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ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA -ZAMBIA

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ABSTRACT

Background: Obesity is increasing in pregnant women and at delivery and is associated with increased risk of instrumental delivery, operative delivery, macrosomia, shoulder dystocia, and poor foetal outcomes. This study aimed to determine the association of maternal obesity with maternal and foetal complications in labour for women delivering at the University Teaching Hospital in Lusaka, Zambia.

Methods: Convenience sampling was used to recruit participants on admission to labour ward. An interviewer administered questionnaire and review of medical records were used to collect data that included sociodemographic characteristics, antenatal and delivery details and maternal and newborn outcome.

Results: There were 262 participants. More obese women (Body Mass Index – BMI >30) delivered by caesarean section or instrumental deliveries 21.4% compared with only 13.7% of those with normal BMI (18.5-25). Of those that delivered vaginally, 14.9% of the obese women had prolonged second stage compared with 10.9% of the normal weight women. Shoulder dystocia was significantly associated with obesity. Mothers who did not have shoulder dystocia had 94% reduced odds for obesity (OR 0.06, CI 0.01 – 0.44, P = 0.01). The average birth weight from the obese women was 3470g whilst the normal weight women delivered babies with an average birth weight of 3170g. Birth weight was significantly associated with obesity. Adjusting for age, knowledge of weight before pregnancy, birth outcome, and shoulder dystocia, the birth outcome was marginally significantly associated with obesity. Compared to live births, stillbirths had on average 6.5 times increased odds of being born from obese mothers (OR 6.5, CI = 0.96 – 44.08, P = 0.06).

Conclusions: Birth weight is associated with maternal BMI and maternal obesity predisposes to prolonged second stage of labour and operative delivery, shoulder dystocia and stillbirths

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Contents

COPYRIGHT DECLARATION i
DECLARATION ii
STATEMENT iii
CERTIFICATE OF APPROVAL iv
ABSTRACT v
ACKNOWLEDGEMENT vi
LIST OF TABLES viii
DEFINITIONS viii
ABBREVIATIONS ix
DEDICATION x
1.0 INTRODUCTION 1
2.0 LITERATURE REVIEW 3
3.0 STUDY JUSTIFICATION 7
4.0 RATIONALE FOR STUDY 7
5.0 RESEARCH QUESTION 8
6.0 OBJECTIVES 8
7.0 RESEARCH METHODOLOGY 9
8.0 DATA ANALYSIS 11
9.0 PATIENT CONSENT 12
10.0 ETHICAL CONSIDERATIONS 12
11.0 RESULTS 13
11.1 Study participants – univariate analysis 13
11.1 Bivariate analysis 21
11.3 Logistic regression analysis 25
12.0 DISCUSSSION 27
13.0 CONCLUSIONS 29
14.0 STUDY LIMITATIONS 29
15.0 RECOMMENDATIONS 29
16.0 REFERENCES 30
APPENDICES 33
Appendix I: Participant information sheet 33
Appendix II: PARTICIPANT CONSENT FORM 35
Appendix III: Questionnaire 36
Appendix IV: Ethics approval and UTH permission 40

LIST OF TABLES

Table 1.1 Sociodemographic characteristics of the study subjects ……14

Table 1.2 Pregnancy characteristics of the study subjects ……16

Table 1.3 Pregnancy outcome of the study subjects ……..……..19

Table 1.4 Summary characteristics of study subjects – continuous variables …..…...20

Table 2.1 Bivariate analysis for association of study variables with obesity……..….22

Table 2.2 Bivariate analysis for association of outcome variables with obesity…..…23

Table 3.1 Logistic regression analysis predicting obesity ……..……..26

DEFINITIONS

Underweight women i.e. pre-pregnant BMI <18.5 (should gain a total of between 12.7kg to 18.1kg during pregnancy)

Normal weight women i.e. pre-pregnancy BMI of 18.5 to 24.9 (should gain a total of 11.3kg to 15.9kg during pregnancy)

Overweight women (BMI 25.0 to 29.9) (should gain a total of 6.8kg to 11.3kg)
Obese (BMI ≥ 30) (should gain between 4.9 to 9.7kg during pregnancy)
(Institute of Medicine, May 2009).

ABBREVIATIONS

BMI	Body Mass Index
CPD	Cephalopelvic disproportionate
GA	Gestation Age
GRZ	Government of the Republic of Zambia
GWG	Gestational Weight Gain
HAART	Highly Active Anti-retroviral Therapy
HIV	Human Immunodeficiency Virus
Ht	Height
HTN	Hypertension
IOM	Institute of Medicine
kg	Kilogram
LBW	Low Birth Weight
LGA	Large for Gestational Age
LMP	Last Menstrual Period
NICU	Neonatal Intensive Care Unit
OR	Odds ratio
PE	Pre-Eclampsia
PG	Postgraduate
PIH	Pregnancy Induced Hypertension
PPH	Postpartum Haemorrhage
SGA	Small for Gestational Age
SVD	spontaneous vaginal delivery
SPSS	statistical package for social scientists
UNZA	University of Zambia
UNZABREC	University of Zambia Biomedical Research Ethics Committee
UTH	University Teaching Hospital
WHO	World Health Organization
Wt	Weight

DEDICATION

This dissertation is dedicated to my late dad Mr Zacchaeus Greenwell Chaambwa, without whom I wouldn't have been who I am.

1.0 INTRODUCTION

Obesity is a global health problem that is increasing in prevalence (WHO, 2015). The World Health Organization characterizes obesity as a pandemic issue with a higher prevalence in females than males (Satpathy HK, 2013). Thus, more women are obese when they become pregnant and they still gain weight whilst pregnant. A maternal weight of 90kg is the upper limit of normal in pregnancy (Dutta, 2011), however body mass index (BMI) expressed as weight (kg) divided by height^2 (m^2) is a better guide to obesity. Ideal BMI should be between 18.5 and 25. Arbitrary cut off points of $\geq$25 and $\geq$30 are considered overweight and obese respectively (WHO, 2015). Obesity during pregnancy is considered a high-risk state because it is associated with many complications. Compared with normal weight patients, obese women have a higher prevalence of infertility. (Athukorala et al, 2010). Once they conceive, they have a higher rate of early miscarriage and congenital anomalies, including neural tube defects. Besides the pre-existing diabetes mellitus and chronic hypertension, obese women are more likely to have pregnancy induced hypertension, gestational diabetes, thromboembolism, macrosomia, and spontaneous intrauterine death in the latter half of pregnancy. (Ellen et al., 2008). Obese women also require instrumental or caesarean section delivery more often than average weight women. Following caesarean section, obese women have a higher incidence of wound infection and disruption. (Sharma, 2012). Irrespective of the delivery mode, children born to obese mothers have a higher incidence of macrosomia and associated shoulder dystocia, which can be highly unpredictable. In addition to being large at birth, children born to obese mothers are more susceptible to obesity in adolescence and adulthood. Several studies have linked maternal obesity to increased adverse pregnancy outcomes outlined above. Shama et al concluded that both pre-gravid body mass and weight

