RISK FACTORS FOR LOW BIRTH WEIGHT FOR TEENAGE MOTHERS IN TSHWANE DISTRICT

By

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Master of Science in Epidemiology

University of Pretoria

Pretoria, Gauteng

2017

Submitted to the School of Health Systems and Public Health in the Faculty of Health Sciences in partial fulfilment of the requirements for the degree of MASTERS OF SCIENCE IN EPIDEMIOLOGY

May 2017

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Acknowledgements

I would like to thank my supervisors, Dr Bernice Harris, Mrs Loveness Dzikiti, and Prof Shinga Feresu. Your guidance meant a lot.

My colleagues in the BCMP program at the University of Pretoria for giving me space to study and concentrate, thanks so much. Friends, Precious Hajison for being there to advise and guide, you were a great support in this adult education journey; Fikile Klaas you meant a lot on this journey through your pushing and nagging.

I really appreciate all the personnel who assisted in the four study centres and for allowing me to access information; as well as creating room for my comfort during data collection

To my family in Malawi who constantly prayed for me and believed that I can achieve anything that I put my mind on, I really appreciate. All friends and family, I really appreciate your encouragement and support

Godfrey Tshotetsi, thanks for giving me time to study as well as for praying for me. A special thanks to my two beautiful teen research assistants; my twin daughters Itumeleng Lily and Boitumelo Lynn Tshotetsi for collecting data with me; all the encouraging words, “you can do it momma, you are clever,” and sitting in when I needed someone. You grew to be the best motivators I have had in life. I couldn’t ask anything better than you. *I dedicate this work entirely to you my princesses.*

Declaration

I declare that the dissertation, which I hereby submit for the degree Master of Science (MSc) in Epidemiology at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

University of Pretoria Ethic Committee Protocol Reference No: *214/2016*

UP Ethics Committee Approval Date: *30/06/2016*

Department of Health, Tshwane Research Committee Ref No*: 28/2016*

Tshwane Research Committee Approval Date: *01/08/2016*

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Executive summary

Introduction: The magnitude of low birth weight was estimated to be 13% globally in 2013 by UNICEF. Some studies have alluded that adolescence is associated with low birth weight. This study was done to assess whether teenage mothers had the same risk factors for low birth weight as the adult mothers in Tshwane District.

Method: A case control study of retrospective data was done comparing low birth weight babies of teenage mothers and low birth weight babies of adult mothers for January to December of 2014. Normal birth weight babies were selected as controls from the same age groups with 1:1 ratio. A total sample size of 1 073 was reached and data analysis using STATA 14® was done to identify risk factors.

Results: Out of a total sample of 1 073, about 77 % were adult mothers and 23% teenage mothers. Our study confirms that mothers are at an increased risk for low birth weight when they deliver prematurely OR 6.81, 95% confidence interval (CI) 3.41 to 13.60 and p value <0.001. Women who attend 4 or less antenatal visits had increased odds (OR 1.39, 95% CI 1.03 to 1.86 and p value 0.028) of delivering a low birth weight baby than mothers who attended 5 or more times. When mothers were grouped by age, teenage mothers were more likely to deliver a low birth weight baby when they delivered prematurely (AOR 5.81, 95 % CI 2.27 to 14.07; p value <0.001) while for adult mothers, delivering prematurely (AOR 6.58, 95% CI 3.38 to 12.82; p value <0.001) and attending antenatal care less than 4 times (AOR 1.33, 95 % CI 1.02 to 1.72; p value 0.032) were risk factors. We further found that delivering preterm low birth weight babies was associated with young maternal age (AOR 0.47; 95% CI 0.31 to 0.71; p value <0.001) and attending less than 4 antenatal visits (AOR 1.92, 95% CI 1.06 to 3.47; p value 0.030).

Conclusion: This study is the first to stratify risk factors for low birth weight for teenage mothers in Tshwane District. Teenage mothers are less likely to deliver low birth weight babies though they have a higher risk if they deliver prematurely.

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RISK FACTORS FOR LOW BIRTH WEIGHT FOR TEENAGE MOTHERS IN TSHWANE DISTRICT

1. Chapter One: Introduction

1.1 Low birth weight

Low birth weight (LBW) is a global challenge because it accounts for many neonatal deaths. In 2015, about 146 million babies were born[1] worldwide though the numbers have been increasing since 2012.[2, 3] Unfortunately, in 2013, about 2.8 million babies died in their first month of life; 1 million or 36 % died on the first day of life as reported by United Nations Children's Fund (UNICEF).[3]

In 2013, UNICEF further reported that there were 22 million LBW babies globally. However, most of these babies are born outside formal hospital/maternity setting in developing countries where there are health care service inequalities. Data on the magnitude of LBW is unknown because such babies are not weighed.[4] In sub-Saharan Africa, UNICEF reported that 13% of babies born in 2013 had LBW while in South Africa there were 209 738 low birth weight babies, representing 14.8%[5] of births as reported by the Perinatal Problem Identification Program (PPIP) survey.

There are several causes that are attributed to LBW that are foetal or maternal related. For instance, maternal causes include infectious diseases like malaria, hypertension, placental insufficiency, malnutrition and drugs, while foetal causes may be chromosomal abnormalities, congenital infection and congenital malformation.[6]

1.1.1 Public health implication

The World Health Organization (WHO) reports that raising a LBW baby has a financial implication which is evident when caring for the new born, for example to keep the baby warm, hygiene measures in order to prevent illnesses[7] since they are susceptible to getting infections. Unfortunately, studies on the cost of raising LBW children are scarce for low and middle income countries.[8]

Cost analysis research done in Mozambique showed that a household would spend US$ 24.12 (CI 95% 21.51 – 26.26) on hospitalisation and care of a LBW baby; while the health system incurred US$ 169 957.61 (CI 95% 144 900 – 195 500).[8]

There are several attributes that previous research had found as contributory to LBW. These include socio-demographic, medical, reproductive, maternal as well as neonatal causes. The risk is higher if the woman did not receive prenatal care (RR 2.29, CI: 1.94 to 2.72); if her literacy level is low – RR 0.20 (CI: 0.12 to 0.32);[9] those with no antenatal care (ANC) as well as those with anaemia carried a 15% (OR: 1.15; 95% CI 1.02 to 1.64) and 41% (OR: 1.41; 95% CI: 1.06 to 1.88) risk of delivering a LBW baby.[10] Chen's study had similar results and further showed that teenage mothers had a higher risk of LBW – RR 1.14 (CI: 1.13 to 1.14). This shows that if a woman is illiterate, teenaged and fails to attend ANC, she is at a higher risk of delivering a LBW baby.[11]

A study reported that teenage mothers in South Africa have more likelihood of delivering low birth weight babies than older women.[12] This is consistent with studies done within Africa and also globally.[13-15] Since adverse birth outcomes like prematurity and LBW carries higher risk of neonatal death, as reported by WHO, UNICEF and Lloyd, it is vital to know the magnitude of this problem within our district so that measures and services can be tailored to manage it.

LBW does not only affects the new born babies due to an increased susceptibility to infections and death, but also leads to several problems in adult life like high risk of obesity, metabolic syndrome and cardiovascular diseases.[16] Besides, there is an increased risk of LBW babies in subsequent pregnancies for the mother and the child, when she gets older.[16, 17] Since LBW risk is higher in teenage mothers, our study compared the risk factors for low birth weight babies born to teenage mothers' and adult mothers. The findings will increase the body of knowledge in South Africa relating to LBW in the Tshwane District.

1.2 Hypothesis, Aim(s) and Objectives

The overall hypothesis of this study was that low birth weight is dependent on maternal age. The lower the maternal age, the higher the risk for low birth weight for the new-borns.

1.2.1 Aim of the study

The aim of the study was to identify risk factors for low birth weight for teenage mothers (13 – 19 years) in comparison to adult mothers (20 – 35 years) who delivered at selected clinics and hospitals in Tshwane District.

1.2.2 Specific objectives

The specific objectives were to:

1. Determine the proportion of low birth weight babies for teenage mothers;

   We hypothesized LBW to be more in teenage mothers than in adult mothers

2. Compare the risk factors of preterm LBW versus term LBW in Tshwane district

   We hypothesized that risk factors for preterm and term LBW was independent of socio-demographic, reproductive, medical and obstetric, and infections

2 Chapter Two: Literature Review

Literature review for this study was derived from using University of Pretoria database searching for the relevant articles and other information relating to LBW and teenage pregnancy. MEDLINE, PubMed and Google Scholar were the search engines that were used apart from using text books and websites for recognised health organisations on relevant topics (UNICEF and WHO webpages).

2.1 Teenage pregnancy

Pregnant women are at an increased risk of developing anxiety disorders[18] especially when they have psychosocial problems.

Similarly, teenage mothers experience the same life events especially if the pregnancy was unwanted and when they experience adverse social issues. The WHO reports that pregnancy has negative social and economic effects, not only on the pregnant teenage mother, but also on her family and the community.[19] Some pregnant teenage women tend to drop out of school thereby failing to secure employment. This in return affects the economy of the country because her potential to contribute to the country through her academically acquired skills had not been attained. Furthermore, being a mother at a tender age might be distressing for the teenage mother. [19]

Teenage pregnancy in low and middle income countries constitutes 95% of global teenage deliveries. Sub- Saharan Africa contributes 50%, China 2%, and Latin America and the Caribbean contribute 18%. There is variation of births from very young teenage mothers (less than 16 years) in Sub Saharan Africa ranging from 0.03% to 12.2%.[19] South Africa, being part of the Sub-Saharan Africa, with middle income country ranking, experiences the same problem as globally since the percentage of teenage pregnancy was 7.7% as reported by the District Health Information System (DHIS) for 2012/13, while in 2013/14, 7.8% was reported.[20] In 2014 5.6% of females in the age group 14–19 years were pregnant[21] as reported by STATSSA (Statistics South Africa) from the General Household Survey which was released in June 2016. The prevalence of pregnancy rose with age, from 0.6% for females aged 14 years, to 9.7% for females aged 19 years.[21] This clearly indicates that teenage pregnancy remains a public health problem within this country. Furthermore, in South Africa, the age when sex can be consented to is from

between 12 and 16 years[22] which might also contribute to high teenage pregnancy rates, though more research to prove this is vital.

Teenage pregnancy is an international concern because teenagers are at a higher risk of developing gynaecological and medical complications; which may result in the death of the mother, her baby and / or serious disabling complications to the woman.[23]

16 million babies are born to mothers between the age of 15 and 19 years each year, representing around 11% of births worldwide. Teenage mothers in South Africa (SA) contributed 49 births per 1 000 teen mothers per year according to 2013 World Bank statistics.[23, 24]

This South African rate may not be a true reflection of the magnitude of teenage births in South Africa since it only comprises adolescent women of the 15 – 19 age groups, omitting the less than 14-year-old girls. Furthermore, some girls deliver in private maternity facilities not included in the DHIS.[25]

There have been several studies which were done to assess adverse birth outcomes for teenage mothers compared to adult mothers in different countries. A multi-country study done in the United States of America (USA) showed that teenage mothers had more adverse birth outcomes than mothers.[11] The risk for preterm baby delivery for teenagers was 12 % in this study. A Thailand study showed that teenage mothers had 24.1% LBW and 24.3% preterm delivery which was statistically significant (p value 0.01).[26] Unfortunately, the studies could not determine which risk factors within the teenage mothers result in adverse birth outcomes.

