Determinants of adverse pregnant outcomes in Mutare district clinics, Manicaland Province, Zimbabwe.

By

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Declaration

I declare that the dissertation titled "**Determinants of adverse pregnant outcomes in Mutare district clinics, Manicaland Province, Zimbabwe.**" which I hereby submit for the degree Master of Public Health to the University of Pretoria is my own original work and where other people's work has been used, it has been properly acknowledged and referenced. Neither this work, nor any part of it, has been submitted to any other tertiary institution for any degree or diploma.

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May the hand of God be upon you all
Blessmore Vimbai Chaibva

Dedication

This dissertation is a special dedication to all women who have seen themselves through the nine months of joy, anxiety and expectation of an addition to their families. This joy however is cut short at the end of the period after the baby has been termed stillbirth or only a few days after giving birth they have to say goodbye to a precious neonate who has just deceased. They ask many questions which remain unanswered. I hope that the findings of this study will help in ensuring that factors that can be addressed from the facility level are rectified so that women come out of the hospital with joy unspeakable.

I also dedicate this work to my late grandfather, Hundivenga Munhanga, a man of God who stood by me in prayer. Grandfather, your love, teachings will always be in my heart. I know you were always in the prayer closet for me. I miss you and may your soul rest in eternal peace. Your life here on earth was well spent and I celebrate what God has done in my life through your teachings.

Executive summary

Globally, neonatal mortality, and still births are major public health problems. Though preventable, nearly three million babies die every year in their first month of life and a similar number are stillborn, accounting for 7% of global burden of disease, which is higher than the burden of Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome (HIV/AIDS). Up to 50% of all deaths within the first month occur within the first 24 hours of life, and up to 75% occur in the first week.

Zimbabwe's Neonatal Mortality Rate (NMR) rose from 33/1000 deaths per 1000 live births in 1990 to 39/1000 in 2012. The country is far from reaching Millennium Development Goal 4 (MDG4) on child survival as the pattern on rising NMR is evident in districts like Mutare. Though interventions like result based financing (RBF), increase in midwifery training, provision of Basic Emergency Obstetric and Neonatal Care (BEMNOC) have been implemented in the district, the district has a high NMR of 55.2 deaths per 1000 live births.

This study aims to explore the determinants of adverse pregnancy outcomes in Mutare facilities. The primary objective of the research is to determine if pregnancy outcomes differ by socio-economic, maternal, neonatal, delivery and health system factors.

The study will employ a retrospective cross-section analytical approach. Records of pregnant women who delivered at 7 sampled facilities during the period January 2014 to June 2014 will be reviewed. The working definition for adverse pregnancy outcomes for this study will be women who had a fresh still birth or early neonatal deaths.

The results from the study will be presented as a report in partial fulfilment of the requirements for the award of the degree on Master of Public Health by the University of Pretoria. A presentation of the results will be made to the Health Executive of Mutare districts as well as Manicaland Province. The results will also be published in a reputable journal and availed for public consumption.

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List of acronyms

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
APH	Antepartum Hemorrhage
BEMNOC	Basic Emergency Maternal Neonatal Obstetric Care
DHE	District Health Executive
DHIS	District Health Information System
ENND	Early Neonatal Death
HIV	Human Immunodeficiency Virus
ICD	International Classification Division
IMAI	Integrated Management of Adolescent and Adult Illness
IMPAC	Integrated Management of Pregnancy And Childbirth
IPTp	Intermittent Preventive Treatment of malaria in pregnancy
LBW	Low Birth Weight
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MOHCC	Ministry of Health and Child Care
MRCZ	Medical Research Council of Zimbabwe
NMR	Neonatal Mortality Rate
NVD	Normal Vertex Delivery
PHE	Provincial Health Executive
PIH	Pregnancy Induced Hypertension
PMD	Provincial Medical Director
RBF	Result Based Financing
RTI	Reproductive Tract Infection
SSA	Sub-Saharan Africa
WHO	World Health Organization
ZDHS	Zimbabwe Demographic Health Survey

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PART ONE: RESEARCH PROTOCOL

1.0 Introduction and literature review

Background information

Definition and epidemiology of pregnancy outcomes

Perinatal outcomes refer to life events that occur to a newborn infant from the age of viability (28 weeks) and the first week of life.[1] The transition of a fetus immersed in amniotic fluid and totally dependent on placenta to a squalling air-breathing baby is a source of wonder to the family.[2] However the transitional process is not always smooth and can result in adverse events to the mother or baby. Pregnancy outcomes vary from pregnancy to pregnancy and can be: a healthy live baby, a low birth weight baby (LBW), prematurity in the baby, a stillborn, intra-uterine fetal death, early neonatal death and late neonatal death. Usually the health of the mother and newborn are inseparable and the most severe adverse outcomes of pregnancy include:- the death of the baby or the mother and in some cases both mother and baby.

The ICD-10 (International Classification of Diseases 10th revision) classifies stillbirths as a loss of a fetus (≥500g) from natural causes or a loss after the 22nd week of pregnancy. Early neonatal deaths (ENND), is defined as deaths that occur within the first seven days of life. Zimbabwe registers and captures fresh stillbirths, macerated stillbirths and early neonatal deaths as pregnancy outcomes in District Health Information System version 2 (DHIS2). Due to limited data, the working definition for adverse pregnancy outcomes for this study includes fresh stillbirths and early neonatal deaths.

Every pregnancy intends for a child, however tragic events to the affected mothers and families like still births and neonatal deaths are common, especially in low and middle income countries. Nearly, 3 million third trimester stillbirths occur every year with low and middle-income countries bearing 98% of the burden.[3] On the other hand, a similar number of children die within the first 28 days of life. While still births rates are less than 5 per 1000 live births in high income countries, these rates are at

least 25 deaths per 1000 live births in low and middle income countries. Of those that die within the first month of life, almost 50% die within 24 hours and 75% within first 7 days of life.[4]

The figure below highlights pregnancy outcomes.

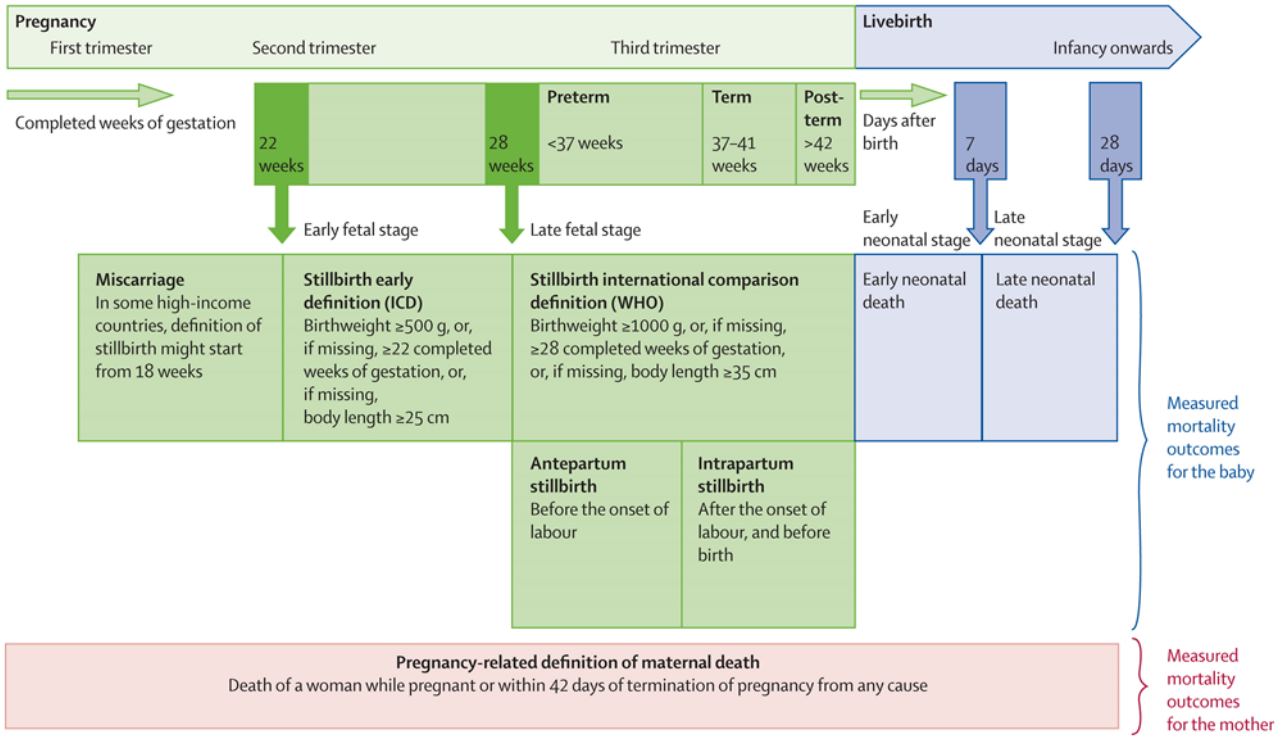

Figure 1: Definition of pregnancy outcomes:
Defining stillbirths and associated pregnancy outcomes for international comparison: Definitions from ICD, tenth revision. ICD=International Classification of Diseases. The Lancet 2011; 377:1448-1463 (DOI:10.1016/S0140-6736(10)62187-3

Global burden child mortality

Globally, under five mortality has reduced by 47% from 90 (CI 89, 92) deaths per 1000 live births in 1990 to 48 (CI 46, 51) in 2012.[5] However, this is far from achieving the MDG4 target of reducing under-5 mortality by two-thirds from the 1990 baseline. Furthermore, there is wide variability in the rates of reduction in under-5 mortality within regions and countries. While most regions have reduced under-5 mortality by at least 50%,[1] sub- Saharan Africa (SSA) rates of decline were 35%. [6]

While under-five mortality is on the decline globally, there is an increase in deaths during the neonatal period. The worlds neonatal mortality rate declined from 33 deaths per 1000 live births in 1990 to 21 in 2012, a 37% decline compared to a

decline from 90 to 48 deaths per 1000 live birth in under 5 mortality a 47% decline. Consequently, the proportion of under-five deaths that occur within the first month of life (the neonatal period) has increased 19 percent since 1990, from 37 percent to 44 percent, because declines in the neonatal mortality rate are slower than those in the mortality rate for older children.[5]

Adverse pregnancy outcomes and burden to the health care

Measurement of maternal, infant and child outcomes are basic indicators of a country's socio-economic, and level of health care.[7] Pregnancy monitoring from antenatal care, delivery and postnatal requires a complete health system from human resources, to governance and infrastructure. Because pregnancy complications (ante- and intra- partum) are often unpredictable they require a timely, rapid, skilled response and availability of tertiary obstetric services that are well coordinated by a team of midwife, obstetrician and paediatrician. Poor coordination of health activities, human and resources towards a pregnancy can result in adverse outcomes, e.g. stillbirths, neonatal and maternal deaths.

