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EFFECT OF ADVANCED MATERNAL AGE ON PREGNANCY OUTCOMES: A CASE CONTROL STUDY AT MPILO TERTIARY TEACHING HOSPITAL, BULAWAYO, ZIMBABWE, 2024 - 2025

BY

ELTON SENGURAYI

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

2025

Abstract

The average age of giving birth by women in developing countries is beginning to catch up to those of developed countries, the reasons for the increase are however different in some respects from those of developed countries – within western societies its mostly choice, but developing world its usually out of desperation or someone's voice, that is choice vs voice. In the developed world the reasons for conceiving well after age of 35 years are usually pursuing demanding careers, furthering education, divorces, amongst others. Unfortunately, these pregnancies by older women are characterised by multiple problems. The current average for advanced maternal age (AMA) Zimbabwe is not well documented. Interestingly, the average varies between rural and urban areas. According to the ZIMSTATS and UNICEF (2019), the Zimbabwe Multiple Cluster Index Survey of 2019 showed that of those surveyed, women less than 20 years had 420 births, those 20-34 years had 1601 births, whilst women of age group 35-49 years had 351 deliveries – this translates to 14.8% contribution from AMA. The study is a prospective comparative observational case control study conducted at the department of Obstetrics and Gynaecology, Mpilo's Maternity Hospital in Bulawayo, Zimbabwe. The study population consists of pregnant women at least 35 years of age including primigravida (delayed childbearing) and multiparous women (continued childbearing). Advanced maternal age is defined as age of mother of 35 years or more at the time of delivery. The study group comprised of women of advanced maternal age who deliver during the study period. The control group are women aged 20-34 years who delivered on the same day as women included in the study group. In this population mode of delivery, low birth weight and low fifth minute Apgar score were found to be significantly associated with maternal age. Babies born from advanced age mothers had 4.2 times higher odds to be born with low birth weight (AOR 4.2, 95% CI (1.76–4.9), $p < 0.001$) as compared to mothers aged less than 35 years after adjusting for other variables. Similarly, babies born from advanced age mothers had 6.7 times higher odds to have low fifth minute Apgar score (AOR 6.7, 95% CI (1.28–12.3), $p = 0.03$) than babies born from mothers aged less than 35 years old holding other variables constant. Furthermore, advanced age mothers were 3.9 times higher odds to undergo caesarean section than their controls (AOR 3.9, (95% CI 1.52–3.78), $p = 0.012$). There was no statistically significant association between maternal haemorrhage and maternal age. The findings in this paper suggests that multiple factors predict AMA births and also many adverse outcomes of such pregnancies. Better characterization of the circumstances that lead to advanced maternal age in Zimbabwe, including exploration of AMA pregnancies within and beyond control is necessary to develop policies and interventions that meet women's needs. For those that get pregnant after 34 years of age a more focused and integrated management pathway should be advocated and implemented.

Keywords: advanced maternal age, pregnancy, adverse obstetric outcome, adverse perinatal outcomes, reasons for advanced maternal age.

Declaration Page

I declare that this dissertation report is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

Student's Full Name: ELTON SENGURAYI

Student's Signature:  Date: 03 APRIL 2025

Main Supervisor's Full Name: DR ABIGAIL KAPFUNDE

Main supervisor's Signature:……. Date……

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ACKNOWLEDGEMENTS

I would like to extend my sincere appreciation for the unwavering support of the many stakeholders in this pursuit of excellence. I am especially indebted to my supervisor and lecturer Professor E. Mugomeri. His attention to the finest of details is exceptional. My supervisor and lecturer, Dr. A. Kapfunde showed massive dedication to this endeavor of mine – I am greatly humbled by the support and contribution in preparation of this document.

Also, much appreciation to the Mpilo hospital management and staff for giving me unfettered access to medical records and patients. This wouldn't have happened without the inputs of the post-partum women – despite the aches and pains characterized by this phase, they allowed me to interview them. The biggest thumbs up are to all the women, for they not only labour during bringing a new life but also labour in the households, fields and other workplaces to make sure the family is well catered for.

Above all I want to thank God almighty for the strength he has and continues to grant me throughout my academic studies.

God bless you all.

DEDICATION

This dissertation is dedicated to my wife, my two hyperactive sons and my inquisitively brilliant daughter.

List of Acronyms and Abbreviations

ACOG	American College of Obstetricians and Gynecologists
AMA	Advanced maternal age
ANC	Antenatal Care
APH	Antepartum Hemorrhage
ART	Assisted Reproductive Technology/Techniques
AVD	Assisted Vaginal Delivery
BMI	Body Mass Index
COPD	Chronic Obstructive Airways Disease
CPD	Cephalopelvic Disproportion
C/S	Caesarean Section
EAMA	Very late maternal age\extremely advanced
IUGR	Intrauterine Growth Restriction
LBW	Low Birth Weight
LGA	Low for Gestational Age
NICU	Neonatal Intensive Care Unit
NVD	Normal Vaginal Delivery
PPH	Postpartum Hemorrhage
PPROM	Preterm Prelabour Rapture of Membranes
RCOG	Royal College of Obstetricians and Gynecologists

ROM	Rapture of Membranes
VAMA	Very advanced maternal age
SCBU	Special Care Baby Unit
SGA	Small for Gestational Age
SES	Socio-economic Status

Definition of terms

Advanced maternal age (AMA) – women who are 35 years or older at estimated date of delivery (ACOG, 2023).

Gestational age – the length of pregnancy after the first day of the last menstrual period (LMP) (Mongelli, 2021).

Assisted/Instrumental/Operative vaginal delivery - vaginal birth of a baby performed with the help of forceps or a vacuum device (ACOG,2023).

Caesarean delivery – delivery of a fetus through surgical incisions made through the abdominal wall (laparotomy) and the uterine wall (hysterotomy) (Saint Louis, 2023).

Chronic Hypertension - systolic blood pressure greater than 140mmHg or diastolic blood pressure greater than 90mmHg confirmed before 20 weeks of gestation (ACOG, 2019).

Gestational Hypertension – blood pressure greater than or equal to 140mmHg systolic or 90mmHg diastolic after 20 weeks of pregnancy (ACOG, 2019).

Preeclampsia –hypertension with greater than or equal to 300mg urine protein excretion in a 24-hour period or a protein/creatinine ratio of greater than or equal to 0.3 or proteinuria of at least 1+ (ACOG, 2019).

Eclampsia – convulsion occurring in pregnant or postpartum woman with hypertension (ACOG, 2019).

Gestational Diabetes Mellitus (GDM) – history of pre-existing diabetes or that was diagnosed first time during pregnancy (WHO, 2006).

- fasting plasma glucose ≥ 7.0 mmol/l (126 mg/ dl)
- 2-hour plasma glucose ≥ 11.1 mmol/l (200 mg/dl) following a 75g oral glucose load
- random plasma glucose ≥ 11.1 mmol/l (200 mg/ dl) in the presence of diabetes symptoms.

Placenta previa – abnormal placentation near or covering the internal cervical os, sometimes associated with per vaginal bleeding (Baker et al, 2024).

Abruptio placenta – premature separation of the placenta from the uterus (Deering, 2023).

Antepartum haemorrhage (APH) – bleeding from or in to the genital tract, occurring from 24+0 weeks of pregnancy and prior to the birth of the baby (RCOG, 2011).

Postpartum haemorrhage (PPH) - excessive loss of blood from a woman who has delivered a baby, of at least 500ml after vaginal delivery or 1000ml after caesarean section (RCOG, 2011).

Preterm labour and birth – babies born alive before 37 weeks of pregnancy are completed (WHO, 2023).

- extremely preterm (less than 28 weeks)
- very preterm (28 to less than 32 weeks)
- moderate to late preterm (32 to 37 weeks).

Postdates pregnancy – pregnancy at or exceeding 40 completed weeks or 280 days of gestation (Galal et al, 2012).

Post-term pregnancy – pregnancy that extends to 42 weeks of gestation or beyond (Galal et al, 2012)

Premature rupture of membranes (PROM) – rupture of membranes (ROM) prior to the onset of labour (Jazayeri, 2023).

Preterm premature rupture of membranes (PPROM) – ROM prior to 37 weeks' gestation (Jazayeri, 2023).

Spontaneous rupture of the membranes (SROM) – ROM after or with the onset of labour (Jazayeri, 2023).

Prolonged ROM – ROM that persists for more than 24 hours and prior to the onset of labour. (Jazayeri, 2023).

Stillbirth – delivery of dead fetus at ≥24 weeks, or weight ≥500 g and exhibiting no signs of life (WHO, 2006).

Neonatal death – newborn deaths during the first 28 completed days of life (WHO, 2023).

- early neonatal deaths, occurring during the first 7 days of life, and

- late neonatal deaths, occurring after the 7th day.

Appearance Pulse Grimace Activity and Respiration (APGAR) score – quantitates clinical signs of neonatal depression such as cyanosis or pallor, bradycardia,

depressed reflex response to stimulation, hypotonia, and apnea or gasping respirations (ACOG, 2021).

Small for gestational age (SGA) – diagnosed based on a birthweight below the 10th centile and often birthweight charts are adjusted for the sex of the baby (RCOG, 2024).

Large for gestational age – baby weighing above the 90th birthweight centile (RCOG, 2024)

Intrauterine growth restriction (IUGR) – implies a pathological restriction of the genetic growth potential of a fetus may manifest evidence of fetal compromise (abnormal Doppler studies, reduced liquor volume) (RCOG, 2024).

Low birth weight – weight at birth of < 2500 grams (5.5 pounds) (WHO, 2019).

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

The average age of giving birth by women in developing countries is beginning to catch up to those of developed countries, the reasons for the increase are however different in some respects from those of developed countries – within western societies its mostly choice, but developing world its usually out of desperation or someone's voice, that is choice vs voice. Pregnancy at advanced maternal age has become more common in both developed and developing countries over the last decades (Kahveci et al, 2018). In the developed world the reasons for conceiving well after age of 35 years are usually pursuing demanding careers, furthering education, divorces, amongst others.

From the author's own anecdotal observations, the situation in the developing countries is that mothers continue to get pregnant well into and after the late 30s because of subfertility, seeking a male child and non-ideal contraception – but the causes are now morphing into those of western societies as urbanisation is evolving. These changes need to be investigated further to aid national and regional policies, and this particular study may be one of the building blocks to such policy changes and/or strengthening.

The current average for advanced maternal age (AMA) Zimbabwe is not well documented. Interestingly, the average varies between rural and urban areas. According to the ZIMSTATS and UNICEF (2019), the Zimbabwe Multiple Cluster Index Survey of 2019 showed that of those surveyed, women less than 20 years had 420 births, those 20-34 years had 1601 births, whilst women of age group 35-49 years had 351 deliveries – this translates to 14.8% contribution from AMA. The same study revealed that from the sample 751(31.7%) were deliveries in urban areas of which 94% delivered in a health care facility, 1 621 were rural deliveries with 81.2% of them delivering in a

designated health care facility. This data may give us a sneak view of proportion of AMA in the rural and urban settings. This study sought to investigate the average age, the reasons and the effect(s) of advanced maternal age in the area of Bulawayo.

Despite the challenges of drawing a cut off for advanced maternal age, it is desirable for the African context to define their own cut off age. It is important to note that in the Zimbabwean context, and in other developing countries the definition of advanced maternal age, anecdotally, used to be 30 years or more not so long ago. Most of these countries have since moved towards the 'international definition'. The literature shows that even developed countries don't have a consensus on the cut off age as illustrated by the American College of Obstetricians and Gynaecologists (2022) who state that there is still no universal definition of advanced maternal age in women, so the 35-year threshold used in most studies is accordingly arbitrary.

There is no standardized definition of AMA, but one common definition is of maternal age above 35 (Pinheiro et al, 2019). Kanmaz et al (2019) further went on to say that maternal age above 40 is considered very advanced maternal age (VAMA), and above 45, very late maternal age\extremely advanced maternal age (EAMA). Advanced maternal age (AMA) is defined as childbearing in a woman over 35 years of age and is a growing trend within high-income countries (RCOG, 2011), but as aforesaid the so called third world countries are catching up.

A Centres for Disease Control and Prevention (CDC) report, as quoted by Martin et al (2010), documented an increasing birth rate among advanced maternal age (AMA, maternal age >35 years) women over the past 3 decades in the United States. The authors went on to further state that analysis of the data from the last decade showed an increase in the birth rate for women aged 35–39 years from 45.9 per 1000 women in

2010, to 52.7 in 2019. Similarly, there was an increase in the birth rate for women aged 40–44 years from 10.2 to 12 per 1000.

The current trend is most commonly attributed to older primigravid women who delay childbearing by lifestyle choice or due to underlying subfertility, but also includes multiparous women continuing childbearing. Even in some countries, women are choosing to pursue careers and financial security, concurrently leading them to postpone childbearing age. Progresses in assisted reproductive technology (ART) have expanded the reproductive window, with resultant increase in the incidence of AMA.

The effects related to increasing age appear to be continuous, so that the risk is greater the older the age at conception, rather than as a threshold effect as the age in question passes (Clearly-Goldman, 2005).