gain significantly influenced birth weight. The studies they reviewed provided strong evidence for the independent association of pre-gravid weight status and outcomes, moderate evidence for age and parity, and weak evidence for race (Sharma, 2012). Pre-pregnancy underweight increases the risk of small for gestational age (SGA) and low birth weight (LBW); pre-pregnancy overweight/obesity increases the risk of large for gestational age (LGA) and macrosomia (Holly et al., 2008). Approximately 30% of pregnant women are obese in the western world. This public health problem is on the increase in the third world, but currently there are no known epidemiologic studies. A study was done in Lusaka based on community adults and concluded that 14.2% (5.1% among male and 18.6% among female) of participants were obese (Rudatsikira, et al., 2012). No study on pregnant women has been done hence the prevalence is not known in Zambia.

It is imperative to investigate the association of maternal obesity with intrapartum complications at UTH Lusaka Zambia. The study will help in coming up with appropriate pre-pregnancy and antenatal counselling of obese women as a study of this nature has not been done in this region yet.

2.0 LITERATURE REVIEW

In 2009, the Institute of Medicine (IOM) updated the recommendation for total gestational weight gain according to pre-pregnancy BMI. To improve maternal and child health outcomes, women not only should be within a normal BMI range when they conceive but also should gain within the ranges recommended in the new guidelines. Meeting these challenges means that women will need preconception counselling, which may include plans for weight loss. For many women, this will mean gaining less weight, which may be particularly challenging for women who are overweight or obese at conception. The new recommendation is such that underweight women i.e. pre-pregnant BMI <18.5 should gain a total of between 12.7kg to 18.1kg during pregnancy, normal weight women i.e. pre-pregnancy BMI of 18.5 to 24.9 should gain a total of 11.3kg to 15.9kg, overweight women (BMI 25.0 to 29.9) should gain a total of 6.8kg to 11.3kg and obese (BMI ≥ 30) should gain between 4.9 to 9.7kg (Institute of Medicine, May 2009).

In Finland, in the 1990s, women giving birth became more overweight; i.e., the frequency of a pre-pregnancy BMI of 25 kg/m2 rose from 18.8% in 1990 to 24.5% in 2000, and the frequency of obesity (BMI > 30 kg/m2) rose from 7.5% to 11.0%. The same increasing trend in the prevalence of maternal obesity has been reported in other European countries and in the United States (Raatikainen, et al., 2006).

Abrams and Laros (1986) reported the effect of maternal weight gain on birth weight in 2946 live births with delivery after 37 weeks' gestation was studied at Moffitt Hospital, University of California (San Francisco), between September, 1980, and December, 1983. The sample was stratified into four categories according to pre-pregnancy weight for height with use of a body mass index. Multiple regression

analysis, controlled for selected co-variables, was carried out on the entire sample and on each pre-pregnancy weight group. For the entire sample, both pre-gravid body mass and weight gain significantly influenced birth weight. For the underweight, ideal weight, and moderately overweight women, each kilogram of maternal weight gain significantly increased birth weight.

In a study done by Sewell et al, it was concluded that overweight/obese women with normal glucose tolerance levels have neonates that are heavier than lean/average weight women because of increased adiposity. The purpose of their study was to compare body composition measures in neonates of women who were overweight/obese (body mass index, ≥25 kg/m2) versus women who were lean/average (body mass index, <25 kg/m2), all of whom had normal glucose tolerance levels (Sewell, et al., October 2006).

Another study on the impact of maternal body mass index on neonate birthweight and body composition, Holly. et al (2008), concluded that neonates born to mothers who have a normal BMI have significantly less total and relative fat and more fat-free mass than neonates born to overweight/obese mothers. Although preliminary, these data suggested that the antecedents of future disease risk (e.g. cardiovascular disease, diabetes, and obesity) occur early in life. (Holly R, et al., 2008)

In China, the incidence of maternal overweight/obesity has been increasing. However, there is not a meta-analysis to determine if pre-pregnancy body mass index is related to infant birth weight and offspring overweight/obesity. Pre-pregnancy underweight increases the risk of small for gestational age and low birth weight; pre-pregnancy overweight/obesity increases the risk of large for gestational age (LGA), macrosomia, and subsequent offspring overweight/obesity (Yu, et al., 2013).

In a Danish study, Nohr et al reviewed that High and very high gestational weight gain (GWG) added to the associations of high pre-pregnancy BMI with caesarean delivery and were strongly associated with high postpartum weight retention. Moreover, greater weight gains and high maternal BMI decreased the risk of growth restriction and increased the risk of the infant's being born large-for-gestational-age or with a low Apgar score. Generally, low GWG was advantageous for the mother, but it increased the risk of having a small baby, particularly for underweight women. It was thus concluded that heavier women may benefit from avoiding high and very high GWG, which brings only a slight increase in the risk of growth restriction for the infant. High weight gain in underweight women does not appear to have deleterious consequences for them or their infants, but they may want to avoid low GWG to prevent having a small baby (Ellen A, et al., June 2008).

To evaluate whether morbidly obese women have an increased risk of pregnancy complications and adverse perinatal outcomes, a study was conducted in Sweden by Cedergren (2004). This study concluded that morbidly obese mothers (BMI greater than 40) as compared with the normal-weight mothers had an increased risk of the following outcomes: preeclampsia, antepartum stillbirth, caesarean delivery, instrumental delivery, shoulder dystocia, meconium aspiration, foetal distress, early neonatal death and large-for-gestational age. The associations were similar for women with BMIs between 35.1 and 40 but to a lesser degree (Cedergren, 2004).

In Australia, approximately 15% of women aged 25 to 34 years were obese between 2004 and 2005. A study on the risk of adverse pregnancy outcomes in women who are overweight or obese concluded that overweight and obese women had increased risk of adverse outcomes (Athukorala et al, 2010). Other authors had concluded that the risk of perinatal death was high among overweight and obese women (Raatikainen, et

al., 2006). There is also evidence to suggest that obesity may be a risk factor for maternal death: The Confidential Enquiry into Maternal and Child Health's report on maternal deaths in the 2003–2005 triennium showed that 28% of mothers who died were obese, whereas the prevalence of obesity in the general maternity population within the same time period was 16-19% (Lewis, 2007). Cross-sectional Demographic and Health Surveys from 27 sub-Saharan countries (2003–09) were pooled and found that maternal obesity is associated with increased risk of early neonatal death. Potential mechanisms include prematurity, intrapartum events, or infections (Cresswell, et al., 2012).