A study in South Africa showed that there was no difference between the teenage mothers and older mothers' adverse birth outcomes - 14.3% of teenage mothers had low birth weight compared to 13.7% adult mothers with a statistically insignificant p value of 0.563 [27, 28] which contradicts with the study done in the USA. Studies in Zimbabwe had shown that teenage mothers had adverse birth outcomes including LBW with a frequency of 16.7% in this age group.[9, 29-31]

2.1.1 Causes for teenage pregnancy

The WHO estimates that more than 30% of women in low and middle income countries get married before 18 years of age while 14 % of the women are girls under 15 years.[19]

There have been many factors relating to teenage women becoming pregnant including that the women face pressure from peers, want to prove adulthood or they just want sex for pleasure.[19, 32]

2.1.1.1 Contraceptive use

Contraception is an activity done to prevent pregnancy. There are many contraceptives on the market ranging from intra-uterine devices, tablets, injections and implants, surgical sterilization and including the natural method of sexual abstinence.[33] In South Africa, most of these methods are free for the population to avoid unintended pregnancy.[19] However, some women do not use contraceptives or use the contraceptives inconsistently, which results in unwanted pregnancy. Similarly, teenage women can prevent pregnancy by using contraceptives: unfortunately, as the WHO reports, they either do not have access, or are ashamed to seek the services.[19] A study in Tshwane District of teenage mothers revealed that contraceptive use in teenage mothers, (<16 years) was lower than older teenage mothers due to the side-effects. Apart from this, teenagers felt that contraceptives changed their menstrual pattern, their physical looks, and made them sick.[34] They had relied mainly on their peers for information instead of seeking medical advice. A study done in Ghana recorded that very young teenage mothers were less likely to use contraceptive (9.2%) versus 31.4% usage by older teenagers (18 – 19 years).[32] Furthermore, the same study showed that women who had not attended school (3.2%) and were not working (19.9%), were least likely to use contraceptives than those who were educated, (12.8% and 28.9 % respectively). It may be that those within the poor communities do not understand the importance of contraception and or their access to such services was limited. The study reported 7.39 odds of contraceptive use in teenage mothers with primary education while those who had secondary or higher education was 11.53 times higher.

It may also be that those who are educated and are working would want to keep their jobs hence using contraceptives to prevent unwanted pregnancies. The researcher further

alludes that the teenage mothers may have challenges in using contraceptives due to lack of knowledge on contraceptive options, the importance of contraceptive use and being less sexually active.[32]

Some authors have suggested that it may not always be that the teenagers do not have access or knowledge on contraceptive, it is because they do not have encouragement to use them and or to sustain the use of the contraceptives.[35]

2.1.1.2 Health seeking behaviour

Some teenage women fail to access health services because of lack of youth friendly services. A study done in the Eastern Cape reported that some health professionals still refuse to assist teenagers, which might be a cause for failure to access reproductive health services. One doctor within the study had mentioned that teenagers were being discriminated when receiving treatment.[36] Similarly**,** Oyedele echoes the same in his study as a problem for failure to access health services/ contraceptives.[37]

2.1.1.3 Lack of knowledge on sexuality

Teenage mothers lack information on sexuality in so much that they fall victim of unwanted pregnancy. Mchunu et.al reports that 55.5 % of the adolescents who became pregnant were unaware of the risk as well as how pregnancy is formed. Furthermore, in this study, 74.1% of the participants indicated that their pregnancy was unwanted.[38] Another study confirmed that the information students receive at their schools is inadequate to address all the issues they face regarding sexuality.[39, 44]

In the same study, which took place in Eastern Cape, the authors showed that 71.2 % of the participants did not know the physiology behind pregnancy as well as the risk involved in having unprotected sex which might put them in danger of sexually transmitted infections and HIV. A finding of interest in this study was that the majority of teenage women were not pressured or forced to engage in sexual activities (86.8%), to get married (78.7%) and even to fall pregnant (87.4%) which has been stated by a few studies to be causes of teenage pregnancy. Furthermore, the authors reported that 85% of teenagers had heard about reproductive information from their teachers while 74.1% got the information from clinic nurses and ≤68.5% got the information from their relatives.[38]

Teenagers often resort to seeking information from their peers other than from their parents regarding sex and other issues.[35] Most parents feel that their children are too young for them to discuss sexual issues or feel it is a taboo. Others are not physically involved in the adolescent period of their children which forces these teenage people to seek help and information from other teenagers. This affects the way they conduct themselves because of peer pressure which has been pointed out to be one of the causes for engaging in early sex[19] would be high. Similarly, Mothiba & Maputle echoes to this fact as stated: "Ignorance, aggravated by cultural taboos to discuss sex with one's parents, combined with real or perceived peer group pressure to engage in sexual activities, cause unnecessary heartache for many teenage women."[40]

2.1.1.4 Other causes of teenage pregnancy

Maternal education and parity are distal socioeconomic and reproductive factors of adverse pregnancy outcomes that are also associated with adolescent pregnancy.[41] Some authors have pointed out that the socioeconomic status is a cause of teenage pregnancy because these teens seek favours from the older men hence in exchange for material or financial gifts they offer their own bodies.[37] Early sex initiation is another major cause of teenage pregnancy. In a study from Limpopo, 62% of teenagers less than 16 years had indicated that they had sexual intercourse already, while a further 4% started having sex between 10 and 12 years of age.[40] In this study, the authors found that peer pressure, sexual coercion, poverty, family breakdown, low self-esteem, low educational expectations and heightened sex-based messages in the social media were some of the reasons for teenage pregnancy and factors influencing the adolescent pregnancy rate in the Greater Giyani.[39]

2.1.2 Teenage pregnancy implications

Many teen pregnancies are vulnerable to various complications for the mother as well as their unborn baby. Firstly, these teenage mothers are not ready to mother a baby; hence resorting to conducting abortion. The WHO states that about 14 % of all unsafe abortions in low- and middle-income countries are amongst adolescent women.[19] This puts them at risk of disabling complications as well as death.[19]

2.1.2.1 Effect of teenage pregnancy on mother

Pregnancy in teenage mothers implies many health problems of which most are associated with negative outcomes of pregnancy. Some of the health concerns faced are anaemia, malaria, HIV and other sexually transmitted infections, postpartum haemorrhage (labour and delivery related), and mental disorders, such as depression. In addition to this around 65% adolescent women develop obstetric fistulas which affects their lives, both physically and socially.[19, 42]

HIV infection in adolescent pregnancy is another great concern. Since these women engage in sex at an early stage, they are more likely to have many sexual partners in their lifetime and they tend not to practice safer sex. Christofides et al. found that in Eastern Cape early adolescent pregnancy women were three times more likely to acquire HIV than the older women (IRR 3.02; 95% CI 1.50 -6.09).[43] In the same study, it had shown that such women experience physical and sexual violence more than older women. The researchers further show that these teenage women tend to be involved with men who are 4 or more years older than them.[43]

2.1.2.2 Effect of teenage pregnancy on baby

Still births and early neonatal deaths are 50 % higher in adolescent mothers[19] Babies born to teenage mothers have an increased rate of being preterm (AOR = 1.60; 95% CI, 1.37 to 1.87), have low birth weight: (AOR = 1.17; 95% CI, 1.01 to 1.37) and asphyxia which pose as risk factors in later life.[44] Some adolescents engage in risky behaviours like drinking and smoking which have an even greater impact on their unborn child. This evidence is supported by Bhutta et al. who found that the odds of foetal growth restriction was 4.6 higher in adolescent mothers (95% CI of 1.5 to 13.5) while the risk of low birthweight odds ratio was 6.5 high (CI 1.6 to 26.7).[45,52]

Adolescent mothers experience greater levels of low birth weight (LBW), preterm birth as shown in a cross sectional study done in central Africa where the odds for teenage mother's LBW delivery was 2.7 with 95% CI 1.1 to 6.5 which concurs with several studies.[46,54]

A study by Althabe et al. supports that teenage mothers had higher relative risk compared to older adolescents and adults for preterm birth with (RR 2.07, 95% CI 1.59-2.70) and LBW (RR 1.81, 95% CI 1.40-2.34) respectively.[41]

A study comparing pregnancy and foetal outcome of pregnant teenagers to adult mothers showed that the adolescent mothers had 56% LBW babies compared to 44% in the adult mothers' group (p value<0.001).[42] Furthermore, the adolescent mothers had 65.3% antepartum complications compared to 34.7% (cephalopelvic disproportion: 100% vs 0.0%, intra uterine growth retardation: 83.3% vs. 16.7% and anaemia: 75% vs. 25%) in comparison to the control group (p<0.05). Intrapartum complications were 66% in the adolescent group compared to 34% in adults. Deep transverse arrest (100% vs 0%), delayed progress of labour (62.5% versus 37.5%) and foetal distress was (66.6% versus. 33.4%) were more in adolescent group (p<0.05).[42]

Neonatal health: a global picture

Child mortality rates, just like maternal rates, are declining on a global level.[47] The previous millennium development goals had helped countries to focus on reduction of child mortality by two thirds. Many countries have failed to arrive at the stated goal, yet efforts have proved rewarding as seen by the progress of 53% reduction.[48] Neonatal and new-born deaths account for 45% of under 5 children deaths. The 75% of all neonatal deaths that occurred during the first week of life were mainly due to prematurity, low birth weight, infection and birth related problems. [19] STASSA reported a decrease of perinatal deaths which had been increasing from 13 020 in 1997 to 25 287 in 2009; however in 2013, 22 116 perinatal deaths were reported. [49]

2.1 Low birth weight picture

2.1.1 Types of low birth weight

2.1.1.1 Small for gestation age

LBW is a baby who is born with weight less than 2500g. This might be due to either the short duration of the foetus in utero (preterm or prematurity) or restricted growth in utero (intrauterine growth retardation – IUGR). [50] Some of the babies may be born with less than 10th percentile of the gestational age, termed as small for gestation age (SGA). Though the IUGR and the SGA are different, yet sometimes they are used

interchangeably. [50] Two types of SGA have been described as symmetric where weight, length and head circumference are below 10th percentile while asymmetric is where weight is low but the head circumference and the length are preserved; the latter being an anomaly during the last trimester of pregnancy.[6] A systematic review in 2010 for 138 countries revealed that SGA was more prevalent in the low income countries than the high income countries – 36 % of live births were SGA (43.3 million babies), preterm or had both[51]. Furthermore, the report showed that 27.8 million were born at term, 10.6 were born at term but were LBW while 3 million were preterm and SGA. [51] All this data is for low income countries. Unfortunately, the researchers lamented the lack of data for the LBW and SGA in most countries hence not knowing the true burden globally.