1.2 Background to the Study

In developing countries childbirth stretches until women are in their 40s, as they try to expand their families or seek for the elusive baby boy. Since the 1970s, there has been a marked increase in the postponement of childbearing in developed countries (Sobotka, 2004). This trend has been marked by sharp increases in the mean age at first birth and in the numbers of births at advanced maternal ages (Billari et al, 2007). In the developed world women are having their first babies in the late 30s upwards as feminism, advancement of careers and shaky marriages take their toll. This article presents a comprehensive and integrated framework for analysing the factors associated with advanced maternal age and the pregnancy outcomes inherent to this particular demography.

In Pakistan especially in rural areas mostly women continue their child bearing in advanced age and taking it as norm and avoid contraception due to religious and social

influences (Shaikh et al, 2012). This situation, anecdotally, is not different to the one in Zimbabwe which is also a conservative and religious society, typically with some of the apostolic sects. The increased cohort of women of at least age of 35 years is being influenced by evolving social and cultural norms. This resultantly and rather unfortunately has been associated with higher rates of divorce/separation, second or more marriages, multiple partners before marriage, and cohabiting before marriage.

Higher levels of socioeconomic and educational status women tend to delay marriage and/or childbearing as these achieved statuses consume most of their young hood. In the same breath, these group of women lean towards more use of contraception. The inexpensive, varied and widespread availability of contraceptive methods may also contribute to the AMA. This has been augmented, mostly in liberal and western societies by access to assisted reproductive technology (ART). In Zimbabwe, because of the prolonged, decades old, economic stagnation some couples have found it hard to start conceiving or they have decided to space their children very wide apart – which may then tip into AMA.

Although the postponement of childbearing has become a common trend across the entire developed/western world, whether and, if so, to what extent women should be advised against giving birth at an advanced age because of the associated health risks are questions that are still being debated (Tough et al, 2002). One reason for the lack of general consensus on this pertinent question of 'how old is too old' (Heffner et al, 2004) is the growing awareness that evidence from earlier periods might not accurately reflect the contemporary association between maternal age and child well-being – as our technology and general healthcare system evolves.

AMA is a known risk factor for poor pregnancy outcomes, with one of the reasons being the biological changes associated or brought about by the chronological aging process. As illustrated by Hseih et al (2011) and de Weger et al (2012), the uterine vascular system, with aging, has less ability to cope with the increased hemodynamic demands of pregnancy. With increase in maternal age, many underlying medical conditions such as Type 2 diabetes mellitus, hypertension, cardiac diseases, renal, autoimmune diseases, increased BMI, gynaecologic diseases, amongst other multitude of diseases/conditions become more prevalent. For those mothers with chronic conditions pregnancy may exacerbate the state of wellbeing, further compromising the pregnancy and its outcomes (Tyer-Viola & Lopez, 2014). Hence the management of such a group of AMA mothers then requires a clear understanding and appreciation of the fragile interplay between age and pre-existing comorbidities. Unfortunately, they then consequently increase adverse pregnancy outcomes.

Many studies have indicated that AMA is significantly associated with poor pregnancy outcomes. Inadequate antenatal attendance is known to be associated with poor pregnancy outcomes. A secondary analysis study by Lukwa et al (2022) of the Zimbabwe Demographic Health Survey (ZDHS) of 2015 showed, as they had expected, maternal services utilization was highest among young women (25-34 years) and significantly low in older women above 44 years. Whilst some authors have reported that AMA has been associated with preterm delivery, low birth weight, perinatal mortality, and higher frequency of caesarean section (Ludford et al, 2008 & Koo et al, 2012), others have reported no apparent differences in overall obstetric outcomes (Smit et al, 1997), perinatal outcomes (Diejomao et al, 2008), birth weight, Apgar scores and admissions to NICU (Takahashi et al, 2012) between the younger and older mothers.

Tsu (1992), by utilising data abstracted from the Greater Harare area of Zimbabwe medical records of 203 women with operative deliveries due to CPD and 299 women with normal unassisted vaginal deliveries, noted that although maternal age < 18 years was not a significant risk factor in this study (perhaps because there were few women in this age group), advanced maternal age (> or = 35 years) was associated with a relative risk of 2.7 compared to women 20-34, after adjusting for other demographic and obstetric factors. According to Abdou (2017), older expectant mothers remain a stigmatised social identity, with some regrettably still referring to them with the obsolete term of 'geriatric pregnancy'. This inadvertently brings about another complication of these pregnancies – the psychological/mental trauma, and possibly poor prenatal care contacts.

AMA is reported to be associated with a range of pregnancy complications including: adverse maternal outcome (i.e. maternal death, operative delivery); pregnancy-related complications (i.e. preeclampsia (PE), placental abruption, prelabour rupture of membranes, abnormal placentation, postpartum haemorrhage); and adverse neonatal outcomes (i.e. stillbirth, fetal growth restriction (FGR), early neonatal death, preterm birth, poor APGAR score, large or small for gestational age, and neonatal intensive care or intermediate medical care unit admission (NICU/IMCU) pre-term birth (PTB) and stillbirth by a series of epidemiological studies (Kenny, 2013). Aboneaaj et al (2015) also corroborated these findings, including association with low birth weight. Birth defects, chromosomal abnormalities and perinatal deaths are significantly associated with AMA (SOGC, 2012).

Against the backdrop of diverse and varied reports on the maternal and perinatal (fetal and neonatal) outcomes of AMA mothers, more so in developing countries, this study

consequently set out to determine the pregnancy outcomes in Zimbabwe, a Sub-Saharan country. This was done in tandem with adjustments for confounding factors.

1.3 Statement of the Problem

Hundreds of thousands of women in developing countries die each year from complications of pregnancy, attempted abortion, and childbirth. Advanced maternal age is associated with various economic, social and health complications to the mother and to the fetus or neonate as well (Olusanya & Solanke, 2012). Coming closer to home, Hoque (2012) did a retrospective comparative study in a South Africa tertiary hospital which revealed that the prevalence of advanced maternal age was 17.5%. A study done by Laopaiboon et al (2014) involving 29 countries (Africa, Asia, Middle East, and Latin America) revealed that the magnitude of pregnant women with advanced maternal age was 12.3%.

A previous study by Mathew and Hamilton (2014) conducted in the United States of America showed that the average age of women at first birth has consistently increased over the last four decades, with the birth rate for women aged 40–44 years more than doubling during the period of 1990 to 2012.The increasing number of women getting pregnant at more advanced age signifies new challenges that need to be addressed by putting more resources towards this age group. Failure to understand and address this evolving phenomenon may consequently lead to adverse maternal and perinatal outcomes. Policies tailored towards older mothers should be put in place, more so in our developing world, hence the need for more researches like this one.

1.4 Research Objectives

i. To evaluate the associations between maternal age and obstetric outcomes on postpartum women at Mpilo Hospital, Bulawayo, Zimbabwe.

ii. To assess the associations between maternal age and perinatal outcomes on postpartum women at Mpilo Hospital, Bulawayo, Zimbabwe.

iii. To analyse the various factors in advanced maternal age that have an effect on pregnancy outcomes on postpartum mothers at Mpilo Hospital, Bulawayo, Zimbabwe.

iv. To establish the driving factors in women leading to advanced maternal age on parturient women at Mpilo Hospital, Bulawayo, Zimbabwe.

1.5 Research Questions and Hypotheses

i. Is there an association between maternal age and obstetric outcomes on postpartum women at Mpilo Hospital, Bulawayo, Zimbabwe?

ii. Is there an association between maternal age and fetal and neonatal outcomes on postpartum mothers at Mpilo Hospital, Bulawayo, Zimbabwe?

iii. Do the various factors in advanced maternal age have an effect on pregnancy outcomes of women at Mpilo Hospital, Bulawayo, Zimbabwe?

iv. What are the factors that push women to give birth after age of 35 years on parturient mothers at Mpilo Hospital, Bulawayo, Zimbabwe?

Assumptions/ Hypotheses

1. Increasing maternal age is associated with specific adverse pregnancy outcomes.

H_0: There is no association between the 2 categorical variables

$H_{1:}$ The 2 categorical variables are associated

2. Increasing maternal age has a continuum rather than a threshold effect on adverse outcomes.

1.6 Significance of the Study

To reduce the prospect of adverse outcomes in AMA, measures may include: (1) reducing the likelihood that a woman becomes pregnant; (2) reducing the likelihood that a pregnant woman may experience a serious complication of pregnancy or childbirth; or (3) improve the outcomes for women with complications. Several types of interventions are most likely to have substantial and immediate effects on maternal mortality, including family planning programs to prevent pregnancies, safe termination of pregnancy services to reduce the incidence of complications, and improvements in labour and delivery services to increase the survival of women who do experience complications.

Evidence on whether and why the association between maternal age and the risk of poor birth outcomes has changed over time is therefore relevant from both a demographic and a medical perspective (Goisis et al, 2017). Whereas in earlier periods advanced maternal age at birth was associated with high parities and low socio-economic status, the more prosperous, educated, and advantaged women today are more likely than disadvantaged women to give birth at an older age (Prioux, 2005). It is therefore possible that older mothers and their children face lower risks of poor health outcomes today than they did two or more decades ago (Carolan, 2003).

With the paucity of data in Zimbabwe on AMA combined with its huge impact on pregnancy outcomes, it is essential to conduct such a study in our own settings. It's important to understand the factors and outcomes peculiar to this important maternal age group. After everything has been done, the ultimate hope is that this study is going be of great influence and importance to the following:

Community, Healthcare and Education Workforce: - So many times we work without understanding the several risk factors and subsequent pregnancy outcomes afflicting older expecting and parturient mothers. This study brings out the several demographic and other factors that older pregnant women are encased in. Such an understanding may assist in adaptation, adoption and assimilation of preventative measures against complications peculiar or more common in these pregnancies.

Other Researchers: - This project is important for other subsequent researchers who may use secondary data to find new interesting avenues and information for the betterment of the human health industry. Subsequent follow up to check on the pregnancy related outcomes can bring out interesting results. The data can also be used to make a comparison with the aftermath of the implementation of mitigatory measures against some or all of the determinants.

The Researcher: - The researcher first and foremost would want to improve his research skills and also his academic profile and record. Attainment of his degree can be one of the many sacrifices of hard work, which should hopefully be rewarded by a better job profile and description.

1.7 Delimitation of the Study

The study has a special focus on Mpilo Hospital in Bulawayo, Zimbabwe. The research covers the maternal cases delivered or referred delivered at Mpilo hospital in Bulawayo and data was gathered from such patients at the institution. With regards to the objectives, conducting the research from the perspective of patients is deemed to be a more ideal or suitable approach. Data was collected from maternal cases of the age of at least 35 years, with corresponding controls between the ages of 20 and 34 years of

age at the time of delivery. Teenage maternal cases are excluded as they offer a whole set of diverse complications or adverse outcomes in pregnancy.

1.8 Limitation of the Study

As expected with any research, some problems are encountered in the course of collecting data. Some of the probable respondents seemed hesitant at first to participate in the research and others were not be prepared to answer certain questions. It may be understandable in a few instances because of discomfort on issues that may involve 'privacy'. Some of the respondents felt that some of the questions are too probing and encroaching into sensitive information or details of personal nature. Though the researcher is a fairly known figure at the institution, the researcher allayed some of their fears by assurance and reassurance of confidentiality in the collection, storage and any sharing of the data.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on advanced maternal age in the global, regional and local context. Particular attention is specified on what other studies have described as potential demographic risk factors, causal factors and outcomes of pregnancy of an older maternal case.

2.2 Theoretical Framework

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge, within the limits of the critical bounding assumptions. The theoretical framework is the "blueprint" for the entire dissertation inquiry. It serves as the guide on which to build and support the study, and also provides the structure to define how the researcher is to philosophically, epistemologically, methodologically, and analytically approach the dissertation as a whole (Grant & Onsanloo, 2014). According to Vinz (2022), theoretical framework is a foundational review of existing theories that serves as a roadmap for developing the arguments that are to be used in researcher's own work. She went on to state that theories are developed by researchers to explain phenomena, draw connections, and make predictions.

In a theoretical framework, the researcher explains the existing theories that support the research, showing that the paper or dissertation topic is relevant and grounded in established ideas. Thus, the theoretical framework justifies and contextualizes the research, and it's a fundamental initial step for the research paper, thesis, or dissertation. This would resultantly, if well guided, set up a successful research and writing process.

Eisenhart (1991) defined a theoretical framework as “a structure that guides research by relying on a formal theory…constructed by using an established, coherent explanation of certain phenomena and relationships”. Theoretical framework is a logically structured representation of concepts, variables and relationship involved in a scientific study with the purpose of clearly identifying what is going to be explored, examined, measured or described.

In the context of advanced maternal age and pregnancy, and its effects on pregnancy outcomes the following theories may be utilised:

1. Theories of Planned Behaviour/Reasoned Action
2. Human Needs Theory
3. Wear and Tear Theory
4. Free Radical Theory
5. Bronfenbrenner's Ecological Systems Theory or Human Ecological Theory
6. Health Belief Model

2.2.1 Theory of Planned Behaviour/Reasoned Action

This theory was proposed by Ajzen and Fishbein in 1975 and suggests that behaviour is determined by intentions, attitudes (beliefs about a behaviour), and subjective norms (beliefs about others' attitudes toward a behaviour). The theory was later expanded to the Theory of Planned Behaviour wherein perceived behavioural control (beliefs about one's ability to perform a behaviour) and behavioural intentions predict behaviour (Neighbors et al, 2013).