Stillbirths and neonatal deaths

Stillbirths and neonatal mortality are pregnancy outcomes of public health concern. Approximately 3 million[8] stillbirths and a similar number of neonatal deaths are recorded worldwide yearly with low and middle income countries contributing, 98% of the cases. This accounts for about 7% of the global burden of disease, which is greater than that contributed from vaccine preventable diseases and malaria.[9] Regional and inter-country still births and neonatal mortality rate variations are quite substantial. While, high income countries have a stillbirth rate of 4 deaths per 1000 live births, low and middle income countries have recorded nine times the rate. Inter-country variations have been recorded in Nigeria, where rural northern communities of Nigeria recorded higher stillbirths compared to teaching hospitals in southern Nigeria.[10,11]

Though stillbirths and neonatal mortality contribute greatly to child mortality, there is low recognition of the problem by policy makers at national and international levels. Outreach, family-community and facility based care when universally available have been shown to avert a 42-75% [12] neonatal mortality worldwide yet the burden of stillbirths and neonatal mortality is on the increase.

Risk factors/determinants of adverse pregnancy outcomes

Various factors which are of a public health concern have been shown to influence pregnancy outcomes. These can be divided into four major groups that are: socio-economic, maternal and health care factors.

The risk factors include:

Socio-demographic factors: maternal and paternal education,[13,14] parity,[15,16,17] gravidity, age of sexual debut, marital status,[18] inter-pregnancy interval (IPI). [19-21]

Maternal factors: age, [22-24] maternal medical history (obesity and diabetes, hypertension, HIV/AIDS),[16,25,26] pre-pregnancy weight, reproductive tract infection, malaria, smoking and alcohol consumption. [27]

Previous pregnancy outcomes: previous spontaneous or induced abortion,[28]

Neonatal factors: sex of the neonate,[29-31] gestational age,[16] birth weight, 5 minute apgar score,

Socio-economic factors: parental occupation,[32] household income,[13] education

Health care factors

Delivery factors: mode of delivery,[24,32] complications during delivery/ mother refereed for delivery services,[24,32] births attended by a trained birth attendant,[33] place of delivery,[22,24,34] use of partograph, free delivery services.[24]

Pre-delivery factors: availability and use of ante-natal care (ANC) services- prenatal care onset, frequency and timing of ANC, number of ANC visits,[35-38] booking status,[39] drug taking or use of plants during pregnancy.[40]

Levels of prevention

The risk factors for pregnancy outcomes are multifactorial and only some of them are preventable or treatable.[16] Primary prevention of adverse outcomes include proper nutrition for the woman to minimize maternal obesity a risk factor for adverse pregnancy outcome, cessation of factors like smoking and alcohol consumption. During the entire period of pregnancy, methods that can be used to prevent adverse pregnancy outcomes are available. These include: immunization against tetanus toxoid, folic-ferrous micronutrient supplementation, Intermittent Preventive Therapy (IPTp) for malaria. Routine screening of and treatment of reproductive tract infections (RTI), and syphilis can prevent adverse outcomes like preterm births. Identification

and early treatment of maternal malaria is important in prevention of severe outcomes like maternal deaths and stillbirths.

In Zimbabwe, adverse pregnancy outcome prevention strategies are through a continuum of care. These include; 4 focused antenatal visits for the pregnant women, integrated management of adulthood illness/ integrated management of pregnancy and childbirth (IMAI/IMPAC), deliveries assisted by skilled birth attendances, postnatal care visits at day 3,7. The country has also embarked on increased training of health workers in BEMNOC, training more midwives, building waiting mother's shelter to ensure that pregnant women can easily access emergency services if need arises. Another strategy that has shown an increase in health facility deliveries is removal of maternity user fees.

Literature review

Introduction

Globally, neonatal mortality is a major public health problem. Though preventable, nearly three million babies die every year in their first month of life and a similar number are stillborn. Within the first month, up to one half of all deaths occur within the first 24 hours of life, and 75% occur in the first week.[41] Neonatal mortality accounts for 7% of the global burden of disease which is higher than the burden of HIV/AIDS.

Sub-Saharan Africa has been termed the most dangerous continent for a baby to be born. The regional neonatal mortality for 2012 was 32 deaths per 1000 live babies contributing, 38% of global neonatal deaths. While 3 million neonates die globally, in Nigeria alone 255 000 neonates die a year.[42] The highest NMR, 66 deaths per 1000 live births, has been recorded in Liberia. Half of Africa's 1.16 million neonate deaths occur in just five countries – Nigeria, Democratic Republic of the Congo, Ethiopia, United Republic of Tanzania and Uganda.

Zimbabwe, has a rising NMR and is far from reaching MDG4 on child survival. Since 1990 to 2012 the NMR has increased from 33 per 1000 live birth to 39 per 1000 live births. According to the 2010/11 Zimbabwe Demographic Health Survey (ZDHS) the infant mortality rate was 57 deaths per 1,000 live births while the overall under-5 mortality rate for the period is 84 deaths per 1,000 live births. Sixty-eight percent of all deaths to children under-5 in Zimbabwe take place before a child's first birthday, with 37 percent occurring during the first month of life.[43]

The health structure in Zimbabwe is divided into primary, secondary, tertiary and quaternary levels. Administratively, the hierarchy is from facility, district, provincial and national level. For example, Mutare district is made up of 48 primary health centres, one secondary health facility (Sakubva maternity hospital) and one tertiary health facility (Mutare Provincial Hospital).

District mortalities have also shown an increasing perinatal mortality. Marondera, a district in Mashonaland East, one of the ten provinces of Zimbabwe, recorded an increase in perinatal mortality of 58.6/1000 and 64.6/1000 live births in 2007 and 2008 respectively.[44] Mutare district recorded 534 (stillbirths + ENND) against 9673 (institutional live births) in 2013 which translated to 55.2 deaths per 1000 live births.[45]

Maternal programs in Mutare District

Mutare district, one of the seven districts in Manicaland is managed by local authority (city), the government and rural district council. The city (local authority) has 9 primary health facilities and a population of 190 314 while district caters for 263 433 people. The expected births for Mutare City and district are 7900 and 10994 respectively.

Primary health care provision at the facilities includes general outpatient consultation, HIV testing and counselling among others. Reproductive health services include family planning services, antenatal care, delivery and postnatal care. Only two of the city clinics provide basic emergency obstetric services - BEMNOC and conduct deliveries while 44 of the facilities (includes 1 secondary and 1 tertiary institution- Mutare Provincial Hospital) provide BEMNOC.

Mutare district maternal services are subsidised through Results Based Financing (RBF) since 2011. Provision of funds through the results based financing program in Mutare district is set to improve the availability, accessibility and quality of key reproductive and child health services and their optimum utilization. RBF means that women can get maternal services at the facilities free of charge and the facility is re-funded through the program (RBF).

Various indicators meant to improve maternal and child survival are being tracked through RBF. Pregnancy indicators that are being monitored include antenatal care visits, pregnant women screened for syphilis, delivery attended by skilled health worker in health institutions and post natal care.

The theory of RBF is financing for results and is set to encourage managers to take responsibility. Health facility managers are empowered to find solutions to solve specific problems and they have the freedom to make decisions of how best to use their revenue, which inputs to buy and from which independent supplier. For example, some facilities decided to build waiting mothers homes as a means to ensure that pregnant women are close to the health facility and basic obstetric care. Despite all these interventions the district recorded a high number of stillbirths and early neonatal deaths (55.2 deaths per live births).

RBF is also there to retain human resources for health. The staff receive 40% of the cash pay-out made to the facility as part of staff individual performance bonuses for results achieved. Though RBF was meant to improve the quality of services to pregnant women and improve pregnancy outcomes, the district had a high number of fresh stillbirths and early neonatal deaths (55.2/1000 deaths per live births) in 2013 which were mostly attributed to poor quality of services at the institutions.

Defining the research problem

Neonatal mortality remains a major contributor to death among children younger than 5 years in Zimbabwe. While under 5 mortality rate rose from 74/1000 live birth in 1990 to 90/1000 in 2012 the NMR increased from 31/1000 live births to 39/1000 in 2012. MICS 2014 showed a continued rising NMR trend from 20 deaths per 1000 live births in 2000 to 29 deaths per 1000 live births in 2014 The rising NMR in Zimbabwe despite interventions is a cause for concern as the country is far off from achieving MDG4 target of child survival.