In a study of community-based adults in Lusaka, Zambia, 14.2% (5.1% among male and 18.6% among female) participants were obese (Rudatsikira, et al., 2012). These figures are higher than those reported in Malawi by Msyamboza et al. who found that 2.0% of men and 7.3% of women were obese. The prevalence of obesity was 11.1% (7.5% among males, and 21.2% among females) in Douala, Cameroon; and in four urban districts of Cameroon (Yaounde, Douala, Garoua and Bamenda) the prevalence of obesity was 6.5% in males and 19.5% in females (Rudatsikira, et al., 2012).

Banda Y et al conducted a study to determine the influence of body mass index (BMI) on pregnancy outcomes of HIV-infected and HIV-uninfected Zambian women and to assess the possible role of BMI on mother-to-child transmission rate of HIV. This study concluded that birth weight increased alongside BMI in both HIV-infected and HIV-uninfected women. There was a suggestion that women with lower BMI had a greater risk of perinatal HIV transmission, even after adjustments for HIV viral load and CD4 count (Banda, et al., 2007).

The prevalence of obesity among Zambian pregnant women is unknown. Neither do we know the statistics of the complications associated with delivery in obese women. No study has been done on this subject.

3.0 STUDY JUSTIFICATION

There are no national statistics available on prevalence of maternal obesity and its association with complications in the antenatal period, during delivery and in the postnatal period. As such, this study will help analyze the complications caused by obesity during delivery. It will also determine the demographic data associated with maternal obesity and serve as a base for future research.

4.0 RATIONALE FOR STUDY

Obesity in pregnancy is on the increase in Zambia (Rudatsikira, et al., 2012). The complications associated with the increase in obesity include: preeclampsia, antepartum stillbirth, caesarean delivery, instrumental delivery, shoulder dystocia, meconium aspiration, foetal distress, early neonatal death and large-for-gestational age (Cedergren, 2004). The prevalence and association of maternal obesity at delivery at UTH is not known. Therefore, it

is imperative that such a study is done to determine the association of maternal obesity with complications during delivery.

5.0 RESEARCH QUESTION

Is maternal obesity associated with maternal foetal complications at delivery?

6.0 OBJECTIVES

6.1 General Objective

To study the association of maternal obesity with maternal and foetal complications in labour for women delivering at the University Teaching Hospital, Lusaka.

6.2 Specific Objectives

1. to determine foeto-maternal complications associated with obesity in labour
2. to determine socio-demographic factors associated with obesity

7.0 RESEARCH METHODOLOGY

7.1 Study Design

The study was a prospective cohort study. Participants were recruited on admission to labour ward. For every obese woman (BMI>30) a normal weight woman (BMI 18.5 to 25) was recruited as control group in the ratio of 1:1. They were followed up until they delivered and for six hours after being sent to postnatal ward.

7.2 Study Site

Study site was the University Teaching Hospital, Department of Obstetrics and Gynaecology, Labour ward, Lusaka.

7.2 Target Population

Target population was all pregnant women at term admitted in labour to labour Ward at UTH, Lusaka.

7.3 Study Population

Labouring women meeting eligibility criteria.

7.4 Study Duration

The study was conducted from July 2015 to January 2016

7.5 Participant Recruitment

Convenience sampling was used to recruit participants after obtaining informed consent. BMI was calculated and participants were stratified into normal weight and obese.

7.6 Inclusion criteria

1. All obese pregnant women at term and in labour
2. All normal weight term pregnant women in labour

7.7 Exclusion criteria

1. All preterm labour women
2. Known diabetic women
3. Multiple gestations
4. All acutely ill patients
6. Informed consent not given

7.8 Sample Size

Open Epi version 3, open source calculator for cohort studies was used to calculate the sample size. It was assumed that 0.5% of patients seen in UTH labour ward being obese (BMI>30) based on anecdotal data. A total of 262 women were enrolled, of which 131 were obese while 131 were normal weight.

7.9 Variables

7.9.1 Independent variables

Age, marital status, education level, employment status, residence, income, smoking BMI status, gestation age and medical condition like diabetes, hypertension and HIV status.

7.9.2 Dependent variables

7.9.2.1Maternal

Mode of delivery, duration of second stage, shoulder dystocia, episiotomy, perineal lacerations, operative delivery, postpartum haemorrhage, admission to MICU, death

7.9.2.1Neonatal

Birth weight, sex, birth outcome, Apgar score, birth trauma, admission to NICU, early neonatal death.

7.10 Procedures

Interviewer administered questionnaire, review of medical records, weight and height.

7.11 Follow up time

The patients were followed up to six hours after delivery.

7.12 Data collection

Interviewer administered questionnaire was used to collect information (Appendix III). The medical records of consenting participants were also reviewed for extra information.

8.0 DATA ANALYSIS

Data were analyzed using the statistical software package SPSS version 21. All statistical tests were at 5% significance level. The Pearson's chi-squared test was used for comparison of proportions between groups. The Fisher's exact test was used when one or more of the cells had an expected frequency of five or less. Both SPSS and MS Excel were utilized for analysis and graphical output. Study variables were checked for evidence of collinearity based on a Spearman correlation coefficient > 0.8. Selection for logistic regression model was considered at level $P < 0.20$ or known clinical significance. Backward selection method was used to obtain the final logistic regression model for predicting obesity. The backward selection method removes terms one at a time beginning with the largest p-value and continuing until all remaining effects are significant at a specified level or removing more terms results in poorer fit.

9.0 PATIENT CONSENT

Information was given and explained in a language that the participant could understand using the information sheet (see Appendix I). Concerns and questions that the participant had were answered and clarified.

Consent form (see Appendix II) was administered to participants aged 18 years or older, for participants younger than 18 years, consent was sought from and signed by their parents or guardian.

10.0 ETHICAL CONSIDERATIONS

Ethical approval was sought from the University of Zambia Biomedical Research Ethics committee (UNZABREC). Permission was obtained from the Senior Medical Superintendent of the University Teaching Hospital and the Head of department of Obstetrics and Gynaecology (Appendix IV). Informed consent was obtained from eligible participants. It was made clear to the participants that their participation in the study was voluntary and that they were free to withdraw from the study at any time without any prejudice to further medical care. Furthermore, participant confidentiality was maintained throughout the study. The risk to participants in this study was less than minimal, because all the procedures that were done were part of the standard of care.