According to Al-Suqri and Al-Kharusi (2015) it uses an “expectancy value” approach to understanding individual behaviour, which assumes that an individual usually evaluates the likelihood of a particular outcome of their behaviour and whether this is

a good thing or not before deciding whether to act. If the person expects an outcome from their behaviour that is perceived to be desirable or valuable, they are to be more likely to hold a more positive attitude towards such actions. According to the theories of reasoned action and planned behaviour, if an individual is of the belief that significant and important people in her life would disapprove the individual getting pregnant at an older age, then she would be less likely to intend to get pregnant when older and consequently less likely to actually become pregnant at advanced age.

2.2.2 Human Needs Theory

The human needs theory was published in 1954 by Abraham Maslow. This theory summarizes a hierarchy of five needs which motivate human behaviour: physiologic, safety and security, love and belonging, self-esteem, and self-actualization. These needs are prioritized so that more basic needs like physiological functioning or safety precede personal growth needs (Maslow, 1954). The movement towards personal growth like being a parent need fulfilment is a multidirectional and dynamic lifelong process. Human needs theory notes that failing to grow toward personal needs leads to feelings of failure, depression, and the perception that life is meaningless, and this may explain why some women start or continue conceiving past the age of 35 years.

2.2.3 Wear and Tear Theory

Cells and tissues have vital parts that wear out, resulting in aging (Van Cauter, Leproult, & Kupfer, 1996). This theory states that body parts eventually wear out from repeated use, just like machinery, killing the parts and then the body. Cells in heart muscles, neurons, striated muscles, and the brain cannot replace themselves after they are destroyed by wear and tear. We can then postulate that aged cells have lost the ability to counteract mechanical, inflammatory, and other injuries due to their senescence. This

may be behind one of the reasons behind poor outcomes associated with older pregnant women more so the multiparous ones, with a combination of other factors likely contributing also.

2.2.4 Free Radical Theory

The free radical theory was developed in 1956 by Denham Harman. This theory posits that aging is due to oxidative metabolism and the effects of free radicals. The term free radical describes any molecule with a free electron, which makes it to destructively react with healthy molecules. This unbalanced energy makes the free radical bind itself to another balanced molecule as it tries to steal electrons. In so doing, the balanced molecule becomes unbalanced, thereby becoming a free radical. Hayflick (1985) further on went say that radicals cause extensive cellular damage to DNA, and can cause DNA strands to break, causing base modifications that lead to gene modulation.

Cellular membrane damage can cause other chemicals to be blocked from their regular receptor sites, thus impacting other processes that may be crucial to cell metabolism. Free radicals can enter reactions with other molecules, such as proteins, lipids, DNA, RNA or along membranes, causing cellular damage. It is known that diet, lifestyle, drugs such as tobacco and alcohol, and radiation are all accelerators of free radical production within the body, and these exposures tend to grow as people age. Older adults are hence more vulnerable to free radical damage as oxidative damage is known to increase with age.

2.2.5 Bronfenbrenner's Ecological Systems Theory or Human Ecological Theory (1977)

The social environment consists of the different types of interactions with individuals, groups, and organizations. Whether its face to face contact, homes people live in, involvement in the community, the different types of jobs and pay that people obtain will affect the outcome of their lives (Kirst & Hull, 2006). The ecological perspective looks at the woman of advanced maternal age in her social environment and how the environment has an impact on her wellbeing if not provided with adequate buffers. The surrounding environment has a huge sway on why women get pregnant at such late stages of reproductive life.

2.2.6 Health Belief Model

The Health Belief Model (HBM) posits that messages or communications will attain prime behaviour change if they fruitfully target perceived barriers, benefits, self-efficacy, and threat. As one of the most widely applied theories of health behaviour (Glanz & Bishop, 2010), the Health Belief Model (HBM) posits that six constructs predict health behaviour: risk susceptibility, risk severity, benefits to action, barriers to action, self-efficacy, and cues to action (Becker, 1974; Champion & Skinner, 2008; Rosenstock, 1974). Originally formulated and framed to model the implementation of preventive health behaviours, HBM has been positively adapted to suit various and diverse cultural and topical contexts.

The HBM derives from psychological and behavioural theory with the foundation that the two components of health-related behaviour are 1) the desire to avoid illness, or equally get well if already ill; and, 2) the belief that a specific health action will prevent, or cure, illness. In the end, an individual's path of action often hinges on the person's

perceptions of the benefits and barriers related to health behaviour. This theory is well suited to the decision of the woman to get pregnant and the course of action she follows in that pregnancy.

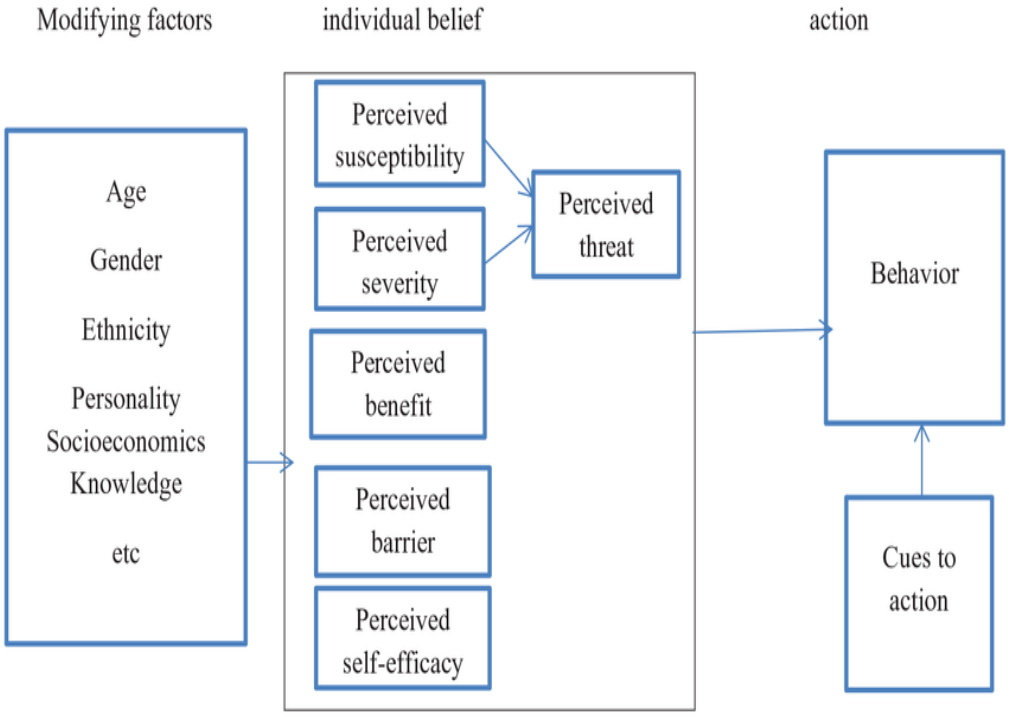

Fig 1: Health Belief Model

Perceived susceptibility - This refers to a person's subjective perception of the risk of acquiring an illness or disease. There is wide variation in a person's feelings of personal vulnerability to an illness or disease. A woman and her important others will assess the vulnerability of getting pregnant at older age, and the implications of complications if they set in whilst pregnant.

Perceived severity - This refers to a person's feelings on the seriousness of contracting an illness or disease (or leaving the illness or disease untreated). There is wide variation in a person's feelings of severity, and often a person considers the medical consequences (e.g., death, disability) and social consequences (e.g., family life, social relationships)

when evaluating the severity. How severe will be the complications of the pregnancy in a background of AMA and other associated factors like hypertension?

Perceived benefits - This refers to a person's perception of the effectiveness of various actions available to reduce the threat of illness or disease (or to cure illness or disease). The course of action a person takes in preventing (or curing) illness or disease relies on consideration and evaluation of both perceived susceptibility and perceived benefit, such that the person would accept the recommended health action if it was perceived as beneficial. At times the AMA cases are better off in ideal settings, hence the push for them to be managed in at least a tertiary hospital.

Perceived barriers - This refers to a person's feelings on the obstacles to performing a recommended health action. There is wide variation in a person's feelings of barriers, or impediments, which lead to a cost/benefit analysis. The person weighs the effectiveness of the actions against the perceptions that it may be expensive, dangerous (e.g., side effects), unpleasant (e.g., painful speculum examination), time-consuming, or inconvenient.

Cue to action - This is the stimulus needed to trigger the decision-making process to accept a recommended health action. These cues can be internal (e.g., vaginal bleeding, pelvic pain, etc.) or external (e.g., advice from others, illness of family member, newspaper article, etc.). Therefore, there is a need to disseminate the requisite information on AMA to the various stakeholders for better outcomes of these women and pregnancies.

Self-efficacy - This refers to the level of a person's confidence in his or her ability to successfully perform a behaviour and it directly relates to whether a person performs the desired behaviour.

2.3 Factors associated with Advanced Maternal Age (Conceptual Framework)

The question of whether there is an association between advanced maternal age and fetal/neonatal/child health remains highly controversial. Concerns about late childbearing have been raised in the medical literature. A large number of studies have suggested that in terms of pregnancy outcomes, the optimal age range for childbearing is 20–35 (Bewley et al, 2005 & 2006). This argument is based on evidence that women who give birth after age 35, and especially after age 40, face increased risks of antepartum, intrapartum, and post-partum complications. The potential complications include miscarriage, high blood pressure, pre-eclampsia, gestational diabetes, and chromosomal abnormalities, as well as problematic neonatal outcomes, such as preterm delivery and LBW (Fretts et al, 1995; Jolly et al. 2000; Kenny et al, 2013).

For this particular research there are quite a number of variables which interlink, the only questions being how, to what extent, which direction and to what effect? There are certain factors which leads women to conceive and give birth after the age of 35 years. These particular women may then have inherent or intimate external factors which may not bode well for that pregnancy, leading to poor maternal and/or perinatal outcomes.

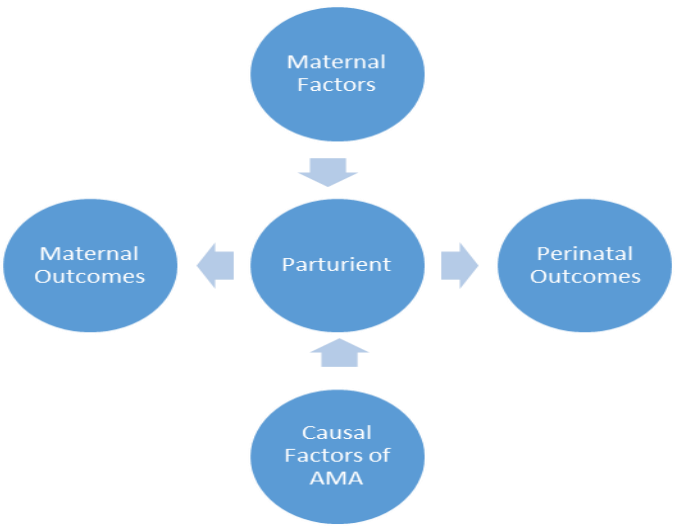

Figure 2: AMA Conceptual Framework (*By Author*)

The **Table 1** below is a summation of all the variables, though not exhaustive, that are of importance and accessible in this research. Source of the literature analysis was extracted from Pubmed, Google Scholar, textbooks, amongst other materials.

Table 1: Variables possibly related to advanced maternal age (*By Author*).

Maternal Factors	Causal Factors of AMA	Maternal Outcomes	Fetal/Neonatal Outcomes
Demographic Data 1. Age 2. BMI/weight 3. Paternal age 4. Residence – urban/rural 5. Employment status 6. Marital status 7. SES Obstetric 1. Parity 2. Booking GA 3. ANC contacts 4. Last Delivery Interval Medical 1. Diabetes 2. Hypertension 3. HIV status 4. Other conditions 5. Medications in pregnancy 6. Haemoglobin or Haematocrit levels	- Contraception - Advancement of career - Subfertility - Preference for a male/female child - Delayed marriage - New remarriage - Others	-Mode of delivery -NVD -AVD -C/S -Hypertension in pregnancy. -Gestational Hypertension -Preeclampsia -Eclampsia -DM -Abruptio Placenta -APH -Abruptio Placentae -Placentae Praevia -PPH -Preterm labour and birth -Postdates pregnancy -Post-term -Pregnancy -PPROM -Prolonged ROM	-Stillbirth -Early neonatal death -APGAR score -SGA -LGA -IUGR -LBW -NICU or SCBU admission

2.3.1 Sociodemographic Factors and Advanced Maternal Age

According to Lean et al (2017), advanced maternal age 35 years or older is associated with a higher risk of having a higher BMI before pregnancy and during pregnancy, as well as increased risks of certain pregnancy complications. Older women are more

likely to have different comorbid conditions such as obesity, diabetes, and hypertension that could negatively impact pregnancy course and outcome (Sheen et al, 2018). Moreover, it was proven that even healthy women of advanced age have increased pregnancy complication rates.

Sheen et al (2018) went on to state that while it is documented in numerous studies that a maternal age of 35 years or more is generally associated with both adverse maternal and neonatal pregnancy outcomes, data on how age influences pregnancy outcomes in the setting of comorbidity are limited. Unfortunately, obesity presents a significant public health problem in many parts of the world. Current investigations found that almost 40% of the world's population is overweight and 13% are obese (Hilden et al, 2019 & Lagana et al, 2017). Visceral fat potentiates and increases insulin resistance leading to development of the metabolic syndrome (Obesity, diabetes mellitus, and heart diseases) and diabetes mellitus.

