. The interviews will take place in a private room and the information you provide will be coded so that you cannot be identified. Disclosure of your information to the relevant authorities will require your permission.*

There are no identified risks associated with participation in this study. However, since we are now living in Covid 19 era, all precaution measures put in place by the hospital will be adhered to like wearing of masks, keeping a social distance during interview, sanitizer and alcohol will be used to clean the tables chairs in the interview room, and washing of hands in between participants will be done, these will be done in order to reduce risk of transmission. Any information received from this study, including your identity will be kept confidential by researcher and my major- advisor. The results of this study will be shown as a group of participants, no specific information from any individual participant. All data will be destroyed completely within 1 year after publishing or presenting the findings.

The study will be conducted by me, Malebogo Queen Nthusang, under supervision of my major-advisor, Assoc. Prof. Dr. Punyarat Lapvongwatana. If you have any questions, please contact me on telephone: +267 77410440/ +267 71299687 or by email: qnthusang@gmail.com and/or my advisor's email address: punyarat.la@buu.ac.th. Your cooperation is greatly appreciated.

Please sign your name on the consent form to indicate your consent to participate in this study. You will be given a copy of this consent form to keep.

*“If the researchers do not follow the research protocol as stated in in the Participant Information Sheet, please contact Burapha University Institutional Review Board Office, Burapha University (Division of Research and Innovation), Tel. +66 038-102620, email buuethics@buu.ac.th” and Health Research and Development Division – Ministry of Health, Tell- +267 3632500.*

Malebogo Queen Nthusang  
Researcher



## Mokwalo wa kitso wa motsayakarolo

**Nomoro ya melawana ya dipatisiso:** .....

Research Title: Tse di ka bakang go ya tlase ga madi a mmele morago ga belegi, mo go bomme ba ba belegeng ko sepatleleng se segolwane sa Nyangabwe Referral Hospital, mo Francistown, Botswana.

Go .....

Leina lame ke Malebogo Queen Nthusang, ke tsena sekolo ke dira dithuto tse dikgolwane tsa Masters tsa booki mo University ya Burapha, Thailand. Ke dira dipatlisiso ka setlhogo sese reng “Tse di ka bakang go ya tlase ga madi a mmele morago ga belegi, mo go bomme ba ba belegeng ko sepatleleng se segolwane sa Nyangabwe Referral Hospital, mo Francistown, Botswana.

Maikaelelo a dipatisiso tse, ke go sekaseka dipalo tsa bomme ba ba fithelwang ka madi a mmele aa ko tlase morago ga pelegi, le go batlisisa se se ka tswang se bakile seemo seo. *Bomme botlhe ba ba tla bong ba belege mo Nyangabwe Referral hospital le ba ba belegetseng ko mahelong a mangwe mme ba romeletswe go robadiwa ko Nyangabwe mo diourenng tse masome mane le boferabobedi morago ga pelegi, mo kgweding ya Tlhakole le Mopitlo ka ngwaga wa 2024, batla kopiwa go tsaya karolo mo dipatlisi tse, go fithelela palo ya bone e tshwara makgolo a le mararo, le metso e le masome a boferabobedi le metso e le methano.*

Mo dipatisong tse, bomme batla kopiwa go tsaya karolo, mme ba botswe dipotso tse di amanang le go kaega le seemo sa gago sa botshelo, tse dia amanang le boimana le pelegi, tse di amanang le madi a mmele jaaka go nwa pilise ee thusang mmele go oketsa madi ammele, dijo tse di oketsang madi ammele, le tse di ka bakiwang ke go ya tlase ga madi a mmele mo motsetseng. Le go sekaseka gore

maikutlo a bone a ritibetse go le kae. Go tsaya karolo mo dipatisong go tla tsaya lebaka la metsoso e le masome a mararo go ya ko go masome a mane le botlhano.

Dipatisiso tse di ka nna le maduo aa ka nnang le mosula mo go wena kana ba banang le kamano le wena. Maduo a dipatisiso tse, a tla thusa badiri ba Botsogo go lemoga dikai tsa tlhalelo ya madi mo mmeleng le go ka tsaya ditshwetso tse di ka bakang bolwetse tsa sireletsa magwe le lesea. Ga o eletsa go itse maduo a dipatisiso o ka iponatsa wa tla wa bolelelwa morago ga tsone.