11.0 RESULTS

11.1 Study participants – univariate analysis

There were 262 women enrolled for this study, 131/262 (50%) obese women (BMI≥30) and 131/262 (50%) normal weight women with BMI between 18.5 and 25.0.

Sociodemographic characteristics of the study subjects

There were 34/262 (13.0%) women less than 20 years, 187/262 (71.4%) aged between 20 and 34 years, 41/262 (15.6%) aged 35 years and above (Table 1.1). The minimum age of the study women was 16 years and maximum 44 years. The mean age of all the study women was 27.9 years (SD = 6.56).

There were 12/262 (4.6%) mothers with no education, 57/262 (21.8%) with primary education, 147/262 (56.1%) with secondary education, and 46/262 (17.6%) with tertiary education. A bigger proportion of the mothers, 198/262 (75.6%), were not employed, 26/262 (9.9%) were in informal employment, and 38/262 (14.5%) were in formal employment. About half of the mothers, 133/262 (50.8%), were from high density residential locations, 85/262 (32.4%) were from medium density locations, 34/262 (13.0%) were from low density locations, and 10/262 (3.8%) from peri-urban locations.

Table 1.1 Sociodemographic characteristics of the study subjects (n = 262)

Variable	**Frequency**	
	n	**%**
Age		
< 20 years	34	13.0
20 - 34 years	187	71.4
35 years or more	41	15.6
Mean age in years (SD) [n=262]; 27.9 (6.56)		
Marital status		
Single	35	13.4
Married	227	86.6
Education		
None	12	4.6
Primary	57	21.8
Secondary	147	56.1
Tertiary	46	17.6
Employment		
Not employed	198	75.6
Informal employment	26	9.9
Formal	38	14.5
Residence		
High density	133	50.8
Medium density	85	32.4
Low density	34	13.0
Peri-Urban	10	3.8

Pregnancy characteristics of the study subjects

Only 61/262 (23.3%) of the mothers knew their weight before pregnancy and the remaining 201/262 (76.7%) of the mothers did not know their weight before pregnancy (Table 1.2). Of the mothers who knew their weight before pregnancy, the mean weight was 79 kg (SD = 16.77). The minimum weight was 43 kg and maximum 125 kg.

The mean early-antenatal weight recorded was 74.7 kg (SD = 17.80). The minimum early-antenatal weight was 44 kg and maximum 147 kg. The mean current weight of the mothers was 82.0 kg (SD = 18.25). The minimum current weight was 52 kg and maximum 150 kg. The mean height of the study mothers was 1.60 m (SD = 0.08). The minimum height was 1.3 m and maximum height 1.8 m.

The mean gestation age was 39.0 weeks (SD = 1.50). The minimum was 37 weeks and maximum 44 weeks.

A greater proportion of the study mothers, 199/262 (76.0%), were HIV negative status. There were only 3/262 (1.1%) of the mothers with unknown HIV status. There were 14/262 (5.3%) mothers that were HIV positive but not on HAART and 46/262 (17.6%) mothers HIV positive and on HAART.

There were 3 women who indicated they had other medical conditions, 1 had gestational diabetes mellitus and 2 had syphilis. All the 3 women were from the obesity group.

There were 13/262 (5.0%) mothers who indicated they were having swollen feet or body and 249/262 (95.0%) had no swollen feet or body. All the mothers indicated they did not smoke except one.

Table 1.2 Pregnancy characteristics of the study subjects (n = 262)

Variable	Frequency	
	n	**%**
Known weight before pregnancy		
No	201	76.7
Yes	61	23.3
Mean weight in kg before pregnancy (SD) [n=61]; 79.0 (16.77)		
Mean current weight in kg (SD) [n=262]; 82.0 (18.25)		
Mean current height in m (SD) [n=262]; 1.6 (0.08)		
*Mean gestation (SD) [n=*262]; 39.0 (1.50)		
BMI		
Healthy weight (18.5 - 24.9)	84	32.1
Overweight (25.0 - 29.9)	47	17.9
Obese (30 or higher)	131	50.0
HIV Status		
Unknown	3	1.1
Negative	199	76.0
Positive not on HAART	14	5.3
Positive on HAART	46	17.6
Swollen feet or body		
No	249	95.0
Yes	13	5.0

Pregnancy outcome

A greater majority of the mothers, 216/262 (82.4%), had delivered by SVD, 5/262 (1.9%) had vaginal assisted breech delivery, and 36/262 (13.7%) had C/S delivery. (Table 1.3). Among the 36 mothers who delivered by C/S, CPD was the indication in19/36 (52.8%), Malposition in 3/36 (8.3%), Foetal distress in 8/36 (22.2%), and other indication in 6/36 (16.7%).

The mean birth weight was 3.3 kg (SD = 0.51). The minimum birth weight was 1.7 kg and maximum 5.5 kg. There were 126/262 (48.1%) females and 136/262 (51.9%) males. There were 12/262 (4.6%) with Apgar score at 5 minutes between 0 and 6, and 250/262 (95.4%) with Apgar score 7 or higher. There was only 1 case of reported birth injury, from the obese group, and this was cephalohematoma. There were 10 stillbirths of which three were macerated and seven were fresh stillbirths.

Among the 252 live births there were 17/252 (6.7%) who were admitted to NICU, the other 235/252 (93.3%) were not admitted to NICU. Birth asphyxia was the main reason for admission to NICU (88% of NICU admission). Others were big baby and trauma (6% apiece). There were only 2/252 (0.8%) early neonatal death within the first 24 hours, and these were from the normal weight group.

There were 121/262 (46.2%) mothers whose duration of the second stage of labour was less than or equal to 30 minutes, 82/262 (31.3%) between 31 and 60 minutes, and 30/262 (11.5%) more than 60 minutes. There were only 8/262 (3.1%) who had shoulder dystocia. An episiotomy was performed on 13/262 (5.0%) whereas 249/262 (95.0%) had no episiotomy performed. There were 95/262 (36.3%) mothers that sustained laceration, while 167/262 (63.7%) did not sustain any laceration. Among the

95 who sustained laceration, 77/95 (81.1%) had first degree, 13/95 (13.7%) had second degree, and 5/95 (5.3%) had third degree.

There were 232/262 (88.5%) mothers who did not have postpartum haemorrhage (PPH) and 30/262 (11.5%) who had PPH. For the 30 who had PPH, 8/30 (26.7%) was caused by atony, 18/30 (60.0%) caused by trauma, and 4/30 (13.3%) was caused by retained tissue. There were only 8/262 (3.1%) who had need for blood transfusion, 254/262 (96.9%) did not need blood transfusion. There was no mother who needed hysterectomy or needed MICU admission. No death was recorded for any of the mothers.