The country embarked on various strategies which stretched throughout the continuum of care from pre-natal to post natal care. In order to improve access to pre-natal and delivery services by pregnant women, the country removed user fees. Peer reviews of maternal and perinatal audits were introduced as a way to improve the quality of antepartum services. Despite these efforts neonatal rates have been on the increase.

Manicaland province recorded the highest number of perinatal deaths in the country in 2013. According to DHIS2 data, the province recorded 1540 perinatal deaths, against 44 610 (42 875 Institutional and 1735 home) deliveries. However, this could be an underestimate due to the poor vital registry system.

DHIS2 data for the period January to June 2013, Manicaland province recorded 493 adverse pregnancy outcomes, against 20869 deliveries. Mutare district contributed close to 40% of the adverse pregnancy outcomes. The district recorded 4690 births out of expected births of 5497 and they also recorded 197 adverse pregnancy outcomes (stillbirths and fresh neonatal deaths)

Despite existing interventions to curb perinatal mortality data on the determinants of high perinatal mortality (adverse pregnancy outcomes) for the province and district is scanty. This study set out to establish the determinants of adverse pregnancy outcomes in Mutare district, and therefore recommend interventions that can be adopted to improve pregnancy outcomes in the district.

Conceptual framework

The Mosley and Chen conceptual framework for the study of child survival in developing countries was adapted, based on available data from the registers used by the Ministry of Health and Child Care (MOHCC) in Zimbabwe. Figure 2 shows the framework used in this study along with the selected possible predictors of neonatal mortality in Zimbabwe.

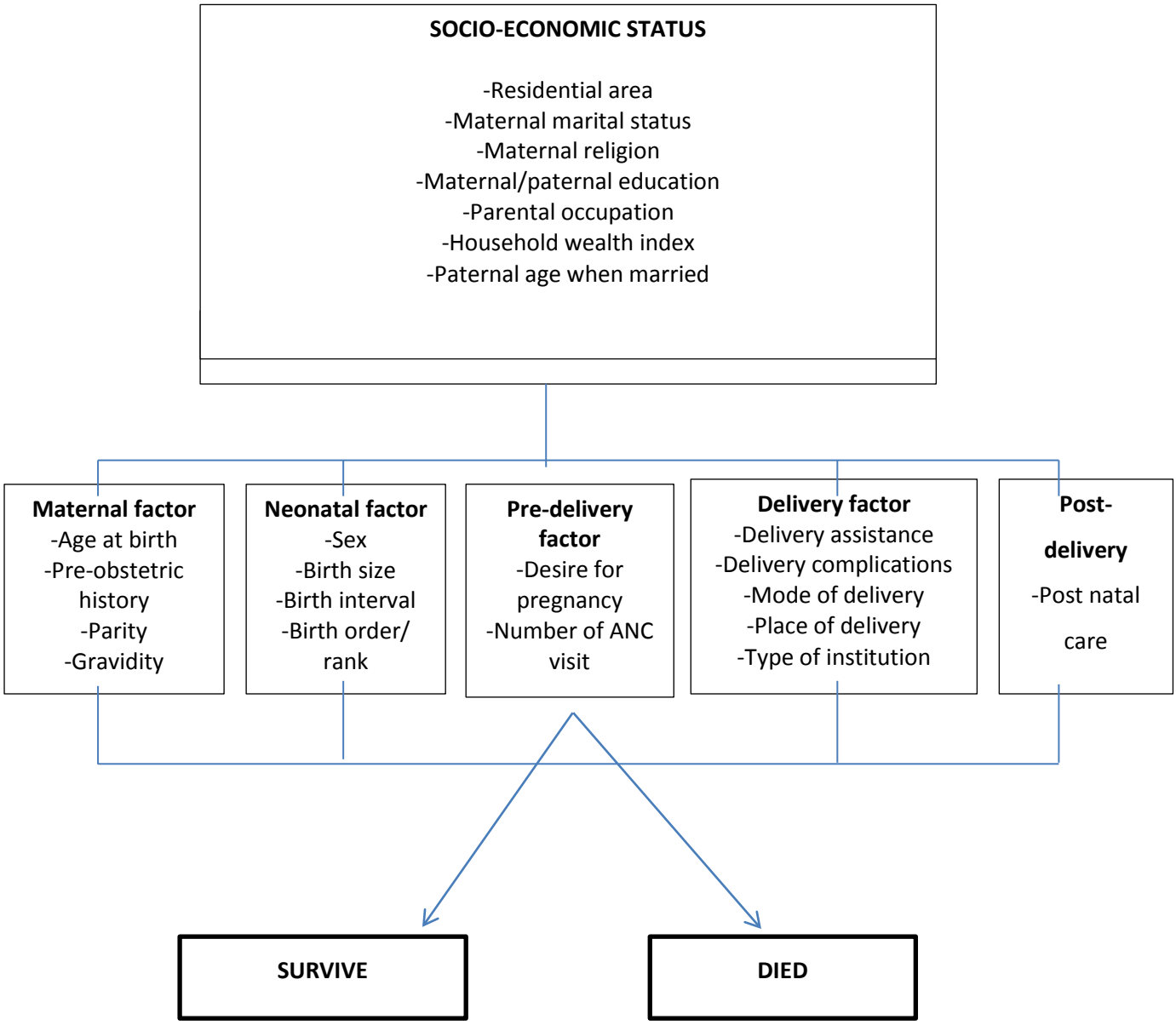

Figure 2: Mosley and Chen Conceptual framework

Conceptual framework for factors influencing pregnancy outcome **adopted from Mosley and Chen**

Research problem

Mutare district has a high proportion (55.2 deaths per 1000 live births) of adverse pregnancy outcomes. High adverse pregnancy outcomes contribute to high infant mortality which might result in the country failing to meet MDG4 target by 2015.

Research question

The research sought to establish the determinants of adverse pregnancy outcomes in Mutare district so as to inform the district to target their interventions in order to reduce the mortality.

Relevance of study

Maternity outcomes are indicative of the health care delivery system. A high rate of adverse pregnancy outcomes reflects a poor health delivery system and is therefore a public health concern. The study sought out to establish the determinants of adverse pregnancy outcomes and therefore, inform the district on appropriate strategies and interventions that can assist in reducing adverse pregnancy outcomes and thereby improve the services offered by the district.

Aims and objectives

Broad objective

The study aimed to explore the determinants of adverse pregnancy outcomes in Mutare district, Manicaland Province, Zimbabwe.

Specific objective

The study aimed to investigate if pregnancy outcomes differ by socio-economic factors, maternal and neonatal factors, health system related and maternal medical history. Specifically:

i. Socio-economic factors (e.g. residential are, maternal education)
ii. Maternal factors (e.g. maternal age, obstetric history)
iii. Neonatal factors (e.g. sex, birth interval)
iv. Maternal prenatal history (e.g. number of ANC visits)
v. Delivery factors (e.g. birth attended by a skilled birth attendant)
vi. Post-natal services provided

Methods

Study design

A retrospective analytical cross-sectional study review was employed. A review of patient records of women who were attended at Mutare district facilities from January 2014 to June 2014 was done. Only relevant data was extracted for the study. Operational definition for adverse pregnancy outcome included fresh still births and early neonatal deaths.

Study variables

Study outcome definition: adverse pregnancy outcome referred to fresh still births and early neonatal deaths. A fresh stillbirth was a neonate with no respiratory or circulatory signs of life at birth after 28 weeks of gestation. Early neonatal mortality included any death in the first 24 hours of life. In descriptive statistics neonatal mortality was defined as the number of neonatal deaths per 1000 live births. The explanatory variables included socio-economic and proximal determinants covering maternal, neonatal, pre-pregnancy, pregnancy and post-pregnancy factors.

Table 1: Operational definitions and categorization of the variables

VARIABLE	DEFINITION AND CATEGORIZATION
SOCIOECONOMIC DETERMINANTS	
Residential area	Residential area (1= urban 2= rural)
Maternal marital status	Marital status of mother (1=currently married 2= not married)
Maternal religion	Maternal religion (1= Christian 2=Moslem 3=Apostolic, 4= African Tradition)
Maternal education	Maternal years of schooling (as continuous variable)
Paternal occupation	Paternal years of schooling (as continuous variable)
Paternal age when married	Paternal age when married (as a continuous variable
PROXIMAL DETERMINANTS	
Maternal factors	
Maternal age	Maternal age at childbirth (as a continuous variable)
Obstetric history	Obstetric history (1=previous Caesarean section 2=previous risk factors like eclampsia, haemorrhage, 3=previous stillbirth/neonatal death; 4=none)
Maternal medical history	Maternal medical history (1=non-HIV/AIDS; 2=HIV/AIDS, 3=HIV/AIDS plus non-HIV/AIDS, 4=none
Maternal malaria	Malaria during pregnancy (1=yes; 2=no)
Maternal syphllis	Syphllis test results during pregnancy (1=positive; 2=negative;3=not done)

Neonatal factors	
Sex	Sex of neonate (1=female, 2=male)
Birth weight	Birth weight of neonate (grams)
Birth interval	Inter-pregnancy interval (number of years)
Parity	Parity (Integers)
Gravidity	Gravidity (Integers)
PRE-DELIVERY FACTORS	
Number of ANC visits	Number of ANC visits (Integers)
Timing of ANC visits	Timing of ANC visits (1= according to WHO recommendations, 2=not as WHO recommendations)
DELIVERY FACTORS	
Delivery assistance	Birth attendance during delivery (1=skilled health professional-midwife, obstetrician; 2=non-midwife health professional; 3=traditional birth attendant/other)
Delivery complications	Complications during delivery (1=No; 2= Yes)
Mode of delivery	Mode of delivery (1=NVD, 2= caesarean section 3= breech)
POSTNATAL SERVICES	
Post natal care	Post natal services received by neonate (1=no; 2=yes)

Study setting

The study was conducted at Sakubva Maternity Hospital, Mutare district, Zimbabwe. The hospital receives referrals from the city and rural clinics.