A cohort study by Bapayeva et al (2022) revealed that 84.8% of women reported pregnancy complications, with a higher prevalence in obese women ($p = 0.003$). However, most children had a good outcome with few early neonatal complications (36.85%). Old and obese women with DM often showed complications, and their new-borns had higher birth weight ($p = 0.003$) and more neonatal complications ($p = 0.041$). Maternal BMI ($p = 0.016$; OR = 1.064), but not age ($p = 0.801$), was found to be a significant predictor of pregnancy complications in this study by Bapayeva et al (2022).

From the total of 1,710 enrolled mothers with complete data, 379 were with AMA, having a prevalence of 22.2% (95% confidence interval [CI] = 20.2, 24.2). Among 379 advanced maternal age (AMA) mothers, 328(84.5%), and 51(15.5) mothers were between 35 and 39 years, and =40 years, respectively. The mean (SD) of maternal age

was 30.0(5.2) years. No significant association was found between AMA, and parent's education, family income, child gender, preterm birth and low birth weight. In multivariable logistic regression analysis, factors significantly associated with AMA were higher parity (adjusted odd ratio [AOR] = 2.24, p-value < 0.001), non-Arab mothers (AOR = 2.44, p-value < 0.001), maternal employment (AOR = 1.37, p-value = 0.019), and caesarean delivery (AOR = 2.44, p-value = 0.011), pre-pregnancy maternal overweight (AOR = 1.49, p-value = 0,006), and pre-pregnancy maternal obesity (AOR = 2.15, p-value = 0.001), (Taha et al, 2024)

According to El-Sayed et al (2012), maternal marriage is protective against preterm birth (PTB), while advanced maternal age is associated with increased PTB risk. In their adjusted models, there was a significant interaction (P<0.001) between marital status and maternal age. The predicted probability of PTB by marital status was marginally different among mothers aged 20-25 years (absolute difference of 1.5%); this difference was substantially higher (3.9% or higher) after 31 years of age. Laopaiboon et al (2016) noted that single marital status was more common (14.9%) in the very advanced age group, with women aged 45 years or older, whereas less than 10% was seen in the other age groups.

The average age of fathers has increased from 29.2 years in 1980 to 32.1 years in 2002 (Bray et al, 2006). Brewley et al (2006) went on to further state that the average parental age is most likely due to the societal trend for couples to delay starting a family for career or financial reasons. The concept of the female "biological clock" (the effect of increasing maternal age on reducing fertility) is well known and is a source of anxiety for many women (Lewis et al, 2006). The same authors went on to further state that this was in contrast to the consequences of increasing paternal age on fertility and other adverse reproductive outcomes which are rarely discussed.

A study in Israel by Harlap et al (2002) found that paternal age of 35 years or older was associated with a higher risk of preeclampsia compared with paternal age of 25–34 years, whereas a study in the US conducted by Khandwala et al (2018) did not observe the association despite both studies being conducted with fairly large sample sizes. Rather unfortunately, there is no biological plausible threshold to define advanced paternal age. Defining reliable threshold requires understanding of whether relationship between paternal age and risk of outcome is linear or non-linear, but such study is lacking. Although maternal and paternal age have been shown to independently affect perinatal outcomes as outlined by Khandwala et al (2018) and Harlap et al (2002), their joint effects were still unclear.

A retrospective study by Mao et al (2021) revealed that advanced paternal age was associated with a higher risk for a preterm birth [35–44 years: adjusted odds ratio (OR) = 1.13, 95%CI (1.03 to 1.24); >44 years: OR = 1.36, 95%CI (1.09 to 1.70)]. Paternal age also exerted an opposite effect on birth weight with an increased risk of SGA among preterm infants (35–44years: OR = 1.85, 95%CI (1.18 to 2.89) and a decreased risk among term infant (35–44years: OR = 0.81, 95%CI (0.68 to 0.98); >44 years: OR = 0.50, 95%CI (0.26 to 0.94). in the same study some U-shaped associations were found in that LGA risk among term infants was higher in both younger (<25 years) (OR = 1.32; 95%CI, 1.07 to 1.62) and older (35–44 years) (OR = 1.07; 95% CI, 1.01 to 1.14) fathers in comparison to those who were 25 to 34 years old at the time of delivery.

One study in the Texas–Mexico border found that paternal age of 35 years or older combined with advanced maternal age was associated with an increased risk of gestational hypertensive disorders, compared to paternal and maternal age younger than 35 years (Ortiz et al, 2018). Contrastingly the other study by Tough et al (2003)

focusing on low birth weight, and preterm birth did not found any significant associations.

Less education was observed with increasing maternal age by Laopaiboon et al (2016) in their multi-country assessment. Education is very considered one of the most robust and clear determinants of health. However, it is unclear whether maternal education and paternal education have differential impacts on perinatal health outcomes.

An analysis of a birth cohort by Swaminathan et al (2022) by comparison of mothers with college or university education versus mothers with a high school education had an odds ratio of 1.37 (95% CI: 1.01-1.87) for SGA. Paternal education was not associated with infant outcomes. When the same authors compared the odds ratios for maternal education and paternal education it showed a stronger association than paternal education at the high school level for SGA birth (difference in odds ratio: 1.95, 95% CI: 1.13-3.36, p = .016) among women at least 25 years old.

There are several reasons why rural women may have poorer pregnancy outcomes than their urban counterparts. These predictors may vary from poor road access, inadequately resourced clinics, lower incomes, etc. Rural pregnant women of low SES have the highest odds for adverse pregnancy outcomes. A retrospective study by Mehrnoush et al (2022) discovered that mothers living in rural areas had a higher risk of developing anaemia, preterm birth, post-term pregnancies, LBW, need for neonatal resuscitation, and NICU admission, but a lower risk of caesarean section.

Haraldsdottir et al (2014) revealed that infants outside the urban areas were more likely to have been delivered by caesarean section, lower prevalence of gestational diabetes (adjusted odds ratio 0.68; 95% CI 0.59–0.78), hypertension (adjusted odds ratio 0.82; 95% CI 0.71–0.94) as well as congenital malformations (adjusted odds ratio 0.55; 95%

CI 0.48–0.63) was observed. The same study observed neither differences in mean birthweight, gestation length nor rate of preterm birth or low birthweight across urban and non-urban area. The odds of perinatal deaths were significantly higher (adjusted odds ratio 1.87; 95% CI 1.18–2.95) outside the urban area in the second half of the study period. Lower prevalence of gestational diabetes and hypertension in the rural areas may be an indication of underreporting and/or lower diagnostic activity.

Factors such as food insecurity/shortages, poor housing facilities, and interpersonal violence can limit access to timely quality care and contribute to poor maternal, fetal and neonatal outcomes. Studies suggest that low-income levels are associated with higher risks of adverse maternal outcomes, including obstructed labour, antepartum haemorrhage, postpartum haemorrhage, hypertensive disorders of pregnancy, preterm delivery, and stillbirth. Women in low-income households are less likely to access quality antenatal care, skilled birth attendants, and emergency obstetric care.

Additionally, poverty affects nutrition, education, and living conditions, all of which can impact maternal and child health outcomes. poverty may limit access to antenatal care, skilled birth attendants, and emergency obstetric care, leading to higher rates of perinatal mortality (Ahinkorah et al, 2021). A population-based study by Nicholls-Dempsey et al (2023) concluded that higher socio-economic status (SES) predisposes to better pregnancy outcomes, even when controlled for confounding factors such as ethnicity and underlying baseline health status.

Adequate antenatal care is strongly associated with improved maternal and infant outcomes, including reduced risks of complications like low birth weight, preterm birth, and maternal mortality. Antenatal care allows for early detection and management of pregnancy-related complications, such as hypertension, anaemia, infections, and

gestational diabetes, which can have serious consequences for both the mother and the baby. Access to regular antenatal check-ups and interventions allows healthcare providers to identify and address potential risks, leading to a lower risk of adverse birth outcomes like low birth weight, preterm birth, and stillbirth. Antenatal care provides crucial information and education to pregnant women about childbirth, breastfeeding, and infant care, empowering them to make informed decisions and prepare for the arrival of their baby.

Antenatal care ensures that pregnant women have access to skilled birth attendants, who can provide safe and appropriate care during labour and delivery, consequently reducing the risk of complications. A two-level mixed-effects model employed using the recent Demographic Health Survey (DHS) data from 22 SSA countries by Tolosa et al (2024) showed that 23.5 % of adolescent mothers experienced adverse birth outcomes. This study found that receiving high quality ANC was associated with a 28 % reduction in the likelihood of adverse birth outcomes (AOR = 0.72, 95 % CI: 0.63, 0.83).

A study by Wenling et al (2024) revealed that the gestational age and the occurrence of neonatal complications were all significantly related to the number of ANC visits to mothers. There was a correlation between gestational age and birth weight with normative ANC and qualified ANC examinations. The authors noted also that as the number of ANC examinations increased, the rates of preterm birth and low birth weight decreased. Notably pregnant women who did not receive normative ANC examinations had a higher risk of preterm birth and neonatal low birth weight compared to those who did. Likewise, pregnant women who did not receive qualified ANC examinations had a higher risk of preterm birth and neonatal low birth weight compared to those who did.

The implications of advanced motherhood (≥35 years) for mothers and their progeny are ambiguous. On the one hand, mothers in this age group, who choose delayed motherhood, often possess higher levels of education, income, and access to prenatal care, which can contribute to their enhanced psychological, social, and economic preparedness for (Iacono et al, 2024).

Maternal health plays a critical role in determining pregnancy outcomes, with maternal haemoglobin levels emerging as a key factor influencing both maternal and neonatal well-being (Tripathy et al, 2025). Maternal haemoglobin levels during pregnancy are strongly associated with various outcomes, with both low and high levels linked to increased risks of adverse pregnancy complications.

Haemoglobin can be categorised as mild, moderate and severe anaemia. The current WHO haemoglobin cut-offs (11.0g/dl) are associated with reduced risk of adverse maternal and neonatal outcomes. The study by Ohuma et al (2023), suggests that the current WHO cut-offs should consider thresholds for both low and high haemoglobin concentrations to fully address the risks associated with pregnancy. Tripathy et al (2025) revealed that low haemoglobin levels (<110 g/L) during the second trimester were associated with a 37% reduction in stillbirth risk, while high haemoglobin levels (≥140 g/L) doubled the risk.

Severe anaemia (haemoglobin <6.0 g/dL) significantly increases the risk of maternal death. Low maternal haemoglobin can lead to reduced perfusion and oxygen supply/delivery to the fetus, consequently increasing the risk of fetal complications such as low birth weight, fetal demise and preterm birth.

2.3.2 The causal effect of AMA and adverse pregnancy outcomes

Numerous and various studies have reported that AMA is associated with multiple adverse pregnancy outcomes. Maternal and perinatal complications, including chromosomal abnormalities, congenital anomalies, low birth weight, preterm birth, diabetes, high blood pressure, preeclampsia, abnormal fetal presentation, operative vaginal delivery, caesarean section, postpartum haemorrhage, birth weight below the 5th percentile, stillbirth and placenta previa (Laopaiboon et al., 2014) are the associated outcomes. Moreover, the consequence of AMA on pregnancy results may be worsened by the magnitude of different risk factors. Thus, in many circumstances, older women have more unfavourable pregnancy outcomes than younger counterparts and various factors such as health inequity and smoking may lead to increased risks of unfavourable pregnancy outcomes.

In the retrospective comparative analytical study by Jolly et al (2000) it was reported that the odds of having gestational diabetes, breech presentation, operative vaginal delivery, elective and emergency caesarean sections, postpartum haemorrhage, preterm birth and stillbirth, in mothers aged over 40 was stronger than mothers aged 35-40. Consequently, the category of women aged over 40 had greater risks of emergent adverse pregnancy aftermaths than the category of 35-40. This cumulative adverse effect of maternal age on pregnancy outcomes emphasizes more on the causal relation of AMA and adverse pregnancy outcomes.

Maternal age can affect the uterine blood flow, which ultimately perfuse the fetus, and with advancing age, uterine blood flow decreases. Pirhonen et al. (2005) in a single centre retrospective cohort study revealed that large uterine infarcts and uteroplacental under perfusion were observed in AMA women. AMA may affect gap junction or ion

channel expression as well as control of electrical activity in the myometrium, hence spontaneous myometrial contractility. Thus, impairment of myometrial contractility may be a possible reason for higher risks of Caesarean section, prolonged labour and emergency Caesarean section in AMA women (Smith et al. 2008).

Furthermore, according to Adashek et al. (1993) the number of oxytocin receptor decreases with advancing age; consequently, a higher dose of oxytocin is needed to prevent postpartum haemorrhage in AMA women. Based on these studies, less efficient uterus in AMA women is expected and these theories emphasized more on the fact that the association of AMA and adverse pregnancy outcomes is plausible.

2.3.3 Reasons for Advanced Maternal Age

Advanced maternal age (AMA), often defined as pregnancies occurring at age 35 or older, is increasingly common due to societal factors like career, gender selection/deselection, pursuance of education as a priority, later marriages, divorces, issues around contraceptive methods and advancements in reproductive technologies. As women weigh that personal desire to forebear children in a background characterised by so many competing social expectations, they may find themselves navigating their own unique pathway shaped largely in part by the region in which they reside.