Table 1.3 Pregnancy outcome of the study subjects (n = 262)

Variable	Frequency	
	n	%
Mode of delivery		
SVD	216	82.4
Vaginal assisted breech	5	1.9
Instrumental vaginal delivery	5	1.9
Caesarean delivery (C/S)	36	13.7
Birth sex		
Female	126	48.1
Male	136	51.9
Birth outcome		
Macerated stillbirth	3	1.1
Fresh stillbirth	7	2.7
Live birth	252	96.2
Foetal Apgar Score (5min)		
0 – 6	12	4.6
7 – 9	250	95.4
NICU admission		
No	235	89.7
Yes	17	6.5
Duration of 2nd stage of labour by partograph		
<=30 min	121	46.2
31 - 60 min	82	31.3
> 60 min	30	11.5
Shoulder dystocia?		
No	254	96.9
Yes	8	3.1
Episiotomy performed?		
No	249	95.0
Yes	13	5.0
Mother sustain any laceration?		
No	167	63.7

Variable	Frequency	
	n	%
Yes	95	36.3
Mother have postpartum haemorrhage (PPH?)		
No	232	88.5
Yes	30	11.5
Need for blood transfusion		
No	254	96.9
Yes	8	3.1

Summary characteristics as continuous variables

Table 1.4 shows summary characteristics of the study mothers and neonates, as well as their outcomes.

Table 1.4 Summary characteristics of study subjects – continuous variables

Variable	n	Mean (SD)
Age (years)	262	27.9 (6.56)
Weight before pregnancy (kg)	61	79.0, 16.77
Early-antenatal weight recorded (kg)	249	74.7 (17.80)
Current weight (kg)	262	82.0 (18.25)
Height (m)	262	1.6 (0.08)
Gestation age (weeks)	262	39.0 (1.50)
Birth weight (kg)	262	3.3 (0.51)

11.1 Bivariate analysis

Table 2.1 and table 2.2 presents the bivariate analysis for association of study variables with obesity. Table 2.1 presents the participant characteristics and their association with obesity. By contrast, table 2.2 presents the outcomes and associations with obesity.

At 5% significance level the following study variables were associated with obesity: age ($P < 0.01$), education ($P = 0.01$), employment ($P < 0.01$), residence ($P = 0.04$), birth weight ($P < 0.01$), and shoulder dystocia ($P = 0.01$). Birth outcome (live birth or stillbirth) was marginally associated with obesity, P-value = 0.05. Marital status, HIV status, mode of delivery, foetal Apgar score, NICU admission, and gestation age were not associated with obesity.

Table 2.1 Bivariate analysis for association of study variables with obesity

Variable	Obese		Normal weight		P-value
	n	%	N	%	
Age					
< 20 years	3	2.3%	31	23.7%	<0.01[c]
20 - 34 years	97	74.0%	90	68.7%	
35 years or more	31	23.7%	10	7.6%	
Marital status					
Single	13	9.9%	22	16.8%	0.10[c]
Married	118	90.1%	109	83.2%	
Education					
Up to Primary	29	22.1%	40	30.5%	0.01[c]
Secondary	70	53.4%	77	58.8%	
Tertiary	32	24.4%	14	10.7%	
Employment					
Not employed	86	65.6%	112	85.5%	<0.01[c]
Employed (informal/formal)	45	34.4%	19	14.5%	
Residence					
High density	58	44.3%	75	57.3%	0.04[c]
Medium density	44	33.6%	41	31.3%	
Low density/Peri-urban	29	22.1%	15	11.5%	
Know weight before pregnancy					
No	87	66.4%	114	87.0%	<0.01[c]
Yes	44	33.6%	17	13.0%	
HIV Status					
Negative	104	80.0%	95	73.6%	0.23[c]
Positive	26	20.0%	34	26.4%	
Swollen feet or body					
No	122	93.1%	127	96.9%	0.16[c]
Yes	9	6.9%	4	3.1%	

[c] = Chi Square Test; [f] = Fisher's Exact Test; [t]= Independent Samples T-Test

Table 2.2 Bivariate analysis for association of outcome variables with obesity

Variable	Obese		Not obese		P-value
	n	%	n	%	
Mode of delivery					
SVD	103	78.6%	113	86.3%	0.10[c]
Caesarean section	28	21.4%	18	13.7%	
Birth sex					
Female	61	46.6%	65	49.6%	0.62[c]
Male	70	53.4%	66	50.4%	
Birth outcome					
Stillbirth	8	6.1%	2	1.5%	0.05[c]
Live birth	123	93.9%	129	98.5%	
Foetal Apgar Score (5min)					
0 – 6	5	3.8%	7	5.3%	0.55[c]
7 – 9	126	96.2%	124	94.7%	
NICU admission					
No	117	95.1%	118	91.5%	0.25[c]
Yes	6	4.9%	11	8.5%	
Duration of 2nd stage of labour by partograph					
<=30 min	57	50.0%	64	53.8%	0.64[c]
31 - 60 min	40	35.1%	42	35.3%	
> 60 min	17	14.9%	13	10.9%	
Shoulder dystocia?					
No	123	93.9%	131	100.0%	0.01[f]
Yes	8	6.1%	0	0.0%	
Episiotomy performed?					
No	125	95.4%	124	94.7%	0.78[c]
Yes	6	4.6%	7	5.3%	
Mother sustain any laceration?					
No	89	67.9%	78	59.5%	0.16[c]
Yes	42	32.1%	53	40.5%	
Mother have postpartum haemorrhage (PPH?)					

Variable	Obese		Not obese		P-value
	n	%	n	%	
No	116	88.5%	116	88.5%	0.99[c]
Yes	15	11.5%	15	11.5%	
Need for blood transfusion					
No	127	96.9%	127	96.9%	0.99[c]
Yes	4	3.1%	4	3.1%	
Age (mean, SD)	30.8, 5.66		24.9, 6.07		<0.01[t]
Gestation age (mean, SD)	39.0, 1.47		39.0, 1.53		0.87[t]
Birth weight (mean, SD)	3.5, 0.54		3.1, 0.41		<0.01[t]

[c] = Chi Square Test; [f] = Fisher's Exact Test; [t]= Independent Samples T-Test

11.3 Logistic regression analysis

Table 3.1 shows the final logistic regression analysis results by backward selection method predicting obesity. Age, birth outcome, shoulder dystocia, birth weight, and knowledge of weight before pregnancy were key factors associated with maternal obesity. Adjusting for knowledge of weight before pregnancy, birth outcome, shoulder dystocia, and birth weight, age was significantly associated with maternal obesity. Compared to mothers above 35 years of age, mothers below 20 years of age had 96% reduced odds for obesity [Odds Ratio (OR) = 0.04, 95% CI = 0.01 – 0.19, P < 0.01]. Mothers between 24 and 34 years had 63% reduced odds for obesity (OR = 0.37, CI = 0.16 – 0.83, P = 0.02). Knowledge of weight before pregnancy was an important factor in predicting pregnancy but not significantly associated with obesity, P = 0.08. Adjusting for age, knowledge of weight before pregnancy, birth outcome, and shoulder dystocia, birth outcome was marginally significantly associated with obesity. Compared to live births, stillbirths had on average 6.5 times increased odds of being born from obese mothers (OR = 6.5, CI = 0.96 – 44.08, P = 0.06). Shoulder dystocia was significantly associated with obesity. Mothers who had no shoulder dystocia had 94% reduced odds for obesity (OR = 0.06, CI = 0.01 – 0.44, P = 0.01). Adjusting for age, knowledge of weight before pregnancy, birth outcome, and shoulder dystocia, birth weight was significantly associated with obesity.