*Ga gona go nna le epe phimolo dikeledi, ka go bane ga o na go nna le di pe ditshenyegelo ka re tla abo re go bonela mo sepatela o santse o robaditswe.*

*Itse gore dipatisiso tsa ga di pateletswe ebile o na le teta ya go ka gana go ka araba dipe dipotso kgotsa wa emisa go tswelela ka dipotso ntle le go ka bonwa molato, e bile ga gona go ama ka gope di thuso tsa gago tsa botsogo. O na le tshwanelo ya go botsa dipotso kana go kopa tlhaloso mo go sepe hela se o bonang o sa se tlhaloganye. Go tla dirisiwa nomoro ya sephiri boemong jwa maina a gago. Puisano ya rona e tlaa nnela mo ntlwaneng ee faphegileng, le dikarabo tsa gago ga dina ka ha ditlaa amanngwang le wena ka teng ka gore re a go dirisa dinomoro e seng maina go di boloka.*

Ga gona diphatsa dipe tse di amanngwang le go tsaya karolo mo dipatlisisong tse. *Le fa gontse jalo, jaaka o itse re le mo nakong ya bololwe ja Covid 19, melawana yotlhe ee beilweng pele ke ba sepatela e tlaa salwa morago jaaka go rwala sethibasefatlhego*, go atologana, le go tlhapa matsogo kgapetsakgapetsa, re tlaa dirisa le sebolaya megare go phepahatsa ditafole le ditilo tse re di dirisang, tse ditla salwa morago go itsa go amogana mogare. Itse gore sepe se o se arabileng ka ga wena se sireletsegile ga sena go amoganwa le ope, se a go nna magare game le morutintshi wame fela. Maduo a dipatisiso a ya go anamisiwa ele a batho botlhe b aba tse reng karolo, e seng ka motho ka bongwe ka bongwe. Morago ga ngwaga maduo a sena go bonwa abo a anamisiwa, tsotlhe tse di dirisitsweng go tsaya megopolo le dipatlisiso tse di tla latlhwa mo go babalesegileng.