2.1.1.2 Intrauterine growth restriction

Intrauterine growth restriction (IUGR) is a condition where a foetus fails to reach its genetically potential size [52]. This occurs due to maternal obstetrical, medical and lifestyle conditions. Since such babies fail to develop appropriately, they are at a higher risk of dying as well as have an increased risk of morbidity and mortality. [52] Babies born with this condition maybe diagnosed in utero or maybe known after delivery when they are born. They can be born preterm or at term with growth restriction. [52]

Preterm births are subdivided into extreme preterm – babies born less than 28 weeks who may weigh less than 1000g; very preterm – babies between 28 – 32 weeks old (1500g), moderate to late preterm are those born after 32 weeks but less than 37 weeks (<2500g). [7]

2.1.1.3 Preterm babies and related causes

In 2014, WHO stated that on a yearly basis, 15 million babies are born preterm; [7] however, the numbers are increasing. The main causes of preterm delivery include non-communicable diseases like hypertension, [53] diabetes, multiple pregnancy and infection. [53] WHO further states that, 60 % of the preterm deliveries occur in the low income countries and in Africa. [7] Since such babies have low immunity and a large surface area hence are prone to hypothermia, infections, hypoglycaemia, electrolyte imbalance which increases the risk of the babies dying neonatally.

Another risk for preterm delivery is teenage pregnancy [23, 54]. Many studies have reported that teenage pregnancy is associated with LBW and prematurity of the baby while others have shown no association between age and prematurity. [9, 27, 55] Similarly, another study had found that the rate of low birth weight was higher in the teenage mothers than in adult mothers. [26]

2.1.2 Why preterm Births and LBW are a public challenge

Every child if he/ she survive has to have a healthy life. Unfortunately, these babies due to several factors are at high risk of dying due to infection, problems with temperature control (hypothermia) and breathing problem. [19] This then increases the neonatal mortality rate which is supposed to be reducing as per the WHO millennium development goal 4 (reduction of child mortality). It is further reported that prematurity is in fact the leading cause of death in the under-five children [7]. A study which was done in Central Africa showed that the odds of dying was 20 times more in premature babies.[56, 57] Morteza's Nigerian study had similar findings where the infant mortality was highly associated with low birth weight (r 0.7, p value <0.001).[58]

2.1.3 Causes of low birth weight

There are many causes of LBW which have been identified. These range from external factors (factors that affect baby indirectly) and internal factors (within utero problems). These can as well be categorised as maternal related or foetal related as will be highlighted below.

2.1.3.1 Anthropometric related LBW causes

Maternal and foetal nutrition and health are best measured by the birth weight of the baby. [59] Mothers who do not consume adequate nutrition have shown to deliver LBW babies because they themselves are undernourished. [60] It has been reported if mothers have a higher BMI, they are less likely to deliver LBW. [61,57] In this cohort study where mothers were recruited during pregnancy and followed up postnatal, results showed that, mothers with higher BMI delivered NBW babies than mothers with less BMI 29.0 ± 6.3 compared to (27.3 ± 5.4) which was quite significant with a p-value of 0.034. [61] A study in Malawi had shown similar evidence; where women who had low BMI had high percentage of LBW babies than those with normal BMI (9.3% versus 3.2%, p-value <0.005[62]

2.1.3.2 Illness related LBW causes

Apart from anthropometric causes, maternal illnesses have an impact on the growth of the baby. If a woman has illnesses like malaria, she is at risk of delivering a low birth weight baby. A study in sub-Saharan Africa, malaria accounted for 94.1% of LBW in Congo and was statistically significant with p value of <0.001 which is a malaria endemic region. The incidence of LBW due to Malaria was 16% [63]. Hypertension is also one of the causes for not only LBW but also premature delivery [61, 53]. In Malawi which is another endemic malaria region, a randomised control trial had shown that women who had malaria had 36.4% premature babies compared to 28.5% women who did not have malaria. [62] Furthermore, the women with anaemia are also at risk of premature delivery reported in the same study and others [64]. This is because hypertension results in placental insufficiency hence depriving the baby of nutrition hence being born prematurely or with LBW. [6] Hypertension has been shown to as well be a cause for increased neonatal mortality and or intrauterine death. [65]

Tuberculosis and HIV have also been reported to be the cause for prematurity and LBW. [53] In this study, it was found that very premature babies (<1500g) whose mothers had PTB were 21% while the ones between 1500g to 2499g were 42%; with a p value of <0.001.

2.1.3.3 Physical related causes

Intimate partner violence has been reported to be one of the causes of LBW as indicated in this study where women had to be assessed for various adverse outcomes like violence and substance use. [66]

2.1.3.4 Intrauterine related causes

Prenatal growth of a baby is dependent on the nutrition that the baby gets, genetic factors, oxygen delivery to the baby as well as hormonal factors. In utero, the cells of the fertilised ovum start dividing and reaches peak in the second semester where most of the baby's development of organs takes place. [67] So if there is any disruption in the process of this growth, the end result in IUGR, LBW and/or prematurity of the baby. There are many causes of intrauterine disturbances that affect the baby's growth, these include

hypertension, placental insufficiency, malnutrition and drugs while the foetal causes may be chromosomal abnormalities, congenital infection and congenital malformation. [6]

3 Chapter Three: Methodology

3.1 Study Design

This was a retrospective case control study. Teenage mothers with LBW babies were compared to teenage mothers with normal birthweight (NBW) babies; and adult mothers with LBW babies were compared to adult mothers with NBW babies as follows: -

Maternal status	Cases	Controls
Teen age	LBW	NBW
Adult	LBW	NBW

We had stratified our analysis for age and for facility so as to control confounding; and to get an understanding of what are the main risk factors for LBW for the different age group. We further compared the age groups so see if there were risk factors for LBW which were present across in both maternal groups

3.1.1 Study setting

The study was done in Tshwane District at Mamelodi Regional Hospital, Pretoria West Hospital, Kgabo Community Health Centre and Laudium Community Health Centre.

3.1.2 Study population and sampling

3.1.2.1 Study population

All mothers, 13 – 35 years were eligible to participate in the study. Their medical, obstetric and social biographic status were assessed for risk factors.

Teenage mothers were further divided into very young mothers and young mothers as few studies have shown that very young teenage mothers have a higher risk of LBW than

older teenagers. 13 – 16 years was categorised as very young teenage mothers while 17 to 19 were older teenage mothers.

3.1.2.2 Sample size

We estimated a sample size of 1 060. A sample of 1 073 was extracted from 4 health facilities maternity wards. The sample comprised 827 adult mothers and 246 teenage mothers and their babies.

3.1.2.3 Sample size calculation

The mean prevalence of LBW is estimated at 16.5% according to Mamelodi Hospital raw data in maternity. This is therefore the p that will be used to calculate the sample size. The q = 1-p = 1 - 0.165 = 0.835. The desired margin of error is 5% for this study.

Margin of error (ME) = $1.96*(p*q)/n$

Therefore n = $(1.96)^2 (p*q)/(ME)^2$

= 211.7

n = 212

Design effect (DEFF) = 4 (estimated since it can't be calculated)

Design Factor (DEFFT) = $\sqrt{}$ (DEFF) = $\sqrt{(4)}$ = 2

Sample size calculation = DEFFT* n

= 2* 212

= 424

Data completeness rate was estimated at 80% or 0.8

The effective sample size was assumed therefore 424/0.8 = 530

Considering a ratio of controls and cases to be 1:1

The required sample size = 2 (case/control) x 530 effective sample size = 1060

Tshwane District has 7 regions. Within the region, there are different levels of health care centres. To select the study sites, stratification of community health centres (CHC) and hospitals was done by region and 4 facilities were randomly selected; namely Mamelodi Hospital, Pretoria West Hospital, Kgabo CHC and Laudium CHC.

From the maternity registers, we sampled mothers with LBW babies purposively (as cases) because of the small number of LBW babies at various health facilities. However, mothers with NBW babies were selected randomly as controls to match the LBW cases using a ratio of 1:1. Unfortunately, this was not achieved for the teenage mothers.

3.1.3 Inclusion and exclusion criteria

All mothers and their babies who had delivered and or were referred during the period of January 2013 – December 2014 were eligible to be included in the study. However, mothers outside the age category were excluded. Mothers with twin babies were also excluded since these may have had an outcome of interest. [23]

Women who delivered more than 5 times (grand multipara) and women more than 35 years[22,23] were excluded in this study.

3.2 Data collection

Data were abstracted from maternity registers and the mother's antenatal record.

Reproductive, medical and obstetrical information including the baby's birth outcome were extracted from these records and data were entered using EpiData. Analysis was done using STATA 14.

3.3 Data processing and analysis

STATA 14[68] was used to analyse data according to the objectives of the study. Analysis steps which were done as per objectives: -

1. Objective 1: To determine the proportion of low birth weight babies in teenage mothers

   The proportion of LBW and NBW was derived by calculating the total LBW for teenage mothers which was a numerator while total LBW babies was the denominator. Similarly, total LBW for adult mothers was a numerator while the

total LBW babies was a denominator. The proportion of NBW was calculated the same way.

2. Objective 2: To compare the risk factors for low birth weight outcomes for mothers in Tshwane District.
   a. To test association between preterm and term gestation for mothers, odds ratios was the measure of association between the groups. A p value of 0.05 and 95% confidence interval is considered statistically significant.

To compare the relationship between LBW for teenage and adult mothers' maternal socio-demographic, reproductive and obstetric characteristics were analysed using multiple logistic regression. To determine the best fitting model, Akaike information criterion (AIC) and Bayesian information criterion(BIC) tests were used in multivariable regression analysis.[69]

3.4 Ethical and legal considerations

The study was approved by the University of Pretoria ethics committee (Ethics reference number 214/2016) and Department of Health Research Committee (Project number 28/2016) prior to the study commencement. The study also got written permission from the chief executive officer of the hospitals and clinics. The obstetrics staff were informed about the study.

The information for the mothers was treated with confidentiality. Patient data were entered without names to ensure patient privacy/anonymity. [70]

3.5 Definition of Key Terms

3.5.1 Case definition

Teenage mother: – is a woman of the age between 13 – 19 years.

Adolescent: - is a person who is between 14 and 19 years

Early adolescent mother: - is a woman who is between 12 – 15 years

Very young teenage mothers: - a woman who is between 13 -16 years

Older teenage mother: - a woman who is 17 to 19 years

Adult mother: - a woman of the age between 20 – 35 years

Low birth weight: – babies born with weight less than 2 500 grams, but more than 500 grams

Preterm LBW babies: - are babies born before 37 completed weeks of gestation with low birth weight

Term LBW babies: - are infants born after 37 completed weeks of gestation with low birth weight

Gestation age: - number of weeks a baby is born from the last menstrual period (LMP)

3.5.2 Control Definition

Controls were:

Preterm NBW babies: - are babies born before 37 weeks but having normal birth weight

Term NBW babies: - are babies born after 37 weeks with normal birth weight (determined as a baby born >37 weeks from last menstrual period)

4 Chapter Four: Results

Our study looked at various risk factors that could affect the baby's birth outcome.