Table 3.1 Logistic regression analysis predicting obesity

Variable	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P-value
Age			
35 years or more	1	1	
< 20 years	0.10 (0.03 - 0.32)	0.04 (0.01 - 0.19)	< 0.01
20 - 34 years	1.08 (0.81 - 1.44)	0.37 (0.16 - 0.83)	0.02
Know weight before pregnancy			
Yes	1	1	
No	0.76 (0.58 - 1.01)	0.54 (0.27 - 1.07)	0.08
Birth outcome			
Live birth	1	1	
Stillbirth	4.0 (0.85 - 18.84)	6.50 (0.96 - 44.08)	0.06
Shoulder dystocia			
Yes	1	1	
No	0.94 (0.73 - 1.20)	0.06 (0.01 - 0.44)	0.01
Birth weight	1.03 (0.96 - 1.10)	3.60 (2.05 - 6.32)	<0.01

Age, birth outcome, shoulder dystocia, birth weight were key factors associated with maternal obesity. Mothers between 24 and 34 years had 63% reduced odds for obesity (OR = 0.37, CI = 0.16 – 0.83, P = 0.02).

Compared to live births, stillbirths had on average 6.5 times increased odds of being born from obese mothers (OR = 6.5, CI = 0.96 – 44.08, P = 0.06).

Shoulder dystocia was significantly associated with obesity. Mothers who had no shoulder dystocia had 94% reduced odds for obesity (OR = 0.06, CI = 0.01 – 0.44, P = 0.01).

12.0 DISCUSSSION

The following sociodemographic characteristics of the study participants were associated with obesity: age, education level, employment status and area of residence. Pregnancy characteristics which were associated with obesity were knowledge of weight antenatally. Pregnancy outcome characteristics which were associated with obesity were birth weight, shoulder dystocia and stillbirth. Birth outcome (live birth or stillbirth) was marginally associated with obesity. Marital status, HIV status, mode of delivery, foetal Apgar score, NICU admission, and gestation age were not associated with obesity. Mothers above 35 years of age were more likely to be obese compared to those less than 35.

The mean birth weight in obese mothers was 3.5kg, while in normal weight mothers it was 3.1kg. This was statistically significant with $P<0.01$ at 95% CI. Shoulder dystocia was significantly associated with obesity. (OR = 0.94, P =0.01, 95%CI)

Stillbirths had on average 6.5 times increased odds of being born from obese mothers (6.1% of babies born from obese mothers were stillbirths and only 1.5% from normal weight mothers were stillbirths). Just over 20% (21.4%) from the obese group had caesarean section and only 13.7% from those with normal weight had caesarean section. The difference was however, not statistically significant (p=0.1). The association of birth weight to maternal obesity correlates with what was found in studies by Abram B, at Moffitt Hospital, University of California (Abrams B, et al, 1986) and Sharma M, et al (Sharma, 2012). This study also found that birth weight increases alongside BMI in both HIV positive and HIV negative women, which is similar to what was found by was found by Banda Y, et al in a study to determine the

influence of BMI on pregnancy and outcomes of HIV positive and HIV negative Zambian women.

Ellen A, et al found that babies born from obese women had a risk of being born with a low Apgar score (Ellen A, et al 2008), however in this study most of the babies who had low Apgar score were from the normal weight group.

The findings in this study that stillbirths, shoulder dystocia and increased rates of operative deliveries are associated with maternal obesity agree with what was found in Sweden by Cerdegren, that stillbirth, shoulder dystocia and caesarean section rates are higher in obese women (Cerdergren, 2004).

There were only two neonatal deaths in this study and both were from the normal weight mothers. This is in contrary to Cross-sectional Demographic and Health Surveys from 27 sub-Saharan countries (2003–09) which concluded that maternal obesity in sub-Saharan Africa was associated with increased risk of early neonatal death. This finding in this study was not significant statistically. The study did not follow up the neonates to distinguish the cause of death of the two at NICU.

The United Kingdom Confidential Enquiry into Maternal and Child Health's report on maternal deaths in the 2003–2005 triennium showed that 28% of mothers who died were obese, however in this study there were no maternal deaths. This could be attributed to the sample size and the duration of study

13.0 CONCLUSIONS

Age, education level, employment status and area of residence were socio-demographic factors that were associated with obesity. From this study, it can be concluded that obese mothers tend to have bigger babies and are at higher risk of shoulder dystocia and stillbirths requiring both prenatal counseling and extra vigilance during pregnancy and childbirth.

14.0 STUDY LIMITATIONS

Most women did not know their pre-pregnancy weight. This limited the calculation of BMI to pregnancy weight. It was thus difficulty to establish the weight gain in the two groups. The gestational age based on last period is subjective. Some babies may not have been term but included in the study. Diabetic women were excluded and since obesity is a strong risk factor for gestational diabetes and poor outcomes, this could be included in future studies.

15.0 RECOMMENDATIONS

1. Obese patients should be treated as high risk for macrosomia, shoulder dystocia and stillbirth
2. To reduce on complications in labour, obese women should be encouraged to lose weight before pregnancy and maintain normal weight throughout pregnancy or gain the recommended total weight gain according to pre-pregnancy BMI.
3. All clinics should make it mandatory to have booking BMI calculated
4. This study was specific to complications during labour, a study on antenatal complications associated with obesity is hereby recommended

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APPENDICES

Appendix I: Participant information sheet

TITLE: ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA -ZAMBIA

My name is Herdley Chaambwa a postgraduate student from the School of Medicine at the University of Zambia. As part of the requirement for the award of a Master's Degree in Medicine, I am hereby conducting a research on the above subject in the department of Obstetrics and Gynaecology at the University Teaching Hospital (UTH) in Lusaka, Zambia

PURPOSE: Obesity is on the increase in Zambia, and is known to be associated with a number of health complications both to the mother and the unborn child. The purpose of this study will be to try and find out what complications are associated with maternal obesity with foetal complications among women delivering at UTH. The information collected will help in advising and managing obese women planning to get pregnant and those already pregnant on possible complications to the mother and on the baby during labour. This study will serve as a base for future research on pregnancy weight.

