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Socio-demographic and clinical factors associated with the deliveries of babies 'born before arrival' at Swartruggens hospital between 2013 and 2014

Oluwole, Oladotun Koledola

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Socio-demographic and Clinical Factors Associated with the Deliveries of Babies 'Born Before Arrival' at Swartruggens Hospital between 2013 and 2014

Oladotun Koledola Oluwole

Student Number: 886246

A research report submitted to the Faculty of Health Sciences, University of Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Public Health (MPH)

Johannesburg, October 2018

DECLARATION

I, **Oladotun Koledola OLUWOLE** declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfillment of the requirements for the degree of Master of Public Health (Rural Health) in the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this university or any other university.

……..

Signed at Johannesburg…….

On the……4th……..day of October……2018

DEDICATION

Firstly, this research is dedicated to the glory of God Almighty, the author and the finisher of my faith.

Secondly, this research work is dedicated to my family; my loving and supportive wife Oluwalaanumi and my sons- Emmanuel, Daniel, David and Timothy.

Thirdly, this research work is dedicated to the memory of my Late Father, Mr. N.I. Oluwole. Daddy, thank you for being such a great inspiration in my life. You will always be missed.

ABSTRACT

Background: It has been established that morbidity and mortality documented in babies 'born before arrival' (BBBAs) and their mothers are worse when compared to those of hospital deliveries. Pregnant women who deliver their newborns at home before bringing them to Swartruggens Hospital expose themselves and their newborns to these worse clinical outcomes.

Aim: To determine the socio-demographic and clinical factors associated with the delivery of babies 'born before arrival' at Swartruggens Hospital between 2013 and 2014

Methods: The research was an unmatched case-control study in which mothers who delivered BBBAs were the cases and mothers who delivered in the hospital were the controls. A two-year retrospective review was conducted on the medical records of the two groups of mothers and their respective babies at Swartruggens Hospital between 2013 and 2014. Data were obtained on sociodemographic variables such as age, marital status, race, education status, estimated distance from home to hospital and clinical variables like parity, booking status, booking trimester, sufficiency of ANC visits, time of delivery. STATA 14 was used to analyse the data.

Results: The following sociodemographic and clinical factors were associated with the home delivery of BBBAs: primary education or none (aOR=2.98, 95% CI=1.42-6.27,p=0.0040), insufficient ANC visits (aOR=3.86, 95% CI=1.62-9.21,p=0.0020), preterm gestational age at delivery (aOR=2.43, 95% CI=1.14-5.21,p=0.0210) and delivery of baby at night time (aOR=9.05, 95% CI=4.15-19.67,p=0.0000).

Complications such as low birthweight, prematurity, hypothermia, hypoglycaemia, neonatal sepsis and neonatal jaundice were more prevalent in the BBBAs.

Conclusion: The findings in this study suggest that the following interventions may reduce the incidence of BBBAs. These interventions include: promulgating governmental policies that ensure that the girl child achieves secondary education at the minimum; the promotion of community awareness and health education for pregnant women that emphasizes the importance of early booking for antenatal care (ANC), attending minimum 4 ANC visits and the delivery of newborns inside hospital. The designation of ambulances solely for the maternity wards of rural hospitals to bring in pregnant women in labour to the hospital at any time could be another intervention.

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TABLE OF CONTENTS

Content **Page**

Declaration ii

Dedication iii

Abstract iv

Acknowledgements vi

List of Figures.....ix

List of Tables.....ix

List of Abbreviations……x

Chapter 1……..1

1. Introduction…….....1

1.1 Background to the Study…….....1

1.2 Literature Review…….....5

1.3 Overview of Study Setting…….....12

1.4 Research Problem…….....14

1.5 Research Question……16

1.6 Justification for the Research……17

1.7 Research Aim and Objectives…….....18

Chapter 2……...19

2. Research Methodology……..19

2.1 Research Design……..19

2.2 Study Population and Sampling……....19

2.3 Data Collection and Measurement……22

2.4 Data Processing and Analysis……...25

Chapter 3…….....30
3. Results……..30
3.1 Sociodemographic profile of the mothers…….30
3.2 Clinical profiles of the mothers……...30
3.3 Clinical Profile: Risks and events in the antenatal period……..35
3.4 Clinical Complications in Mothers and Babies…….36
3.5 Process and Exit Outcomes……...38
3.6 Factors Associated with delivering a BBBA…….40
Chapter 4…….....43
4. Discussion…….43
4.1 Study Limitations……..52
4.2 Conclusions……...53
4.3 Recommendations……...54
References……...56
Appendices……67
Appendix 1: Plagiarism Declaration…….....67
Appendix 2: Phases in delay in seeking maternity care…….68
Appendix 3: Sample Size Calculation……69
Appendix 4: Data capture sheet…….70
Appendix 5: University of Witwatersrand Ethical Clearance Letter……..78
Appendix 6: Permission Letter from North West Health Department……..79

LIST OF FIGURE

Figure 3.1: Booking Blood Pressure and Booking Haemoglobin……..33

LIST OF TABLES

Table 2.1: Summary of Deliveries……..20

Table 2.2: Analytical Techniques……27

Table 3.1: Sociodemographic profile of the mothers……..31

Table 3.2: Clinical profile of the mothers…….....32

Table 3.3: Clinical Profile: Risks/Events in the antenatal period……...35

Table 3.4: Complications in the mothers……...36

Table 3.5: Clinical complications in the babies……37

Table 3.6: Duration of Hospital Stay (Mothers and Babies)……..38

Table 3.7: Other Process and Exit Outcomes (Babies)…….39

Table 3.8: Process and Exit Outcomes (Mothers)……..39

Table 3.9: Socioeconomic and clinical factors associated with the delivery of BBBA…….40

LIST OF ABBREVIATIONS

AIDS - Acquired Immune Deficiency Syndrome

ANC- Antenatal Care

APH – Antepartum Haemorrhage

ARVs- Antiretroviral Drugs

BBBAs - Babies Born Before Arrival

BPDM - Bojanala Platinum District Municipality

CDC - Centre for Disease Control, USA.

CI – Confidence Interval

CMR- Child Mortality Ratio

CPD - Cephalopelvic Disproportion

C/S – Caesarean Section

DM - Diabetes Mellitus

HIE - Hypoxic Ischeamic Encephalopathy

HIV - Human Immunodeficiency Virus

HAART- Highly Active Antiretroviral Therapy

HSRC- Human Sciences Research Council

HREC- Human Research Ethics Committee

IUGR- Intrauterine Growth Restriction

LBW - Low Birth Weight

MCH - Maternal and Child Health

MDGs - Millennium Development Goals

NaPeMMCo - National Perinatal Morbidity and Mortality Committee

NCCEMD - National Committee on the Confidential Enquiry into Maternal Deaths

NDOH - National Department of Health, South Africa.

NMR - Neonatal Mortality Ratio

MMR - Maternal Mortality Ratio

NNJ - Neonatal Jaundice

NNS - Neonatal Sepsis

NSDA - Negotiated Service Delivery Agreement

NWDOH - North West Provincial Department of Health

OR – Odds Ratio

PAAB – Patient Administration and Billing System

PET – Preeclampsia Toxaemia

PHC - Primary Health Care

PMTCT- Prevention of Mother-To-Child Transmission of HIV

PPH - Post-Partum Haemorrhage

PROM - Premature Rupture of Membranes

SDGs - Sustainable Development Goals

STATA – Statistics and Data

StatsSA - National Statistics Department, South Africa

UN – United Nations

UNAIDS- Joint United Nations Programme on HIV/AIDS

UTI - Urinary Tract Infection

VDS - Vaginal Discharge Syndrome

CHAPTER ONE

1. INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Babies 'Born Before Arrival' (BBBAs) are babies that are delivered outside a health facility and subsequently brought to the health facility after delivery (Bassingthwaighte, 2013). These deliveries frequently take place at home and may have been assisted by relatives of the pregnant woman or a traditional birth attendant in the community. However, the delivery of some BBBAs may take place while the woman in labour is in transit to the health facility (Parag et al, 2014). BBBAs are classified as home delivery as long as the delivery does not take place in a health facility (Bassingthwaighte, 2013).

There are two main categories of BBBAs. The first category is those planned home deliveries in which skilled health professionals attend to the births. The second category is the unplanned home deliveries which are not attended by skilled health professionals (Parag et al, 2014).The first category is uncommon in developing countries and seems limited to developed countries in Europe, North America and Australia. The second category is the type that is common in Africa and it is the main focus of this research because of the poor health outcomes associated with this group (Parag et al, 2014).

BBBAs are a common obstetric occurrence in developing countries due to limited, or lack of, access to health facilities where labour and delivery can be monitored by monitored by qualified health professionals (Peltzer et al., 2006; Kodkany et al.,

2004; Sibley et al., 2004). This lack of access to health facilities is more prevalent in rural and remote communities where the access to a health facility may be limited by a variety of factors like geographical distance to the facility, lack of transport, poor road conditions, unfavourable weather conditions etc (KNBS, 2010; Rockers et al., 2009).

High rates of perinatal morbidity and mortality are a global public health concern (WHO, 2010). BBBAs constitute a special category of neonates that are prone to higher risk of morbidity and mortality (Bassingthwaighte, 2013; Rodie et al, 2002). It has been established that the degrees of morbidity and mortality documented in mothers of BBBAs and in BBBAs are worse when compared with mothers delivering in hospital (Parag et al, 2014). Therefore, reducing the rates of perinatal morbidity and mortality may be achievable if all deliveries are conducted or assisted by a skilled health professional (Gabrysch & Campbell, 2009)

In 2010, the World Health Organisation (WHO) reported that about 32.8 million neonatal deaths occurred globally (Black et al, 2010). At the same time, the average neonatal deaths in the African sub-region were 60 per 1000 live births (WHO, 2010). Maternal mortality ratio (MMR) in the African sub-region averaged 900 per 100,000 live births (WHO, 2010). The estimated neonatal mortality ratio (NMR) in South Africa was 28 per 1000 live births (WHO, 2010). In South Africa, the estimated MMR was at 400 per 100,000 live births (WHO, 2010). These maternal and neonatal mortality statistics in South Africa were considered too high in comparison to other countries of similar socioeconomic status (NCCEMD, 2012). The National Committee on the Confidential Enquiry into Maternal Deaths (NCCEMD) reported

that the perinatal mortality rate in North West Province during the period 2008-2010 averaged 33 per 1000 live births (NaPeMMCo, 2011).

The 2012 and 2015 NCCEMD reports identified some community-based factors responsible for the causation of maternal and neonatal deaths. Poor access to maternity services in health facilities was identified as one of the causes of high perinatal morbidity and mortality in South Africa (NCCEMD, 2015; NCCEMD, 2012). Other contributory factors include poor attendance of ante-natal services, delay in seeking services at health facilities, poor quality of care provided in terms of clinical competency and skills, lack of transport for emergency cases and delay in the commencement of Anti-Retroviral Treatment (ART) for PMTCT (NCCEMD, 2015; NCCEMD, 2012; Tann et al., 2007; Peltzer, 2006).

The prevalence of BBBAs is under 1% in developed countries; the prevalence is averaging 50% in most parts of low and middle income countries especially in Sub-Saharan Africa and Asia (Parag et al, 2014). The documented BBBA rates available from the National Department of Health (NDOH) are 5% and 5.7% in Gauteng and KwaZulu-Natal Provinces respectively (NDOH, 2010). The BBBA rate in North West Province in 2010 was 21.7% and 25.6% in 2015 according data available on District Health Information System (Gray & Day, 2017).