A total sample of 1 073 was extracted from the 4 facilities' maternity registers and antenatal records. The description of the study participants is displayed in table 1 below.

Table 1: Descriptive analysis for the study participants

Variable Name	Frequency (n)	Percent	Total Sample
Maternal information			
Age			1 073†
13-19 years	246	22.93	
20-35 years	827	77.07	
Marital status			402
single	312	77.61	
married	67	16.67	
stable relation	23	5.72	
Race			753
African	693	92.27	
Asian	24	3.19	
White	34	4.52	
ANC attendance			1 067
yes	994	93.16	
no	73	6.84	
RPR status			1 059
Negative	932	88.01	
Positive	6	0.57	
Unknown	121	11.43	
No. of ANC attendance			960
≤2	311	32.4	
3 to 4 times	478	49.79	
≥5	171	17.81	
Gravida			1 069
1	379	35.45	
2	392	36.67	
3	212	19.83	
4	62	5.8	
5	19	1.78	
6	4	0.37	
9	1	0.09	
Parity			1 069
0	268	25.07	
1	399	37.32	
2	260	24.32	
3	110	10.32	
4	22	2.06	
5	7	0.65	
6	2	0.19	
10	1	0.09	
HIV status			1 069
Negative	821	76.8	
Positive	221	20.67	
Unknown	27	2.53	
Baby Information			
Baby sex			1 063
female	528	49.67	
Male	535	50.33	
Gestation age at Birth			956
≥37 weeks	651	68.1	
<37 weeks	305	31.9	
Birth weight			1 069
<2500	517	48.36	
≥2500	552	51.64	

† complete sample, the rest had missing data

The proportion of teenage mothers in this study was 23% while adults were 77%. Most of the mothers were single (77%) and were black Africans (92%). Mothers who had attended antenatal care were 93%.

Babies who were weighed at birth in our study were 1 069 of whom 52% were normal birth weight and 48% had low birth weight (see table 2 below). Furthermore, the gestation age of the babies was determined at birth; 68 % babies were born at term and 32 % were preterm babies.

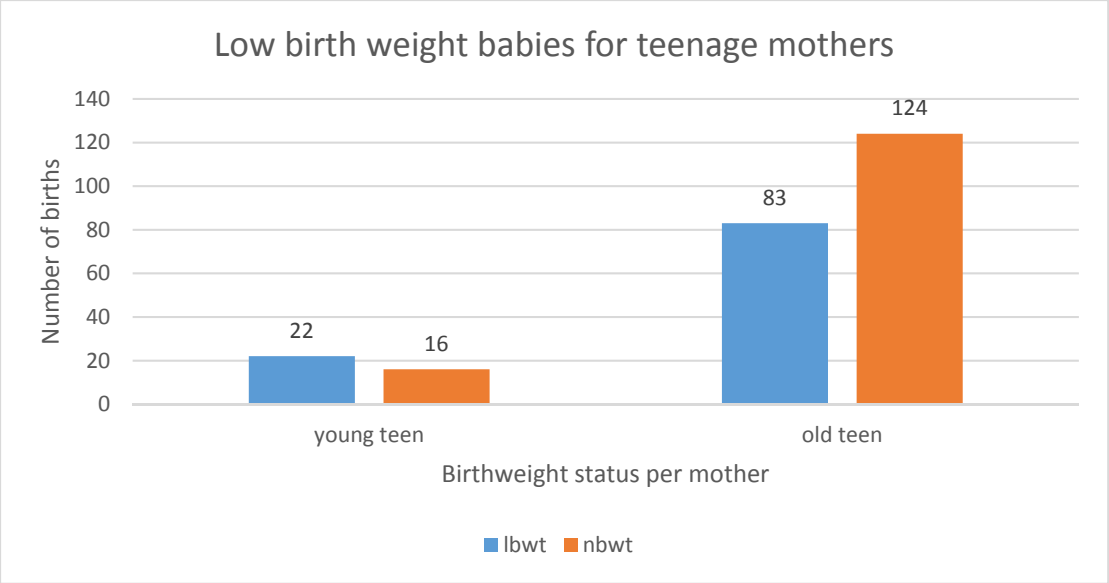
Table 2: Case and control sample summary

Baby weight status	**Adult mother**	**Teenage mother**	**Total**
Normal birth weight	412	140	552
	38.54	*13.10*	*51.64*[ϕ]
Low birth weight	412	105	517
	38.54	*9.82*	*48.36*
Total	824	245	1,069
	77.08	*22.92*	*100.00*

[ϕ] Number in italics are frequencies

4.1. Proportion of low birthweight

To answer the first objective “determine the proportion of low birth weight babies for teenage mothers”, this study found that, low birth weight amongst the teenage mothers was 20% of the whole sample (n = 105 of 1 069). Teenage mothers were further sub-categorised into very young teenage and older teenage, and data for the outcome is displayed in figure 1 below.



[1]

Figure 1 Teenage mothers' low birth weight babies

Very teenage mothers had increased odds of having LBW babies by 2.05 times more than older teenage mothers and it was statistically significant (AOR 2.05 95% CI: 1.32 to 3.17 and p value of 0.001).

4.2. Risk factors for low birthweight

To answer the second objective of "comparing the risk factors of preterm LBW and term LBW in Tshwane district," we analysed the data by multiple logistic regression, stratifying for gestation age of the baby.

In determining risk factors for LBW; all mothers regardless of age group, who were included in our sample were analysed. The results are displayed in table 2 below.

[1] Lbwt = low birth weight; nbwt = normal birth weight

Table 3: All mothers Risk factors for Low birth weight

	Univariate Analysis		**Multivariate analysis n = 609**			**Multivariate analysis n = 875**	
Variables	**OR***	**P value**	**OR***	**P value**	**OR***	**95% Conf. Interval**	**P value**
Age	*0.75*	*0.05*	*0.49*	*<0.001*	0.54	*0.36 to 0.82*	0.004
Baby sex	0.77	0.193	0.55	0.026	0.64	0.40 to 1.00	0.053
Gestation age	*6.82*	*<0.001*	*4.92*	*<0.001*	6.81	3.41 to 13.60	*<0.001*
ANC	*0.61*	*<0.001*	*1.33*	0.030	1.39	1.03 to 1.86	0.028
Race	0.74	0.193	1.04	0.825			
RPR *status*	*1.54*	*0.070*	*1.44*	0.164			
HIV	*0.81*	*0.116*	*1.05*	0.835			

OR* = odds ratio; n = sample size; RPR = blood test for syphilis

In table 2 above, the risk factors for LBW which we found in this study for all mothers were teenage mother, which had the odds of 0.54 with a 95% CI of 0.36 to 0.82 and p value 0.004; preterm gestation (AOR: 6.81 at 95 % CI 3.41 to 13.60); attending antenatal care for less than four visits (AOR 1.39 at a 95 % CI 1.03 to 1.86).

4.2.1. Age specific LBW risk factors

“To compare between teenage and adult mothers’ (20 – 35 years) LBW risk factors,” maternal socio-demographic, reproductive and obstetric characteristics was analysed by using of multiple logistic regression. The identified risk factors are summarised in table 3(a) and 3(b) below.

Table 4: Mothers' risk factors for LBW stratified for age

Table 3(a): Adult mothers risk factors

	Univariate Analysis		Initial Multivariate Model; n = 475			Final Model Multivariate analysis n= 680		
Variables	**OR***	**P- value**	**AOR***	**P value**		**AOR***	**95% Conf. Interval**	**P value**
Parity	0.87	0.008	0.81	0.085		0.86	0.72 to 1.03	0.111
Gestation age	7.22	<0.001	4.65	<0.001		6.58	3.38 to 12.82	<0.001
ANC	1.52	<0.001	1.35	<0.001		1.33	1.02 to 1.72	0.032
RPR status	1.48	0.218	1.47	0.379				
Race	0.79	0.041	1.03	0.846				
HIV	0.77	0.051	0.99	0.982				

AIC 3.90 and BIC 3.90 *AOR = adjusted odds ratio; n = sample size

Table 3(b): Teenage mothers Risk Factors

	Univariate Analysis		Multivariate analysis n = 137			Multivariate analysis n = 200		
Variables	**OR***	**P value**	**AOR***	**P - value**		**AOR***	**95% CI**	**P value**
Gestation age	6.30	<0.001	5.15	0.001		5.65	2.27 to 14.07	<0.001
ANC	2.48	0.002	2.10	0.111		2.18	0.98 to 4.86	0.056
Baby sex	0.62	<0.001	0.63	0.215		0.65	0.33 to 1.28	0.222
Parity	2.16	0.111	1.77	0.366				
RPR status	1.77	0.002	0.87	0.593				

AIC 8.69 BIC 8.84

The risk factors for LBW which we identified in our study after stratifying for maternal age were gestation age at delivery of the baby and the number of ANC visits for the adult mothers as indicated in table 3(a). The odds of delivering a LBW when an adult mother has premature birth is six times more (AOR: 6.46, 95 % CI 3.77 - 12.39) which was highly statistically significant. Furthermore, adult mothers were also more likely to deliver LBW babies if they attended less than 5 ANC visits (AOR 1.33; 95 % CI 1.02 to 1.73 and p value 0.032) as shown in table 3(a).

In the teenage mothers' category, preterm delivery was the only risk factor for LBW which was statistically significant with AOR of 5.65 at 95 % CI of 2.27 to 14.08 and p value of <0.001 (see table 3(b). Furthermore, even though ANC attendance had a high risk of LBW delivery if the mother attended less than 5 ANC, yet it was not statistically significant with a p value of 0.056 and a 95 % CI 0.98 to 5.86 (AOR 2.18).

4.2.2. Gestation age related LBW risks

Multiple logistic regression was done to compare the risk factors for gestation age related low birth weight outcomes in Tshwane District for teenage mothers and adult mothers. The results are presented in table 4(a) and 4(b) below.

Table 5: Mothers' risk factors for LBW stratified by gestation age

Table 4(a): Preterm gestation age related LBW risk factors

univariate analysis			Initial Multivariate Model; n = 270			Final Multivariate model n = 271	
Variable	**OR#**	**P value**	**AOR***	**P - value**	**AOR***	**95% Conf. Interval**	**P value**
Age	0.57	0.020	0.52	0.008	0.47	0.31 to 0.71	<0.001
ANC	1.24	0.029	1.81	0.047	1.92	1.06 to 3.47	0.030
Gravida	1.32	0.101	1.18	0.150			
Baby sex	0.56	0.036	0.54	0.167			

AIC 1.24 and BIC 1.26; # OR = odds ratio; *AOR = adjusted odds ratio; n = sample size

Table 4(b): Term gestation age related low birth weight risk factors

univariate analysis			Initial Multivariate model n = 609		Final Multivariate model n = 610		
Variable	**OR**	**P value**	**AOR***	**P - value**	**AOR***	**95% Conf. Interval**	**P value**
Age	0.66	0.063	0.62	0.163	0.60	0.35 to 1.03	0.065
HIV	1.45	0.004	0.70	0.326	0.70	0.34 to 1.40	0.319
ANC	0.80	0.022	1.27	0.003	1.29	1.08 to 1.54	0.005
RPR status	1.19	0.249	1.14	0.561			
Gravida	1.09	0.223	1.02	0.816			

AIC 2.73 and BIC 2.73

4.2.2.1. LBW according to gestation age stratification status

Our study stratified gestation age into preterm and term using multivariate analysis in order to compare the risk factors that contribute to LBW in preterm and term gestation groups. The tables 4(a) and 4(b) above present the risk factors that were identified.