Better characterization of the circumstances that lead to advanced maternal age in a particular region, including exploration of unintended and unwanted AMA pregnancy, is necessary to develop policies and interventions that meet women's needs (Maloney et al, 2021).

The dominant narrative around increasing rates of birth at advanced maternal age suggests that these births are predominantly the result of intentional delayed pregnancy.

A study by Maloney et al (2021) showed that the prevalence of AMA births in their sample was 18.2 percent, with 3.4 percent of mothers giving birth at age 40 and above. Overall, 44.5 percent of women reported that their most recent pregnancy was wanted at the time they became pregnant. Mistimed and unwanted pregnancies were higher for mothers of advanced maternal age. Women who gave birth at age 35 and above were more likely to report an unwanted pregnancy (Maloney et al, 2021) One third of mothers in the dataset who gave birth at age 35 and above became pregnant unintentionally.

Against the background of increased obstetric risk, the factors underlying the increase in delayed childbearing are not fully understood. Changes in gender roles and particularly the achievement of educational and career goals for women are often cited (Cooke et al, 2012). Reducing unintended pregnancies and the percentage of pregnancies conceived within 24 months of a previous live birth are nationwide health improvement priorities for Zimbabwe and other countries.

Unintended pregnancies and closely spaced pregnancies have been associated with adverse outcomes for the mother and infant, and both may potentially be prevented through access to family planning services (Ahrens et al, 2018). Ahrens et al (2018) in a national survey further found out that, overall, 40% of pregnancies following a live birth were unintended and this decreased across maternal age category, from 54% in women ages 15–19 to 33% in women ages 30–44 (p-value<0.01).

Many individuals, both women and men, these days are prioritising education, career advancement, and financial stability, resultantly leading to delayed childbearing until later in life. The wide and various educational and career choices inspire women to pursue their professional and envisioned goals. This particular trend of marrying later

in the lifecycle contributes to a higher proportion of pregnancies occurring at older ages, most so in first time parents. While some individuals inadvertently delay parenthood due to unstable relationships, having a stable partner is also linked to having children later in life. Because of various factors like women empowerment, role diversification, etc., women are increasingly pursuing higher education and career paths, which often results in the delay in childbearing.

Contemporary technologies like in-vitro fertilisation and other assisted reproductive techniques have expanded and varied the reproductive window for women, allowing them to conceive very much later in life. Inexpensive and easy access to modern, safe and varied contraceptive methods has enabled them to realise better control of fertility. Effective and a plethora of contraceptive options allow for better control over family planning and enable individuals to space adequately or delay childbearing. In the same vein, women may also get unplanned pregnancy at these extreme ages because of failure of contraception through intrinsic or extrinsic causes.

Primary and secondary infertility due to various reasons may also cause a delayed conception. According to Rajput et al (2018), increasing rates of divorce is another cause for delay in conceiving, more so in the western world. The authors went on to state that in the developing countries the scenario is different where poor socio-economic status, lack of contraceptive knowledge, religious issues, desire for male child, concept of large family and women conceiving from marriage to menopause, are the common causes of pregnancy with advanced maternal age. Study conducted by Giri et al (2012) also shows desire for male child was 21.1% as a cause for advanced maternal age which was similar to the prospective study by Rajput et al (2018).

2.3.4 Maternal Effects

Advanced maternal age is a known risk factor for multiple gestations in naturally conceived pregnancies that result from multiple ovulations, usually arising from the associated higher maternal follicle-stimulating hormone (FSH) levels. This may also be as a consequence of wider use and rates of ART used in older women. However, according to Zipori et al (2020), the outcome of multiple pregnancies in AMA women is as good as the outcome in younger women.

A retrospective population-based cohort study that was conducted to compare the pregnancy outcomes for women aged 35–39 years and ≥40 years with women aged 25–29 years, analysing 34 695 records from the South Australian Perinatal Database between 1998 and 2008 by Ludford et al. (2012) found higher rates of pre-existing medical conditions such as diabetes and high blood pressure in advanced maternal age women compared to women aged 25 to 29 years. Even after controlling for potential confounding factors, the strength of association between AMA and pregnancy outcomes persisted (Cleary-Goldman et al. 2005).

Furthermore, Grotegut et al (2014) reported that the number of women giving birth at 45 years and more is increasing and found that these women had increased risks of maternal death. In addition, Blanc et al. (2013) noted that the aggregated results of 38 countries revealed maternal mortality has a "J" shaped curve and the risk increased after age 30. However, other studies have found no or only limited evidence of increased risks of adverse pregnancy outcomes among older mothers (Kirz et al, 985; Carolan et al, 2011). A study by Bianco et al, (1996) and Ziadeh et al (2011) noted that older mothers face higher risks of operative delivery (e.g., caesarean) and morbidity (e.g., gestational hypertension).

2.3.5 Fetal and Neonatal Effects

Holzman et al. (2009) in a multisite collaboration linked census and vital record data analytical study stated that, based on "weathering" hypothesis, the risk of preterm birth in older African Americans was greater than white American mothers. The authors went on to further state that according to "weathering" hypothesis, the effect of health inequality coupled with AMA, widened the gap between adverse pregnancy outcomes in African Americans and white Americans. It has been reported that the risk of adverse neonatal outcomes increases in AMA women because of increase in the risk of congenital malformations and chromosomal anomalies, but after controlling for the confounding effect of congenital malformations, the magnitude of associations was still existent (Luke & Brown, 2007), but it also appears that neonatal outcomes are not affected by maternal age (Bianco et al, 1996; Ziadeh et al, 2011).

Therefore, the results of these studies and many unmentioned articles indicate that AMA contributes to multiple adverse effects rather than a single effect on pregnancy. It's not only the age-related complications such diabetes or hypertensions, but it is linked with higher risks of numerous other maternal and neonatal adverse outcomes. The existence of statistically significant associations in the bulk of studies illustrates more on the importance of AMA as a risk factor for several pregnancy complications and indicates that AMA quantitatively and clinically is coupled to adverse outcomes in pregnancies.

2.3.6 Way Forward

According to ICPD (1994) as quoted from the AU Commission (2006) definition of reproductive rights, "…Implicit in this last condition are the rights of men and women to be informed and to have access to safe, effective, affordable and acceptable methods

of family planning of their choice, as well as other methods of their choice for regulation of fertility which are not against the law, and the right of access to appropriate health-care services that will enable women to go safely through pregnancy and childbirth and provide couples with the best chance of having a healthy infant". WHO, from the same document, estimates that the major causes of maternal mortality are: bleeding after delivery, followed by infection, unsafe abortion, high blood pressure and obstructed labour.

These statements from above illustrate some of the relations that are tied to adverse pregnancy outcomes and these can be addressed at policy level. Haemorrhage, infections, hypertension, dysfunctional labour, amongst other complications may be as a result of poor pregnancy preparation – poor contraceptive methods being one of them. Therefore, policy makers need to address factors that lead to AMA and the adverse outcomes that come with it.

2.4 Summary

From the literature analysis it can be deducted that there are many factors, some unknown, which contribute to adverse maternal and fetal/neonatal outcomes. Despite the attendant risks with these pregnancies, women still voluntarily conceive at these extremes of age because of a variety of reasons.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter outlines the research design, study setting, study population, sampling criteria and methods, data collection methods, data analysis plan, dissemination of findings modalities and ethical considerations.

3.2 The Research Philosophy, Design and its appropriateness

3.2 Design of the study

The study is a prospective comparative observational case control study conducted at the department of Obstetrics and Gynaecology, Mpilo's Maternity Hospital in Bulawayo, Zimbabwe. The study period spanned from August 2024 to March 2025. The study population consists of pregnant women at least 35 years of age including primigravida (delayed childbearing) and multiparous women (continued childbearing).

Advanced maternal age is defined as age of mother of 35 years or more at the time of delivery. The study group comprises of women of advanced maternal age who deliver during the study period. The control group are women aged 20-34 years who delivered on the same day as women included in the study group. In order to provide better visual evaluation, maternal age is categorized as 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years and 45-50 years, to assess the unadjusted risk of maternal age on pregnancy outcomes.

The women were enrolled for the study from labour ward after taking informed consent. Using the maternity delivery book and specially designed proforma, participants' demographic data, obstetric information, pre-existing medical conditions and medical and obstetric complications can be identified in women at the time of delivery. Mothers

and neonates were followed up until time of discharge or demise. Outcomes among women aged at least 35 years were compared to women under age 35 but above 20 years to determine any difference in risk between the older and younger groups.

The major obstetrics parameters compared between these two groups are parity, obstetric complication (antepartum haemorrhage, prelabour rupture of membrane, postpartum haemorrhage), medical disorder associated with pregnancy (hypertension in pregnancy and gestational diabetes) and mode of delivery (normal vaginal delivery, instrumental/assisted vaginal delivery and caesarean section).

The age of viability, according to WHO is 24 completed weeks of gestation or conceptus of birthweight of at least 500g at birth. For low resource setting the age of viability is generally 28 weeks of gestation or a baby weighing at least 1000g at delivery. Taking into consideration the WHO definition, deliveries occurring before 24 weeks and birthweights below 500g are excluded from the study. The perinatal information compared are fetal/newborn congenital anomalies, birth weight, birth outcome (whether live birth or still birth) and Apgar score at 1 and 5 minutes of life.

The neonatal intensive care unit (NICU) admission criteria are defined as follow; low birthweight (< 2500 g), prematurity (36 weeks gestation or less), respiratory problems (apnoea or cyanotic episodes, any respiratory distress causing concern), suspicion of infection with clinical concern, gastrointestinal problems (feeding problems, bile stained vomiting, or other clinical signs suggesting bowel obstruction), metabolic problems, central nervous system problems (convulsion, neonatal encephalopathy), cardiovascular problems requiring monitoring or intervention and any baby that is causing concern to the attending doctor that the baby requires observation or treatment

in NICU. Less sick, but unwell new-borns are generally admitted in special baby care unit (SCBU).

3.3. Study setting and rationale for selection

Mpilo Tertiary Teaching Hospital in Bulawayo city, Zimbabwe is the site of the study. Bulawayo is the second largest city in the country and is an urban setting. This research was specifically carried out at Mpilo's Maternity Hospital in the department of Obstetrics and Gynecology. This is an ideal setting as it is one of the biggest maternity unit in the country and being one of the six referral hospitals in the country. Due to the nature of the referrals to this hospital, there is a mixture of patients from the rural and urban areas – with the urban ones predominating. Various patient groups are referred to this hospital because of high risk pregnancies, but it also caters for lesser risk groups.

3.4 Study Population and Inclusion/Exclusion Criteria

3.4.1 Population

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query. The idea behind sampling is that by selecting only certain elements of that population, a researcher may draw conclusions about the entire population (Cooper & Schindler, 2003). Hair et al. (2010) also concur that it is important that researchers should use a representative sample of the population if they wish to generalise the findings. The total population for this study are parturient mothers in Zimbabwe. Population of Bulawayo is 665 952 (15 178 957) with 358 081 (53.8%) females as per 2022 census (ZimStats, 2023). For the purpose of this very study, the target population comprised of Mpilo Hospital's newly delivered mothers.

3.4.2 Exclusion criteria

These are all pregnant women coming for medical termination of pregnancy even if they were more than thirty-five years of the age, teenage mothers, patients not willing for participation in the study, patients with chronic renal failure, severe cardiac disease, chronic liver disease, chronic lung disease like pulmonary tuberculosis and COPD etc.

3.5 Sample Size and Sampling Procedure

3.5.1 Sampling

Sampling is a technique of selecting individual members or a subset of the population to make statistical inferences from them and estimate characteristics of the whole population. This is so that we can then generalize the results so obtained back to the population from which they were retrieved. Kumar (2005) defines a sample as the selected subset of elements from the population. The sample size for this study is calculated by using the statistical formula:

Formulae for the minimum sample size pair for an unmatched case-control study based on Fleiss test:

$$n_{cases-Fleiss} = \frac{\left[z_{\alpha/2}\sqrt{(r+1)*p*(1-p)} + z_{1-\beta}\sqrt{r*p_0*(1-p_0)+p_1*(1-p_1)}\right]^2}{r*(p_0-p_1)^2}$$

$$p = \frac{p_0 + r*p_1}{r+1}$$

Variable Notations:

α = The probability of type I error (significance level) is the probability of rejecting the true null hypothesis = 0.05

β = The probability of type II error or probability of failing to reject the false null

hypothesis = 0.1.

P_0 = The proportion for cases. P_1 = The proportion for controls.

r = The ratio of case-control (1 case/r controls)

N_{Fleiss} Required sample size for cases using Fleiss's formula

Alternatively, Epi Info was also utilised to calculate sample size.

The proportions are extrapolated from an analytical comparative study in Ethiopia by Mehari et al (2020). In this study the AMA group had caesarean section rate of 66.3%, whilst the younger group had 33.7% prevalence, and odds ratio of 2.7. The anticipated power of the study is 90% and significance level is 95%. This gives the researcher an ideal sample size of 88 in each group. Adjustments at 10% for possible non-responders is considered, to give sample size of 97 in each group.

3.5.2 Sampling Frame

According to Sarndal C et al (2003), a sampling frame is the source material or device from which a sample is drawn. It is a list of all those within a population who can be sampled, and may include individuals, households or institutions. A sampling frame is a list of all the items in the population and includes everyone or everything wanted for the study. Population in research is general but sample frame is specific. Sample frame should outline the sample size to be included in the study. This particular study utilizes a sample size calculated using Fleiss formula or Epi Info and all composed of recently delivered women at Mpilo hospital.