The commitment of the United Nations (UN) to the reduction of maternal and child mortality led to the emergence of two millennium development goals (MDGs) among the 8 MDGs geared towards human development at the United Nations General Assembly in Geneva in the year 2000. These MDGs were set as common goals for

all the UN member countries (including South Africa) to achieve by the year 2015 (WHO, 2008). The two MDGs linked directly to maternal and child health (MCH) issues were as follows; MDG 4 - reduction of child mortality – the indicators were: i) reduction of infant mortality to below 35 per 1000 live births and ii) reduction of under-five mortality rate by two-thirds (UN, 2014). MDG 5 - Improvement of maternal health – the indicators were: i) reduction of MMR by three-quarters, ii) increment of proportion of childbirths attended by skilled health professional, and iii) increased ANC coverage (UN, 2014). The MDGs have been replaced in 2015 by the UN with Sustainable Development Goals (SDGs).

In line with meeting the MDGs target for 2015, the South African government made decreasing maternal and child mortality as outputs for the Negotiated Service Delivery Agreement (NSDA) 2010-2014. The target was to ensure that by 2014 the proportion of births attended by skilled health personnel would be 100% in comparison to 94.3% in 2009. The NDOH intended to reduce South Africa's Maternal Mortality Ratio (MMR) to ≤100 deaths per 100,000 live births and child mortality rate (CMR) to ≤20 deaths per 1,000 live births by 2014 (NaPeMMCo, 2011) The National Department of Health Strategic Plan 2015/16- 2019/2020 has set targets that aim to reduce MMR from 269 per 100,000 live births in 2014 to ≤100 deaths 100,000 per live births in 2020 and reduce NMR from 13.9 per 1000 live births to 6 per 1000 live births in 2020 (NDOH, 2015). However, the situation whereby some pregnant women continue to deliver their neonates at their homes in rural places constitute a threat to the achievement of these NSDA targets and strategic plan objectives stated above.

This study explores reasons for BBBA in a rural health facility located in Swartruggens in the North West Province of the Republic of South Africa
The researcher observed in Swartruggens Hospital over a period of time that a significant number of mothers who brought their newborns delivered at home to the hospital within hours of delivery were actually living close to the hospital. This has also been observed in other similar studies (Ogolla, 2015; Envuladu, 2013; Finlayson & Downe, 2013; Mrisho et al, 2007; and van Eijk et al, 2006). Another observation is that some mothers of BBBAs live far away from the Swartruggens hospital. This study aimed at determining the factors associated with the deliveries of BBBAs at Swartruggens hospital is motivated by these observations as well as the increased health risks and complications in BBBAs and their mothers that has been documented in previous studies (Parag et al, 2014; Bassingthwaighte, 2013; Rodie et al, 2002)

1.2 LITERATURE REVIEW

BBBAs are common occurrences in clinical practice especially in Sub-Saharan African countries (Chiragdin, 2013). In Sub-Saharan Africa, over 60% of deliveries take place at home, especially in rural areas without a skilled attendant (Diallo et al 2005, Kabba et al, 2004). Several studies have identified factors responsible for mothers delivering at home and then bringing the child to the hospital after delivery. These factors are linked in different ways to delays in seeking the help at a health facility. These delays in seeking help of health professionals for obstetric care at health facilities are conceptualized to be in three phases.

The three delays model was developed by Gabrysch and Campbell in 2009. A diagrammatic flow chart of these delays is presented in Appendix 2. The first two phases are more applicable to the BBBAs in this study and are described below.

Phase 1 delay: This is a delay in making the decision to seek health care. This could be due to the following factors:

a) Failure of the mother to recognize the onset of labour and (or) rapid progression of the labour: This can happen if the woman is unbooked for antenatal care (ANC) or the ANC visits are inadequate. This may cause poor knowledge of symptoms and signs of labours, or lack of or poor preparation of the mother for labour during the ANC visit (Gabrysch & Campbell, 2009).
b) Low economic status of women: this may prevent them from being able to afford transport to facility or afford a phone or airtime to call an ambulance (Gabrysch & Campbell, 2009).
c) Socio-cultural barriers to seeking maternity care: circumstances such as women's inability to control resources and being dependent on partners, inability to make independent decision due to interference from partners or family members, religious beliefs, and traditional beliefs and practices connected to childbirth and delivery etc. (Gabrysch & Campbell, 2009).
d) Education: low level of formal education among pregnant women may contribute to delay in presenting at a health facility in labour (Gabrysch & Campbell, 2009).

Phase 2 Delay: These are factors that can cause delay in reaching a health facility, such as:

a) Lack of or poor infrastructure: roads linking the home of the pregnant woman with the health facility may be absent or in bad shape especially in rural and remote arrears (Gabrysch & Campbell, 2009).

b) Unfavourable weather conditions: heavy rains, floods, hail or very cold wintry conditions may compel a pregnant woman to deliver at home (Gabrysch & Campbell, 2009).

c) Security concerns: The risks of security threats at night such as sexual assaults, physical assaults and robberies in rural places may prevent a pregnant woman in labour from seeking health service (Gabrysch & Campbell, 2009).

d) Access to health facility: Geographical access to the health facility may be limited due the long distance from the residence of the pregnant mother to the health facility. Geographical access may also be compromised by lack of emergency ambulance services or delayed response by the emergency ambulance services to the call of the pregnant woman in labour away from a health facility (Gabrysch & Campbell, 2009).

These aforementioned factors may be responsible for the delays by pregnant women in seeking help from health facilities during labour and delivery. These factors may compel such pregnant women to deliver at home and bring BBBAs to health facilities later.

There are established associations between certain sociodemographic and clinical factors and choice of home delivery by pregnant women. Regarding sociodemographic factors, some studies have found associations between certain age groups and home deliveries. Some studies found home deliveries are associated with maternal age greater than 30 years (Envuladu et al, 2013; Mrisho et al, 2007; Mpebeni et al, 2007) or maternal age greater than 35 years (Mehari, 2013; Garg et al, 2010; Pradhan, 2005). A study done in South Africa however found no association between maternal age and home delivery (Parag et al, 2014).

There are studies that have found that being ever married (married, divorced or widowed) is a factor associated with home delivery (Moindi et al, 2016; Ogolla, 2015; Envuladu et al, 2013, Gabrysch & Campbell, 2009, Pradhan, 2005). The reason advanced here was that pregnant women cannot make independent decisions on the choice of place of delivery because the sociocultural settings ensured that the husbands and senior female relatives of the husbands have undue and dominant influence on the decisions of the pregnant women (Moindi et al, 2016; Ogolla, 2015; Envuladu et al, 2013, Gabrysch & Campbell, 2009, Pradhan, 2005).

Certain studies have also identified low socioeconomic status as a factor associated with home deliveries in pregnant women in Africa and Asia (Ogolla, 2015; Envuladu et al, 2013; Mehari, 2013, Iyaniwura & Yusuf, 2009; van Eijk et al, 2006). Some of the reasons advanced for home deliveries in pregnant women with low socioeconomic status were inability to afford the cost of transport to health facilities and inability to afford the monetary costs of facility-based delivery (Ogolla, 2015; Envuladu et al, 2013; Mehari, 2013, Iyaniwura & Yusuf, 2009; van Eijk et al, 2006).

Education level is also a social factor strongly linked with the choice of place of delivery. According to some studies, women with low education attainment (primary education or no education) are more likely than women with higher education to have home delivery of BBBAs (Abdella et al, 2017; Sprague et al, 2016; Envuladu et al, 2013; Mehari, 2013; Adelaja, 2011; Iyaniwura & Yusuf, 2009; Mrisho et al, 2007; van Eijk et al, 2006; Stephenson et al, 2006).

The distance of the home of the pregnant woman to the health facility is another sociodemographic factor that affects the physical access of the woman to the nearest health facility (Moindi et al, 2016). It has been shown in some studies that living more than 10km from the health facility is associated with home delivery (Moindi et al, 2016; Ogolla, 2015; Mpebeni et al, 2007; van Eijk et al, 2006). Another study found no association between living more than 10km from facility and home delivery (Parag et al, 2014). The dichotomy in these findings is that while Parag et al did their study in semi-urban Pietermaritzburg in South Africa, the other studies were done in rural settings.

Some of the above mentioned sociodemographic factors associated with home deliveries are related to the different phases of the three delays model. Low economic status, low education, marital status and associated sociocultural issues are factors related to phase one delays. Living at a distance of more than 10km or more than an hour walking distance to a health facility is related to phase 2 delays (Gabrysch & Campbell, 2009).

There are clinical factors that have been documented as determinant of home delivery in pregnant women. Some of these clinical factors include: parity of the pregnant woman, the timing of the onset of labour, timing of the booking for ANC and sufficiency of the number of ANC visits during pregnancy. These factors and the citation of the relevant references are elaborated below.

In some studies, parity of 5 or more viable deliveries has been associated with home deliveries in pregnant women (Sprague et al, 2016; Mehari, 2013; Agha &Carton,

2011; Montagu et al. 2011; Eyerusalem 2010; van Eijk et al, 2006; Pradhan 2005). Women with a parity ≥5 (also called grandmultiparity) were associated with delivery or childbirth at home complications (Mehari, 2013; Montagu et al. 2011; Eyerusalem 2010). It was suggested that grandmultiparous women may choose to deliver at home if their previous childbirth experiences at home did not lead to any serious complications during labour and puerperium (Mehari, 2013; Montagu et al. 2011; Eyerusalem 2010).

The timing of the onset of labour is a clinical factor that can determine the place where a pregnant woman in labour may deliver her infant. There have been studies that have found association between the onset of labour at night and home deliveries (Tann et al, 2007; van Eijk et al, 2006; Scot & Esen, 2005). These findings suggest that a woman who goes into labour at night is more likely to deliver at home that the one who went into labour during the day.

The WHO recommends early booking for ANC within the first trimester for all pregnant women (Villar et al, 2001). Being unbooked for ANC (Parag et al, 2014; Bassingthwaighte, 2013; Ochako et al, 2011; Geberehiwot, 2009) or late booking for ANC (Ochako et al, 2011; Fotso et al, 2008; Magadi et al, 2000) are also factors associated with home deliveries in African and Asian pregnant women. The WHO also recommends that every pregnant woman must attend a minimum of four ANC visits to be considered sufficient enough to favour the choice to deliver in a health facility (Villar et al, 2001). Insufficient number of ANC visits (less than four visits) in pregnancy have been shown in some studies as a factor associated with home

delivery (Gultie et al, 2016; Ochako et al, 2011; Geberehiwot, 2009; Nketiah-Amponsah and Sagoe-Moses, 2009).

It is important to understand the factors contributing to the home deliveries of BBBAs because of the complications that may arise from home deliveries. The delivery of newborns outside health facilities is associated with potential complications and poor health outcomes in such mothers and their newborns (Parag et al, 2014; Bassingthwaighte, 2013; Scott & Esen, 2005). A study done in rural India revealed that about 53% of the women who delivered at home usually present with varying degrees of morbidity during labour and puerperium (Bang et al, 2004). About 18% present with severe intra-partum complications while about 43% of them develop complications during the puerperium (Bang et al, 2004). About 17% were in need of emergency obstetric care due to life threatening situations. Another 33% presented with conditions where medical attention is indicated. The most common complications were prolonged labour, postpartum haemorrhage, and puerperal sepsis and breasts problems (Bang et al, 2004). Foetal malpresentation and postpartum conditions such as puerperal sepsis, puerperal psychosis and eclamptic seizures were associated with poor perinatal outcomes (Bang et al, 2004)

BBBAs also develop complications and have higher hospital admission rates than their counterparts delivered in hospital. Hypothermia is more prevalent in BBBAs compared to babies delivered in health facilities (Scott and Esen, 2005). Prematurity and low birth weight and prolonged hospital stay are also more prevalent in BBBAs than hospital deliveries (Parag et al, 2014; Seghal et al, 2001). Other common complications in BBBAs are hypoglycaemia, anaemia, birth asphyxia, respiratory

distress syndrome, unknown Apgar score, HIV exposure without PMTCT, neonatal sepsis, and neonatal jaundice (Bassingthwaighte, 2013; Chopra et al, 2009; Scott & Esen, 2005).