Study population

Records of all pregnant women who were attended to at Sakubva maternity hospital during the period January 2014 to June 2014 who met the inclusion criteria were considered for the study.

Inclusion criteria:

Women who had singleton deliveries at Sakubva maternity hospital, Mutare District during the period January to June 2014

- Women whose age is 18 years and above
- Women resident in Mutare District.

Exclusion criteria

- Women aged less than 17 years
- Women referred from other districts beside Mutare and referred from other provinces

Sampling method

A random sample of the women who delivered in Mutare district was considered for the study.

Sample size calculation

The Dobson's formula was used to calculate the sample size

$$n = z^2 p(1-p)/\Delta^2$$

Where:

n = sample size

z = maximum allowable error risk

p = proportion of women who have adverse pregnancy outcomes

(1-p) = proportion of women who do not experience any adverse pregnancy outcomes

And

Δ=absolute precision

Using a 95% confidence interval (z=1.96), Δ =0.05 and p= 0.18(where 18% of women had an adverse pregnancy outcome)[15]

$$= (1.96)^2 \frac{0.18 \times 0.82}{(0.05)^2}$$

= 227

Assuming a response rate of 80% (analogous to completeness of records)

n = (1/0.8) * 227

n = 283

the minimum sample which was required in the study is 300.

Measurement

Routine paper managed data from January to June 2014 was used in the study. Records of women who were attended to at Sakubva maternity hospital from

January to June 2014 were used so as to ensure validity of the study. Missing data was completed through calling the women via telephone.

Data Management and Analysis

Patient database in Mutare district is manual. Data, variables necessary for analysis were extracted from manual registers, perinatal deaths forms to Excel. Data was then imported to Stata 13 for analysis. The final analysis was under the guidance of the mentors.

Descriptive statistics were computed for all variables. STATA 13.0 (Stata Corp, College Station, TX) was used to summarize data, compare variables and test hypotheses by generating means, frequencies, proportions, p-values and 95% confidence intervals (CI).

Univariate and multivariable logistic regression was applied. The Univariate identified individual factors that influence the outcome of measure (Survive or died).

Multivariate logistic regression was used to model the joint effects of all the factors that influence pregnancy outcome. The problem of multiplicity was addressed.

Ethical considerations

Ethical approval for the study was obtained from the University of Pretoria Research Ethics Committee and Medical Research Council of Zimbabwe (MRCZ).

No personal identifiers such as names and registration numbers of patients appeared in the final report to ensure confidentiality and anonymity. Identification (registration) numbers were used to aid in the analysis of data and as reference.

Only the researchers directly involved in this study had access to the data and only for the purpose of this study.

No physical harm was inflicted since no human specimens were extracted from participants.

Permissions

Permission to access records was obtained from the Provincial Medical Director: Manicaland Province and the District Medical Officer Mutare District.

Logistics and time schedule

The Gantt chart attached in Appendix 1 shows the management of the project with regards to time.

Budget/ resources

Appendix 2 shows and estimated budget of ZAR 21380.00 for the study which was funded by the researcher.

Reporting of results

The findings of this study were presented as a research report in partial fulfilment of the requirements for the award of the degree of Master of Public Health (MPH) at the University of Pretoria. A copy of the report was also be presented to the Health Executive of the District and Manicaland Province -DHE and PHE respectively.
The results were forwarded to a reputable journal for peer review and publication and for general public.
Ms B. V. Chaibva was the first author and Prof Beke, Prof Olorunju and Dr Nyadundu were second, third and fourth authors respectively.

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Appendix 1: Study Gantt Chart

Activity	June	July	August	Sept	Oct
Final draft of protocol					
Presentation to UP Research Ethics Committee					
Approval from UP REC					
Presentation to Medical Research Council of Zimbabwe MRCZ					
Approval from MRCZ					
Permission from PMD					
Preparation for data collection					
Data collection and entry					
Preparation for data analysis					
Data analysis					
First draft of final report					
Final draft of report					

Appendix 2: Estimated Study Budget / Resources

Budget Item	Quantity	Units	Unit Cost (ZAR)	Total Cost (ZAR)
Photocopying and Printing				
Research protocol (7 copies)	7	Copies	40	280
Research report	2	CDs	50	100
Research report Paper	4	Copies	250	1000
Questionnaire – codebook	1000	Copies	2	2000
Toner	1	Containers	600	600
Miscellaneous				2000
Sub-Total				**7180**
Communication				
Internet and communication	5	Months	500	2500
External hard drive & USB	2		900	1800
Sub-Total				**4300**
Data Collection				
Travel to and from site	10	Days	150	1500
Travel- South Africa and Zimbabwe	2		4000	8000
Sub-Total				**9500**
Dissemination of data				
Posters	2		800	1600
GRAND TOTAL				**21380**

PART TWO: JOURNAL ARTICLE

2.1 Cover Letter

Faculty of Health Sciences
School of Health systems and Public Health
HW Snyman Building (North)
31 Bophelo Road
Gezina
Pretoria

16th December 2014

The Editor
BMC Pregnancy and Childbirth

REF: SUBMISSION OF MANUSCRIPT

Dear Sir/Madam,

Please find attached our manuscript entitled **"Determinants of adverse pregnant outcomes in Mutare district Clinics, Manicaland Province, Zimbabwe"** by Chaibva B V, Beke A, Olorunju SAS and Nyadundu S, a research article for consideration for publication in your journal.

We believe the results presented in the manuscript provide insight into the development of appropriate strategies and interventions to help to reduce stillbirths and neonatal deaths and contribute to lower mortality among under five children.

All authors listed have approved the manuscript and declared no competing interests. We declare that this manuscript has not been published in any scientific journal or meeting and is not being considered for publication by another journal.

Thank you for your consideration. Please address all correspondence to me by e-mail: bvchaibva@gmail.com.

Yours sincerely,

Blessmore V Chaibva

2.2 Manuscript

Determinants of adverse pregnant outcomes in Mutare district clinics, Manicaland Province, Zimbabwe.

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Abstract

Background: Perinatal deaths are adverse pregnancy outcomes that account for about 7% of global burden of disease, with developing countries contributing about 98% of deaths. This study aimed at determining the factors associated with adverse pregnancy outcomes among women at Sakubva hospital, Mutare district, Zimbabwe from January to June 2014.

Methods: A retrospective review of 346 patient records, of women who delivered at Sakubva hospital and those referred from Mutare district facilities to Mutare Provincial Hospital, between January and June 2014. Multilevel logistic regression using a backward hierarchical approach was performed to compare twenty-four variables associated with outcome. Variables with more than 80% data available were considered for analysis. Stata 12.0 was used to analyse the data.

Results: Of the 346 women included in this study, 54 (15.61%) experienced an adverse pregnancy outcome (stillbirth or early neonatal death). Delivery by non-normal vertex method (caesarean section or breech presentation) has a four times odds of adverse pregnancy outcomes compared to those who delivered a cephalic presentation by normal vertex delivery (OR= 4.26; p<0.001). Experiencing pregnancy associated complications has a 5 times risk of an adverse pregnancy outcome compared to no complications (OR=5.85; p<0.001). Neonatal birth weight of less than 2500grams was marginally significantly (OR = 2.48; p=0.053) associated with adverse pregnancy outcome.

Conclusions: Clearly, the determinants of adverse pregnancy outcomes in Mutare are; non-normal vertex delivery methods, complications during pregnancy/birth and low birth weight (<2500grams). Firstly, identification of complications and breech presentation during the third trimester by midwifes should be recognised as high risk and these are to be monitored closely or referred to gynaecologist for assistance. Secondly, management of low birth weight neonates has proven interventions which include special baby care unit and kangaroo care which Sakubva could implement to improve survival of these neonates. Lastly, further research is critical to identify the root cause of association of method of delivery (caesarean section) and adverse pregnancy outcomes.

Key words: Perinatal deaths, adverse pregnancy outcomes, Mutare district, stillbirth

Background

Worldwide, nearly 3 million third trimester stillbirths occur every year and a similar number of children die within the first 28 days of life.[1, 2] These account for approximately 7% of global burden of disease which is higher than that from HIV/AIDS.[3] Low and middle-income countries bear 98% of the burden with sub-Saharan Africa reporting the highest burden globally.[4, 5] In sub-Saharan Africa about 14% of all births could result in stillbirths.[6] Most deaths (43%) among the under-fives occur within the first month of life (the neonatal period).[7]

Zimbabwe's 2010/11 Demographic Health Survey (ZDHS) reported an infant mortality rate of 57 deaths per 1,000 live births while the overall under-5 mortality rate for the period was 84 deaths per 1,000 live births. There has been an increase in neonatal mortality ratio (NMR) from 33 to 39 deaths per 1000 live births from 1990 to 2012.[8] Zimbabwe Multiple Indicator Cluster Survey (MICS) 2014 also showed an upward trend in NMR from 20 deaths per 1000 live births in 2000 to 29 deaths per 1000 live births in 2014.[9] The rising NMR in Zimbabwe is occurring despite the various interventions that include: subsidising maternal services through Results Based Financing (RBF) which has resulted in removal of direct user fees. Peer reviews of maternal and perinatal audits were introduced as a way to improve the quality of services throughout the management of pregnancy. These efforts may be contributing factors towards the overall downward trend in under-five mortality.[9] However, Zimbabwe is far off from achieving the Millennium Development Goal 4 (MDG4) target of child survival due to the increasing neonatal mortality despite an overall decrease in under 5 mortality. Therefore an understanding of the risk factors and determinants of neonatal deaths would assist in addressing child survival challenges.[10]

Risk factors that have been shown to influence adverse pregnancy outcomes, like neonatal deaths, can be categorized into socio-demographic factors,[11-17] maternal factors,[18-21] previous pregnancy outcomes,[22] neonatal factors,[23] socio-economic and health system related factors.[24-30] There is sparse data on the prevalence and determinants of adverse pregnancy outcomes in sub-Saharan Africa.