3.6 Sampling Technique

The study makes use of quantitative analytical methodology. The cases are all eligible parturient of at least 35 years of age. Controls are those at least 20 years but less than 35 years of age. The two sets would have delivered on the same day to try to reduce

differences in terms of the maternity teams, resources availability, day of the week, etc. The ideal control closest to the case was selected to reduce bias.

Purposive Sampling: Also known as purposeful, judgmental, selective or subjective sampling is a non-probability sampling technique that researchers use to recruit participants who can provide in-depth and detailed information about the phenomenon under investigation. It is highly subjective and determined by the researcher generating the qualifying criteria each participant must meet to be considered for the research study. The sampling is to be premised on the judgement of the researcher when it comes to selecting the subjects at Mpilo Hospital. Reason for using purposive sampling is to delve in particular characteristics of a population that are of particular interest, and hence assist the researcher in answering the research questions. Purposive sampling is ideal for this research and researcher because it is cost- and time-effective.

3.7 Data Collection Instruments – All tools' sections and variables

The women were enrolled for the study from labour ward after taking informed consent. Structured questionnaires were then created. Information related to patient's demographical information, antenatal booking status, associated medical disorder, cause for delayed pregnancy, complication during pregnancy, mode of delivery, maternal and neonatal outcome were collected in a specially designed research proforma. Some of these parameters were extracted from the delivery register, clinical notes, and antenatal booking form.

3.7.1 Variables and definitions

Variables in the antenatal booking form are usually recorded by nurses or midwives during obstetric visits in pregnancy. In this study, gestational age is estimated by ultrasonography during first and second trimesters or calculated according to last

menstrual period. Antenatal contacts/visits are categorized as 0, 1 to 4 contacts, 5 to 10 contacts, and more than 10 contacts. Smoking and /or drinking are self-reported variables and categorized in three categories including non-smokers/non-drinkers, smoking/drinking only during the first trimester and smoking/drinking throughout pregnancy.

3.7.2 Independent variables

Based on the most common definition of AMA, maternal age is categorized into two age groups less than 35 years and 35 years or older, with a reasonable size of the population in both categories. Women less than 35 years were selected as the reference group and this age group contains the median age of women in this population. Body mass index (BMI), paternal age, marital status, educational level, number of antenatal contacts, first booking contact, smoking, alcohol drinking, syphilis test results, HIV status, haemoglobin levels, parity, use of antenatal medications, medical conditions, obstetric conditions, employment status, socio-economic status and factors contributing to advanced maternal age

3.7.3 Dependent variables

In assessing the effect of maternal age on pregnancy outcomes, there are two sets of outcomes, maternal and perinatal outcomes. The main maternal and perinatal outcomes are placental abruption, perineal injuries, preterm birth, NICU admission, low birth weight and low Apgar score at 5 minutes. Placental abruption is diagnosed by clinical examinations. Variable blood transfusion is coded as (yes) for women who received any transfusion of blood products. Infants less than 2500 g are to be classified as low birth weight. Preterm birth is recorded for births less than 37 weeks of gestation.

Apgar scores between 0-6 is to be recorded as low Apgar scores at 5 minutes. Apgar score is defined by a scoring method and used by birth attendant; a score less than 7 is usually considered a low Apgar score (Apgar, 1953). NICU admission is considered when infants are usually or intent to be intubated.

3.7.4 Confounding variables

The effect of maternal age on pregnancy outcomes can easily be distorted by the effect of confounding factors. This distorting effect of confounding factors can overestimate or underestimate the effect of maternal age on pregnancy outcomes. In this thesis, in order to deal with the effect of confounding variables, variables were interred in the regression modelling. For the association of advanced maternal age and pregnancy outcomes parity, smoking, prior Caesarean section is considered as potential confounding variables. Some of the variables like preterm delivery are not considered as a confounding variables for the association of maternal age and adverse outcomes, because they are in the pathway of the association.

3.8 Pretesting of instruments - Validity and Reliability

Pretesting is a more focused and detailed examination of research instruments, especially the questions, items, or statements. It may involve asking a small group of experts, peers, or potential respondents, usually 5 to 10 people, to review, comment, or answer on items on the instruments. In this study the researcher asked 5 possible participants to answer and comment on instruments using interviews. Pretesting can help improve the relevance, clarity, and readability of the instruments, and to ensure that they align with research objectives and hypotheses.

3.9 Data Collection Procedure

Prior to the data collection, the checklist was reviewed by senior researchers for its validity. Four graduate midwives with previous experience in data collection were hired as data collectors. Adequate training on data collection was provided. The data collected was then entered manually on paper then transferred to Excel or SPSS spreadsheets. The principal investigator monitored the overall tasks.

3.10 Analysis and Organization of Data - dummy tables

This study used quantitative research methods hence employed the quantitative data analysis methods. Primary data was collected using the questionnaires. The questionnaires were checked for completeness, then the data captured and analysed using the excel and Stata 17 software. Frequency tables, histograms, bar graphs and pie charts are then used to analyse and present the data.

3.10.1 Statistical Analysis

Statistical analysis was conducted using Excel, Python and Stata version 17. Demographic and clinical characteristics of the study population were then compared between women less than 35 years and 35 years or older by using Chi-Squared test to find any association between categorical variables. P values less than 0.05 are considered significant at 95% Confidence Intervals (CI). The association between advanced maternal age and pregnancy outcomes is modelled using a logistic regression to calculate adjusted odds ratios and 95% confidence intervals. Confounding factors are selected based on literature review or significant associations in bivariate analysis and variables without statistically significant results p value less than 0.5 in bivariate models are checked in logistic regression to ensure the same results.

Multivariable logistic regression modelling to investigate the association of maternal age with adverse maternal and perinatal outcomes by considering the effect of confounding variables was utilised. Results are reported in adjusted odds ratios with 95% CI and P value, with a P value < 0.05 considered significant.

3.11 Dissemination of Results

The researcher is going to share the results with Africa University, Mpilo Hospital management, MoHCC staff, academics, and the general public who may be interested in this particular research.

3.12 Ethical Considerations

A letter of permission was written to the Mpilo hospital ethical board and subsequently approved. Ethical clearance for the study was sought from the Institutional Review Board of Africa University, AUREC, and was given with approval number **AUREC 3480/24**. Furthermore, confidentiality was not breached as the checklist that was developed was anonymous and did not identify participating mothers' personal information.

3.13 Summary

This chapter dealt in detail the study methodology that was utilised by unfolding the study design, study setting, study population, sampling technique of preference, data collection tools, procedures and data analysis, ultimately with the ethical considerations that steered the study.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTEPRETATION

4.1 Introduction

This chapter presents the results according to the research question and objectives of the study posed in the background section. Sample characteristics and bivariate association between multiple independent variables and the outcome variable are presented in this chapter. In addition, perinatal outcomes and magnitude of adverse obstetrical outcomes are also presented.

4.2 Socio-demographic characteristics of participants

Data collection was conducted over a period starting November 2024 and ending February 2025. None of the patients declined giving a consent to participate. A total of 247 charts of mothers were reviewed in this study (case=132 and controls=115). The provided output is a detailed analysis of various factors related to advanced maternal age (AMA) and its potential effects on pregnancy outcomes for postpartum mothers at Mpilo Hospital, Bulawayo, Zimbabwe. The study aims to understand how advanced maternal age impacts pregnancy outcomes compared to controls, considering a wide range of risk factors and perinatal outcomes. The analysis includes both categorical and continuous variables, with a focus on maternal characteristics, treatment interventions, and perinatal outcomes.

Age:

Mean (Age <35): 26.44, Mean (Age 35–75): 37.92

T-test p-value: 0.0000

Weight:

Mean (Age <35): 71.08, Mean (Age 35–75): 76.08

T-test p-value: 0.0146

Height:

Mean (Age <35): 2.97, Mean (Age 35–75): 1.61

T-test p-value: 0.3179

Table 2: Marital Status

Age Group	Divorced	Widowed	Married	Missing	Single
0	0	1	95	1	18
1	1	0	116	7	8

Non-2x2 table: Chi-square p-value: 0.0496

Partner's Age:

Mean (Age <35): 32.26, Mean (Age 35–75): 43.33

T-test p-value: 0.0000

Table 3: Partner’s Education

Age Group	Primary	Secondary	Tertiary	Missing
0	8	81	19	7
1	16	89	17	11

Non-2x2 table: Chi-square p-value: 0.04871

Table 3: Residence

Age Group	Rural	Urban	Missing
0	24	88	3
1	27	98	7

Non-2x2 table: Chi-square p-value: 0.9031

Table 5: Patient Employment Status

Age Group	Employed	Unemployed	Vendor	Self-employed	Missing
0	25	67	20	1	18
1	34	58	31	7	8

Non-2x2 table: Chi-square p-value: 0.4323

Table 6: Partner Employment Status

Age Group	Employed	Unemployed	Vendor	Other Self-employed
0	80	5	16	14
1	83	5	23	21

Non-2x2 table: Chi-square p-value: 0.6121

Table 7: Patient's Education

Age Group	Primary	Secondary	Tertiary	Missing
0	20	60	10	25
1	30	64	17	13

Non-2x2 table: Chi-square p-value: 0.0486

Parity:

Mean (Age <35): 2.32, Mean (Age 35–75): 3.97

T-test p-value: 0.0000

Gravida:

Mean (Age <35): 2.32, Mean (Age 35–75): 4.12

T-test p-value: 0.0000

ANC Contacts:

Mean (Age <35): 4.27, Mean (Age 35–75): 4.21

T-test p-value: 0.8472

Last Delivery Interval Years:

Mean (Age <35): 4.86, Mean (Age 35–75): 7.01

T-test p-value: 0.0000

1. Age: The mean age of the case group (≥ 35 years old) was found to be 37.9 years with (SD=2.7) whereas the mean age of the control group (<35 years old) was 26.4 years with a standard deviation of 4.1, with a t-test p-value of 0.0000, indicating a clear distinction between the two age groups. This confirms the central variable of the study, with advanced maternal age being associated with higher risks for adverse pregnancy outcomes.

2. Weight: The average weight for women in the younger group (less than 35 years) was 71.08 kg, while for the older group, it was 76.08 kg. The t-test p-value of 0.0146 suggests that maternal weight increases with age. This weight difference may have implications for the risk of complications such as gestational diabetes, hypertension, or preeclampsia, which are more commonly observed in heavier women during pregnancy.

3. Height: There was no statistically significant difference in height between the two age groups, with the younger group having an average height of 1.57 meters and the older group 1.61 meters (p-value = 0.3179). This suggests that height may not be a major factor affecting pregnancy outcomes in relation to advanced maternal age.

4. Marital Status: Majority of the mothers were married among cases 87.1%, while 83.5% were married among the controls. The chi-square test for marital status revealed a significant association (p-value = 0.0496), with a higher percentage of married women in the younger group (95 out of 115) compared to the older group (116 out of 132). The younger group also had a higher proportion of single women (18 vs. 8). These

differences may reflect social factors that influence access to healthcare, emotional support, and stability, which are known to impact pregnancy outcomes.

5. Partner's Age: The average age of partners for younger women was 32.26 years, while for older women, it was 43.33 years (p-value = 0.0000). This highlights a significant age gap between partners of women in the two groups, which could suggest differences in socio-economic status, health behaviors, and potential risks in pregnancy. Older partners may also have their own set of health concerns that could affect the pregnancy, potentially influencing outcomes.
6. Educational level status of this study participants was good with more than half of controls (71.3%) and cases (59.1%) reached secondary education.
7. Higher average BMI was found among cases 29.5± 5.9 and 27.2±6.4 among the controls**.**
8. Partner's Education: The chi-square test for partner's education indicated a significant difference (p-value = 0.0487), with younger women more likely to have partners with a higher educational level. For instance, the younger group had 23 partners with A-level education compared to 11 in the older group. Higher education may be associated with better health literacy, access to healthcare, and better health outcomes.
9. Residence: Urban dwellers constituted the most in this study, with only 20.5% of cases residing in rural areas. The chi-square test for residence status (urban or rural) showed no significant difference between the two age groups (p-value = 0.9031). This suggests that where the women live, whether in urban or rural areas, does not significantly affect pregnancy outcomes based on maternal age in this study.
10. Patient Employment Status: There were no significant differences in employment status between the two age groups (p-value = 0.4323). Most of the mothers were either

housewives or were self-employed. A considerable proportion of the mothers were employed with 31.8% among cases and 27.8% among control group. While the younger age group had more housewives (56 vs. 48) and fewer employed women, the differences are not substantial enough to suggest that employment status is a major risk factor for adverse pregnancy outcomes in this context.

11. Partner Employment Status: Similar to patient employment status, there were no significant differences in partner employment status (p-value = 0.6121). This indicates that the employment status of partners may not significantly affect pregnancy outcomes in relation to advanced maternal age in this sample.

12. Parity and Gravida: There was a clear difference in the mean parity and gravida between the two groups, with the older age group having a higher mean number of pregnancies (3.97 vs. 2.32) and a higher number of previous live births (3.97 vs. 2.32). The t-test for both variables had p-values of 0.0000, indicating a significant difference. Higher parity and gravida can be associated with an increased risk of complications like preterm birth, gestational diabetes, and hypertension, which are more common in older women.