Risk factors for LBW deliveries common to both preterm gestation and term mothers was attending 4 or less ANC visits.

The odds for a preterm new-born baby to be LBW when mothers were teenage was 0.47 (95 % CI: 0.31 to 0.71, p value <0.001) whereas if the baby was term, the odds was 0.60 95% CI 0.35 to 1.03, p value 0.65 as shown in table 4(a) and (b).

Furthermore, mothers who attended ANC less than 5 times were more likely to deliver a LBW if they have preterm delivery (AOR: 1.92, 95% CI: 1.06 to 3.48) – see table 4(a).

Moreover, our study did not show that LBW was associated with HIV infection (AOR 0.77, 95 % CI 0.34 to 1.40; p value 0.319) even though this variable was included in the final model in 4(b).

5. Chapter Five: Discussion

5.1. Discussion

Our study is the first, to the best of our knowledge, to compare the risk factors for LBW for teenage mothers to adult mothers in Tshwane District, South Africa. This study failed to prove the hypothesis that teenage mothers (13 – 19 years) have a higher risk for low birth weight for their babies. However, for very young teenage mothers, 13 – 16 years old, we failed to reject this hypothesis because the risk for LBW was highly significant. This evidence is supported the WHO and by Oladeinde. [19, 71]

5.1.1 Maternal age related low birth weight risk factors

5.1.1.1 Teenage mothers risk factors

We had further stratified the mothers into very young teenage mother (13 – 16 years) and young teenage mothers (17 – 19 years). Very young teenage mothers, are at an increased odds of delivering LBW babies than young teenage mothers and the test was highly statistically significant. Our finding correlates with other studies like Kaur and Ngoma where mothers aged ≤16 years had a higher risk for the delivery of a low birthweight baby. In the same study, preterm delivery was associated with very young teenage maternal age (≤16 years) [46, 64, 72] as is the case with our findings.

It was interesting to note that, our study found that teenage mothers were less likely to deliver a LBW baby. Some studies have reported that teenage mothers have high risk of LBW [2, 12] while others have indicated that teenage mothers and adult mothers experience the same risk factors for LBW. [9] Having a larger sample for teenage mothers will influence whether this hypothesis can be proved or disproved.

When we analysed other risk factors for LBW, our study showed that teenage mothers were at risk of LBW if they attended less than 5 ANC visits as was the case with the adult mothers. Unfortunately, this finding was not statistically significant. To the best of our knowledge, most studies that have shown an association between LBW and ANC visits had not categorised the mothers according to ages as was the case in Althabe et.al [27, 28, 41]. However, we found that delivering a preterm baby was the only significant risk factor for LBW in the teenage mothers.

Delivering a preterm baby is a risk factor for LBW because the baby grows and matures in the latter period of pregnancy. [57] Therefore, if a baby is born before that time; the baby is more likely to be LBW. This is the case in not only teenage mothers but also adult mothers. Our finding is consistent with studies that had shown that a teenage mother has a high risk of delivering a LBW when the baby was a preterm gestation. [23, 61]

5.1.2.1. Adult mothers LBW risk factors

Adult mothers who deliver before term have a high risk of having a low birth weight baby. This finding again confirms studies done in several areas to be a risk for LBW. [57]

It is therefore important that mothers are screened so that pregnancies can be prolonged up to term thereby reducing LBW deliveries.

In case of adult mothers, having 4 or less ANC visits made them more likely to deliver a LBW baby. This might be due to the fact that at ANC, the baby and the mother's wellbeing are assessed and risk factors addressed in time to avoid adverse outcomes. Studies done in other countries, for example Zimbabwe, had shown that mothers were at high risk of delivering LBW if they attended fewer ANC visits. [6]

5.2. Preterm and term gestation risk factors

Preterm delivery is a major cause of LBW which we identified in our study. Mothers are at risk of delivering preterm babies which have low birth weight due to a number of reasons. Social habits like smoking and alcohol, medical conditions like anaemia [61] and hypertension are some of the causes. In our study these did not contribute to preterm delivery though some studies have shown this. [6]

Attendance of ANC more than 4 times can never be emphasised as this has been shown to protect not only the mother, but also the baby not to be born with LBW and other adverse outcomes. [6] Interestingly, when we stratified gestation age into preterm and term, only attending less than 5 ANC visits was a risk factor for LBW to both groups while the mother being a teenager was identified in the preterm gestation group.

5.1.2 HIV infection and LBW

Our study had 21 % mothers who were HIV infected while 3 % had unknown HIV status. HIV in a few studies has been shown to be a risk factor for different adverse birth outcomes including LBW. [19, 61] Our study had failed to show that HIV positive status was associated with delivering a LBW baby. This might be due to the fact that once a woman is diagnosed with HIV, is taking good nutrition and antiretroviral therapy (ART), the baby in utero grows normally. Alemu et.al reports in their systematic analysis that ART was associated with LBW babies. In some studies there was no association.[73] It is important to note that with early screening and viral suppression of HIV, mothers are less susceptible to infections which can reduce LBW deliveries in HIV infected mothers. Unfortunately, HIV related risk factors focussing on the various outcomes was not assessed in our study due to missing data which may bias our results.

5.1.3 Other causes of LBW

Our study could not show risk factors for LBW which were associated with habits (alcohol and smoking), marital status, rhesus factor for the mother's blood type, anaemia, race and parity. However, during univariate logistic regression, low birth weight was associated with maternal race, positive RPR status, positive HIV status and the sex of the baby.

5.2.1 Limitations

Babies' gestation age was self-reported by the mother according to her LMP; hence it might have been a wrong prediction of the babies' age.

Missing data was another challenge since it was a retrospective study; hence other information like the medical, obstetric and social aspect of the mother were not known at the community health centres and when the baby or mother was referred out to another hospital. This affected the result since the sample size for most risk factors was small and therefore results cannot be generalised.

Our study had included all birth outcomes which were randomly selected at the public health institution only but excluded the deliveries at private institutions and at home. This may be another reason for the findings and may affect generalisability of the results.

Likelihood ratio test (Lrtest) was not done during analysis because invalid results were obtained which might be due to small samples within variables.

1.3.1 Conclusion

This research confirms that very young teenage mothers are at risk of delivering LBW babies especially when they give birth prematurely. Furthermore, we proved our hypothesis that the lower the maternal age the higher the risk for low birth weight for a mother's new-born baby.

However, since this study found teenage mothers are less likely to deliver LBW, contrary to some studies, further research needs to be conducted in South Africa so that it reflects the true magnitude and risk factors for LBW in the country.

We further recommend that advocacy for increased access to ANC for pregnant mothers should be done so that screening for risks which can result in preterm delivery or LBW can be managed in time.

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6. Chapter Six: Research Article

Risk factors for low birth weight: comparing teenage mothers to adult mothers in Tshwane, South Africa

ABSTRACT

Background: Low birth weight babies face many health risks, both in childhood and adult life. These complications can burden public health services in developing countries. This study compared the risk factors associated with low birth weight outcomes for teenage and adult mothers in Tshwane District.

Methods: A secondary dataset of 1 073 randomly selected deliveries from four randomly selected health facilities was abstracted in a case control study of teenage (13-19 years) and adult (20-35 years) mothers. Maternal and neonatal data were collected from antenatal cards and delivery registers. Risk factors for low birth weight were identified using multiple logistic regression and chi-square tests.

Results: The sample comprised 246 teenage mothers (23%) and 824 adult mothers (77%). For teenage mothers, low birth weight babies were associated with pre-term delivery (OR: 5.65, CI:2.27-14.07). For adult mothers, low birth weight babies were associated with less than 5 antenatal visits (OR 1.33, CI: 1.02 – 1.72) and delivering prematurely (OR: 6.58, CI: 3.38 to 12.82). For the whole sample, low birth weight was associated with teenage mothers' age (OR: 0.54, CI: 0.36 to 0.82)

Conclusion: In Tshwane, South Africa, the age category of the mother was associated with low birth weight babies. Attending less than five antenatal visits and delivering a premature baby are also risk factors for having a low birth weight baby regardless of maternal age.

Keywords: low birthweight, baby, teenage mother, adult mother, gestation, Tshwane

Background

Low birth weight (LBW) is a global challenge because it contributes to 60-80% of neonatal deaths. In 2013, UNICEF reported that there were 22 million LBW babies born globally. Unfortunately, however, the true magnitude of LBW is unknown because most of these babies are born outside formal hospital/maternity setting where they are not weighed, especially in developing countries.[1] In sub-Saharan Africa, UNICEF reported that 13% of babies born in 2013 had LBW, while in South Africa there were 209 738 LBW babies, 14.8% of all births[2] as reported by the Perinatal Problem Identification Program (PPIP) survey.

Raising a LBW baby is costly not only for the family but also a country.[3] Unfortunately, studies on cost of LBW are scarce for low and middle income countries. Cost analysis research done in Mozambique showed that a household would spent US$ 24.12 on the hospitalisation and care of a LBW baby, while the health system incurred US$ 69 957.[4]

There are several factors associated with LBW that are foetal or maternal related. Maternal factors include malaria;[5,6,7] hypertension, placental insufficiency, malnutrition and drugs, while foetal factors include chromosomal abnormalities, congenital infection and congenital malformation.[8,19]

Some research found that LBW is associated with socio-demographic, medical and reproductive causes. A woman is at risk if she does not receive antenatal care (ANC) and if her literacy is low.[7] The risk for delivering a LBW baby is even higher with no antenatal care attendance.[9] Some studies found that teenage mothers have a higher

risk compared to older adolescents and adults for preterm birth and LBW.[10,11] Few studies done within Africa and globally, attests to this.[12,13, 14]

Methods

A retrospective case control study was done in Tshwane District, South Africa, where 4 health facilities were randomly selected. A sample of 1 073 births was abstracted from ANC files and maternity registers for mothers aged 13 to 19 (teenage) and 20 to 35 years (adult) who were eligible for inclusion in the study. Purposive sampling of mothers with their low birth weight babies (cases) was done while mothers with their normal birth weight babies (controls) were selected randomly for the same maternal age group. Babies from twin pregnancy and those born to mothers outside the 13 to 35 years were excluded.

Maternal age was recorded from the maternity register or antenatal file. The gestation of the baby was determined from the mother's last menstrual period which was recorded in maternity registers or ANC file.