In conclusion, the studies mentioned above have shown that there are certain sociodemographic and clinical factors associated with home delivery. Some of these factors have been linked to delay in presentation at facilities by pregnant women when they go into labour. Subsequently, they deliver at home and come with their BBBAs to the hospital later. Therefore, it is important to investigate the extent to which such sociodemographic and clinical factors are contributing the home deliveries of BBBAs in the rural context of the Swartruggens community.

1.3 OVERVIEW OF THE STUDY SETTING

Swartruggens Hospital is located in a rural community called Swartruggens. The community is in the Kgetleng Sub-District of the Bojanala District in the North West Province of South Africa. It is a community lying on the N4 highway that links Gauteng to the Republic of Botswana. Swartruggens lies, by travel distance, 60km north of Rustenburg and 170km north of Pretoria on the N4 and about 150km on the N4/R49 road from Mafikeng, the provincial capital of North West Province (AfriGis, 2016).

Swartruggens is made up of three major zones. These are Swartruggens SP, Borolelo and Rodeona as well as the several farm settlements around it. According to the 2011 National census, the population of Swartruggens is 12,491 people and the community lies on an area that is about 16 square kilometres. The population density is 780 persons per square kilometres (STATs SA, 2011). Swartruggens is

sparsely populated and fits rural typologies with the narrative that rural communities are usually sparsely populated and dispersed settlements (ENRD, 2010). Swartruggens is a multiracial community. The majority (68%) of the population are Black Africans while the Caucasians and Asians are about 15% of the population each. There a few Coloured people forming less than 2% of the population (STATsSA, 2011).The unemployment rate is high in Swartruggens as with many rural communities in South Africa. The unemployment rate in rural South Africa was put at 73% (Makgetla, 2008)

Swartruggens Hospital provides health services to the people of Swartruggens and surrounding villages and settlements. The hospital serves a population of about 30,000 people in the catchment area (STATsSA, 2011). The hospital is a 34-bed district hospital (BPDM, 2012). Swartruggens hospital offers health services like operating theatre (especially for obstetrics procedures like caesarean sections), maternity ward admissions including a neonatal unit, out-patient departments, emergency and casualty unit, pharmacy, X-rays and Ultrasound scans, and medical laboratory services. There is a maternity waiting home on the premises of the hospital for high risk patients living in far villages (BPDM, 2012). There is a general medical ward that usually receives admissions for pregnant women who are less than 26 week of gestation.

Swartruggens Hospital is geographically located at the centre of the Swartruggens community. Large parts of the residential area of the community are within 2km radius of the hospital except for the Mazista RDP settlement that is just less than 10km away (AfriGis, 2016). The setting is such that geographical access to the facility is relatively easy. At the same time, maternity services are available 24 hours

as well as theatre for elective and emergency caesarean sections. There is also a 24-hour emergency ambulance service.

The hospital received referrals from nearby Borolelo and Swartruggens primary health care clinics (PHC clinics). It also receives referrals from PHC clinics in the catchment areas located in villages like Silwerkraans, Pella, Madikwe, Vrede 1, Vrede 2, Reitfontein, and Brankuil etc. Other villages and settlements in the catchment areas are Moedwil, Groot Marico, and Waterval etc (BPDM, 2012). The closest of these PHC clinics is at least 25km from the hospital (AfriGis, 2016). There are mobiles clinics run by primary health care nurses who visit farms and remote informal settlements to see patients including pregnant women who require antenatal monitoring and care (BPDM, 2012). The main referral centres are Job Shimankane Tabane Hospital in Rustenburg, Klerksdorp Hospital, Klerksdorp and Dr George Mukhari Hospital, Ga-Rankuwa in Pretoria. However, most obstetric and neonatal referral cases are sent to the hospital in Rustenburg (BPDM, 2012)

1.4 RESEARCH PROBLEM

Despite the good geographical access to the facility and the 24-hour availability of obstetric and emergency ambulance services as stated in the study settings above, there are pregnant women who deliver at home and bring their BBBAs to the hospital. This is available on the hospital records. Reporting in the hospital within hours or minutes after delivery may be because the patient realised that the delivery should have taken place in the hospital or that a complication arose during and/or after the delivery at home which prompted them to go to the hospital (van Eijk et al,

2006). It could also be because the mother wants to go for immediate check-up on her health and that of her newborn. Another reason for coming to hospital after delivery at home may be to register the birth of their babies at the facility which would enable them to obtain birth certificates at the local office of the Department of Home affairs.

Ironically, the hospital's maternity unit also receives some clients from Rustenburg who come to seek services as walk-in clients. Rustenburg is an urban area that is about 60km from the hospital. The researcher had some informal interactions with some clients from Rustenburg with a view to understand why they avail themselves of the services of a rural hospital that is situated far away from Rustenburg. Some of the reasons given during these informal interactions were perceived good quality of service, ease of access to service delivery and recommendations from previous users of the maternity services at Swartruggens Hospital. So, it appeared paradoxical that some of those who are living close to the same facility or living within the catchment area were not availing themselves of these services while other people living beyond the catchment area were happy to use the same services.

The maternity facility and services were put in place by the government with the aim of preventing morbidity and mortality in mothers and newborns in the community and surrounding settlements. The researcher was concerned that the hospital may have to deal with potential complications that could arise from the deliveries of BBBAs at home (Parag et al, 2014, Bassingthwaighte, 2013). The concerns were that these women could have delivered their babies in the hospital and also have the opportunity to get necessary check-ups, monitoring, treatment, birth registrations as

part of the whole package of obstetric services without exposing themselves and their BBBAs to risks and complications associated with delivering at home in the absence of a health professional.

It is a public health problem when pregnant women living near Swartruggens hospital or living within the catchment areas of the facility choose to deliver their babies at home instead of delivering them in the health facility. The factors associated with this behaviour are, however, unknown. There may be factors that limited the women's access to the hospital after labour onset at home. It is possible that the idea of going to the hospital during labour is a difficult proposition for the mothers of BBBAs. Some of these factors may be related to the phase 1 and phase 2 delays in the three phase delay model described in the literature review (Gabrysch & Campbell, 2009).

Therefore, it will be useful to know the factors associated with mothers delivering babies at home and then coming with the neonate to the hospital in within a few hours after delivery. The researcher intends to thus determine the socio-demographic and clinical factors associated with the deliveries of BBBAs presenting at the Swartruggens Hospital between 2013 and 2014.

1.5 RESEARCH QUESTION

What are the socio-demographic and clinical factors associated with the deliveries of babies 'born before arrival' (BBBAs) at Swartruggens Hospital between 2013 and 2014?

1.6 JUSTIFICATION FOR THE RESEARCH

Reducing maternal and child morbidity and mortality are important public health issues to the South African Government. These issues cannot be well addressed if we still have delivery of neonates outside health facilities in places believed to have adequate health services coverage at no financial cost to the pregnant woman (NaPeMMCo, 2011; NCCEMD, 2012). It is of public health interest that associated factors responsible for home deliveries in mothers of BBBAs at Swartruggens can be explored so that solutions may be offered in order to reduce maternal and child morbidity and mortality.

It is of public interest to know the factors that were responsible for the inability of the North West Province to achieve the national target of 100% facility-based skilled birth attendance by 2014 (NaPeMMCo, 2011), because DHIS records show that the province could only achieve 74.4% in 2015 (Gray & Day 2017). The delivery of BBBAs threatens the National Department of Health Strategic Plan 2015/16-2019/2020 targets that aim to reduce MMR from 269 per 100,000 live births in 2014 to 100,000 per live births in 2020 and reduce NMR from 13.9 per 1000 live births to 6 per live births in 2020 (NDOH, 2015)

There is paucity of studies done on mothers of BBBAs and BBBAs in South African rural settings. This study is intended to reveal factors that may be peculiar to the rural context, among others, and may form the basis for further in-depth study on the subject.

1.7 RESEARCH AIM AND OBJECTIVES

AIM: To determine the socio-demographic and clinical factors associated with the deliveries of babies 'born before arrival' at Swartruggens Hospital between 2013 and 2014.

OBJECTIVES:

1. To describe the socio-demographic and clinical profiles of the mothers of babies 'born before arrival' at Swartruggens hospital as well as the clinical outcomes of their respective babies in this hospital between 2013 and 2014.

2. To describe the sociodemographic and clinical profiles of mothers of babies delivered at Swartruggens Hospital as well as the clinical outcomes of their respective babies in this hospital between 2013 and 2014.

3. To compare clinical profiles of mothers of BBBAs and the mothers who delivered in hospital and the clinical outcomes between BBBAs and babies born in Swartruggens hospital between 2013 and 2014.

4. To determine the association between maternal socio-demographic and clinical factors and having babies 'born before arrival' at Swartruggens Hospital between 2013 and 2014.

CHAPTER 2

RESEARCH METHODOLOGY

2.1 STUDY DESIGN

This research is an unmatched case-control study. The study intended to compare cases with a health outcome of study interest with controls that did not have the health outcome of interest. A case was the mother of a baby 'born before arrival'. A control was a mother who delivered her baby in the hospital. This research involved a retrospective review of the medical records of the two groups (cases and controls) at Swartruggens Hospital over a period of two years (2013-2014).

2.2 STUDY POPULATION AND SAMPLING

The study population was all the mothers of neonates documented in the maternity delivery register at Swartruggens Hospital from January 2013 to December 2014. The maternity delivery register is a birth register containing the summary of clinical records of the delivery of newborns by their mothers both in the hospital and those born before arrival in the hospital.

Inclusion Criteria:

Cases: A mother of a BBBA older than 26 weeks gestation (which is considered the age of viability in South Africa), who is documented in the maternity register between January 2013 and December 2014.

Controls: A mother who delivered a neonate in the hospital at or greater than 26 weeks gestational age and is documented in the maternity register from January 2013 to December 2014.

Table 2.1: Summary of Deliveries

	2013	2014	Combined
Total number of deliveries	402	515	917
Hospital Deliveries	371	464	835
BBBAs	31	51	82
BBBAs proportion	7.7%	9.9%	8.9%

The sample size for the study was determined by using a software model for calculating a sample size for unmatched case control studies, which is available online at openepi.com (Kelsey et al, 1996).The calculation is presented in Appendix 3. The risk factor used in the model was exposure to primary education or below because this factor had a strong association with home deliveries from many studies reviewed in the literature (Envuladu et al, 2013; Adelaja, 2011; Iyaniwura & Yusuf, 2009; Mrisho et al, 2007; van Eijk et al, 2006). The following were entered into the online software to calculate the sample size: hypothetical percentages of mothers exposed to primary education or below (60% for cases and 40% in the controls); the ratio of the sample size for controls to be selected was made to be twice that of the cases so as to improve the chances of increasing the total sample size for the study; power (or chances of detecting a difference) was put at 80% (as per conventional practice (Kelsey et al, 1996)) and the desired two-sided confidence level was put at 95%. The sample size calculated after entering these parameters into this online model was 80 and 160 for cases and control respectively. This is shown in Appendix 3.Therefore, all the 82 BBBAs deliveries were considered for inclusion as cases in this research. The BBBAs were easily identified on the maternity delivery register as they were usually entered in the register with red ink by the midwives. The total numbers of subjects in the study were 242.