13. Last Delivery Interval: The mean interval between the last delivery for the younger group was 4.86 years, while for the older group, it was significantly longer at 7.01 years (p-value = 0.0000). A longer interval may reflect a change in fertility or health conditions affecting older women's pregnancies, potentially leading to higher risks for pregnancy complications due to reduced reproductive health.

Socio-demographic characteristics of study participants are further listed in **Table 8**.

Results of bivariate analysis show that marital status was significantly associated with maternal age.

Table 8: Socio-demographic characteristics and Its association with maternal age

Variable	Case Maternal age (≥ 35) n = 132(%)	Control Maternal age (< 35) n=115(%)	P-value
Marital status			
Married	115(87.1)	96(83.5)	
Single	8(6.1)	18(15.7)	
Divorced	1(0.76)	0	
Missing	1(0.76)	1(0.87)	0.012[b]
Education level			
Primary and below	26(19.7)	17(14.8)	
Secondary	78(59.1)	82(71.3)	
Tertiary	17(12.8)	11(9.5_	
Missing	11(8.3)	5(4.4)	0.224
Place of residence			
Urban	97(73.5)	88(76.5)	
Rural	27(20.5)	24(20.9)	
Missing	8(6.1)	3(2.6)	0.420
Employment status			
Housewife	48(36.4)	56(48.7)	
Self-employed	31(23.5)	21(18.3)	
Employed	41(31.8)	32(27.8)	
Unemployed	3(2.3)	3(2.6)	
Missing	8(6.1)	3(2.6)	0.286
Body Mass index	29.5±5.9	27.2±6.4	0.075[b]

Data are mean ± standard deviation or number (%). p values were calculated from Chi-square or t-test

4.3 Treatment and Health Conditions

Table 9: Other Conditions

Age Group	Syphilis	Varicose Veins
0	0	0
1	3	1

Non-2x2 table: Chi-square p-value: 0.0447

Haemoglobin Or Haematocrit Levels:

Mean (Age <35): 10.88, Mean (Age 35–75): 11.40

T-test p-value: 0.1562

1. Hypertension and Diabetes Treatments: The chi-square tests for hypertension and diabetes treatment were non-significant, with p-values of 1.0000 and 0.6390, respectively. This suggests that treatment for hypertension or diabetes did not differ

significantly between the age groups. However, the increased prevalence of hypertension in older women (as seen in the previous analysis) may indicate that these conditions should be closely monitored in AMA pregnancies, even if treatment does not vary.

2. Other Conditions State: The chi-square test for other conditions (asthma, fibroids, cervical cerclage, syphilis, etc.) showed a significant difference for varicose veins and syphilis (p-value = 0.0447). The older group had more cases of varicose veins (1 vs. 0) and syphilis (3 vs. 0). These conditions could complicate pregnancy and may require special management, especially in women of advanced maternal age, where the body may not cope as well with additional health concerns.

3. Medications in Pregnancy: The chi-square test for medications in pregnancy showed no significant differences (p-value = 0.4825), suggesting that medication use during pregnancy did not vary significantly between the two age groups. However, the use of medications like nifedipine and methyldopa in the older group indicates that management of hypertension or other pregnancy-related conditions may differ between age groups.

4.4 Causal factors for advanced maternal age

Table 10: Reasons for Advanced Maternal Age

Reason	Number	%
Contraceptive Failure	10	10,9%
Advancement of Career	4	4.3%
Subfertility	2	2.2%
Seeking a Male or Female Child	27	29.3%
Delayed marriage	15	16.3%
Re-marriage or New marriage	21	22.8%
Wanting to have more children	13	14.1%
Other causes	2	2.2%

The total number of women of at least age 35 years who were able to give responses to the reason why they had children at this particular age were 92. Predictors for AMA birth were selected a priori and included contraception, career advancement, subfertility, preference for a certain sex of the baby, delayed marriage, re-marriage/new marriage, and other otherwise not classified reasons. The leading reason, as illustrated in Table 3 was seeking a certain gender (29.3%, n =27), with the least attributable cause being issues to do with subfertility (2.2%, n=2).

4.5 Obstetric and Medical characteristics

Obstetric and medical characteristics comparing the case and comparison groups are presented in Table 3. Almost one third (34%) of advanced maternal age mothers in this study had ANC follow up of less than four times. High HIV positivity rate was found among the cases (21.9%). In this study number of ANC visits, gravida and HIV status was not significantly associated with maternal age.

Table 11: Obstetric and Medical history

Variable	Case Maternal age (≥ 35) N=132(%)	Control Maternal age (< 35) N=115(%)	P-value
Number of ANC visits			
Less than four visits	46(34.8)	40(34.8)	
Four and above visits	72(54.6)	67(58.3)	0.785[b]
Missing	14(10.6)	8(6.9)	
HIV status			
Positive	29(21.9)	17(14.7)	
Negative	93(70.5)	87(75.7)	
Unknown	1(0.76)	1(0.87)	
Missing	9(6.8)	10(9.7)	0.501[b]

b =t-test

4.6 Maternal outcomes

Table 12: Hypertension In Pregnancy

Age Group	Chronic Hypertension	Eclampsia	Gestational Hypertension	Pre-eclampsia	Nil
0	2	0	20	2	92
1	7	1	34	4	85

Chi-square p-value (non-binary outcome): 0.0492

Table 13: APH

Age Group	Nil	Yes
0	112	3
1	131	1

Chi-square p-value (non-binary outcome): 0.0489

Table 14: Abruptio Placentae

Age Group	Nil	Yes
0	115	0
1	131	1

Chi-square p-value: 1.0000

Odds Ratio: 0.560 (95% CI: 0.019–16.857)

Table 15: Placentae Praevia

Age Group	Nil	Yes
0	115	0
1	131	1

Chi-square p-value: 1.0000

Odds Ratio: 1.785 (95% CI: 0.059–53.687)

Table 16: PPROM

Age Group	Nil	Yes
0	114	1
1	132	0

Chi-square p-value: 0.9514

Odds Ratio: 2.278 (95% CI: 0.076–68.539)

PPH (ml):

Mean (Age <35): 1200.00, Mean (Age 35–75): 1900.00

T-test p-value: nan

Blood Transfusion (Units):

Mean (Age <35): 1.71, Mean (Age 35–75): 1.62

T-test p-value: 0.7857

The evaluation of associations between maternal age and obstetric outcomes at Mpilo Hospital provides essential insights into the potential risks and complications faced by postpartum women, particularly those of advanced maternal age. The study employs chi-square tests and odds ratios to analyse categorical outcomes, alongside t-tests for continuous variables, revealing significant differences in certain obstetric conditions based on maternal age.

Focusing on hypertension in pregnancy, the data indicates a stark contrast between the two age groups. Among younger mothers (age <35), only 2 cases of chronic hypertension and no cases of eclampsia were recorded. In contrast, older mothers (age 35–75) presented with 7 cases of chronic hypertension and 1 case of eclampsia. Additionally, the incidence of gestational hypertension was also higher in the older cohort, with 34 cases compared to 20 in the younger group. The chi-square p-value of 0.0492 suggests a statistically significant association, indicating that advanced maternal age may indeed elevate the risk of hypertension-related complications during pregnancy. This finding has important clinical implications, as it emphasizes the necessity for healthcare providers to implement more rigorous monitoring and management strategies for older pregnant women to mitigate these risks.

The analysis of abruptio placentae reveals no significant association with maternal age, as evidenced by a chi-square p-value of 1.0000. Among younger mothers, there were no cases of abruptio placentae, while one case was recorded in the older group. The odds ratio of 0.560 indicates a lower risk, albeit with a wide confidence interval, suggesting that the relationship between advanced maternal age and abruptio placentae is not well-defined and requires further investigation.

Similarly, placenta previa presented no significant associations, with nil cases in younger mothers compared to 1 in the older cohort, and a chi-square p-value of 1.0000. The odds ratio of 1.785 reflects a potential, albeit not statistically significant, increased risk among older mothers. This suggests that while advanced maternal age may not strongly correlate with placenta previa, ongoing monitoring remains important given the variability in individual risk factors.

The analysis of preterm premature rupture of membranes (PPROM) and prolonged rupture of membranes also yielded non-significant results, with chi-square p-values of 0.9514 and 1.0000, respectively. These findings indicate that maternal age may not significantly influence the incidence of these conditions, suggesting that other factors could play a more pivotal role.

In terms of continuous outcomes, the mean postpartum haemorrhage (PPH) for younger mothers is 1200 ml, compared to 1900 ml for older mothers. Although the t-test p-value is not applicable, this substantial difference suggests that older mothers may experience more severe bleeding, highlighting the need for enhanced preparedness and intervention strategies during labour and delivery. The mean units of blood transfusion also show minimal difference between the two groups (1.71 for younger mothers and 1.62 for older mothers), with a t-test p-value of 0.7857 indicating no significant association.

Figure 3 shows the proportion of PPH, PROM, blood transfusion and abruption placentae among the case group and control group. This study revealed that the magnitude of PPH was higher among advanced age mothers (4.5%) compared to 3.4% among the control group. Only one advanced age mother was complicated by abruption of the placenta. PROM was high among the control group with a prevalence of (4.3%). Slightly increased prevalence of blood transfusion among advanced age mothers was found (4.5%) as compared to the control group (4.3%).

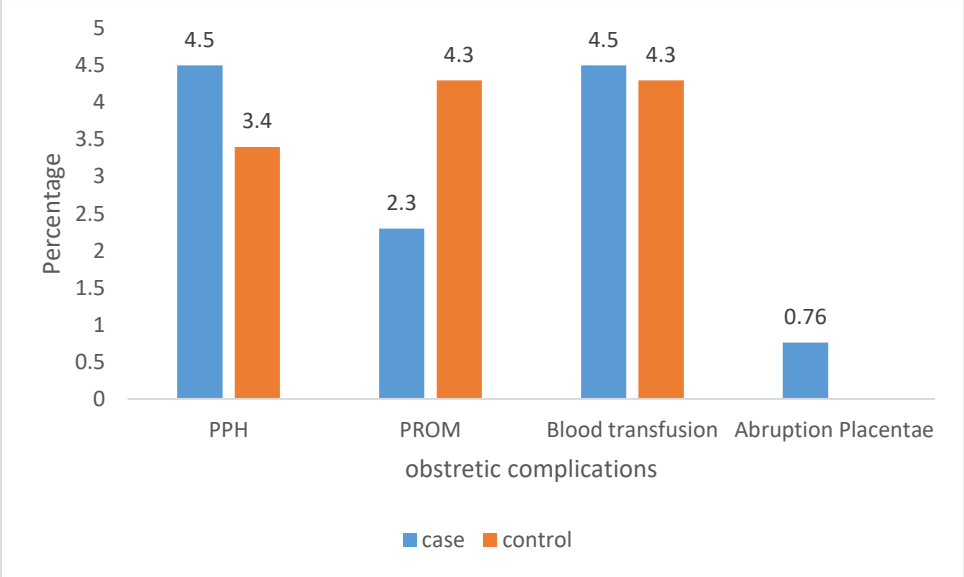

Figure 3: Proportion of PPH, PROM Blood transfusion and Abruption placenta

More than half (53.6%) of advanced age mothers delivered through normal vaginal which is slightly higher than the controls, 53.2% (Figure 4). Overall, about a (46.4%) of advanced age mothers in this study gave birth via caesarean section. The most common reason for caesarean were APH, fetal distress, poor progress and previous caesarean section. However, results of the bivariate analysis show a statistical significance between mode of delivery and maternal age of p=0.097. A higher number of patients had no perineal damage (Figure 5). None of the patients suffered severe perineal injuries, i.e. 3rd or 4th degree tears.

In conclusion, this analysis underscores the complex interplay between maternal age and obstetric outcomes. The significant associations found with hypertension suggest that advanced maternal age poses increased risks, warranting tailored clinical interventions for older mothers. Conversely, the lack of significant relationships in other outcomes emphasizes the need for a comprehensive approach that considers a multitude of risk factors in maternal healthcare. These findings advocate for continued

research to further understand the dynamics at play, ultimately contributing to improved maternal and fetal health outcomes in Bulawayo, Zimbabwe.