Data were analysed using chi square, logistic regression and multiple regression clustered for facility using Stata 14. A P- value of 0.25 was the criteria for excluding a variable in multivariate logistic regression according to Vittinghoff.[15] Furthermore, the most suited model was chosen using AIC (Akaike information criterion) and BIC (Bayesian information criterion).[16]

Ethical clearance was obtained from University of Pretoria and Department of Health Research committees. Furthermore, permission to review records was obtained from the facility management.

Results and discussion

Description of study participants

A description of the study participants is displayed in table 1 below.

Table 1 here

The proportion of teenage mothers was 23% while adults were 77 %. Most of the mothers were single, 77% and black Africans, 92 %. Mothers who had attended ANC were 93 %.

Babies who were weighed at birth in our study were 1 069 whereby 52% were normal birth weight and 48% had low birth weight. Furthermore, the gestation age of the babies was determined at birth; 68% babies were born at term (more than 37 weeks' gestation) and only 32 % were preterm babies

Proportion of low birthweight

To answer the first objective, determining the proportion of LBW babies for teenage mothers, this study found that LBW amongst the teenage mothers was 20% (n = 105 of the 1 069) while 25 % had normal birth weight (n= 140 of 1 069).

Teenage mothers were further categorised into very young teenage (13 to 16 years old) and young teenage (17 to 19 years old). Their proportion of LBW was assessed (see figure 1 below).

Figure 1 here

Very young teenage mothers had an increased risk of having LBW babies by AOR 2.05 more than young teenage mothers which was statistically significant with a 95% CI: 1.32 to 3.17 and p value of 0.001.

Risk factors for low birthweight

To determine risk factors for LBW, all mothers regardless of age group were analysed using multiple logistic regression. The results are displayed in table 2 below.

Table 2 here

Table 2, above, shows that teenage mothers are less likely to deliver a LBW; had the odds of 0.54 with a 95% CI of 0.33 to 0.82 and a p value 0.004. Our study found that preterm gestation is a risk factor for delivering a LBW baby which had the odds of 6.81, (95 % CI 3.41 to 13.60) compared to mothers who have term gestation. The number of ANC visits is associated with increased odds of a mother delivering a LBW. If a mother attends less than 5 ANC visit, the OR 1.39 (95 % CI 1.03 to 1.86) is more than mothers who attend 5 times or more. All these risk factors for LBW were statistically significant.

Maternal age specific LBW risk factors

To compare between teenage and adult mothers' LBW risk factors, maternal socio-demographic, reproductive and obstetric characteristics were analysed using multiple logistic regression. The identified risk factors are summarised in table 3(a) and (b) below.

Table 3 here

The risk factors for LBW identified in our study, after stratifying for maternal age, were gestation age of the baby and the number of ANC visits for the adult mothers. For teenage mothers only gestation age was a risk factor.

The risk for LBW delivery was AOR 6.58, (95 % CI 3.38 to 12.82; p value <0.001) in adult mothers when they deliver before term. Similarly, adult mothers were more likely to deliver LBW babies if they attended less than 5 ANC visits (AOR 1.33; 95 % CI 1.02 to 1.72 and p value 0.032).

Teenage mothers had AOR of 5.65 (95 % CI of 2.27 to 14.07; p- value <0.001) to deliver a LBW baby if they had a preterm delivery.

Gestation related LBW risks

Our study stratified gestation age into preterm and term using multivariate analysis to compare the risk factors that contribute to LBW in the preterm and term gestation groups. Tables 4 (a) and (b) below present the risk factors that were identified.

Table 4 here

Risk factors for LBW in preterm gestation were found to be the age of the mother and number of ANC visits while in the term gestation group, it is only the number of ANC visits that was a risk.

When a baby is born prematurely to a teenage mother, the baby is less likely to have LBW (AOR 0.47, 95% CI 0.31 to 0.71; p value <0.001) compared to babies born to

adult mothers. Mothers' who attend less than 5 ANC visits, had more than AOR 1.92 of delivering a LBW baby (95% CI 1.06 to 3.47; p value 0.030). See table 4(a).

The risk factor for LBW birth in term babies was only when a mother attended less than 5 ANC visits (AOR 1.29, 95 % CI 1.08 to 1.54; p value of 0.005).

Discussion

Our study is the first, to the best of our knowledge, to compare the risk factors for LBW for teenage and adult mothers in Tshwane, South Africa. This study, affirms that delivering a preterm baby is the main cause of LBW regardless of maternal age [3,17,18] which is consistent with studies done both locally and globally. A baby born preterm is still in a growing phase in utero, and if the pregnancy is terminated prematurely due to various causes, the likelihood for the baby to have a LBW is high.

Very young teenage mothers, are at an increased risk of delivering LBW babies, which correlates with some studies done; [11,19] while teenage mothers are less likely to have LBW outcomes. It was interesting to note that, though teenage mothers are said to be at increased risk for complications, our study found they were less likely to have a LBW baby compared to adult mothers. Our finding contradicts Hoque's studies which found no difference between teenage mothers and adult mothers' LBW risk factors.[20, 21]

The only factor associated with LBW was if a teenage mother had a preterm delivery. Our finding confirms findings which show that a teenage mother has a high risk of delivering a LBW if they deliver prematurely.[7, 22,17]

In case of adult mothers, fewer ANC visits made them more likely to deliver a LBW baby. This might be due to the fact that at ANC, the baby and the mother's wellbeing is assessed and problems/risks are addressed in time to prevent adverse outcomes. Studies done in other country have shown that mothers were at high risk of delivering LBW babies if they attended fewer ANC visits.[7, 9] Adult mothers were at risk of delivering LBW babies when the baby was born before term. Similarly, this might be attributed to the immature utero growth of the baby.

We further analysed the gestation age of the baby to determine the LBW risk factors for term and preterm babies.

Attending ANC 5 times or more can never be over-emphasised as this has been shown to protect not only the mother, but also the baby not to be born of LBW and other adverse outcomes. Interestingly, when we stratified gestation age into preterm and term, attending less than 5 ANC visits was the only common risk factor for LBW in both groups; while teenage mothers' age was only identified as a risk in the preterm gestation group.

Limitations

Even though our study is the first to identify the age specific risk factors to LBW, there were few limitations. The sample size for the teenage mothers was small, hence the results may not be generalized to a larger context. Lrtest was not done because it returned invalid results which we attribute to the cluster analysis.

Conclusion

Our study highlighted preterm gestation as the biggest risk factor for LBW. We

recommend that pregnant women should be encouraged to attend more than 4 ANC visits so that screening during ANC can be done to reduce preterm deliveries.

Funding

This work was supported by the School of Health Systems and Public Health Research committee, University of Pretoria.

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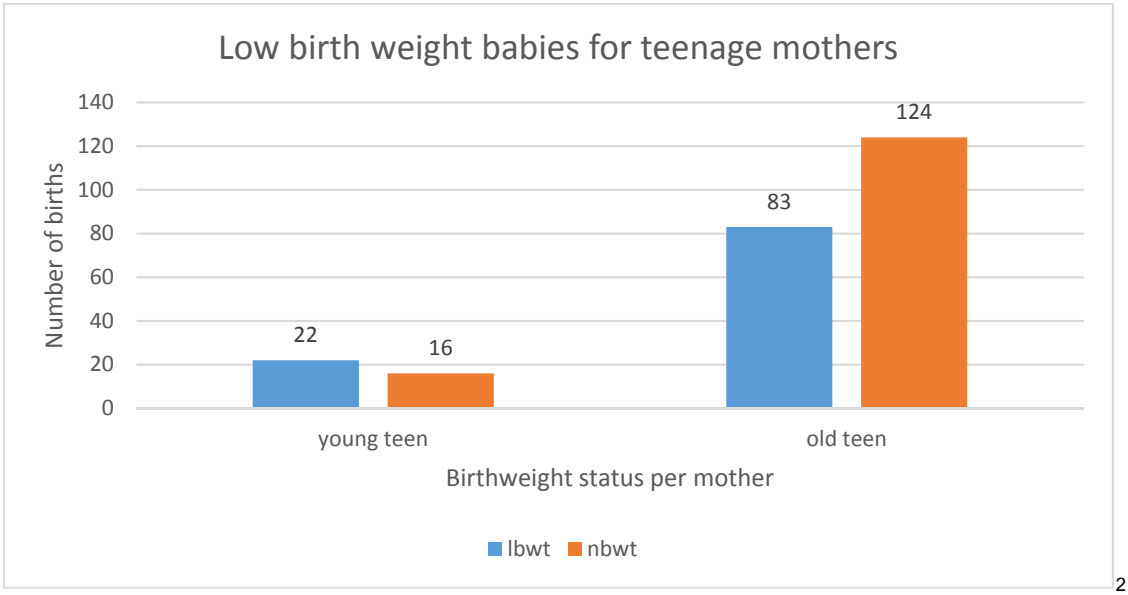
Tables and figures



[2]

Figure 1 teenage mothers' low birth weight babies

[2] Lbwt = low birth weight; nbwt = normal birth weight

Table 6: Descriptive analysis for the study participants

Variable Name	Frequency (n)	Percent	Total Sample
Maternal information			
Age			1 073†
13-19 years	246	22.93	
20-35 years	827	77.07	
Marital status			402
single	312	77.61	
married	67	16.67	
stable relation	23	5.72	
Race			753
African	693	92.27	
Asian	24	3.19	
White	34	4.52	
ANC attendance			1 067
yes	994	93.16	
no	73	6.84	
RPR status			1 059
Negative	932	88.01	
Positive	6	0.57	
Unknown	121	11.43	
No. of ANC attendance			960
≤2	311	32.4	
3 to 4 times	478	49.79	
≥5	171	17.81	
Gravida			1 069
1	379	35.45	
2	392	36.67	
3	212	19.83	
4	62	5.8	
5	19	1.78	
6	4	0.37	
9	1	0.09	
Parity			1 069
0	268	25.07	
1	399	37.32	
2	260	24.32	
3	110	10.32	
4	22	2.06	
5	7	0.65	
6	2	0.19	
10	1	0.09	
HIV status			1 069
Negative	821	76.8	
Positive	221	20.67	
Unknown	27	2.53	
Baby Information			
Baby sex			1 063
female	528	49.67	
Male	535	50.33	
Gestation age at Birth			956
≥37 weeks	651	68.1	
<37 weeks	305	31.9	
Birth weight			1 069
<2500	517	48.36	
≥2500	552	51.64	

† complete sample, the rest had missing data

Table 2 All mothers Risk factors for Low birth weight

	Univariate Analysis		Multivariate analysis n = 609			Multivariate analysis n = 874		
Variables	**OR***	**P value**	**OR***	**P value**		**OR***	**95% Conf. Interval**	**P value**
Age	*0.75*	*0.05*	*0.49*	*<0.001*		0.54	*0.36 to 0.82*	0.004
Sex	0.77	0.193	0.55	0.026		0.64	0.40 to 1.00	0.053
Gestation age	*6.82*	*<0.001*	*4.92*	*<0.001*		6.81	3.41 to 13.60	*<0.001*
ANC	*0.61*	*<0.001*	*1.33*	0.030		1.39	1.03 to 1.86	0.028
Race	0.74	0.193	1.04	0.825				
RPR status	*1.54*	*0.070*	*1.44*	0.164				
HIV	*0.81*	*0.116*	*1.05*	0.835				