This study's operational definition for adverse pregnancy outcome included fresh and macerated still births and early neonatal deaths. The study aimed to identify the risk factors for adverse pregnancy outcomes in Mutare district, Zimbabwe.

Identification of risk factors for adverse pregnancy outcomes may contribute to reduction in infant mortality by ascertaining factors that can be modified by appropriate public health interventions.

Methods

Study design and setting

Mutare district population is served by a network of health facilities: primary, secondary and tertiary health centres. The study area was Sakubva and Mutare Provincial Hospital in Manicaland Province, Zimbabwe. The hospitals manage clients from Mutare's urban and rural population. Sakubva hospital receives and manages clients from the rural and city primary facilities. It also, refers clients to Mutare Provincial Hospital a tertiary institution. All referrals from Sakubva were followed up at Mutare Provincial Hospital and considered as part of the study.

A retrospective cross-sectional analysis was done on the "delivery register" of childbirths in Mutare district, from the period January 1st to June 30th, 2014. Other records used were patient's admission notes and antenatal (ANC) registers. All women who met the inclusion criteria and delivered within the period January to June 2014 were eligible to participate. For each birth record, information on socio-demographics, maternal factors like previous obstetric history, neonatal information (sex, birth-weight) and delivery factors which included attendance by a skilled health worker, mode of delivery) and post natal factors were extracted.

The main outcomes examined in this study were stillbirths and early neonatal deaths. Stillbirth was defined in accordance with World Health Organisation-agreed definition of stillbirth for international comparison as death of a fetus weighing at least 500 g or after 22 completed weeks of gestation occurring before the complete expulsion or extraction from its mother [ICD-10]. Early neonatal death was defined, for the purposes of this study, as death that occurred within the first seven days of life.

Data from registers was double entered into Excel, cleaned and transferred to Stata 12.0 (Stata Corp, Texas, and USA) for analysis. Descriptive statistics was used to analyse categorical data.

Chi2 tests were used for univariable comparisons of dichotomous data to measure association between outcome and variable data (more than five observation

expected in all cells) or Fisher's exact test (five or fewer expected observations in one or more cells).

Mantel- Haenszel test of homogeneity was used to establish effect modification or confounding among variables. Univariable analysis was performed to examine the association of each variable with adverse pregnancy outcome. Factors significant at $p = 0.05$[31] were considered into multivariate logistic. Multivariate regression was modelled using the backward stepwise approach. Evaluation of the model was done using the Pearsons GOF, ROC curve analysis. Effects of outliers was analysed using the m-asymptotic residuals method. The model was checked for statistical interactions and adequacy before being approved as final. The p values for all hypothesis tests were two-sided and significance was set at $p<0.05$.

Ethical approval

The ethical clearance was granted by the University of Pretoria, Faculty of Health Sciences Research Ethics Committee as well as the Medical and Research Council of Zimbabwe. Permission to conduct and access patient records was obtained from the Provincial Medical Directorate, Manicaland Province and the District Medical Office, Mutare District Zimbabwe. Confidentiality of records was adhered to and there were no personal identifiers used in the final report.

Results and discussion

The total number of records sampled was 427 of which 81 were discarded due to more than 80% of the data being missing. Of the discarded records, 3.2% had an adverse pregnancy outcome, 8.6% had complications and 6.2% had delivered by non-vertex delivery methods. Three hundred and forty six records were then analysed. The study was limited to Sakubva and Mutare Provincial hospitals due to logistical challenges. Of the 346 records sampled 54 (15.61%) records had an adverse pregnancy outcome (stillbirth or neonatal death) while 292 (84.39%) where live births.

Background and characteristics of participants

The age of the women in the study ranged from 17 to 43 with a mean age of 26 (SD: 6.42). Seventy two percent (72.43%) were aged between 20-34 years old and 13.78% were 35 years old and above. Majority of the women (62.10%) in the study sample attended to at Sakubva or referred to Mutare Provincial hospital (from Sakubva hospital) resided in urban areas, while 37.90% were resident from rural

areas and was mostly referred for maternal services. The majority of the women sampled (97.92%) were currently married while 2.08% were separated, divorced or single. Close to 98% of the study population were Christians (either Pentecostal or orthodox, apostolic sect), 1.38% Moslem and 0.46% belonged to the African Tradition religion. Though the data on education was minimal (maternal education n=73) it showed that education among the women was widespread with none of the women having had no form of education. Twenty two percent of the women had some form of primary education and more than 60% secondary education. Of the 346 women sampled only 12.7% were formally employed as teachers, cashier or nurse aide while 87.3% were involved in informal trading or were housewives. Paternal variables were not analysed due to unavailability of data.

Reproductive health characteristics

In terms of reproductive health characteristics, 67% had no history of previous complications while 33% had experienced a complication like stillbirth, neonatal death or abortion. Delivery by caesarean section in the previous pregnancy was recorded as previous complications. Also, 15% of the women sampled were HIV positive while 2% of the women had non-HIV chronic conditions like hypertension, asthma, and psychosis prior to pregnancy. Approximately 8% of the women had an episode of malaria (n=64) and 3% had tested positive for syphilis (n=34) during the duration of the pregnancy. The median parity and gravidity were 1 and 2 respectively. The inter-pregnancy interval between the delivery under review and the previous births was analysed with a median interval of 4 (IQR 2-7).

Neonate demographics

Approximately, fifty one percent of the neonates were female and 49% male. The interquartile weight range for the neonates was 2700 to 3400 grams with a mean weight of 3000g (SD= 599.26). The mean gestation age of the women was 37 weeks while the minimum and maximum were 24 and 43 respectively.

Delivery factors

The study was conducted at Sakubva hospital, due to the many referrals occurring from primary health care centres to Sakubva. Referrals out from Sakubva where followed up at Mutare Provincial hospital and therefore included in the study. Most of the adverse pregnancy outcomes in the district occur at the two hospitals. Seventy six percent of the women had a normal vertex delivery (NVD), 18%, caesarean

section and 5% breech presentation deliveries. Of these deliveries 63% experienced pregnancy associated complications like pregnancy induced hypertension (PIH), prolonged labour and foetal distress. Majority of deliveries (94%) were attended to by a skilled health professional, midwife or doctor and the rest by non-skilled professional. Skilled professional was defined as either a midwife or doctor as this could be identified from the register.

Table 2: Socio-demographic characteristics of women delivering at Sakubva hospital, January to June 2014.

Variable	N (%)	%	95% Confidence interval
Residential area	n=343		
Urban	213	62.10	0.57 – 0.67
Rural	130	37.90	0.33 – 0.43
Marital status	n= 288		
Not married	6	2.08	0.004 – 0.037
Married	282	97.92	0.96 – 1.00
Maternal religion	n=217		
Non-Apostolic	144	66.36	0.60 -0.73
Apostolic	73	33.64	0.27 – 0.40

$p<0.05$

Descriptive statistics was divided into:

Table 2: Socio-demographics

Table 3: Reproductive, maternal, neonatal and health system factors

The majority of the patients (88.15%) delivered at Sakubva hospital a secondary level facility while 11.85 were referred to Mutare Provincial Hospital, a tertiary level hospital for further management. Reasons for referrals included, complications of pregnancy, need for blood transfusion among others. Non- normal vertex delivery (NVD) in this study was categorised as caesarean section deliveries for various reasons (including breech) or delivery of a breech presentation (termed breech delivery).

Table 3: Reproductive, maternal, neonatal, and health system characteristics of women delivering at SDH, January- June 2014.

Variable	N (%)	%	95% Confidence interval
Maternal age	n= 341		
<20	47	13.78	0.10 - 0.17
20-34	247	72.43	0.68 – 0.77
35 +	47	13.78	0.10 – 0.17
Obstetric history	n= 282		
None	190	67.38	0.62 – 0.73
Present	92	32.62	0.27 – 0.38
HIV status	n= 303		
Negative	257	84.82	0.81 -- 0.89
Positive	46	15.18	0.11 – 0.19
Neonatal sex	n = 333		
Male	166	49.85	0.44 – 0.55
Female	167	50.15	0.45 – 0.56
Birth weight	n= 322		
<2500g	47	14.60	0.11 – 0.18
2500 – 4000g	269	83.54	0.79 – 0.88
4000+	6	1.86	0.004 – 0.033
Gestational age	n =316		
≥32	303	95.89	0.94 – 0.98
<32	13	4.11	0.02 – 0.06
Parity	n=334		
0	109	32.63	0.28 – 0.38
1-3	195	58.38	0.53 – 0.64
4+	30	8.98	0.06 – 0.12
Gravidity	n= 333		
<4	260	78.08	0.74 – 0.83
≥4	73	2.92	0.17 – 0.26
Birth attendant	n= 337		
Unskilled	18	5.34	0.03 – 0.08
Skilled	319	94.66	0.92 – 0.97
Delivery complications	n= 334		
None	121	36.23	0.31 – 0.41
Present	213	63.77	0.59 – 0.69
Delivery method	n = 338		
NVD	260	76.92	0.72 – 0.81
Non - NVD	78	23.08	0.19 – 0.28

p<0.05

NB: unskilled referred to any professionals who are not a doctor or midwife.