EXPLANATION OF THE PROCEDURE: You have been invited to participate in this study to help us see whether there is an association between your weight and any complications that may arise during delivery. If you agree to take part, you be given a consent form to complete and then will proceed with asking you some questions. The information you give on interview and that extracted from your medical records will be recorded on the questionnaire. We ask you to have your weight and height taken to enable us calculate your Body Mass Index (BMI). I wish to emphasise that no name(s) will be documented on this questionnaire and the information obtained from you will strictly be kept confidential and only used for this so purpose of this study.

I further wish to state that there is nothing new that will be administered to you. Your labour will be managed according to the standard of care at this hospital. Your

participation is purely voluntary and should you feel like withdrawing from this study at any time, you are free to do that and you will still receive the same standard medical care delivery.

BENEFITS: By agreeing to take part in the study, the participant will receive health counselling on obesity in pregnancy and complication associated with obesity to the mother and the baby during childbirth. The participant will also be entitled to know her BMI. No monetary benefit or special treatment will be given for participation into the study.

RISKS: There are no invasive risks that will be involved to the participants except for the anxiety and /or stress that may be induced from being aware of the risks associated with obesity in pregnancy to the mother and the baby but with proper counselling that will be offered during recruitment, this risk will be minimal.

If you agree to take part into the study, please sign the consent form which will allow us to enrol you into this study. Should you have any questions or seek more information related to this study, you can contact the following persons on the addresses below:

Principal Researcher

Dr Herdley Chaambwa

Cell: 0977818090

Ethics Committee

University Teaching Hospital

Department of OBGY

P/Bag RW1X

Lusaka.

herdley86@gmail.com

The Chairperson

Phone 0211-256067

UNZA Biomedical Research

Ridgeway Campus

P.O.BOX 50110

Lusaka

Appendix II: Participant Consent Form

ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA -ZAMBIA

I have read and understood all the information concerning this study and my participation into the study is purely voluntary.

Name: _____

Signature/right thumb print: _____ Date: _____

Witness

Name: _____

Signature: _____ Date: _____

Appendix III: Questionnaire

ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA -ZAMBIA

File #:_____ Firm: _____
LMP: _____ GA: _____
Phone number #:_____
Please tick or enter in the appropriate space.

SOCIO-DEMOGRAPHIC CHARACTERISTICS

1.0 Age: _____

1.1 Marital Status: 0.Unmarried ( )
1. Married ( )

***1.2** Education Level*

0. None ( )
1. Lower Primary (Grade 1-5) ( )
2. Upper primary (Grade 5-7) ( )
2. Junior Secondary ( )
3. Senior secondary ( )
4. Tertiary ( )

***1.3 Are** you employed?*

0. Not employed ( )
1. Informal ( )
2. Formal ( )

***1.4** What is your net monthly income in Zambian Kwacha?*

0. 0 - 1,000 ( )
1. 1,001 - 3, 000 ( )
2. 3,001 - 5,000 ( )
3. 0ver 5,000 ( )

1.5 Residence (write name of place of stay) _____

0. High density ( )
1. Medium density ( )
2. Low density ( )
3. Peri-urban ( )

ANTENATAL HISTORY

2.0 What was your weight before pregnancy?

0. Unknown ( )
1. known ( )

2.1 If known, enter figure in Kg _____

3.0 Early-Antenatal weight recorded (Kg):_____

Current weight (kg) _____

Height (m):_____

BMI (Earliest recorded Weight (kg) divided by Height squared (m^2))_____

4.0 Do you know your HIV status?

0. Unknown ( )
1. Negative ( )
2. Positive not on HAART ( )
3. Positive on HAART ( )

4.1 Any other medical condition? State: _____

***5.0 A**re you having swollen feet or body?*

0. No ( )
1. Yes ( )

6.0 Do you smoke?

0. No ( )

1. Yes ( )

EXAMINATION

7.0 Height of fundus: _____cm

OUTCOME

***8.0** Mode of delivery*

0. Spontaneous vaginal delivery ( )
1. Vaginal Assisted Breech ( )
2. Instrumental vaginal delivery (Ventouse or forceps) ( )
3. Caesarean section ( )

If delivered by caesarean section,

8.1 What was the indication?

0. CPD ( )
1. Malposition ( )
2. Foetal Distress ( )
3. Others ( ) state_____

8.2 What type of anaesthesia was used?

0. Spinal anaesthesia ( )
1. General anaesthesia ( )

8.3 was there any difficulties with anaesthesia

0. No ( )
1. Yes ( )

8.4 If yes what was the difficulty_____

8.5 Any anaesthetic complications?

0. No ( )
1. Yes ( )

8.6 If yes what was the complication_____

Foetal outcome

9.0 Birth weight _____

9.1 Baby sex:

0. Female ( )
1. Male ( )

***9.2** Birth*

0. Fresh stillbirth ( )
1. Macerated stillbirth ( )
2. Live birth ( )

***9.3** Live birth*

Apgar score, (a) 1min____
(b) 5min ____
(c) 10min_____

9.4 Did the baby sustain any birth injury?

0. No ( )
1. Yes ( )

*9.5 If yes what Type of injuries*_____

***9.6** Admission to NICU (**D11**)*

0. No ( )
1. Yes ( )

9.7 If yes, reason _____

9.8 Early neonatal death within the first 24 hours

0. No ( )
1. Yes ( )

Maternal outcome

10.0 Duration of the second stage of labour by partogragh

0. Less than or equal to 30 minutes ( )
1. Between 30 and 60 minutes ( )
2. More than 60minutes ( )

10.1 Was there shoulder dystocia?

0. No ( )
1. Yes ( )

10.2 Was an episiotomy performed?

0. No ( )
1. Yes ( )

10.3 Did the mother sustain any laceration?

0. No ( )
1. Yes ( )

10.4 If "yes", was it.

0. 1st degree ( )
1. 2nd degree ( )
2. 3rd degree ( )
3. 4th degree ( )