OR* = odds ratio; n = sample size

AIC 19.83 and BIC 19.91

Table 3: Age stratified risk factors

Table 3(a): Adult mothers risk factors for LBW

	Univariate Analysis		Initial Multivariate Model; n = 475			Final Model Multivariate analysis n= 680		
Variables	OR	P- value	AOR*	P value		AOR*	95% Conf. Interval	P value
Parity	0.87	0.008	0.81	0.085		0.86	0.72 to 1.03	0.111
Gestation age	7.22	<0.001	4.65	<0.001		6.58	3.38 to 12.82	<0.001
ANC	1.52	<0.001	1.35	<0.001		1.33	1.02 to 1.72	0.032
RPR status	1.48	0.218	1.47	0.379				
Race	0.79	0.041	1.03	0.846				
HIV	0.77	0.051	0.99	0.982				

AIC 3.90 and BIC 3.90; *AOR = adjusted odds ratio

Table 3(b): Teenage mothers Risk Factors for LBW

	Univariate Analysis		**Multivariate analysis n = 137**			**Multivariate analysis n = 200**		
Variables	**OR**	**P value**	**AOR***	**P - value**		**AOR***	**95% CI**	**P value**
Gestation age	6.30	<0.001	5.15	0.001		5.65	2.27 to 14.07	<0.001
ANC	2.48	0.002	2.10	0.111		2.18	0.98 to 4.86	0.056
Baby sex	0.62	<0.001	0.63	0.215		0.65	0.33 to 1.28	0.222
Parity	2.16	0.111	1.77	0.366				
RPR status	1.77	0.002	0.87	0.593				

AIC 8.69 BIC 8.84

Table 4: Gestational age related risk factors

Table 4(a): Preterm gestation related LBW risk factors

univariate analysis			Initial Multivariate Model; n = 270			Final Multivariate model n = 271	
Variable	**OR**	**P value**	**AOR***	**P - value**	**AOR***	**95% Conf. Interval**	**P value**
Age	0.57	0.020	0.52	0.008	0.47	0.31 to 0.71	<0.001
ANC	1.24	0.029	1.81	0.047	1.92	1.06 to 3.47	0.030
Gravida	1.32	0.101	1.18	0.150			
Baby sex	0.56	0.036	0.54	0.167			

AIC 1.24 and BIC 1.26; AOR = adjusted odds ratio

Table 4(b): Term gestation related low birth weight risk factors

univariate analysis			Initial Multivariate model n = 609		Final Multivariate model n = 610		
Variable	**OR**	**P value**	**AOR***	**P - value**	**AOR***	**95% Conf. Interval**	**P value**
Age	0.66	0.063	0.62	0.163	0.60	0.35 to 1.03	0.065
HIV	1.45	0.004	0.70	0.326	0.70	0.34 to 1.40	0.319
ANC	0.80	0.022	1.27	0.003	1.29	1.08 to 1.54	0.005
RPR status	1.19	0.249	1.14	0.561			
Gravida	1.09	0.223	1.02	0.816			

AIC 2.73 and BIC 2.73

Appendix

Appendix 1: Instruction to author

Author Guidelines

Paediatric and Perinatal Epidemiology welcomes discussion documents, review articles, book reviews and correspondence as well as original research reports. The last of these should deal with original research not previously published or being considered for publication elsewhere. Topics of interest include the application of epidemiologic methods to studies of pregnancy complications, birth outcomes, fertility, genetic susceptibilities, and the influence of the fetal and early environment on child or adult health and development. We also encourage submissions on the development and applications of new and innovative methods to studies in paediatric and perinatal epidemiology.

All authors are expected to meet the criteria for authorship which they confirm by their signature on the letter of submission.

Case Reports

The journal does not accept case reports for publication. Authors of case reports are encouraged to submit to the Wiley Open Access journal, Clinical Case Reports www.clinicalcasesjournal.comwhich aims to directly improve health outcomes by identifying and disseminating examples of best clinical practice.

Manuscript Submission

Paediatric and Perinatal Epidemiology requires all manuscript to be submitted electronically at: (http://mc.manuscriptcentral.com/PPE). Log-in or click the “Create Account” option if you are a first-time user of ScholarOne Manuscripts. Full instructions and support for authors (and reviewers) are available on the site. Support can be contacted by e-mail at support@scholarone.com or athttp://authorservices.wiley.com/bauthor/journal.asp. If you are having trouble submitting online, the Editorial Assistant (PPEoffice@wiley.com) may be able to assist.

Manuscript Structure

Manuscripts in English should be typed with double spacing on one side of the paper only. Pages should be numbered consecutively.

For original articles, submissions should be kept to a maximum of 3,500 words, with a maximum of 5 tables/figures and 35 references. They should include a structured abstracts (maximum 250 words) under headings: Background, Methods, Results, Conclusions. Main subdivisions of the manuscript should be entitled Introduction, Methods, Results and Comments.

For review articles, submissions should be kept to a maximum of 4,500 words, with a maximum of 5 tables/figures and 50 references. They should include a structured abstracts (maximum 250 words) under headings: Background, Methods, Results, Conclusions.

For study design articles, submissions should be kept to a maximum of 4,500 words, with a maximum of 5 tables/figures and 35 references. They should included an unstructured abstract (maximum 250 words).

For methodology articles, submissions should be kept to a maximum of 3,500 words, with a maximum of 4 tables/figures and 35 references. They should included an unstructured abstract (maximum 250 words).

For brief reports, submissions should be kept to a maximum of 1,500 words, with a maximum of 3 tables/figures and 15 references. They should included an abstract (maximum 250 words), structure is optional.
For editorials the word limit is 1500 words. For commentaries the word limit is 1000 words. For letters to the editor the word limit is 400 words. These article types do not require an abstract.
The ***Title Page*** of the manuscript should contain:
• The title of the paper
• List of authors (excluding qualifications), each followed by a superscript letter to link with an affiliation.
• The affiliations of the authors preceded by superscript letters denoting which author is at each institution.
• Address for correspondence (full mailing address, telephone and fax numbers and e-mail address).

The ***Abstract*** should always appear at the beginning of the manuscript, entitled Abstract and structured with the following sub-headings: Background, Methods, Results, Conclusions (250 words)
Text and references should be printed in double spacing, with indented paragraphs. Tables should be typed with double spacing, each on a separate sheet, numbered consecutively with Arabic numerals, containing only horizontal lines, and with a concise legend. Place explanatory matter in footnotes which should be indicated alphabetically in superscript. Tables should be created such that it is easy to determine what is being shown.
P-values: For results of regression analyses, give the P-value of the whole variable, not of each individual item. In general, actual P-values should be quoted, particularly for those of marginal significance. Where, in addition, levels of statistical significance are indicated in a table, use the following symbols: *P0.05; **P0.01; ***P0.001; ****P0.0001.

We strongly encourage authors to present confidence intervals (instead of P-values) in tables and text. Confidence intervals should be put in square brackets, separated by a comma not a dash.

The *reference* category should always be labelled ”Reference” (not 'ref').
Figures: authors' original artwork will be used; labelling should be in Calibri typeface so that after reduction it is no smaller than 8pts; symbols and lines should be distinct after reduction; histograms should be black, white or hatched in distinctive ways; background rules should not be used. Legends for figures should be typed on a separate sheet. In the full-text online edition of the journal, figure legends may be truncated in abbreviated links to the full-screen version. Therefore, the first 100 characters of any legend should inform the reader of key aspects of the figure. Full details of submission of figures in electronic format are available at http://authorservices.wiley.com/bauthor/illustration.asp
Artwork: It is the policy of Paediatric and Perinatal Epidemiology for authors to pay the full cost for the reproduction of their colour artwork. Therefore, please note that if there is colour artwork in your manuscript when it is accepted for publication, Wiley-Blackwell require you to complete and return a colour work agreement form before your paper can be published. Once completed, please return the form to the Production Editor at ppe@wiley.com. Any article received by Wiley-Blackwell with colour work will not be published until the form has been received.
Acknowledgements (including details of funding) should be placed at the end of the text.
References in the text should be referred to by a superscript number after the punctuation. The ***list of references*** at the end of the paper should be listed in the order in which they appear in the text. Note that journal names should be spelt out in full, and both the beginning and ending page numbers should be listed in full. References to personal communications, unpublished data or manuscripts “in preparation” should not be included. If essential, such material may be incorporated at the appropriate place in the text. The style should be as follows:

For articles, give authors' names followed by initials, full title of the article, full name of journal, year of publication, volume number, first and last relevant page numbers. List all authors and if the number exceeds six give the first six, followed by et al.

For books, give authors' names followed by initials, title of chapter/article, title of book preceded by 'In:', 'Editor(s):' followed by name(s) and initial(s), place of publication, publisher's name, year of publication, first and last relevant page numbers.

Examples

• Sophist J, Paradigm K. The variation in infant sex ratio according to degree of maternal pedantry. *International Journal of Perinatal Variation* 1979; 7:143-152.

• Cart A. Patterns of illness in children living in an area of heavy pollution. In: *Horse Sense*. Editors: Loh J, Mee K, Soh AH. Solihull: Khyber Press, 1984; pp. 14-83.

We strongly recommend the use of a tool such as Reference Manager for reference management and formatting. Reference Manager reference styles can be searched for here:
http://www.refman.com/support/rmstyles.asp

Proofs will be sent via E-mail as an Acrobat PDF (portable document format) file. They should be returned to the publisher within 3 days of receipt. Major alterations to the text and illustrations are only allowed in exceptional circumstances and the additional cost may be charged to the author.

The following house style is used:

• Birthweight not birth weight; stillbirth not still birth
• Breast feeding (noun) not breastfeeding; and breast-feeding mothers (adjective)
• Preterm or low birthweight never premature
• Confidence intervals not confidence limits
• Multivariable not multivariate, for regression models with a single outcome variable
• Parity to refer to the number of viable previous pregnancies. Definitions vary - always define the term in the methods. Use parity 0 if the pregnant or delivering woman has had no previous viable pregnancies, and refer to her as a primipara (plural primiparae). A woman who has had at least one prior viable pregnancy is a multipara (plural multiparae).

Race, ethnicity and nationality

When race, ethnicity or nationality are identified as research variables, the authors should make clear the purpose for using such variables. Authors should describe their methods of definition and classification of racial, ethnic or national groups. Ethnocentricity should be avoided. For example, in choosing a reference group, it should not be assumed that the majority racial, or ethnic group is necessarily the best choice. Care should be taken to explain the choice of referent. Limitations of race, ethnicity and nationality data and measurement should be clearly stated. Known or potential causes of the observed differences between groups should be explored and discussed.

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Appendix 2: Permission letters from institutions

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MAMELODI HOSPITAL
Private Bag x 0032 P.O. Rethabile 0122
Tel no. +27 12 841 8300/8301

DECLERATION OF INTENT FROM THE CLINICAL MANAGER

I give preliminary permission to Lumbani Tshotetsi (Name of researcher)

to do his or her research on Risk factors for low birthweight in Teenage Mothers.