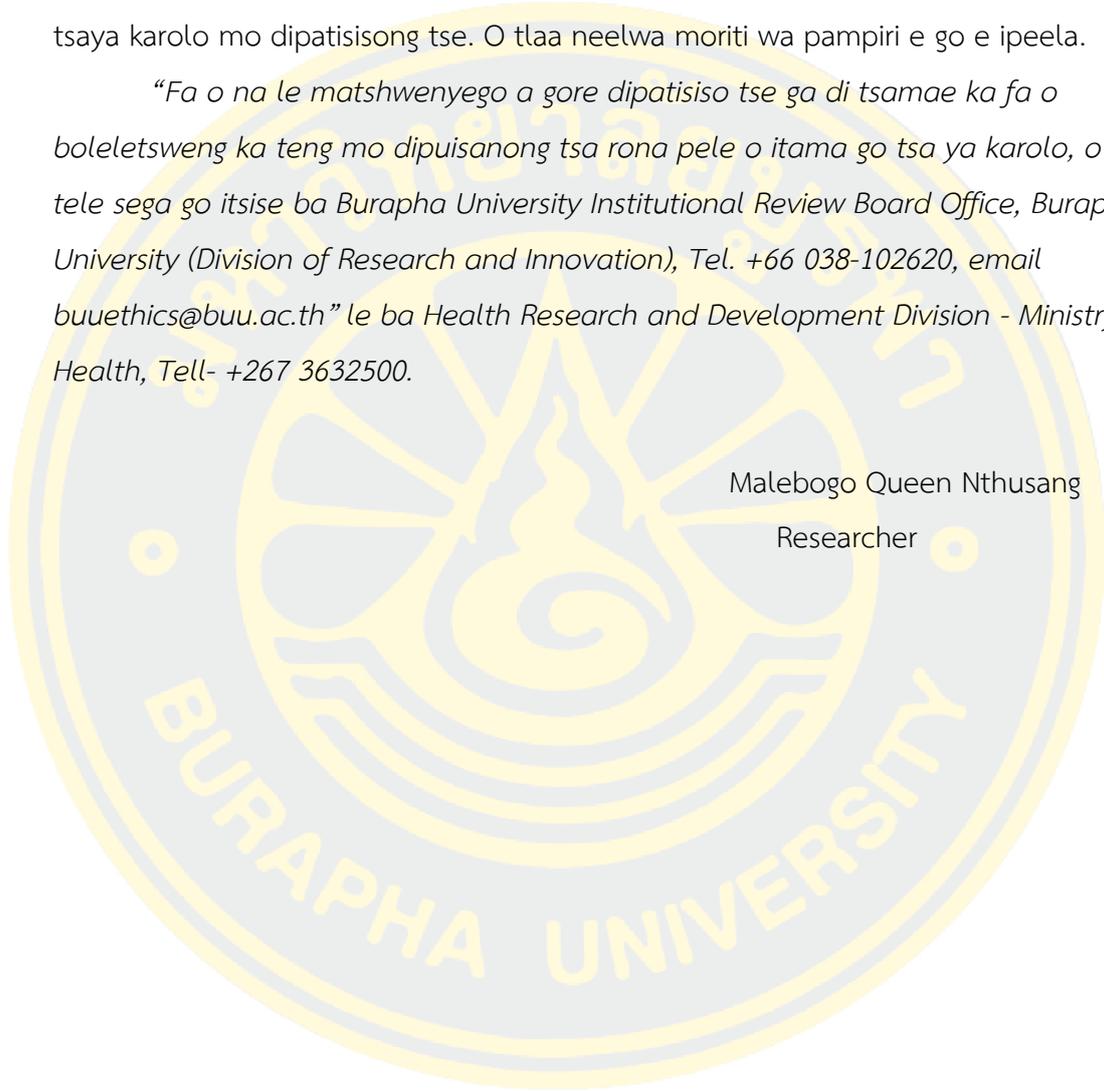
Dipatlisiso tse di tla tsamaisiwa ke Malebogo Queen Nthusang a okametswe ke motlhatlhelela dithuto wa gagwe ebong Assoc. Prof. Dr Punyarat Lapvongwatana.

Ga o nale dipotso. Tsweetswe leletsa nomoro e +267 77410440 kgotsa +267 71299687 kgotsa romela molaetsa ko qnthusang@gmail.com kgotsa mo go morutabana wame ko punyارات.la@buu.ac.th. Re lebogela tirisanyo mmogo ya gago.

Ke kopa gore o bee monwana mo pampiri ya teta go supa fa o amogela go tsaya karolo mo dipatisisong tse. O tlaa neelwa moriti wa pampiri e go e ipeela.

*“Fa o na le matshwenyego a gore dipatisiso tse ga di tsamae ka fa o boleletsweng ka teng mo dipuisanong tsa rona pele o itama go tsa ya karolo, o a le tele sega go itsise ba Burapha University Institutional Review Board Office, Burapha University (Division of Research and Innovation), Tel. +66 038-102620, email buuethics@buu.ac.th” le ba Health Research and Development Division - Ministry of Health, Tell- +267 3632500.*

Malebogo Queen Nthusang  
Researcher





## Consent Form

Research Code: .....

Research Title: Predicting factors of postpartum anemia among delivered mothers at Nyangabwe Referral Hospital, Francistown, Botswana.

Date ..... Month ..... Year .....

Before signing the consent form for this research participation, I was provided the information about the purposes and the processes of the research in the participant information sheet, which the researcher has given to me. I have fully understood the preceding explanation and the researcher has undertaken to answer my questions willingly and without concealment to my satisfaction.

*I voluntarily agree to participate in this research project. I may decline to participate or withdraw my consent at any point during the study. If I withdraw, I was insured that my care will not be affected in any way. I was informed that I have the right to ask any question or clarifications at any time during the study. I have been assured that the information that I will provide will not be identified with me. The interviews will take place in a private room and the information I provide will be coded so that I cannot be identified. I have been informed that disclosure of my information to the relevant authorities will require my permission.*

I have read and fully understood the above statements in all respects and have signed this consent document willingly.

In the case that I cannot read or write, the researcher has read the statement in the consent form to me until I fully understand it well. Therefore, I willingly signed or stamped my thumb on this consent form.