The cases and controls were not matched as it was practically difficult to do so. This is because matching them would have meant matching every case with two controls that delivered on the same day that had similar age range, parity, race etc. This would have been very difficult and rare to achieve for each of the cases. However, effort was made to make sure the proportion of the cases in 2013 to the proportion of cases in 2014 is reflected as the same proportion of controls selected in 2013 to the proportion of controls selected for 2014.From the table above, the proportion of cases in 2013 to the proportion of cases in 2014 was ratio 3 to 5. The total number of controls for each year was then selected to ensure the same proportional distribution as for the cases. The 3 to 5 ratio was therefore applied to the controls and this meant that there were 60 controls selected from the population of hospital deliveries in 2013 and 100 controls selected from 2014, to make up the total of 160 controls.

Selection of controls was done by systematic random sampling of eligible hospital deliveries from the maternity register. Based on the proportion of controls to be selected for each year, the selection interval Nth was determined by total number required from station 1 to the end station. In 2013, 60 controls were to be selected from a sample population of 371. Using systematic random sampling, every sixth subject was selected from the first qualifying patient on the delivery register till the 60th subject was reached. In 2014, 100 controls were to be selected from 464. This means approximately every $4^{1/2th}$ subject should have been selected but this was practically impossible because there is no halve person. The researcher made a decision to select every 4th and 5th subject in an alternating fashion from the start point till 100 were selected from the delivery register. The corresponding babies for each case and control were sampled along with their mothers.

2.3 DATA COLLECTION AND MEASUREMENT

Data were obtained from the delivery register in the maternity ward as from the PAAB patient information software, the main hospital files and maternity case books of the selected cases and controls that were obtained from the Admissions and Records Department of Swartruggens Hospital. The PAAB patient information software on the computers at the Admissions and Records department contains sociodemographic information on each patient as well as records of the dates of each of their visits to the hospital. The main patient file is the primary medical record document of each patient and contains all the historical clinical information on each patient including the obstetric and non-obstetric information. The maternity case book is an antenatal booklet that acts a diary of obstetric clinical information of a pregnant woman from the booking visit for antenatal care till delivery and immediate post-delivery period. The pregnant woman is in possession of the book throughout pregnancy and is only handed back for hospital filing after delivery.

A data capture sheet was developed for the purpose of this study and used to abstract and record from the above data sources the data of interest for each patient in the study. The data capture sheet is presented in Appendix 4. Data collected for objectives 1, 2, and 3 include:

- The socio-demographics of the mothers: age, employment status, education level, marital status, racial group and estimated distance from home to the hospital. The estimated distance from home to the hospital of the patients were categorized to those less than 10km from the hospital and greater than 10km from the hospital. The estimated distance from home to the hospital was

assessed from the map of the community and the surrounding villages and settlements obtained from Google Maps (AfriGis, 2016). The home addresses of the subjects served as reference points to the hospital and the map was used as guidance to estimate if the distance from home to the hospital was within 10km or beyond 10km from the hospital.

- Clinical profiles of the mothers : These include; (i) obstetric history (parity, booking status, booking trimester, booking blood pressure, booking haemoglobin, sufficiency of antenatal visits, gestational age of pregnancy at delivery, time of delivery and HIV status). (ii) clinical events and risks in index pregnancy such as hypertension, pre-eclampsia toxaemia (PET), anaemia, diabetes mellitus, urinary tract infection (UTI), vaginal discharge syndrome (VDS), hyperemesis gravidarum, dyspepsia, asthma, epilepsy, previous caesarean section (previous C/S), oligohydraminos, polyhydraminos, multiple gestation, premature rupture of membranes (PROM), intrauterine growth restriction (IUGR) etc.

- Clinical outcomes in the mothers and babies. These included: i) clinical complications in the mothers (e.g. genital lacerations, post-partum heaomrrhage (PPH), anaemia, puerperal sepsis etc) and in the babies (e.g. low birthweight, hypothermia, hypoglycaemia, neonatal jaundice etc); and ii) process and exit outcomes such as duration of hospital stay, use of antibiotics, use of oxygen for more than 6 hours, use of blood transfusion, referral to higher level hospital etc.

These data were routinely recorded in the available hospital records described above. The availability of these data was confirmed after perusing the files of 10

patients each in the BBBAs group and the hospital delivery group in order to ascertain completeness of records and whether they contained these variables.

In spite of these, it does not necessarily mean that there were no missing data or records. Since the data from these data sources were retrospective review of data documented previously by other people, the accuracy and completeness of the data is dependent on the documented observations of the health workers who entered the information into the data sources. To a very large extent, the sociodemographic profiles of the patients were easily obtainable and verifiable from the PAAB software. However, the clinical profiles, clinical risks and clinical complications are dependent on what was entered into the patients' files and maternity register by the health professionals. So it was possible that not all the clinical risks, clinical events and complications that actually took place in the patients were documented. All these possible omissions are potentially 'missing data' in a study involving retrospective record review. Nevertheless, data on clinical factors such as booking parameters, parity, gestational age at delivery, time of onset of labour, HIV status were just basic records that were readily available from the patients' files and the maternity register.

All the files of the BBBAs were fortunately obtainable, perhaps, due to the efficiency of the records department of the hospital and because of the relatively small number of the BBBAs population. With regards to the control that has a much larger population, there were 3 patients whose files were missing. However, these were replaced by the available files of the next eligible patients on the list from the maternity register during systematic random sampling.

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2.4 DATA PROCESSING AND ANALYSIS

The data extracted from the patients' records into the data capture sheets were coded and captured into an MS-Excel spreadsheet. Data were imported from the MS-Excel spreadsheet to the statistical software programme STATA Version 14. Table 2.2 provides the summary of analytical techniques deployed for analysing variables towards the achievement of the objectives of the study. For objectives one to three descriptive statistics were used to describe the socio-demographic and clinical profiles of the mothers; clinical risks and (or) events in the mothers during pregnancy; and the clinical outcomes and complications in both the mothers and babies (Table 2.2).

For the fourth objective, tests of association between the outcome of (home delivery of a BBBA) and the various sociodemographic and clinical exposure variables described in Objective 1 to 2 were carried out. The outcome variables were binary. These were either BBBA (case) or not BBBA (control). The exposure variables which were initially numerical (age and parity) were changed to categorical variables in order to obtain odd ratios which is the measure of association for case-control studies. On the basis of information from the literature review, age was categorised into greater than equal to 35 years (advanced maternal age) or less than 35 years and parity was categorised into greater than equal to 5 (grandmultiparity) and less than 5.

Initially, univariate analyses were done to test for statistically significant differences in the sociodemographic and clinical profiles of the cases and controls. Categorical exposure variables were analysed to obtain p-values and crude odd ratios using Chi-

Square test (or the Fischer's Exact test if any cell had <5 values).The T-test was used where the exposure variables were numerical to obtain the P-values. Statistical significance level was set at P-value ≤ 0.05. However on the basis of information from the literature review and for the ease of analysis, categorical variables which were more than two categories were re-categorised into two categories. Education status was categorised into primary or no education and greater than primary education. Marital status was re-categorised into single (never married) and ever married (married, divorced and widowed). Race was re-categorised into Black African and Non-Blacks (Caucasian, coloured and Asian). Booking Trimester for ANC was re-categorised into late booking (second and third trimester booking) and Early Booking (first trimester booking). Gestational age at delivery was also re-categorised into Pre-term delivery (less than 37 weeks) and term delivery (greater than or equal to 37 weeks). These changes were made to make analysis simpler and compare results with the findings of previous similar studies on the subject matter.

The measure of association used for objective 4 was odds ratio. The analysis involved obtaining P-values, crude odd ratios (ORs) and confidence intervals (CI) at 95% confidence level in the univariate analyses. Those variables in which the P-value values were statistically significant in the univariate analyses were then entered into a logistic regression model to obtain the adjusted odd ratios (aORs) at 95% CI in the multivariate analyses. The analyses for objective 4 were to determine the association between exposure variables (mothers' socio-demographic and clinical variables) and the health outcome of interest (Joubert et al, 2012). The health outcome of interest was babies born before arrival at the health facility

TABLE 2.2: ANALYTICAL TECHNIQUES

OBJECTIVE	VARIABLES MEASURED	ANALYTICAL TECHNIQUE
Description of sociodemographic profiles of mothers	Numerical variables: Age, Categorical variables: employment status, education level, marital status, racial group and estimated distance from home to the hospital (<10km or >10km), Age category (≥35 or <35)	Numerical variable: range, mean, standard deviation and significance using T-test. Categorical variables: percentages and significance testing using Chi-square test and Fischer's Exact Test
Description of clinical profiles of mothers	Numerical Variable: Parity Categorical variables: booking status, booking trimester, booking blood pressure (<140/90mmHg or >140/90mmHg, booking haemoglobin <10g/dL or >10g/dL, sufficiency of antenatal visits, gestational age of pregnancy at delivery (<32weeks, 32-36weeks, >36weeks) time of delivery (day or night) and HIV status, parity category (≥5 or <5)	Numerical variable: range, mean, standard deviation and significance using T-test. Categorical variables: percentages and statistical significance testing using Chi-square test or Fischer's Exact Test
Description of clinical risks or events in pregnancy among the mothers	All were categorical binary variables (Yes/No). hypertension, pre-eclampsia toxaemia (PET), anaemia, diabetes mellitus, urinary tract infection (UTI), vaginal discharge syndrome (VDS), hyperemesis gravidarum, dyspepsia, asthma, epilepsy, previous caesarean section (previous C/S),	Simple proportions were applied.

	oligohydraminos, polyhydraminos, multiple gestation, premature rupture of membranes (PROM), intrauterine growth restriction (IUGR) etc	
Clinical outcomes in mothers and babies	Clinical complications, process and exit outcomes in mothers and babies	Simple proportions were applied
Measures of association	Outcome variables : BBBAs (cases) and Not BBBAs i.e. Hospital deliveries (Controls) Exposure variables: sociodemographic and clinical variables of the mothers as outlined above	Multivariate analysis using logistic regression. - Univariate analyses to compute crude odd ratios - A multivariate model to compute adjusted odd ratios

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2.5 ETHICS

Ethical clearance to conduct this study was also obtained from the Human Research Ethics Committee (HREC) of the University of Witwatersrand, Johannesburg (Reference Number M170307). This can be seen in Appendix 5. Permission to have access to patients' records for the purpose of the study was obtained from the Policy, Planning, Research, and Monitoring and Evaluation division at the North West Provincial Department of Health (NWDOH) in Mafikeng. The permission letter can be seen in Appendix 6.

This study was not commenced until after all the necessary clearance and approvals were obtained. There was maintenance of anonymity and confidentiality of the subjects as data were being entered into the data capture sheets. Collated data were kept safe and accessible only to the researcher and the supervisors (if need be) during the research study and will be available until after the article is published.