Test of association

An analysis of the association of variables using the chi square test and Fischer's exact test showed significant association of some maternal, neonatal, reproductive and health system factors while none of the socio-demographic factors were significantly associated.

Logistic regression

The variables were analysed after grouping them into three broad categories: A socio-demographics, B: maternal (pre, intra, post-partum period) pre-pregnancy and delivery factors and C, neonatal and child related factors.

Table 4: Bivariate analysis (Crude Odds Ratio) for Socio-demographic characteristics associated with adverse outcomes among women who delivered at SDH, January – June 2014.

Variable	Crude OR	p-value	95% CI
Residential area			
Urban	Reference		
Rural	0.90	0.708	0.49 – 1.66
Marital status			
Married	Reference		
Not married	1		
Maternal religion			
Non Apostolic	Reference		
Apostolic	1.40	0.347	0.69 – 2.85

P<0.05

All the socio-demographic factors were not significant on binary logistic analysis.

Table 5: Bivariate analysis for health care system factors associated with adverse outcomes among women who delivered at SDH, January- June 2014

Variable	Crude OR	p-value	95% CI
Birth attendant			
Skilled	Reference		
Unskilled	0.66	0.583	0.15 –2.94
Delivery method			
NVD	Reference		
Non- NVD	5.26	**0.000**	**2.83-9.78**
Delivery complications			
None	Reference		
Present	3.78	**0.001**	**1.72 – 8.33**

p<0.05

Health facility type was not analysed due to the difference in levels of care between the two facilities. Tertiary level facilities manage patients that have been referred by secondary level while secondary manages those referred by primary level. Health system factors that were significantly associated with adverse pregnancy outcome on bivariate analysis are: none normal vertex delivery (OR = 5.26; 95% CI: 2.83 – 9.78) and delivery complications (OR= 3.78; 95%CI: 1.72- 8.33). Birth attendant was not significant.

Table 6: Bivariate analysis for maternal, neonatal factors, reproductive

Variable	Crude OR	p-value	95% CI
Maternal age			
20-34	Reference		
<20	0.33	0.076	0.10 – 1.12
35+	1.16	0.722	0.52 – 2.57
Obstetric history (poor)			
None	Reference		
Present	0.74	0.385	0.38 – 1.45
HIV status			
Negative	Reference		
Positive	0.79	0.616	0.31 – 1.98
Neonatal sex			
Female	Reference		
Male	1.34	0.346	0.73 – 2.45
Neonatal birth weight			
2500 - 4000	Reference		
<2500	3.73	**0.000**	**1.82 – 7.68**
4000+	3.98	0.119	0.70 – 22.68
Gestational age			
≥32	Reference		
<32	10.22	**0.000**	**3.19 – 32.77**
Parity			
1-3	Reference		
0 (nulliparous)	0.95	0.886	0.48 – 1.87
≥4	2.56	**0.036**	**1.06 – 6.15**
Gravidity			
<4	Reference		
≥4	1.69	0.115	0.88 – 3.26

p<0.05

Maternal age and HIV status were not significantly associated with adverse pregnancy outcomes on bivariate analysis. Neonatal factors significantly associated with adverse pregnancy outcome were gestation age less than 32 weeks (OR=

10.22; 95%CI: 3.19 –32.77) and birth weight less than 2500 grams (OR= 3.73, 95% CI 1.82 – 7.68). Parity and gravidity were not significant.

Hierarchical backwards approach was employed in multivariable logistic regression

Table 7: Multivariable analysis of factors associated with adverse pregnancy outcomes.

Variable	OR	95% CI	p-value
Delivery method			
NVD	Reference		
Non-NVD	4.24	2.02 – 8.92	**0.000**
Complications during pregnancy			
None	Reference		
Present	6.04	1.90 – 19.22	**0.002**
Neonatal birth weight			
2500 – 4000	Reference		
<2500	2.48	0.99 – 6.19	**0.053**
Gestational age			
≥ 32 weeks	Reference		
< 32 weeks	3.89	0.83 – 18.21	0.084
Parity			
1-3	Reference		
≥ 4	2.89	0.88 – 9.50	0.080

p<0.05

Variables that were independently associated with adverse pregnancy outcomes in our study were, other delivery methods that were not NVD (OR= 4.24; 95%CI 2.02 – 8.92), presence of complications during delivery (OR= 6.04; 95% CI; 1.90 – 19.22). Neonatal birth weight less than 2500g was marginally significant (OR: 2.48 p=0.053) Women who delivered a baby by other methods not normal vertex delivery section were 4.2 times more likely to experience an adverse pregnancy outcome (stillbirth or neonatal death) than those who delivered by normal vertex delivery. Also, experiencing complications like PIH, eclampsia during pregnancy/delivery had close to 6 times risk of an adverse pregnancy outcome compared to no complications. Lastly, the odds of a perinatal death were 2 times more on a neonate delivered weighing less than 2500g compared to a neonate of weight greater than 2500g.

Post regression tests carried out showed a ROC curve area of 0.80 indicating good predictive power of the model. There was good agreement between the model estimates/ predictions and the observed risks of adverse pregnancy outcomes in the

population. Analysis of the m-asymptotic residuals revealed that there were no model outliers influencing the parameter estimates unduly. Therefore the model was valid in estimating the risk factors for adverse pregnancy outcomes from socio-demographic, maternal and neonatal & child variables.

Discussion

Our study has shown that the prevalence of adverse pregnancy outcomes (stillbirths and early neonatal deaths) at Sakubva hospital in Mutare district for the period January to June 2014 was 15.61%. Method of delivery other than normal-vertex-delivery of cephalic presentation (i.e. caesarean section or breech presentation) and presents of complications during pregnancy/delivery (e.g. eclampsia, pregnancy induced hypertension) are important independent predictors of adverse pregnancy outcomes in Mutare district. Neonatal birth weight of <2500grams was marginally significant as a factor associated with adverse pregnancy outcome.

The observed adverse pregnancy outcome prevalence rate of 15.6% is comparable to other study findings conducted within the region.[19, 31] High neonatal mortality have been recorded in sub-Saharan Africa, Asia and Latin America, where about 25% of stillbirths are most likely to result from complications of birth.[32] In Tanzania, [13] the prevalence of stillbirths and intra-uterine deaths was reported as 18% while Nigeria[20] reported a 7.9% prevalence of perinatal deaths. In addition, South Africa has a 13% prevalence rate of adverse pregnancy outcomes.[33] The factors contributing to this high prevalence in low-to-medium countries in Africa are varying from human resources, nutrition and health systems. Shortages of an appropriate number of well performing health workers, (human resources for health), shortages of essential medicines, supplies and equipment[34] could be possible reasons for high prevalence of adverse outcomes in Mutare. Other possible factors include, poor nutritional status, lack of antenatal care and a number of behaviours which are associated with low-socioeconomic status.[35] Health system factors that might contribute to high prevalence of pregnancy outcomes include geographical barriers to health care (distance to nearest health facility), user fees and health care worker attitudes.[36]

The independent predictors of adverse pregnancy outcomes identified in this study have been previously documented. There was a strong association between method

of delivery other than normal vertex delivery of a cephalic presentation (breech presentation delivery or caesarean section) and adverse pregnancy outcomes.

Other studies have shown an increased risk of neonatal mortality and morbidity with delivery by either elective or emergency caesarean section,[37,38, 39] and delivery of a breech presentation by vaginal method.[40] It is common in our low-resource setting for caesarean section to be instituted after prolonged and unsuccessful vaginal delivery which might increase the risk of adverse outcomes.[41] Adverse pregnancy outcomes association with caesarean section delivery could also be due to the fact that many caesarean sections have been performed as emergencies without proper preparations.[42] Also; caesarean section delivery has been associated with risks of pre-rupture of membranes and therefore contributes to the high perinatal deaths. Morbidity associated with caesarean section delivery is higher as the neonates require more oxygen compared to NVD.

Firstly, method of delivery (vaginal delivery of breech presentation, emergency or elective C/S) has been shown to contribute to outcomes that undermine early childhood development of the newborn.[42] High adverse outcomes in vaginal delivery of a breech presentation have been associated with complications such as cord prolapse, aspiration of amniotic fluid, and complications associated with difficulties of delivering the after-coming resulting in greater risk among vaginal delivery in breech presentation compared with vaginal delivery in cephalic presentation.[43]The caesarean section rate at Sakubva maternity hospital was 238 deliveries by caesarean section out of total deliveries of 1732 during the period, January to June 2014,[44] which might be due to a high referral rate from other facilities.

On another hand, caesarean section delivery, when appropriately instituted has been shown to be protective of perinatal deaths.[39] Good caesarean delivery practices require technical, appropriate and timely decision-making to produce favourable results. However these aspects of caesarean section delivery were not established in this study. Caesarean section challenges that contribute to adverse outcomes could occur before, during and after the surgical procedure. The current study however could not establish the timing of caesarean section from the registers. Therefore, this finding is difficult to interpret and calls for further studies to understand the root cause of delivery method being associated with adverse pregnancy outcomes.