Participant's signature .....

(.....)

Researcher's signature .....

(Malebogo Queen Nthusang)

**Note:** If the participant gave thumbprint as their consent, witness signature will be needed.



### Pampiri ya tumelano

Nomoro ya patisiso: .....

Setlhogo sa patisiso: Tse di ka bakang go ya tlase ga madi a mmele morago ga belegi, mo bomme ba ba belegeng ko sepatleleng se segolwane sa Nyangabwe Referral Hospital, mo Francistown, Botswana.

Date ..... Month ..... Year .....

Ke neetswe kitsiso yotlhe ka botlalo le go itse bomosola jwa go tsenelela patlisiso pele ke ka itlama go e tsenelela. Ke tlhaloganya ka botlalo maikaelelo le ditsamaiso tsotlhe, le mmatlisisi le ene one a kgona go ka araba ka botswapelo dipotso le sepe se ke neng ke se thaela.

*Ke itse gore dipatisiso tse ga di pateletswe ebile kena le teta ya go ka gana go araba dipe dipotso kgotsa ka emisa go tswaledisa dipuisanyo ntle le go ka bonwa molato, e bile ga gona go ama ka gope di thuso tsame tsa botsogo. Ke na le tshwanelo ya go botsa dipotso kana go kopa tlhaloso mo go sepe hela se ke bonang ke sa se tlhaloganye. Go tla dirisiwa nomoro ya sephiri boemong jwa maina a me. Ke solofeditse gore puisano ya rona e tlaa nnela mo ntlwaneng ee faphegileng, le dikarabo tsame ga dina ka ha ditlala amanngwang le lenna ka teng ka gore re a go dirisa dinomoro e seng maina go di boloka. Sepe same se se tla gasiwang phatlalatsa se ka kgonafala fela fa ke file tetla.*

Ke badile ditsetlana tsotlhe ke bo ke baya monwana ke sa pateletswe.

Go ke senang bokgoni jwa go bala le go kwala, mmatlisisi o kgonne go mpalela go fitlhela ke tlhaloganya ka botlalo. Ka se ke a saena kgotsa ke baya monwana go rurifatsa go tsaya karolo game.

Monwana wa motsayakarolo:.....

(.....)

Researcher's signature .....

(Malebogo Queen Nthusang)

**E la tlhoko:** Ha e le gore motsenelela patisiso o file tumelano ka go irisa moriti wa monwana, go a go tlhokahala monwana wa mosupi.



**Appendix D**  
List of Bilingual Translators

## LIST OF BILINGUAL TRANSLATORS

1. Modiegi Diseko (RN, MD, BPH),  
Study coordinator  
Botswana Harvard AIDS Institute,  
Botswana.
2. Boitshwarelo Masuku (RN, MD, BNS, MBA),  
Nursing Officer I  
Greater Francistown DHMT, Ministry of Health,  
Botswana.
3. Itumeleng Rasetshwane, (RN, BNSc, MEHE),  
Senior lecturer I  
Institute of Health Sciences, Bamalete School of Nursing,  
Botswana.
4. Wada Gaolaolwe (RN, PMHN, BA Cur, PGDHE, MPH, MNS, PhD  
candidate),  
Senior lecturer I  
Institute of Health Sciences, Lobatse  
Ministry of Education,  
Botswana.



**Appendix E**  
Additional data analysis

### ADDITIONAL DATA ANALYSIS

Table A1 . Realibility scale of factor in the questionnaire

<b>Variables</b>	<b>Cronbach's alpha</b>	<b>No. of items</b>
Perceived stress scale	0.77	10

Table A2: Bivariate correlation using Pearson correlation for scale validity for Dietary Diversity Scale

<b>Variables</b>	<b>Pearson correlation</b>
<b>Dietary Diversity Scale</b>	
1.Organ meat	0.471**
2.Flesh meat	0.099
3.Insects	0.304**
4.Seafood	0.398**
5.Vegetables	0.163**
6.Legumes	0.426**
7.Fruits	0.344**
8.Whole grain	0.344**
9.Sweets	0.509**

Table A3: Bivariate correlation using Pearson correlation for scale validity for Perceived Stress Score