CHAPTER 3

RESULTS

3.1 Sociodemographic profiles of the mothers

The age range, mean and standard deviation were similar in both groups (cases and controls). Unemployment, single marital status and black African race were in higher proportions and similar in the profiles of the mothers in both groups. The proportions of cases that had below secondary education were higher than the controls. The sociodemographic profiles of the mothers are shown in Table 3.1. The p-values in Table 3.1 demonstrate the statistical significance of each of the sociodemographic factors in the univariate analysis. The essence of these p-values is further explained in Section 3.6

3.2 Clinical profiles of the mothers

The range of the parity of the mothers was similar in both groups but the mean parity was higher in the cases. The majority of the mothers were booked for ANC but the controls had higher proportions of mothers who were booked for ANC. The proportions of mothers who booked early (first trimester) were low in both groups. Insufficient ANC visits, preterm gestational age at delivery and delivery at night time were in higher proportion among the cases. The clinical profiles of the mothers are shown in Table 3.2. The p-values in Table 3.2 demonstrate the statistical significance of each of the clinical factors in the univariate analysis. The essence of these p-values is further explained in Section 3.6.

Table 3.1: Sociodemographic profile of the mothers

Variable	All (n=242)	Cases (n=82)	Control (n=160)	Significance (P-value)
Age ***Mean(SD)***	27.0 (7.2)	27.7 (7.1)	26.7(7.7)	0.3054
Min-Max	14-44	14-43	15-44	
Marital Status ***n (%)***				0.1270
Single	205 (85)	75 (91.5)	130 (81)	
Married	32 (13)	6 (7.3)	26 (16)	
Divorced	3 (1)	0 (0)	3 (2)	
Widowed	2 (1)	1 (1.2)	1 (1)	
Race ***n (%)***				0.0367
African (Black)	210 (87)	78 (95)	132 (82)	
Caucasian	13 (5)	0 (0)	13 (8)	
Asian	4 (20	0 (0)	4(3)	
Coloured	15 (6)	4 (5)	11(7)	
Education Status ***n (%)***				0.0475
No Education	22 (9)	13 (16)	9 (6)	
Primary	87 (36)	45 (55)	4 (27)	
Secondary	128 (53)	24 (29)	104 (65)	
Post- Secondary	4 (2)	0 (0)	4 (3)	
Employment Status ***n (%)***				0.0000
Unemployed	217 (90)	78 (95)	139 (87)	
Employed	25 (10)	4 (5)	21 (13)	
Estimated Distance from Home to Hospital ***n (%)***				0.2430
More than 10km	113 (47)	34 (42)	79 (49)	
Less than 10km	129 (53)	48 (58)	81 (51)	

Table 3.2: Clinical profiles of the mothers (obstetric history)

Variable	All (n=242)	Cases (n=82)	Control (n=160)	Significance (P-value)
Parity ***Mean(SD)***	2.7 (1.6)	3.2 (1.7)	2.5 (1.5)	
Min-Max	1-9	1-8	1-9	0.0026
ANC Booking Status *n (%)*				
Unbooked	26(11)	18 (22)	8 (5)	0.000056
Booked	216(89)	64 (78)	152 (95)	
Sufficiency of ANC Visits *n (%)*				
Insufficient (<4 ANC visits)	74 (31)	44 (54)	30 (19)	0.0000
Sufficient (≥4 ANC visits)	168 (69)	38 (46)	130 (81)	
Gestational Age at Delivery *n (%)*				
<32weeks	5 (2)	1 (1)	4 (3)	
32-36 weeks	63 (26)	37 (45)	26 (16)	0.0000
>36weeks	174 (72)	44 (54)	130 (81)	
Time of Delivery *n (%)*				
Night	123 (51)	66 (80)	59 (37)	0.0000
Day	119 (49)	16 (20)	101 (63)	
HIV Status *n (%)*				
Positive	71 (29)	25 (30)	46 (29)	0.7787
Negative	121 (71)	57 (70)	114 (71)	
Use of ARVS for PMTCT *n (%)*				
Used	52 (73)	15 (60)	37 (80)	
Defaulted	14 (20)	9 (36)	5 (11)	0.0780
Never used	5 (7)	1 (4)	4 (9)	

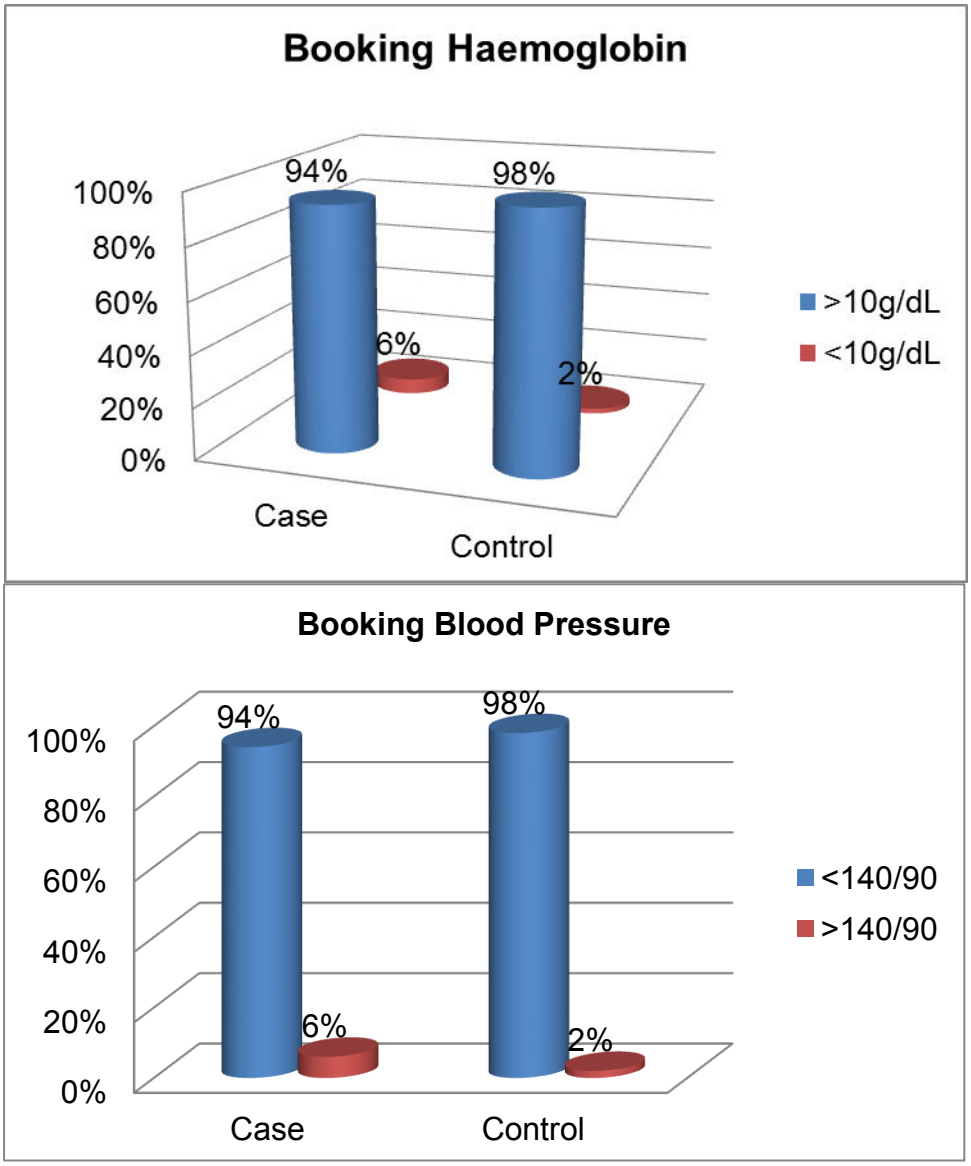


Figure 3.1: Booking blood pressure and booking haemoglobin

The booking blood pressure and booking haemoglobin (Hb) are presented in Figure 1. The proportions of mothers with normal (<140/90mmHg) and abnormal booking blood pressure (>140/90mmHg) are similar in the cases and control groups. This is also likewise for normal booking haemoglobin (>10g/dL) and abnormal booking haemoglobin (<10g/dL).

3.3 Clinical Profile: Risks and events in the antenatal period

The clinical risks and events that occur during pregnancy (antenatal period) were assessed in the two groups among the women who booked for ANC. Patients who did not book for ANC had no records of any clinical event in pregnancy except for things that happened in labour and after delivery. The results are shown in Table 3.3

Table 3.3: Clinical Profile: Risks/Events in the Antenatal period

Clinical Risks	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
None	69 (28.5)	25 (30)	44 (28)
Anaemia	57 (23.6)	21(26)	36 (22.5)
Urinary Tract Infection	34 (32)	14 (17)	20 (12.5)
Hypertension	26 (11)	12 (15)	14 (9)
Vaginal Discharge Syndrome	23 (9.5)	12 (19)	11(7)
Previous Caesarean Section	13 (5)	1 (1.2)	12 (7.5)
PROM	10 (4)	2 (2.4)	8 (5)
Preeclampsia Toxaemia	7 (3)	1(1.2)	6 (2.8)
IUGR	6 (2.5)	2 (2.4)	4 (2.5)
Dyspepsia	5 (2)	2 (2.4)	3 (1.9)
Polyhydraminos	5 (2)	1(1.2)	4 (2.5)
Hyperemesis Gravidarum	5 (2)	1(1.2)	4 (2.5)
Diabetes Mellitus	3 (1.3)	1(1.2)	2 (1.3)
Antepartum Haemorrhage	3 (1.3)	0 (0)	3 (1.9)
Multiple Gestation	2 (0.8)	0 (0)	2 (1.3)
Oligohydraminos	2 (0.8)	0 (0)	2 (1.3)
Foetal Macrosomia	2 (0.8)	0 (0)	2 (1.3)
Pulmonary Tuberculosis	1 (0.4)	1 (1.2)	0 (0)
Others	5 (2)	0 (0)	5 (3)

The commonest clinical conditions in the antenatal period in both groups were anaemia, hypertension in pregnancy, urinary tract infection and vaginal discharge syndrome. These conditions were more prevalent among the cases than the controls. However, the proportion women who did not have any clinical risks in pregnancy were similar in both groups. Conditions listed as others include Eclampsia, Asthma, Epilepsy, Psychiatric conditions and Pneumonia**.**

3.4 Clinical Complications in Mothers and Babies

The clinical complications experienced by mothers during labour, delivery or soon after delivery are presented in Table 3.4. The results in Table 3.4 show that the commonest maternal perinatal complication in both groups was genital laceration, followed by anaemia. Anaemia was reported at a higher proportion among the cases compared to the controls. Severe or life threatening complications such as PPH, Foetal Malpresentations, Retained Placenta and CPD that would require intervention by trained health professionals were absent among the cases but present in the controls.

Table 3.4: Complications in the mothers

Complications in the mothers	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
Genital Lacerations	116 (48)	39 (48)	77 (48)
Anaemia	60 (25)	28 (34)	32 (20)
None	52 (21)	21 (25)	31 (19)
Caesarean delivery	22 (9)	0 (0)	22 (14)
Foetal Malpresentations	7 (3)	0 (0)	7 (4)
Post-partum Haemorrhage	5 (2)	0 (0)	5 (3)
Cephalopelvic Disproportion	4 (1.7)	0 (0)	4 (2.5)
Retained Placenta	3 (1.2)	0 (0)	3 (2)
Puerperal Sepsis	3 (1.2)	1(1.2)	2 (1.3)
Others	4 (1.7)	1 (1.3)	3 (2)

The clinical complications documented in neonatal life in the babies were also explored in both groups. The documented complications are shown in Table 3.5.