Secondly, women who experienced complications (cord prolapse, mal-presentation, antepartum haemorrhage (APH), eclampsia, prolonged labour, and pregnancy induced hypertension) had a six times odds of an adverse pregnancy outcome compared to women who did not experience any form of complication. This finding is in consistence with an earlier study conducted in Marondera district, Zimbabwe[45] and other studies in the region, Tanzania, [46] Nigeria[47] and globally China. [48, 49] Pregnancy associated conditions like gestational diabetes or hypertension have well recognised adverse effects on pregnancy outcomes.[50] Placental insufficiency in hypertension during pregnancy, cord prolapse, malpresentation, could explain the high risk of adverse pregnancy outcome among women who experienced complications. Also, intra-uterine bleeding due to antepartum haemorrhage are some of the causes of anaemia in pregnancy that result in neonatal death due to oxygen deficiency.[51]

Lastly, low birth-weight (LBW) <2500 grams has been documented as a risk of adverse pregnancy outcome. Our study showed that neonates with a weight < 2500grams were almost twice at risk of adverse outcomes (OR=2.48 p=0.053) though marginally significant. This finding has been established in previous studies.[47]Neonates born with low birth weight are at increased risk of neonatal deaths due to hypoglycaemia, hypocalcaemia and hypothermia. Successful interventions to care for low birth weight and preterm babies include special baby care unit (SBCU), exclusive breastfeeding and skin-to-skin care “kangaroo mother care.” which is part of the care for these neonates at Sakubva hospital. Sakubva hospital has been practising kangaroo mother care since 2012 and therefore this needs to be intensified.[44]

The current study did not show any association between socio-demographic factors: residential area (rural or urban), marital status and adverse pregnancy outcomes. Though residential areas of low-socio-economic[52] status have been shown to influence delivery outcome, the current study did not gather information on economic status of the women.

The study suffered from the limitation of being facility based. Hospital based studies may underestimate the true perinatal mortality. A community study is recommended. The study being cross- sectional by design did not capture the events for the nine months duration of pregnancy. Another limitation was, as a

retrospective analysis, the study was limited to the available data in the delivery register which excluded such factors as paternal education and paternal age when married. Information of outcomes was also limited to the duration the neonate was at the facility and referrals out before seven days could not be followed up to ascertain if perinatal death occurred. A lot of the data was missing which is an indication of poor record keeping at the facility.

Though malaria is endemic in the province (Manicaland) the study had a low sample size of 64 for this variable and therefore no meaningful conclusion could be established on the variable. The record of malaria were limited to the delivery time, therefore there is need for further studies to investigate specific variables like malaria and syphilis.

Calling of patients, health worker interview to fill in missing data might have subjected the study to recall bias. Our findings in Mutare cannot be generalised to the rest of the population due to selection bias, however can be generalised to similar hospitals within the province. Notwithstanding these limitations, the study identifies important factors associated with adverse pregnancy outcomes in this low resource setting.

Conclusion

In conclusion, early identification of complications of pregnancy during antenatal care visits is critical toward the reduction of adverse pregnancy outcomes. Breech presentation identification by midwives during the third trimester of pregnancy should be recognised as high risk and therefore must be closely monitored or referred for further management. Prioritization of admission to waiting mother's shelter of women identified to have complications and those with breech presentation of neonate should be considered in the district. Furthermore high risk pregnancies should be referred to the obstetrician at the earliest time possible for further assistance. It is also recommended that partners support gynaecologists so that they can be available and improve management of complicated cases.

Further research on delivery method is recommended to understand the root causes of its association with adverse pregnancy outcomes.

Abbreviations

ZDHS, Zimbabwe's 2010/11 Demographic Health Survey; NMR, Neonatal Mortality Ration; MDG, Millennium Development Goal; HIV/AIDS, Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome.

Competing interests

The authors declare that there are no competing interests.

Author's contributions

BVC conceived and designed the study. BVC, SASO, SN analysed the data. BVC wrote the paper. All authors read and approved the final manuscript

Author's information

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Acknowledgements

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673 **Appendices**

674 **Appendix 1: Data capturing sheet**

675 **Appendix 2: University of Pretoria Ethical Approval**

676 **Appendix 3: Medical Research Council of Zimbabwe Ethical Approval**

677 **Appendix 4: Manicaland Provincial Medical Directorate Letter of no Objection**

678 **to Conduct Research**

679 **Appendix 5: Mutare District Permission letter to access records**

680 **Appendix 6: PMC Pregnancy and Childbirth Manuscript Guidelines**

681

12163733- Chaibva B. V.

Data capture sheet No._____

Determinants of adverse pregnancy outcomes in Mutare health facilities, Manicaland Province, Zimbabwe.

Section A – Socio- economic factors

Q1. Women residential area

1 Rural

0 Urban

Q2. Social/ marital status of women

1 Currently married

0 Not married (divorced/ Separated / Widowed/ Single)

Q3. Maternal religion

0 Non Apostolic

1 Apostolic

Q4. What is the maternal education level –years of education

---

1 None (0-≤1)

2 Primary (1- 7 years)

3 Secondary (7-12)

4 Tertiary (≥ 13)

Q5. What is the maternal occupation

1 Formal

0 Informal

Q6. Paternal years of education – years of education

Q7. Paternal age when married

_____

Section B-Proximal determinants

B1. Maternal factors

Q8. Maternal age at delivery

Q9. Obstetric history

0 Nil
1 Adverse obstetric history

Q10. HIV status

0 Negative
1 Positive

Q11. Malaria during pregnancy

1 Positive
0 Negative

Q12. Syphllis test results during pregnancy

1 Positive
0 Negative

B2. Section Child related

Q13. Sex of neonate

1 Female
0 Male

Q14. Birth weight of neonate

0 2500-4000g
1 <2500g
2 >4000g

Q15. What was the gestation age of the infant

1 < 32 weeks
0 ≥32 weeks

Q16. Inter-pregnancy interval

1 ≤2years

0 >2years

Q17. Parity

0 1, 2nd and 3rd parity
1 Nulliparous
2 ≥4 parity

Q18. Gravidity

1 < 4
0 ≥ 4

B4-Delivery factors

Q21. Birth attendance during delivery

1 Skilled health professional-midwife, obstetrician, doctor
0 Unskilled

Q22. Complications during delivery

0 None
1 Present

Q23. Mode of delivery

0 NVD
1 Non-NVD

Q25. Type of health facility

1 Secondary health institution
0 Tertiary institution

B5-Post natal services

Q26. Post natal services received by neonate

0 No
1 Yes

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

4/09/2014

Approval Certificate
New Application

Ethics Reference No.: 296/2014

Title: Determinants of adverse pregnant outcomes in Mutare District Clinics, Manicaland Province, Zimbabwe

Dear Ms Blessmore V. Chaibva

The **New Application** as supported by documents specified in your cover letter for your research received on the 17/07/2014, was approved by the Faculty of Health Sciences Research Ethics Committee on the 27/08/2014.

Please note the following about your ethics approval:
- Ethics Approval is valid for 1 year
- Please remember to use your protocol number (**296/2014**) 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

Dr R Sommers; MBChB; MMed (Int); MPharMed.
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).

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Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

REF: MRCZ/B/709 **24 September 2014**

Blessmore Chaibva
University of Pretoria
South Africa

RE: Determinants Of Adverse Pregnancy Outcomes In Mutare District, Manicaland Province

Thank you for the application for review of Research Activity that you submitted to the Medical Research Council of Zimbabwe (MRCZ). Please be advised that the Medical Research Council of Zimbabwe has **reviewed** and **approved** your application to conduct the above titled study.

This approval is based on the review and approval of the following documents that were submitted to MRCZ for review:-

a) Study proposal
b) Data Collection Tools

- **TYPE OF MEETING : Expedited**
- **EFFECTIVE APPROVAL DATE : 24 September 2014**
- **EXPIRATION DATE : 23 September 2015**

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted three months before the expiration date for continuing review.

• **SERIOUS ADVERSE EVENT REPORTING**: All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices or website.

• **MODIFICATIONS**: Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).

• **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices or website.

• **QUESTIONS**: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw

Other

- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

.....

MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2014 -11- 04
APPROVED
P.O. BOX CY 573 CAUSEWAY, HARARE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

Telephone: 60624/60655
Fax: 60698/64401

ZIMBABWE

Reference:

PROVINCIAL MEDICAL DIRECTOR
MANICALAND
P.O. Box 323
Mutare

University of Pretoria

Faculty of Health Sciences

Research Ethics Committee

School of Health Systems & Public Health

HW, Synman Building (North)

31 Bophelo Road

Gezina

Pretoria

Dear Sir/Madam

REF: DECLARATION OF NO OBJECTION TO CONDUCT RESEARCH~Ms B V CHAIBVA

This serves to inform that the Manicaland Provincial Medical Director has granted Ms. B V Chaibva permission to conduct her research titled: "Determinants of adverse pregnancy outcomes in Mutare district, Manicaland Province, Zimbabwe."

We therefore declare that we have no objection to her accessing patient records to facilitate her research provided that approval of her protocol is granted first by the University of Pretoria, Research Ethics Committee and secondly by Medical Research Council of Zimbabwe.

Yours sincerely

PROVINCIAL MEDICAL DIRECTOR
MANICALAND
2014 -07- 07
P.O. BOX 323, MUTARE
ZIMBABWE TEL: 020-60624

Dr P T Mafaune

Manicaland Provincial Medical Director

Permission to access Records / ta base at Health Facilities in Mutare Urban

To: Provincial Medical Director
Manicaland Province

Dr Mafaune

From: The Investigator
Mutare Facilities

B V Chaibva

Re: Permission to do research at Health Facilities in Mutare Health Facilities

I am a Master of Public Health student with the University of Pretoria. I am requesting permission to conduct a study on the Determinants of adverse pregnancy outcomes in Mutare Health facilities that involves access to patient records.