10.5 Did she have postpartum haemorrhage (PPH?)

0. No ( )
1. Yes ( )

10.6 If "yes" what was the cause for PPH?

0. Atony ( )
1. Trauma ( )
2. Retained tissue ( )
3. Bleeding disorder ( )

9.7 Was there need for blood transfusion?

0. No ( )
1. Yes ( )

9.8 If yes, how many units were transfused? _____

9.9 Was there need for Hysterectomy?

0. No ( )
1. Yes ( )

9.10 Was there need for MICU admission?

0. No ( )
1. Yes ( )

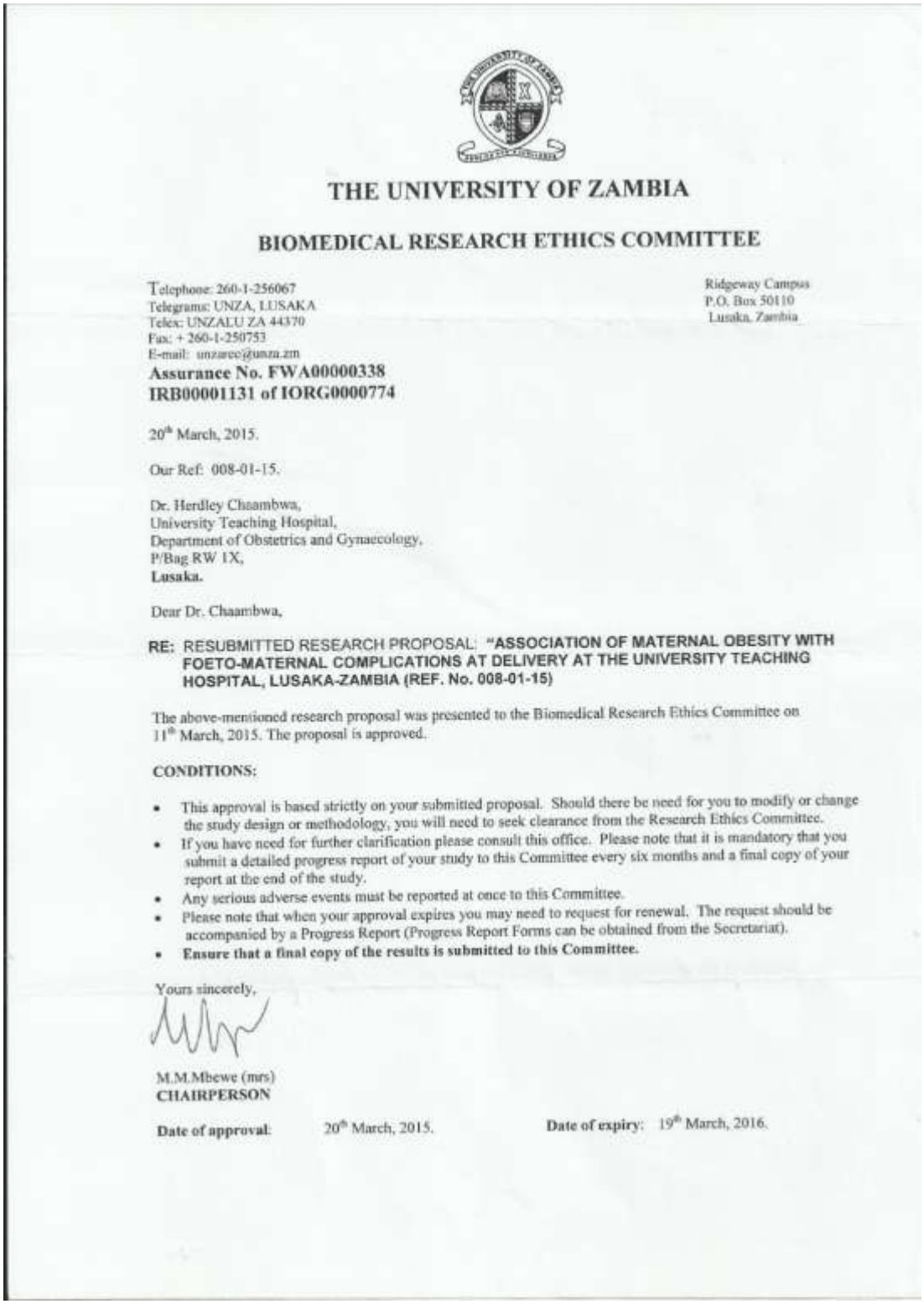
9.11 If "yes" what was the reason for MICU admission? _____

9.12 Death?

0. No. ( )
1. Yes ( )

9.13 If yes what was the cause? _____

Appendix IV: Ethics approval and UTH permission



THE UNIVERSITY OF ZAMBIA

BIOMEDICAL RESEARCH ETHICS COMMITTEE

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Lusaka, Zambia

Assurance No. FWA00000338
IRB00001131 of IORG0000774

20th March, 2015.

Our Ref: 008-01-15.

Dr. Herdley Chaambwa,
University Teaching Hospital,
Department of Obstetrics and Gynaecology,
P/Bag RW 1X,
Lusaka.

Dear Dr. Chaambwa,

RE: RESUBMITTED RESEARCH PROPOSAL: **"ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA-ZAMBIA (REF. No. 008-01-15)**

The above-mentioned research proposal was presented to the Biomedical Research Ethics Committee on 11th March, 2015. The proposal is approved.

CONDITIONS:

- This approval is based strictly on your submitted proposal. Should there be need for you to modify or change the study design or methodology, you will need to seek clearance from the Research Ethics Committee.
- If you have need for further clarification please consult this office. Please note that it is mandatory that you submit a detailed progress report of your study to this Committee every six months and a final copy of your report at the end of the study.
- Any serious adverse events must be reported at once to this Committee.
- Please note that when your approval expires you may need to request for renewal. The request should be accompanied by a Progress Report (Progress Report Forms can be obtained from the Secretariat).
- **Ensure that a final copy of the results is submitted to this Committee.**

Yours sincerely,

M.M.Mbewe (mrs)
CHAIRPERSON

Date of approval: 20th March, 2015. **Date of expiry:** 19th March, 2016.

Herdley Chaambwa
Dept of Obs &Gynae
The University ofZambia
LUSAKA

30th December, 2014

The Senior Medical Superintendent
University Teaching Hospital
LUSAKA

Dear Sir,

RE: PERMISSION TO CONDUCT A RESEARCH ENTITLED: ASSOCIATION OF MATERNAL OBESITY WITH FOETO-MATERNAL COMPLICATIONS AT DELIVERY AT UTH

I am hereby seeking permission to conduct the above captioned study in the Department of Obstetrics and Gynaecology of UTH. This is part of the requirement for the award of a **Masters of Medicine Degree in Obstetrics and Gynaecology.**

Kindly receive my research proposal for your consideration.

Your favourable response to this matter will be highly appreciated.

Thank you.

Yours faithfully,

HERDLEY CHAAMBWA