Table 3.5: **Clinical complications in the babies**

Clinical complications in the babies	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
None	103 (43)	28 (34)	75 (47)
Premature baby	68 (28)	38 (46)	30 (19)
Low Birth Weight	62 (26)	35 (43)	27 (17)
Caput succedaneum	34 (14)	9 (11)	25 (16)
Cord Complications	31 (13)	0 (0)	31(0)
Hypothermia	18 (7.4)	18 (22)	0 (0)
Respiratory Distress Syndrome	9 (3.7)	3 (3.7)	6 (3.8)
Hypoglycaemia	5 (2)	5 (6)	0 (0)
Neonatal Sepsis	3 (1.2)	2 (2.4)	1 (0.6)
Congenital Malformations	3 (1.2)	1 (1.2)	2 (1.3)
Neonatal Jaundice	2 (0.8)	2 (2.4)	0 (0)
Anaemia	1 (0.4)	0 (0)	1(0.6)
Others	3 (1.2)	1(1.2)	2 (1.3)
None	103 (43)	28 (34)	75 (47)

The proportion of prematurity, low birthweight, hypothermia and hypoglycaemia observed were higher in the case than the controls. Cord complications were reported in the controls while none were documented in the cases because the labour and delivery were outside the facility. Congenital Malformations documented across both groups were club foot, cleft lip, cleft palate and polydactyl. Conditions listed as ‘others’ was Hypoxic Ischeamic Encephalopathy in one of the babies in the case group and Birth Asphyxia in two babies in the control group. Overall, babies who had no complications were more among the controls than the cases.

3.5 Process and Exit Outcomes

The process and exit outcomes of the mothers and babies in both the BBBAs and non-BBBAs groups were also explored. Starting with the duration of stay in the hospital after delivery, which is the number of days spent before discharge or transfer or death. The results of the duration of stay in hospital for the babies and mothers are shown in Table 3.6.

Table 3.6: Duration of Hospital Stay in mothers and babies

Duration of Hospital Stay (Days)	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
0	2 (0.8)	0 (0)	2 (1.3)
1-2	211 (87)	79 (96.3)	132 (82.5)
3	25 (10.2)	1(1.2)	24 (15)
>3	4 (2.0)	2 (2.4)	1 (1.2)

Mothers and babies normally have the same hospital stay in terms of the number of days spent in hospital before discharge and they are usually discharged at the same time. All babies in the case group stayed at least one day because they were brought alive in contrast to the control group where the stillbirths did not stay for one day. However, the mothers of the stillbirths stayed for one day before discharge. This explains the difference between hospital stay of mothers and babies. The majority of the mothers and babies that stayed for 3 days in the control group were delivered by caesarean sections. It was a standard hospital practice to put patients that underwent C/S delivery on observations and treatment for at about 72hours after delivery. The highest hospital stay was seen in two patients among the cases. They

stayed for 7 days and 16 days respectively. Other **process and exit outcomes** in the babies and mothers are shown in Table 3.7 and 3.8 respectively.

Table 3.7: **Other Process and Exit Outcomes (Babies)**

Process and Exit Outcomes	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
Used antibiotics	13 (5.4)	6 (7.3)	7 (4.4)
Used blood transfusion	0 (0)	0 (0)	0 (0)
Used Phototherapy	2 (0.8)	2 (2.4)	0 (0)
Used oxygen for more than 6 hours	19 (8)	8 (10)	11 (7)
Referral to higher level hospital	1(0.4)	1 (1.2)	0 (0)
Death/Stillbirths	5 (2)	2 (2.4)	3 (2)
Refused hospital Treatment	2 (0.8)	0 (0)	2 (1.3)

Table 3.8: **Process and Exit Outcomes (Mothers)**

Process and Exit Outcomes	All (N=242) n (%)	Case (N=82) n (%)	Control (N=160) n (%)
Used Antibiotics used	29 (12)	2 (2.4)	27(17)
Used blood transfusion	4 (1.7)	1 (1.2)	3 (1.9)
Used oxygen for more than 6 hours	1 (0.4)	0 (0)	1 (0.6)
Referral to higher level hospital	1 (0.4)	1 (1.2)	0 (0)
Death	0 (0)	0 (0)	0 (0)
Refused hospital Treatment	2 (0.8)	0 (0)	2 (1.3)

3.6 Factors Associated with delivering a BBBA

Table 3.9: Socioeconomic and clinical factors associated with the delivery of BBBA

Variable	Crude OR (95% CI)	P-value	Adjusted OR (95%CI)	P-value
Age				
<35 years	1.0	0.0223	1.0	0.3760
≥35 years	2.16 (1.11-4.22)		1.53 (0.59-3.97)	
Marital Status				
Ever married	1.0	0.0367	1.0	0.1050
Single (Never married)	2.47 (1.04-5.90)		2.71 (0.81-9.05)	
Employment Status				
Employed	1.0	0.0475	1.0	0.7090
Unemployed	2.95 (0.98- 8.89)		0.75 (0.17-3.28)	
Education status				
>Primary	1.0	0.0000	1.0	0.0040
≤Primary	5.02 (2.81- 8.96)		2.98 (1.42-6.27)	
Race				
Non Black African	1.0	0.0050	1.0	0.1240
Black African	4.14(1.40-12.23)		2.91(0.75-11.31)	
Distance from home to Hospital				
<10km	1.0	0.2430		
>10km	0.73 (0.42-1.24)			
Parity				
<5	1.0	0.0322	1.0	0.6650
≥5	2.20 (1.06-4.58)		1.26 (0.44-3.54)	
Booking Status				
Booked	1.0	0.0006	1.0	0.7110
Unbooked	5.34(2.21-12.92)		1.26 (0.37-4.26)	
Booking Trimester				
Early Booking	1.0	0.0005	1.0	0.12100
Late Booking	4.51 (1.83-11.2)		2.43 (0.79-7.4)	

Adequacy of ANC visits Sufficient (≥4 ANC visits) Insufficient (<4 ANC visits)	1.0 5.02 (2.79-9.04	0.0000	1.0 3.86 (1.62-9.21)	0.0020
Gestational age at Delivery Term Preterm	1.0 3.74 (2.08-6.74)	0.0000	1.0 2.43 (1.14-5.21)	0.0210
Time of Delivery Day time Night Time	1.0 7.06(3.75-13.31)	0.0000	1.0 9.05(4.15-19.67)	0.0000
HIV Status Negative Positive	1.0 0.76 (051-1.65)	0.7786		

In the univariate analysis, some factors were associated with home delivery of BBBAS because their P-values were less than 0.05. These were: age greater than or equal to 35 years, single marital status, unemployment, black African race, parity greater than or equal to 5, being unbooked for ANC, late booking for ANC ,insufficient ANC visits, preterm gestational age at delivery and delivery at night (Table 3.9). However, living at more than 10km from the hospital and HIV positive status were not associated with the home delivery of BBBAs in the univariate analysis because their P-values were greater than 0.05. Therefore, these two factors were not entered into the multivariate logistic regression model to determine the adjusted odd ratios after adjusting for other factors (Table 3.9).

In the multivariate logistic regression, primary education or below (p= 0.0040), fewer than 4 ANC visits (p=0.0020), preterm gestational age at delivery (p=0.0210) and night time delivery (p=0.000) were associated with the delivery of BBBA. Age≥35 years, single marital status, Black African race, parity≥5, unbooked for ANC and late booking for ANC were not associated with the delivery BBBAs because their p-values were >0.05 even when their adjusted ORs were greater than 1. Unemployment was also not associated with the delivery of BBBAs.

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CHAPTER 4

4 DISCUSSION

This research explores the factors associated with home deliveries of BBBAs. The study finds that maternal factors such as primary education or below (p= 0.0040), fewer than 4 ANC visits (p=0.0020), preterm gestational age at delivery (p=0.0210) and night time delivery (p=0.0000) may influence the delivery of babies outside the hospital. This chapter discusses these findings in the light of the literature review and highlights the public health relevance of the factors associated with the delivery of BBBAs in this study.

Maternal age is an important demographic factor that influences decision to either deliver neonates at home or at a health facility (Mehari, 2013; Garg et al, 2010; Pradhan, 2005). The age range of the mothers in this study is within the South African reproductive age range from 15-49 years (StatsSA, 2011). Advanced maternal age (maternal age ≥35 years) is not statistically associated with home delivery of BBBAs. This result is not in agreement with other studies done in rural Asia and Africa which found association between advanced maternal age and delivering babies at home (Mehari, 2013; Garg et al, 2010; Pradhan 2005). According to such studies, maternal age ≥35 years is usually accompanied with more childbirth experience and mothers in that age bracket were believed to incline towards delivering babies at home especially if there were no complications in previous childbirths (Mehari, 2013 Montagu et al. 2011; Eyerusalem 2010).

Being a single woman was not associated with the delivery of BBBA in this study. Marital status is however, well-known from previous studies as a determinant factor

for choice of place of delivery in pregnant women (Moindi et al, 2016; Ogolla, 2015; Envuladu et al, 2013, Gabrysch & Campbell, 2009, Pradhan, 2005). These previous studies found an association between been ever married (married, divorced or widowed) and home delivery. In contrast to those studies where the larger proportions of the women in those countries are married, a larger proportion of the mothers of BBBAs are single (never married) in this study. The possible explanation could be that the rates of being married among people aged between 20 years and 45 years in South Africa is low (StatsSA, 2012), there are more single women in the reproductive age group of the population than married women. According to the 2011 population, 55 % of South African people who were between 20 and 45 years were never married (StatsSA, 2012). This is in contrast to those countries where those studies found that being married is associated with home deliveries. In such countries, the culture of marriage is very strong and a much higher population in those Asian and Sub-Saharan countries are married.

Employment is an indicator of individual economic power and status through the earning of income (Jacobs & Slaus, 2010). This study used employment status as a proxy for the socioeconomic status of the mothers. This is because the household income bracket of all the women could not be obtained from their medical records as it was not readily available. From this study, unemployment which may imply low socioeconomic status in the mothers was not associated with the home delivery of BBBAs. This study does not agree with findings in other studies which found association between low socioeconomic status and home delivery (Ogolla, 2015; Envuladu et al, 2013; Mehari, 2013, Iyaniwura & Yusuf, 2009 and van Eijk et al, 2006). The reason for the finding in this study may be that large proportions of the

patients in both groups are unemployed because of the high unemployment rate in rural South African population (Andrew & Jacob, 2009; Makgetla, 2008)

In other studies, there is established association between low educational attainment (primary level or no formal education) and home delivery (Abdella et al, 2017; Sprague et al, 2016;Envuladu et al, 2013; Mehari, 2013; Adelaja, 2011; Iyaniwura & Yusuf, 2009; Mrisho et al, 2007; van Eijk et al, 2006; Stephenson et al, 2006) . This study agrees with those studies as primary level or no formal education was found to be associated with the home delivery of BBBAs. A higher education attainment influences the amount of knowledge and understanding a pregnant woman would have about risks in pregnancy, labour and deliveries and enhances the tendency to deliver in a health facility than at home (Abdella, et al, 2017; Sprague et al, 2016; Anyait et al, 2012)

There were a significantly higher proportion of blacks amongst the cases than the controls, but neither the Caucasians (white people) nor the Asians selected in this study delivered outside the hospital. This study however revealed no association between race and the home delivery of BBBAs. This may be because of the small sample of non-blacks. The higher proportions of Black Africans in this study reflect the population distribution in the settlement where the study was conducted (StatsSA, 2011).