<b>Variables</b>	<b>Pearson correlation</b>
<b>Perceived stress scale</b>	
<b>Upset because of something that happened unexpectedly (PSS1)</b>	0.685**
<b>Felt that you were unable to control the important things in your life (PSS2)</b>	0.693**
<b>Felt nervous and “stressed” (PSS3)</b>	0.576**
<b>Felt confident about your ability to handle your personal problems (PSS4)</b>	0.477**
<b>Felt that things were going your way (PSS5)</b>	0.549**
<b>Found that you could not cope with all the things that you had to do (PSS6)</b>	0.471**
<b>Been able to control irritations in your life (PSS7)</b>	0.439**
<b>Felt that you were on top of things (PSS8)</b>	0.483**
<b>Been angered because of things that were outside your control (PSS9)</b>	0.645**
<b>Felt difficulties were piling up so high that you could not overcome them (PSS10)</b>	0.646**

#### **SUPPLEMENTARY ANALYSIS**

The feelings and thoughts about mothers during their pregnancy is presented in Table A4. Nearly a half (47.8%) of mothers often felt nervous and “stressed” during pregnancy. Moreover, 47.2% of mothers often felt difficulties were piling up so high that they could not overcome them.

Table A4: Perceived Stress Scale among delivered mothers admitted at NRH postpartum ward in Francistown, Botswana (n= 385).

<b>Items</b>	<b>Never</b>	<b>Almost never</b>	<b>Sometimes</b>	<b>Fairly Often</b>	<b>Very Often</b>
<b>Upset because of something that happened unexpectedly</b>	97(25.3)	41(10.7)	93(24.2)	89(23.2)	64(16.7)
<b>Felt that you were unable to control the important things in your life</b>	93(24.2)	68(17.7)	93(24.2)	70(18.2)	61(15.8)
<b>Felt nervous and “stressed”</b>	53(13.8)	32(8.3)	116(30.1)	100(26.0)	84(21.8)
<b>Felt confident about your ability to handle your personal problems</b>	86(22.3)	81(21.0)	73(19.0)	95(24.7)	50(13.0)
<b>Felt that things were going your way</b>	59(15.3)	54(14.0)	111(28.8)	98(25.5)	63(16.4)
<b>Found that you could not cope with all the things that you had to do.</b>	55(14.3)	65(16.9)	129(33.5)	96(24.9)	40(10.4)
<b>Been able to control irritations in your life.</b>	58(15.1)	85(22.1)	102(26.6)	78(20.3)	61(15.9)
<b>Felt that you were on top of things</b>	40(10.4)	74(19.2)	94(24.4)	89(23.1)	88(22.9)
<b>Been angered because of things that were outside your control</b>	52(13.5)	51(13.3)	94(24.4)	104(27.0)	84(21.8)
<b>Felt difficulties were piling up so high that you could not overcome them?</b>	75(19.5)	54(14.0)	74(19.2)	91(23.6)	91(23.6)

Table A5: Craving of non-food substances (pica) among delivered mothers admitted at NRH postpartum ward in Francistown, Botswana (n= 179).

<b>Variable</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Non-food substances eaten</b>		
<b>Termiteria mounds</b>	173	96.7
<b>Clay</b>	5	2.8
<b>Termiteria mounds and chalk</b>	1	0.5

Majority (96.7%) of mothers highlighted that they consumed were termiteria mounds during their pregnancy and only 2.8% mentioned that they ate clay (Table A5).

Table A6: Food avoided and reason for food taboo among delivered mothers admitted at NRH postpartum ward in Francistown, Botswana (n= 169).

<b>Variable</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Food avoided during pregnancy</b>		
<b>Eggs</b>	103	61.0
<b>Intestines</b>	20	11.8
<b>Liver</b>	14	8.3
<b>Other (sour milk, mophane worms, fish, corn)</b>	32	18.9
<b>Reasons for food taboo</b>		
<b>Cultural belief</b>	167	98.8
<b>Religious belief</b>	1	0.6
<b>Social media</b>	1	0.6

In Table A6, of mothers who practice food taboos, two-thirds (60.1%) avoided eggs while 8.3% avoided liver. Majority of the reason for practicing food taboo was due to cultural beliefs (98.8%).

## **BIOGRAPHY**

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