The request is lodged with you in terms of the requirements of the Promotion of Access to Information Act. No. 2 of 2000.

The title of the study is: Determinants of adverse pregnancy outcomes in Mutare health facilities

The researcher requests access to the following information:

Access to the clinical files, record book and the data base.

I intend to publish the findings of the study in a professional journal and/ or at professional meeting like symposia, congresses, or other meetings of such a nature.

I intend to protect the personal identity of the patients by assigning each patient a random code number.

I undertake not to proceed with the study until I have received approval from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, and the Medical and Research Council of Zimbabwe.

Yours sincerely

Permission to do the research study at Mutare Health Facilities and to access the information as requested, is hereby approved.

Provincial Medical Director
Manicaland Province

Dr MAFAUNE

P Uzge
Signature of the PMD

PROVINCIAL MEDICAL DIRECTOR
MANICALAND
2014 -06- 27
P.O BOX 323, MUTARE
ZIMBABWE TEL. 020-60624

Permission to access Records / Files / Dat UNIVERSITEIT VAN PRETORIA UNIVERSITY OF PRETORIA YUNIBESITHI YA PRETORIA itare Health Facilities

To: The District Medical Officer
Mutare District
Zimbabwe

From: Blessmore V Chaibva
University of Pretoria
Faculty of Health Science
School of Health Systems and Public Health
HW, Synman Building (North), 31 Bophelo Road, Gezina,
Pretoria
South Africa

Dear Sir

Re: Permission to do research at Mutare Health facilities

THE TITLE OF THE STUDY IS: DETERMINANTS OF ADVERSE PREGNANCY OUTCOMES AT MUTARE HEALTH FACILITIES, MANICALAND PROVINCE, ZIMBABWE

The request is lodged with you in terms of the requirements of the Promotion of Access to Information Act. No.2 of 2000.

I am a student with the University of Pretoria, pursuing my Master of Public Health Degree (MPH) Epidemiology and Biostatistics- Monitoring and Evaluation sub-track programme. I am working with Prof Andy Beke, my academic supervisor from the University of Pretoria, School of Health System and Public Health. I hereby make a request on behalf of all of us to conduct the above mention research at Facilities in Mutare facilities.

The research is a retrospective cross-sectional analytical study that involves access to patient clinical files, record book and databases with records from January 2014 to June 2014 on all pregnant women who were attended at health facilities.

We intend to publish the findings of the study in a professional journal and/ or at professional meeting like symposia, congresses, or other meetings of such a nature.

We intend to protect the personal identity of the patients by assigning each patient a random code number.

We undertake not to proceed with the study until we have received approval from the Faculty of Health Sciences Research Ethics Committee, University of Pretoria.

Yours sincerely

Chaibva

Permission to do the research at [redacted] Health Facilities and to access the information as requested, is hereby approved.

Name and title of Medical Officer: DR TALENT MAPHOSA
DISTRICT MEDICAL OFFICER

Signature of the DMO

MIN. OF HEALTH & CHILD W/FARE
DISTRICT MEDICAL OFFICER
MUTARE DISTRICT
07 JUL 2014
P.O. BOX 3093, MUTARE
ZIMBABWE TEL: 020-65494/

Instructions for authors

Research articles

Criteria | Submission process | Preparing main manuscript text | Preparing illustrations and figures |Preparing tables | Preparing additional files | Style and language

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See below for examples of word processor and graphics file formats that can be accepted for the main manuscript document by the online submission system. Additional files of any type, such asmovies, animations, or original data files, can also be submitted as part of the manuscript.

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Overview of manuscript sections for Research articles

Manuscripts for Research articles submitted to *BMC Pregnancy and Childbirth* should be divided into the following sections (in this order):

- Title page
- Abstract
- Keywords
- Background
- Methods
- Results and discussion
- Conclusions
- List of abbreviations used (if any)
- Competing interests
- Authors' contributions
- Authors' information
- Acknowledgements
- Endnotes
- References
- Illustrations and figures (if any)
- Tables and captions
- Preparing additional files

The **Accession Numbers** of any nucleic acid sequences, protein sequences or atomic coordinates cited in the manuscript should be provided, in square brackets and include the

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The databases for which we can provide direct links are: EMBL Nucleotide Sequence Database (EMBL), DNA Data Bank of Japan (DDBJ), GenBank at the NCBI (GenBank), Protein Data Bank (PDB), Protein Information Resource (PIR) and the Swiss-Prot Protein Database (Swiss-Prot).

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For reporting standards please see the information in the About section.

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The title page should:

- provide the title of the article
- list the full names, institutional addresses and email addresses for all authors
- indicate the corresponding author

Please note:

- the title should include the study design, for example "A versus B in the treatment of C: a randomized controlled trial X is a risk factor for Y: a case control study"
- abbreviations within the title should be avoided

Abstract

The Abstract of the manuscript should not exceed 350 words and must be structured into separate sections: **Background,** the context and purpose of the study; **Methods**, how the study was performed and statistical tests used; **Results**, the main findings; **Conclusions**, brief summary and potential implications. Please minimize the use of abbreviations and do not cite references in the abstract. **Trial registration**, if your research article reports the results of a controlled health care intervention, please list your trial registry, along with the unique identifying number (e.g. **Trial registration**: Current Controlled Trials ISRCTN73824458). Please note that there should be no space between the letters and numbers of your trial registration number. We recommend manuscripts that report randomized controlled trials follow the CONSORT extension for abstracts.

Keywords

Three to ten keywords representing the main content of the article.

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The Background section should be written in a way that is accessible to researchers without specialist knowledge in that area and must clearly state - and, if helpful, illustrate - the background to the research and its aims. Reports of clinical research should, where

appropriate, include a summary of a search of the literature to indicate why this study was necessary and what it aimed to contribute to the field. The section should end with a brief statement of what is being reported in the article.

Methods

The methods section should include the design of the study, the setting, the type of participants or materials involved, a clear description of all interventions and comparisons, and the type of analysis used, including a power calculation if appropriate. Generic drug names should generally be used. When proprietary brands are used in research, include the brand names in parentheses in the Methods section.

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Acknowledgements

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Article within a journal supplement

Orengo CA, Bray JE, Hubbard T, LoConte L, Sillitoe I: **Analysis and assessment of ab initio three-dimensional prediction, secondary structure, and contacts prediction.** *Proteins* 1999,**43**(Suppl 3):149-170.

In press article

Kharitonov SA, Barnes PJ: **Clinical aspects of exhaled nitric oxide.** *Eur Respir J*, in press.

Published abstract

Zvaifler NJ, Burger JA, Marinova-Mutafchieva L, Taylor P, Maini RN: **Mesenchymal cells, stromal derived factor-1 and rheumatoid arthritis [abstract].** *Arthritis Rheum* 1999, **42:**s250.

Article within conference proceedings

Jones X: **Zeolites and synthetic mechanisms.** In *Proceedings of the First National Conference on Porous Sieves: 27-30 June 1996; Baltimore.* Edited by Smith Y. Stoneham: Butterworth-Heinemann; 1996:16-27.

Book chapter, or article within a book

Schnepf E: **From prey via endosymbiont to plastids: comparative studies in dinoflagellates.** In *Origins of Plastids. Volume 2.* 2nd edition. Edited by Lewin RA. New York: Chapman and Hall; 1993:53-76.

Whole issue of journal

Ponder B, Johnston S, Chodosh L (Eds): **Innovative oncology.** In *Breast Cancer Res* 1998, **10:**1-72.

Whole conference proceedings

Smith Y (Ed): *Proceedings of the First National Conference on Porous Sieves: 27-30 June 1996; Baltimore.* Stoneham: Butterworth-Heinemann; 1996.

Complete book

Margulis L: *Origin of Eukaryotic Cells.* New Haven: Yale University Press; 1970.

Monograph or book in a series

Hunninghake GW, Gadek JE: **The alveolar macrophage.** In *Cultured Human Cells and Tissues.*Edited by Harris TJR. New York: Academic Press; 1995:54-56. [Stoner G (Series Editor): *Methods and Perspectives in Cell Biology,* vol 1.]

Book with institutional author

Advisory Committee on Genetic Modification: *Annual Report.* London; 1999.

PhD thesis

Kohavi R: **Wrappers for performance enhancement and oblivious decision graphs.** *PhD thesis.* Stanford University, Computer Science Department; 1995.

Link / URL

The Mouse Tumor Biology Database [http://tumor.informatics.jax.org/mtbwi/index.do]

Link / URL with author(s)

Corpas M: **The Crowdfunding Genome Project: a personal genomics community with open source values** [http://blogs.biomedcentral.com/bmcblog/2012/07/16/the-crowdfunding-genome-project-a-personal-genomics-community-with-open-source-values/]

Dataset with persistent identifier

Zheng, L-Y; Guo, X-S; He, B; Sun, L-J; Peng, Y; Dong, S-S; Liu, T-F; Jiang, S; Ramachandran, S; Liu, C-M; Jing, H-C (2011): **Genome data from sweet and grain sorghum (Sorghum bicolor)**.*GigaScience Database*. http://dx.doi.org/10.5524/100012.

Clinical trial registration record with persistent identifier

Mendelow, AD (2006): **Surgical Trial in Lobar Intracerebral Haemorrhage**. Current Controlled Trials. http://dx.doi.org/10.1186/ISRCTN22153967

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