Several studies have demonstrated that living more than 10km from a health facility is associated with home delivery (Moindi et al, 2016; Ogolla, 2015; Mpebeni et al, 2007; van Eijk et al, 2006). It is believed that this distance limits the physical access of the women to their nearest health facility (Moindi et al, 2016). The distance will

require probably more than one hour walk for the pregnant woman to reach the facility if she does not have a means of transport or have no money to pay for available transport (Moindi et al, 2016; Ogolla, 2015; Mpebeni et al, 2007). But the results from this study shows that there is no association between living more than 10km from the health facility and home delivery of BBBAs even in the univariate analysis. The reason is because of similar proportions of mothers living more than 10km to the facility in both the BBBA cases and the hospital deliveries. This study is consistent with another South African study which found no association between distance more than 10km from home to health facility and home delivery (Parag et al, 2014). The reason for the finding this study is similar to the reason adduced by Parag et al for their finding in 2014.

Among the clinical factors that may influence the choice of place of delivery is parity. In this study, grandmultiparity (parity ≥5 in the number of viable childbirths) was also not associated with the delivery of BBBAs. This finding is not in agreement with the findings in some studies done in rural African and Asian settlements which found association between the parity (≥5) of pregnant women and home deliveries (Sprague et al, 2016; Mehari, 2013; Agha &Carton, 2011; Montagu et al. 2011; Eyerusalem 2010; van Eijk et al, 2006; and Pradhan 2005). The explanation for those findings was that mothers with more childbirth experience have the tendency to deliver neonates at home especially if there were no complications in previous childbirths (Mehari, 2013; Montagu et al. 2011; and Eyerusalem 2010). However, that cannot be said about this study because statistical evidence shows otherwise, despite the aOR for delivering a BBBA being slightly in favour of grandmultiparous women. The reason for this finding may be the small sample size of this study.

The booking for antenatal care is important to the monitoring of the pregnancy and the plans for the delivery of the pregnant woman. This study reveals that there is no association between being unbooked for ANC and home delivery of BBBAs. This finding is not consistent with the findings in some other studies that reported association between unbooked for ANC and home deliveries (Parag et al, 2014; Bassingthwaighte, 2013; Ochako et al, 2011; and Geberehiwot, 2009). This finding can be explained by the high proportions of patients who booked for ANC in both the BBBA cases and the hospital deliveries.

The timing of the first antenatal visit is important to the type and place of delivery assistance that the pregnant woman could utilise (Ochako et al, 2011). In this study, the uptake of antenatal care is high. However, the timing of the first ANC visit was not impressive in both groups. Early booking for ANC in the first trimester is recommended by the World Health Organisation (Villar et al, 2001). However, smaller proportions of the women in both group booked early for ANC. In the univariate analysis, the odds for delivering BBBA are almost 5 times more likely in a late booker. Yet after adjusting for other factors, this study found no statistically significant association between late booking for ANC and the home delivery of BBBAs. The finding is not consistent with the findings in other studies where late initiation of antenatal care was associated with home delivery (Ochako et al, 2011; Fotso et al, 2008; and Magadi et al, 2000). This is probably because larger proportions of both the cases and controls in this study booked late for ANC. The small sample size in this study may also be contributory to this finding.

The sufficiency of the number of ANC visits is one of the predictors of the choice of a whether a pregnant woman will deliver at home or in health facility (Gultie et al,

2016). The results of this study shows that women who had fewer than 4 ANC visits are more likely to have a home delivery of BBBAs than mothers who had four or more ANC visits. This finding corroborates other studies that found the link between less than 4 ANC visits in pregnancy and delivery outside health facilities (Gultie et al, 2016; Ochako et al, 2011; Geberehiwot, 2009; and Nketiah-Amponsah and Sagoe-Moses 2009). The WHO recommended at least 4 ANC visits as minimally sufficient during pregnancy (Villar et al, 2001). The more frequent a pregnant woman visits ANC, the more the likelihood of her delivering at a health facility and vice versa (Ochako et al, 2011). It is believed that a woman who had 4 or more ANC visits is more likely to be equipped with more information and understanding of the importance of delivering in a health facility (Gultie et al, 2016; Ochako et al, 2011; Villar, 2001). The attitudes of such women are believed to show less apathy toward hospital delivery due to their familiarity with the health facility environment and services (Gultie et al, 2016; Ochako et al, 2011; Geberehiwot, 2009).

This study examined a possible link between home deliveries and preterm gestational age at delivery. In this study, the proportion of the cases who delivered at a preterm gestational age is twice those of the controls. This means that the likelihood of preterm delivery is twice in the mothers of the BBBAs compared to the hospital delivery. This study found an association between preterm gestational age at delivery and home deliveries of BBBAs. There are different possible explanations for this finding. The onset of preterm labour at home may limit access of the pregnant woman to tocolytics that can be used to stop premature labour in hospitals. Mothers who did not book for ANC and or had insufficient ANC visits in pregnancy may be lacking in knowledge about the symptoms of labour onset, or they may be

deficient in the knowledge about the actual timing of delivery at term or they may not have access to transport to hospital at the onset of premature labour. Overall, an early, unexpected and unplanned labour would have resulted in a premature delivery of BBBAs before the mother have the chance to reach the hospital. All these factors may contribute to premature delivery.

There have been studies that have associated home deliveries with the onset of labour at night (Tann et al, 2007; van Eijk et al, 2006; Scot & Esen, 2005). The result from this study also found a similar association between home deliveries of BBBAs and delivery at night time. The delivery of neonates at home at night might have been due to different factors such as lack of transport at night and lack of security at night which may have prevented mothers from coming to the hospital immediately after labour commenced.

This study also found no association between existence of HIV infection in the mother and home delivery of BBBAs. This finding is tandem with the finding from another South African study which also found no association between home delivery and being HIV positive (Parag et al, 2014) .

The clinical events and risks in pregnancy were also explored in both groups. The proportion of mothers who delivered BBBAs at home that had common obstetric conditions like Pregnancy induced hypertension, Urinary Tract Infection in Pregnancy, Anaemia in Pregnancy and Vaginal Discharge Syndrome were more than the hospital deliveries. Overall, the proportions of mothers who had no clinical risks or event in pregnancy were similar in both the case and the controls. The proportions of mothers that had at least one perinatal complication were slightly

more in the controls than the cases. Also the more severe or life threatening complications such as PPH, foetal malpresentation, retained placenta and CPD that would require intervention by trained health professionals were absent among the cases but present in the controls. This is in contrast to other studies where more severe or life threatening complications were more prevalent in mothers who delivered outside health facilities (Parag et al, 2014; Bassingthwaighte, 2013; Scott & Esen, 2005 ; Bang et al, 2004).

The explanation for this study finding with regards to severity and frequency of maternal perinatal complications is because the health professionals were able to identify these conditions and document them during the course of monitoring labour and delivery of the mothers who delivered in the hospital. This is in contrast to home deliveries where there may be no one to recognise and document any complications that may have arisen in labour and delivery at home. It is also possible that there could be bias by health professionals towards recording the complications for mothers who delivered in hospital compared to the mother of BBBAs who may be given less attention because they were not being seen as much responsibility as those who were delivered in the hospital. Another reason is that if a baby is delivered at home as a stillbirth because of CPD and fetal malpresentation, the baby may not have been brought as a BBBA and will be undocumented. Also, a maternal death from PPH or retained placenta may also not have been brought to hospital and therefore, may not be documented. Generally, complications in labour and delivery are more likely to be identified and reported in the hospital deliveries than the deliveries of BBBAs.

In this study, complications such as prematurity, low birthweight, hypothermia, and hypoglycaemia were more prevalent in the BBBAs compared to the babies born in the hospital. This consistent with other studies which found that BBBAs are more prone to such complications (Parag et al, 2014; Scott & Esen, 2005; Seghal et al, 2001). In this study, preterm gestational age at delivery was associated with having a BBBA. Therefore, it appears that preterm deliveries were responsible for higher prevalence of prematurity and low birthweight in BBBAs because the labour was early and unexpected and may not give the pregnant mother the chance to reach the hospital before the baby is delivered as a BBBA (Adhikari et al, 2016). Furthermore, hypoglycaemia, neonatal sepsis, neonatal jaundice and higher risk of exposure to HIV from the mother were more frequent in the BBBAs than the hospital deliveries as documented in others studies (Bassingthwaighte, 2013; Chopra et al, 2009; and Scott & Esen, 2005).

Again, premature and low birthweight BBBAs delivered during preterm deliveries are clinically vulnerable to developing neonatal jaundice, hypoglycaemia and neonatal sepsis because of immature liver, inadequate glycogen stores and immature immunity respectively (Adhikari et al, 2016). Cord complications were more in the hospital deliveries but the majority of them were ‘cord-round-the-neck’ noted during delivery but which could not have been documented for home deliveries because the labour and delivery process were not monitored by a trained health professional.

4.1 STUDY LIMITATIONS

The following are some of the limitations of this study:-

- The cases and controls could not be matched due to many characteristics of both groups that make it practically difficult to do so. Theoretically, each case should have been matched with a control that delivered on the same day with the same age and parity. However, the relatively low number of deliveries in a rural hospital such as Swartruggens renders such matching impossible.

- Employment was used as a proxy of socioeconomic status because the household income could not be obtained from the patients' records. This could only have been obtained by interviewing the patients. Employment may not be a good proxy for socioeconomic status because some unemployed women may have partners that are employed and earning a good income.

- Apgar scores would have been one the best indicators for comparing the outcomes of the babies in the two groups, but the Apgar scores of the BBBAs are not available because their delivery was not supervised by health professionals.

- The use of records review as a means of data collection is not entirely reliable to ensure good quality of data is collected. Over time, data may become missing due to incomplete entry, or lost records or misfiling. The quality of data relies heavily on the efficiency of those who entered the records and the manner of storage of the records (Sarkar & Seshadri, 2014). However, it is a pragmatic and efficient approach to auditing a health outcome like this.

4.2 CONCLUSIONS

The aim of this research was to determine the socio-demographic and clinical factors associated with the deliveries of babies 'born before arrival' at Swartruggens Hospital between 2013 and 2014. The conclusions from this study are as follows:

- The sociodemographic factor associated with delivering a baby 'born before arrival' at Swartruggens Hospital between 2013 and 2014 is the lack of education beyond primary school level.

- The clinical factors associated with delivering a baby 'born before arrival' at Swartruggens Hospital between 2013 and 2014 are fewer than 4 ANC visits, preterm delivery and delivery of babies at night time.

- The frequency of poor clinical outcomes was higher in the BBBAs than in the babies delivered in the hospital. BBBAs were more likely to be born during preterm labour as premature, low birthweight neonates. These make them more susceptible to further complications such as hypothermia, hypoglycaemia, neonatal jaundice and neonatal sepsis.

4.3 RECOMMENDATIONS

- It is important for government to prioritize the provision of quality education to the girl-child up to the secondary level, at the least.
- The need to book early for pregnancy, attend at least four ANC visits and deliver in health facilities must be emphasized to all pregnant women through communication channels such as local radio, distribution of fliers, and holding town hall meetings with community leaders and rural residents so as to educate rural communities on the subject matter.
- Existing strategies for communicating maternal health education messages (such as MumConnect) must also be made available to women who are not pregnant but intending to get pregnant. This will enable women in pre-conception stage to receive health messages on healthy pre-conception lifestyle and the importance of early booking. This type of women can be registered by the nurses in the clinic facilities and mobile clinics as well as community health workers (CHWs) in Ward-Based Outreach Teams. Early booking is more likely to improve the numbers of ANC visits and therefore improve the chances of facility-based delivery in such pregnant women.
- Increase accessibility to patients' transport during the night. For example, all rural government hospitals should be allocated an on-site ambulance that is specifically assigned to maternity services. This can be used for transporting pregnant women to a health facility for delivery especially if they go into labour at night, irrespective of the distance of their home to the hospital.