(Research topic)

in Mamelodi Hospital (Name of hospital).

Other Comments or Conditions prescribed by the Clinical Manager:

Final permission will be granted only after receiving ① Approved protocol, ② Ethical Clearance certificate and ③ Approval letter from Gauteng department of Health and. the permission is subject to approval by Mamelodi Research committee.

9/6/2016

Signature:
Clinical Manager

Appendix 3: Kgabo Clinic Research approval

Annexure 1: Declaration of intent from the clinic manager or hospital CEO

I give preliminary permission to LUMBANI TSHOTETSI (name of researcher) to do his or her

research on RISK FACTORS FOR LOW BIRTH WEIGHT FOR TEENAGE MOTHERS IN TSHWANE DISTRICT (research topic) in

(name of clinic) or

KGABO (name of CHC) or

(name of hospital).

I know that the final approval will be from the Tshwane Research Ethics Committee and that this is only to indicate that the clinic/hospital is willing to assist.

Other comments or conditions prescribed by the clinic or CHC manager or hospital CEO:

NONE

Signature
Clinic Manager/CHC Manager/CEO

LEHABE KGOMOTSO
Facility Manager & PHC Services
13375250

GAUTENG PROVINCIAL GOVERNMENT
TSHWANE DISTRICT HEALTH SERVICES
2016 -07- 13
KGABO CHC

Appendix 4: Pretoria West Hospital

School of Health Sciences and Public Health

University of Pretoria

31 Bophelo Road, Gezina

0084

21 May 2016

The Chief Executive Officer

Pretoria West Hospital

Private Bag X02

Pretoria

0001

Dear Dr Mosoane

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT INSTITUTION

I am a registered Masters student (No. 11158108) in the Department of Biostatistics and Epidemiology at the University of Pretoria. My supervisor is *Prof Shingairai Feresu* who is as well the head of the department for Biostatistics and Epidemiology track.

I am intending to conduct a case controlled study at your institution titled **Risk factors for low birthweight in Teenage mothers**. The study will compare the low birthweight and normal birthweight between the teenage and the adult mothers. Data collection will be through record review of mothers who had delivered from January 2014 to December 2014. I am therefore seeking your permission to allow me access to your data. Upon completion of the study, I undertake to report to you our research findings.

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:

My supervisor: - Prof Shinga Feresu** – Shinga.Feresu@up.ac.za **(Phone: 012 354 2376, fax: 012 354 2071)

Student: - Lumbani Tshotetsi** – Lumbani.Tshotetsi@up.ac.za **(Phone: 012 354 2142, Cell: 078 224 5342)

Your approval to conduct this study will be greatly appreciated.

If you agree, kindly sign below include hospital stamp and return the signed form either through email or fax. Alternatively, you may utilize a letter headed letter from your institution acknowledging that consent to conduct the study has been granted at your institution.

Yours sincerely,

Lumbani Tshotetsi

GAUTENG
DISTRICT HOSPITAL
06 JUN 2016
PRETORIA WEST HOSPITAL
PRIVATE BAG X02
PRETORIA WEST 0117

Approved by:

Mosoane HM (Dr) 06/06/2016

Print your name and title here | Signature | Dates

Appendix 5: Department of Health Research committee approval

Kuyasheshwa! Gauteng Working Better

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

427 Hilda Street, 4th floor, The Fields Building, Hatfield Pretoria 0001 South Africa. Tel: +27 12 451 9036
Enquiries: Dr. Molapane Chueu-Shabangu
e-mail: Molapane.Shabangu@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE

CLEARANCE CERTIFICATE

Meeting: N/A

PROJECT NUMBER: 28/2016

Title: Risk Factors for Low Birth Weight outcome for Teenage mothers in Tshwane District

Researcher: Lumbani Tshotetsi

Supervisor: Professor Shingairai Feresu

Co-Supervisor: Mrs Loveness Dzikiti

Department: Public Health, University of Pretoria

DECISION OF THE COMMITTEE

Approved

NB: THIS OFFICE REQUESTED A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE

Date: 01/08/2016

.....
Dr. Molapane Chueu-Shabangu
Chairperson Tshwane Research Committee
Tshwane Health District

.....
Mr. Pitsi Mathomone
Chief Director: Tshwane District Health
Tshwane District

NOTE: Resubmission of the protocol by researcher(s) is required if there is departure from the protocol procedures as approved by the committee.

Appendix 6: University of Pretoria Research Ethics Approval letter

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.
- FWA 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
- IRB 0000 2235 IORG0001762 Approved dd 22/04/2014 and Expires 22/04/2017.

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Health Sciences Research Ethics Committee

30/06/2016

Approval Certificate
New Application

Ethics Reference No.: 214/2016

Title: Risk factors for low birth weight for teenage mothers in Tshwane District

Dear Lumbani Tshotetsi

The **New Application** as supported by documents specified in your cover letter dated 24/06/2016 for your research received on the 24/06/2016, was approved by the Faculty of Health Sciences Research Ethics Committee on its quorate meeting of 29/06/2016.

Please note the following about your ethics approval:
- Ethics Approval is valid for 1 year
- Please remember to use your protocol number (**214/2016**) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, or monitor the conduct of your research.

Ethics approval is subject to the following:
- The ethics approval is conditional on the receipt of **6 monthly written Progress Reports**, and
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

We wish you the best with your research.

Yours sincerely

*** Kindly collect your original signed approval certificate from our offices, Faculty of Health Sciences, Research Ethics Committee, Tswelopele Building, Level 4-59*

Dr R Sommers; MBChB; MMed (Int); MPharMed,PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

The Faculty of Health Sciences Research Ethics Committee complies with the SA National Act 61 of 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 and 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

☎ 012 356 3085 fhsethics@up.ac.za http://www.up.ac.za/healthethics
✉ Private Bag X323, Arcadia, 0007 - Tswelopele Building, Level 4-59, Gezina, Pretoria

Appendix 7: Data collection tool

Maternal information

Biographic data	CODE
Date of data extraction……	**------/------/----------**
1. Age	☐ ☐☐
2. **Marital status** Single ----------0 Married ----------1 stable relationship----------2	
3. **Place of residence** Urban ----------0 Rural ----------1 Semi – urban ----------2	☐
Health status **4. Past Medical condition** **Diabetes** Yes ----------1 No ----------0	☐
Asthma Yes ----------1 No ----------0	☐
Tuberculosis Yes ----------1 No ----------0	☐
RH factor negative Yes ----------1 No ----------0	☐

Anaemia Yes ----------1 No ----------0	
Hypertension Yes ----------1 No ----------0	
Epilepsy Yes ----------1 No ----------0	
Sexually transmitted infection Yes ----------1 No ----------0 Other(specify)……	
5. **Tested for syphilis (RPR)** Yes ----------1 No ----------0 Unknown ----------2	
6. **If Yes indicate……** Treated ----------1 Not treated----------0	
7. **HIV status** HIV positive----------1 Negative----------0 Unkown ……2	

Positive not on ARV----------3 Positive on ARV----------4	
8. **Date of last menstrual period……**	**------/------/----------**
9. Did you attend antenatal care? Yes ----------1 No ----------0	☐
Gestation age (GA) in weeks of first booking reported by patient LMP …….	☐☐
Gestation age (GA) in weeks of first booking recorded by midwife	☐☐
10. How many times (time) has she attended the ANC?	☐
11. Was she referred to the hospital? Yes ……1 No ……..0	☐
12. **History of previous pregnancy/ies** **Living children** Yes ----------1 No ----------0	☐
Abortion Yes ----------1 No ----------0	☐
Still births Yes ----------1 No ----------0	☐

Preterm births Yes ----------1 No ----------0	☐
Low birth weight (< 2500 grams) Yes ----------1 No ----------0	☐
IUD Yes ----------1 No ----------0	☐
neonatal death (NND) Yes ----------1 No ----------0	☐
13. **Complications during previous pregnancy** Yes ----------1 No ----------0	☐ If 2 >> 16
14. Complication **Hypertension** Yes ----------1 No ----------0	☐
Anaemia Yes ----------1 No ----------0	☐
Pre/Eclampsia Yes ----------1 No ----------0	☐

Oligohydramnios Yes ----------1 No ----------0	☐
Polyhydramnios Yes ----------1 No ----------0	☐
Antepartum haemorrhage Yes ----------1 No ----------0	☐
Postpartum haemorrhage Yes ----------1 No ----------0	☐
Preterm rupture of membranes Yes ----------1 No ----------0	☐
Infection Yes ----------1 No ----------0	☐
15. **Preterm delivery** No ----------1 Not applicable ----------0	☐
16. Gravida……	Put number ☐

17. Parity……	Put number ☐
18. Complications during this pregnancy **Hypertension** Yes ----------1 No ----------0	☐
Anaemia Yes ----------1 No ----------0	☐
Pre/Eclampsia Yes ----------1 No ----------0	☐
Oligohydramnios Yes ----------1 No ----------0	☐
Polyhydramnios Yes ----------1 No ----------0	☐
Antepartum haemorrhage Yes ----------1 No ----------0	☐
Postpartum haemorrhage Yes ----------1 No ----------0	☐

Preterm rupture of membranes Yes ----------1 No ----------0	☐
Infections Yes ----------1 No ----------0	☐
Labour and delivery ***19.*** *Duration of labour* Adequate time ----------1 Less time ----------0 Prolonged ----------2	☐
20. **Was labour spontaneous** Yes ……1 No ……..0	☐
21. Any abnormalities in labour? Poor progress in the latent phase of labour------1 Poor progress in the active phase of labour -----2 Meconium staining of the liquor ----------3	☐
22. **Any emergencies during delivery?** Foetal distress ----------1 Cord prolapse ----------2 Shoulder dystocia ----------3	☐
23. **Type of delivery** Assisted (vacuum/ forceps) ----------1 Caesarean section----------2 Spontaneous ----------3	☐
All missing values will have code	**99**

Neonatal information

Item	Code
1. Date of delivery	-------/--------/--------
2. Time of birth (24 hour clock)	------- : ---------
3. Infant sex: male / female	Male = 1 Female = 0 ☐
4. Birth status: alive / dead	Alive = 1 Dead = 0 ☐
5. If dead, is it macerated still birth / fresh still birth	MSB = 0 FSB = 1 ☐
6. Estimated gestation at birth in weeks rounded to completed weeks (from last menstrual period)	- - (weeks)
7. Infant birth weight (birth mass) in grams (no decimals), rounded to nearest gram at 0.5 grams and above……..	- - - - (gram)
8. Apgar score at 1 minute.....	☐☐
9. Apgar score at 5 minutes.....	☐☐
10. Any abnormality: Yes / No (please specify……	Yes = 1 No = 0 ☐
11. Head circumference in centimetres…….	☐☐
12. Was the baby resuscitated? Yes / No	Yes = 1 No = 0 ☐
All missing values will have code 99	