- Further research is required to have in-depth understanding of the factors influencing the delivery of BBBAs, from the mothers' perspective. A qualitative cross-sectional study can be done in the future to examine factors influencing home deliveries in the mothers of BBBAs. A fully-matched case-control study with a larger sample size may also be done in the future to explore the factors associated with the delivery of BBBAs. A large sample size will improve the internal and external validity of the proposed study (Faber & Fonseca, 2014).

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PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

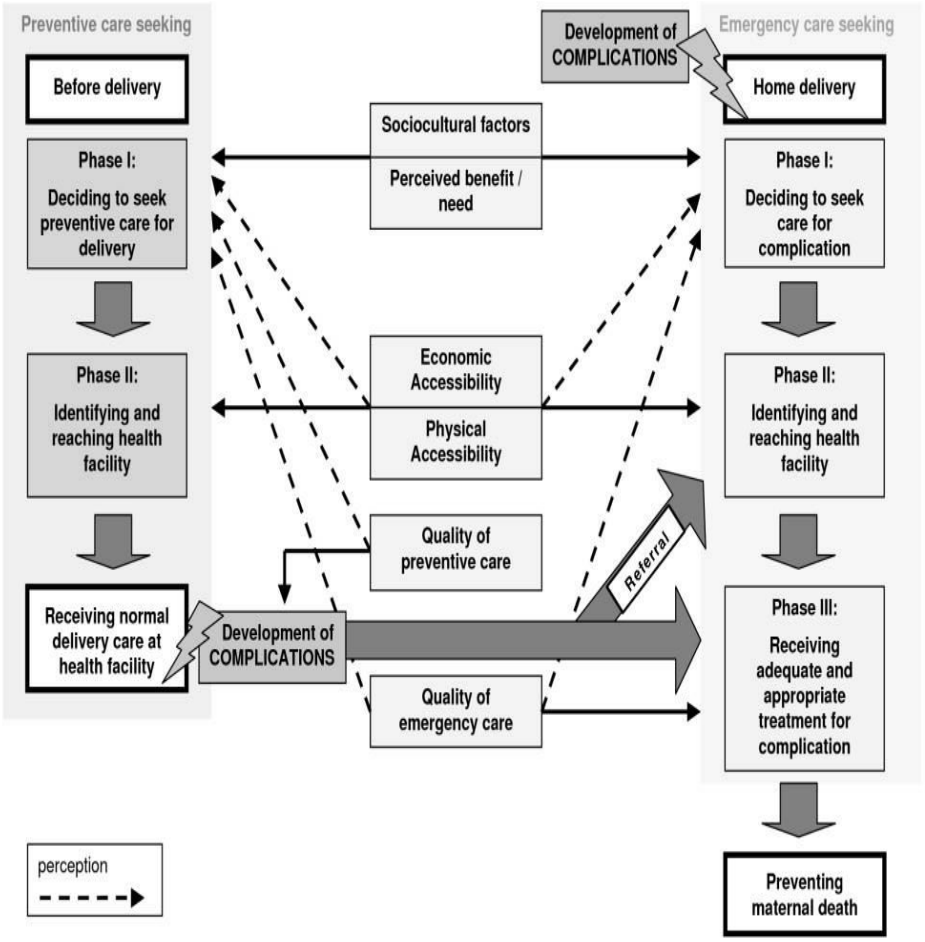
I **Oladotun Koledola Oluwole** (Student number: **886246)** am a student registered for the degree of **Master of Public Health (Rural Health)** in the academic year **2018**.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission And /or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature: _____Date: **04/10/2018**

APPENDIX 2



PHASES OF DELAYS IN SEEKING MATERNITY CARE

Gabrysch, S., Campbell, O.M.R. 2009. Still too far to walk: Literature review of the determinants of delivery service use. *BMC Pregnancy and Childbirth, (9) 34*

APPENDIX 3

SAMPLE SIZE CALCULATION

Two-sided confidence level (1-alpha)	95
Power(% chance of detecting)	80
Ratio of Controls to Cases	2
Hypothetical proportion of controls with exposure	40
Hypothetical proportion of cases with exposure:	60
Least extreme Odds Ratio to be detected:	2.25

	Kelsey	**Fleiss**	**Fleiss with CC**
Sample Size - Cases	74	73	**80**
Sample Size - Controls	147	145	**160**
Total sample size:	221	218	**240**

APPENDIX 4

DATA CAPTURE SHEET

SUBJECT CODE ID…….

GROUP: CASE (1)…. CONTROL (2)….. (Mark √)

SECTION A

SOCIODEMOGRAPHIC VARIABLES

1. MARITAL STATUS (mark √)

Single	1
Married	2
Divorced	3
Widowed	4

2. EMPLOYMENT STATUS (mark √)

Unemployed	1
Employed	2

3. EDUCATION STATUS (mark √)

No Education	1
Primary	2
Secondary	3
Post-Secondary	4

4. AGE_____(enter figure)

5. RACIAL GROUP: (mark √)

Black (African)	1
Caucasian	2
Asian	3
Coloured	4

6. ESTIMATED DISTANCE FROM HOME TO HOSPITAL (mark √)

Estimated >10km	1
Estimated<10km	2

SECTION B

CLINICAL VARIABLES

1. PARITY_____(enter figure)

2. BOOKED FOR ANC? (mark √)

Unbooked	1
Booked	2

3. IF BOOKED, TRIMESTER OF BOOKING? (mark √)

1st Trimester	1
2nd Trimester	2
3rd Trimester	3
Booked at Delivery	0

4. SUFFICIENCY OF ANC VISITS? (mark √)

Insufficient (Attended < 4 ANC visits)	1
Sufficient (Attended 4≥ ANC visits	2

5. GESTATIONAL AGE AT DELIVERY (mark √)

< 32 weeks	1
32-36 weeks	2
> 36 weeks	3

6. TIME OF DELIVERY (mark √)

6pm-6am (Night)	1
6am-6pm (Day)	2

7. HIV STATUS? (mark √)

.HIV Positive	1
HIV Negative	2

8. IF HIV POSITIVE, USED ARVS FOR PMTCT? (mark √)

Used PMTCT	1
Defaulted PMTCT	2
Never used PMTCT	3
Not Applicable	0

9. BOOKING BLOOD PRESSURE (mark √)

. <140/90 mmHg	1
>140/90 mmHg	2
Not Applicable	0

10. BOOKING HAEMOGLOBIN: (mark √)

. ≤10g/dL	1
>10g/dL	2
Not Applicable	0

11. CLINICAL EVENTS/ RISKS IN PREGNANCY (mark √)

	Yes	No
Hypertension in Pregnancy	1	0
Diabetes Mellitus	1	0
Urinary Tract Infection	1	0
Vaginal Discharge Syndrome	1	0
Anaemia in pregnancy	1	0
Hyperemesis Gravidarum	1	0
Multiple gestation	1	0
Polyhydraminos	1	0
Oligohydraminos	1	0
Preeclampsia Toxaemia	1	0
Eclampsia	1	0
Dyspepsia	1	0
Fetal Macrosomia/Big Baby	1	0
Pulmonary Tuberculosis	1	0
Asthma	1	0
Epilepsy	1	0
Psychiatry Conditions	1	0
Previous Caesarean Section	1	0
Ante partum Haemorrhage	1	0
IUGR	1	0
PROM	1	0
Others	1	0

None	9	0

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SECTION C

PERINATAL COMPLICATIONS

1. COMPLICATIONS IN THE MOTHERS (mark √)

	Yes	No
Genital Lacerations	1	0
Post-partum Haemorrhage	1	0
Fetal Malpresentations	1	0
Retained Placenta	1	0
Eclampsia	1	0
Anaemia	1	0
Puerperal Sepsis	1	0
Caesarean Delivery	1	0
CPD	1	0
Others	1	0
None	9	0

2. COMPLICATIONS IN THE BABIES (mark √)

	Yes	No
Premature Baby	1	0
Low Birthweight	1	0
Hypothermia	1	0
Neonatal Jaundice	1	0
Neonatal Sepsis	1	0
Cord Complications	1	0
Anaemia	1	0
Caput Succedaneum	1	0
Hypoglycaemia	1	0
Respiratory Distress	1	0
Congenital malformations	1	0
Others	1	0
None	9	0

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SECTION D

PROCESS AND EXIT OUTCOMES IN BABY

Duration of stay in hospital(number of days)		
	Yes	**No**
Antibiotic used	1	0
Used blood transfusion	1	0
Used oxygen more than 6 hours(Babies only)	1	0
Referral to higher level hospital	1	0
Death/Still births	1	0
Refused hospital treatment	1	0

PROCESS AND EXIT OUTCOMES IN MOTHER

Duration of stay in hospital(number of days)		
	Yes	**No**
Antibiotic used	1	0
Used blood transfusion	1	0
Used Phototherapy (Babies only)	1	0
Used oxygen more than 6 hours(Babies only)	1	0
Referral to higher level hospital	1	0
Death/Still births	1	0
Refused hospital treatment	1	0

APPENDIX 5

WITS ETHICAL CLEARANCE LETTER

R14/49 Dr Oladotun Koledola Oluwole

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170307

NAME: (Principal Investigator)	Dr Oladotun Koledola Oluwole
DEPARTMENT:	School of Public Health Swartruggens Hospital, North West Province
PROJECT TITLE:	Socio-demographic and clinical factors associated with the deliveries of babies 'born before arrival' at Swartruggens hospital between 2013 and 2014
DATE CONSIDERED:	31/03/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Ian Cooper and Dr Mary Kawonga
APPROVED BY:	Prof P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	03/04/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in March and will therefore be due in the month of March each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 6

APPROVAL LETTER: NORTH WEST DEPARTMENT OF HEALTH

health
Department of
Health
North West Province
REPUBLIC OF SOUTH AFRICA

Cnr Sekame & First Street
New Office Park
Mafiheng, 2745
Private Bag X2068
MMABATHO, 2735

Enq: Nthabiseng Mapogo
Tel: 018 391 4504
Fax: 018 388 6202
NMapogo@nwpg.gov.za
www.nwhealth.gov.za

2030 NDP

POLICY, PLANNING, RESEARCH, MONITORING AND EVALUATION

Name of researcher : **Dr. O. K. Oluwole**
University of the Witwatersrand

Physical Address (Work/ Institution) Swartruggens Hospital Swartruggens 2835.

Subject : **Research Approval Letter–Socio-demographic and clinical factors associated with the deliveries of babies 'Born Before Arrival' at Swartruggens Hospital between 2013 and 2014.**

This letter serves to inform the Researcher that permission to undertake the above mentioned study has been granted by the North West Department of Health. The Researcher is expected to arrange in advance with the chosen facilities, and issue this letter as proof that permission has been granted by the Provincial office.

This letter of permission should be signed and a copy returned to the department. By signing, the Researcher agrees, binds him/herself and undertakes to furnish the Department with an electronic copy of the final research report. Alternatively, the Researcher can also provide the Department with electronic summary highlighting recommendations that will assist the department in its planning to improve some of its services where possible. Through this the Researcher will not only contribute to the academic body of knowledge but also contributes towards the bettering of health care services and thus the overall health of citizens in the North West Province.

Kindest regards.

Dr. FRM Reichel
Director: PPRM&E

LEPAPHA LA BOITEKANELO
DEPARTMENT OF HEALTH
Kgetsana Poso /Private Bag X2068
Mmabatho,2735
21 APR 2017
NORTH WEST PROVINCE
REPUBLIC OF SOUTH AFRICA

29/04/2017
Date

Researcher

25/04/2017
Date

1

Healthy Living for All