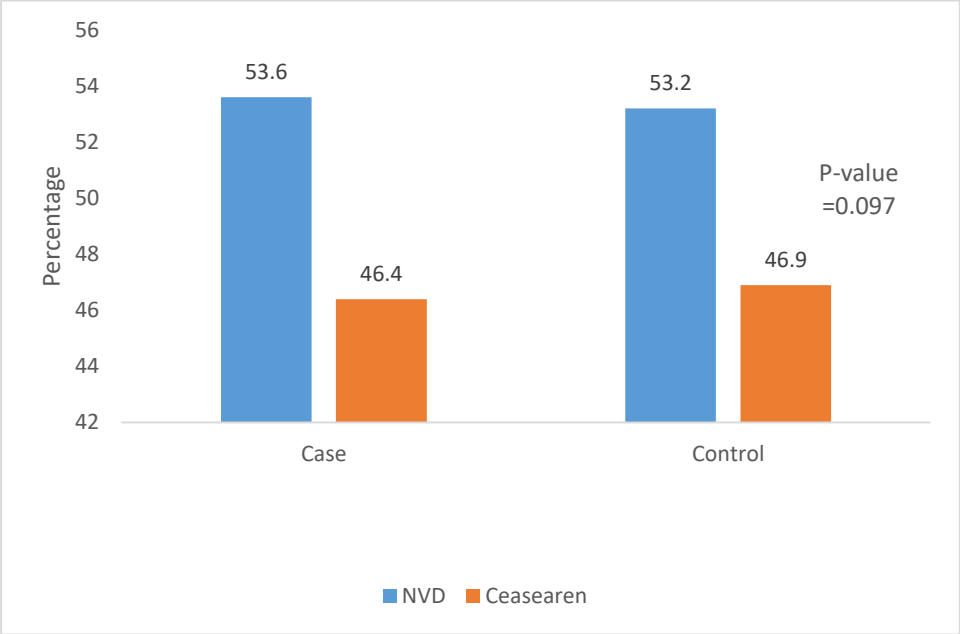

Figure 4: Mode of delivery by maternal age

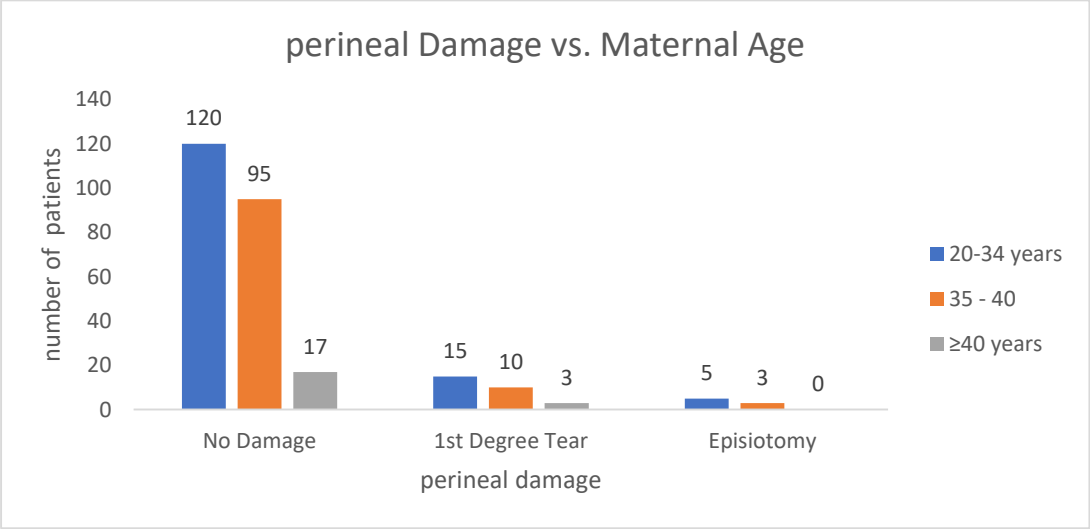

Figure 5: Perineal damage

4.7 Perinatal outcomes according to maternal age group

Table 17: Early Neonatal Death

Age Group	Nil	Yes
0	115	0
1	131	1

Chi-square p-value: 1.0000

Odds Ratio: nan (95% CI: nan–nan)

Table 18: IUGR

Age Group	Nil	Yes
0	113	2
1	132	0

Chi-square p-value: 0.4250

Odds Ratio: 0.000 (95% CI: N/A)

Apgar Score At 1 Min:

Mean (Age <35): 7.57, Mean (Age 35–75): 7.21

T-test p-value: 0.0450

Apgar Score At 5 Mins:

Mean (Age <35): 8.51, Mean (Age 35–75): 8.09

T-test p-value: 0.0457

Apgar Scores: The 1-minute and 5-minute Apgar scores were significantly lower in the older age group compared to the younger group (p-values of 0.0471 and 0.0457, respectively). The mean 1-minute Apgar score for younger women was 7.57, while for older women, it was 7.21. Similarly, the 5-minute Apgar scores were 8.51 for younger women and 8.09 for older women. These findings suggest that advanced maternal age may be associated with slightly worse perinatal outcomes, likely due to complications such as fetal distress or preterm birth. Only one early neonatal death was documented in this study. The reason for the death was severe prematurity compounded with respiratory distress.

The mean gestational age among the case group was 37.4 weeks ±3.7 (mean ± SD) which is not markedly different from the control group's, 38.01 weeks ±4.3 (mean ± SD). Similarly, the mean birth weight of babies born from advanced age mothers was 2852 g ± 762.6 (mean ± SD) while babies born from control group had a mean birth weight of 2925 g ± 666.9 (mean ± SD). Higher low birth weight babies were born among advanced age mothers 27(20.4%) as compared to the control group 21(18.3%). In this study low birth weight status was significantly associated with maternal age (P<0.001).

The rates of first- and fifth-minute APGAR scores of neonates were similar between the groups as shown in Table 4 below. While admission to the neonatal intensive care unit was more frequent in the advanced maternal age groups compared with the control group.

Table 19: Perinatal outcomes according to maternal age group

Variable	**Case n=132**	**Control n=115**	**P-value**
Gestational age	37.4 weeks ±3.7	38.01 weeks ±4.3	0.083[a]
Birth weight	2852 g ± 762.6	2925 g ± 666.9	0.414[a]
Birth weight status			
Normal	105(79.5)	94(81.7)	
LBW	27(20.5)	21(18.3)	<0.001
Apgar score(5min)			
<7	13(9.8)	10(8.7)	
≥7	119(90.2)	109(94.8)	0.342
Apgar score(1min)			
<7	21(15.9)	10(8.7)	
≥7	111(84.1)	110(95.7)	
Not reported	15(11.4)	11(9.6)	0.213
Sex of baby			
Male	56(51.4)	52(53.6)	
Female	53(48.6)	45(46.4)	0.749
IUGR			
Yes	18(13.6)	13(11.3)	
No	114(86.4)	102(88.7)	0.431
Early Neonatal death			
Yes	1(0.76)	0	-
No	131(99.2)	115(100)	

a-Two independent t-test

4.8 Regression analysis on pregnancy outcome variables

Adjusted Multivariable Logistic Regression (MLR) analyses for covariates and confounders were applied in order to examine the association between maternal age, perinatal outcomes and obstetric outcomes. All variables which were statistically significant in the bivariate analysis were considered candidates for MLR. The logistic regression model showing the association of independent variables with the outcome variable are presented below on Table 4.

In this population mode of delivery, low birth weight and low fifth minute Apgar score were found to be significantly associated with maternal age. Babies born from advanced age mothers had 4.2 times higher odds to be born with low birth weight (AOR 4.2, 95% CI (1.76–4.9), $p < 0.001$) as compared to mothers aged less than 35 years after adjusting for other variables. Similarly, babies born from advanced age mothers had 6.7 times higher odds to have low fifth minute Apgar score (AOR 6.7, 95% CI (1.28–12.3), p =0.03) than babies born from mothers aged less than 35 years old holding other variables constant. Furthermore, advanced age mothers were 3.9 times higher odds to undergo caesarean section than their controls (AOR 3.9, (95% CI 1.52–3.78), $p = 0.012$). There was no statistically significant association between marital status and maternal age.

Table 20: Multivariable Logistic regression

Variable	AOR	95% CI		P-Value
		Lower	Upper	
Marital status				
Married	2.7	0.94	3.46	
Single	1	-	-	0.241
Birth weight status				
Normal(≥2500g)	1	-	-	
LBW(<2500g)	4.2	1.76	4.9	<0.001
Apgar score (5 min)				
<7	6.7	1.28	12.3	
≥7	1	-	-	0.03
Mode of delivery				
NVD	1	-	-	
Caesarean	3.9	1.52	3.78	0.012

*AOR-Adjusted Odds Ratio

4.9 Summary

In this population mode of delivery, low birth weight and low fifth minute Apgar score were found to be significantly associated with maternal age. Babies born from advanced age mothers had 4.2 times higher odds to be born with low birth weight as compared to mothers aged less than 35 years after adjusting for other variables. Similarly, babies born from advanced age mothers had 6.7 times higher odds to have low fifth minute Apgar score than babies born from mothers aged less than 35 years old holding other variables constant. Furthermore, advanced age mothers were 3.9 times higher odds to undergo caesarean section than their controls. There was no statistically significant association between ANC contacts and maternal age.

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter will discuss the findings of the effects of advanced maternal age on pregnancy outcomes at Mpilo Hospital in Bulawayo between the period November 2024 to February 2025. The researcher will also give recommendations that can support the hospital, the province, the nation and much wider authority bodies to manage advanced maternal age patients, and hopefully leading to better health outcomes.

5.2 Discussion

The purpose of this study was to probe and examine the association of advanced maternal age to adverse pregnancy outcomes vis a vis maternal and perinatal outcome. A prospective case-control methodology was utilised. The results of this study revealed that advanced maternal age, after adjustment for other maternal characteristics and risk factors, is associated with increased risk for a wide range of adverse pregnancy outcomes, including NICU/SCBU admission, PPH, low birthweight, low 5-minute Apgar scores and caesarean section deliveries.

The rising trend of delayed childbearing secondary to education, career opportunities, delayed marriage, remarriage, seeking a certain baby gender and failed contraception allow these findings to be of particular interest to both the women and their healthcare providers (Khalil et al, 2013). Interestingly so, advanced maternal age was in some instances a protective factor against an adverse outcome. For example, in this study mothers aged 35 and greater had a lesser likelihood of having a post-dates pregnancy as compared to those younger. In addition, some of the complications of pregnancy started to tee off at around 30 years of age or well after 40 years. This raises the question, of whether age 35 is still the appropriate de facto standard to define advanced maternal age. As Nilsen et al., (2014) suggested, age is a continuum of risk, and an

arbitrary “cut-off” point may not be appropriate. The older you are the more likely it is that you may experience a negative pregnancy outcome.

The overall adverse pregnancy outcome among advanced age mothers and adult mothers was 64.6% and 37.8%, respectively, which indicates that there is a significant difference between the two groups. The result is in line with the reports in studies in worldwide multicounty assessment (Laopaiboon, 2014).

According to the study findings there were lower five-minute Apgar scores of infants and a higher prevalence of preeclampsia, gestational hypertension, inadequate prenatal care, and Caesarean delivery among the AMA subjects than among the younger women. Nevertheless, no significant difference was found between the groups with regard to the prevalence of APH, Placenta praevia, PPH, and PROM.

Based on our findings, educational level was different between the groups. Advanced-age mothers had less secondary but higher tertiary education than those aged 20–34 years old. An Italian population-based study by Cantarutti et al (2017) showed that mothers with higher levels of education had a lower risk of several adverse pregnancy outcomes. Ruiz (2015 in a meta-analysis across 12 European countries found a 48% risk excess of preterm births associated with low maternal education. Co-morbidities are more prevalent in advanced-age mothers and may be independently associated with adverse pregnancy outcomes, hence such findings should not be overlooked.

Advanced maternal age mothers had higher rates of HIV positive results than their younger counterparts i.e. 21.9% vs 14.7%. The mechanisms of the association between maternal age and HIV infection with adverse birth outcomes are not clearly pronounced, but may involve demographic, medications, lifestyle factors (e.g. illicit drug use), as well as pregnancy-related clinical conditions. Some age-related factors may place older people at risk for acquiring HIV. Age-related thinning and dryness of

the vagina may increase the risk tearing of the mucosa hence increase the chances of HIV transmission. Anecdotally, older people may be less likely to be concerned about pregnancy therefore may be less likely to use condoms during sex. The older women may also be a cohort of patients who got infected when ARVs were less readily available and also not as effective as the current regimes.

The pregnancy incidence among women living with HIV has gone higher though this has been accompanied by increases in life expectancy and a decline in mother-to-child HIV transmission (MTCT) rates to < 1% in some regions (Townsend et al, 2014 & Nesheim et al, 2013). In many countries in North America and Europe, maternal age has been increasing both in the general obstetric population and among HIV-positive women (Townsend et al, 2017). According to Flenady (2011) and Luke (2007), advanced maternal age in pregnancy is associated with an increased risk of obstetric complications, including pre-eclampsia, gestational diabetes, preterm birth and stillbirth. In addition, as Short (2024) stated, both HIV infection and antiretroviral therapy in pregnancy are themselves risk factors for adverse pregnancy outcomes such as preterm birth.

Our study did not find any woman with diabetes mellitus. This may be attributable to very poor screening for this common and debilitating condition. Shortage of blood sugar check machines and/or strips is widespread across our heath care facilities.

Physiological aging is at times accompanied by increasing resistance to insulin action with consequential elevated glycaemia. This hyperglycaemia may then lead to macrosomia in babies born to affected mothers. According to Fulop et al (2003), this decline in insulin sensitivity with age is probably as a result of progressive deterioration of pancreatic-cell function. The study did not observe an age-related upsurge in the risk

of macrosomia. These findings are in tandem with previous study findings by Kahvechi et al (2018).

One of the main findings of this study was the association of maternal age with hypertensive disorders of pregnancy. Consistent with studies by Mehari et al (2017) and Kahveci et al (2018), advanced-age mothers were more likely to encounter hypertensive than their adult counterparts ($p = 0.0495$). The study findings revealed that AMA was associated with the increased prevalence of preeclampsia and other hypertensive disorders of pregnancy which is in line with the results of similar studies (ACOG, 2018 & Collier et al, 2019). This result can be attributed to the fact poor uterine vascularization is understood to cause a deficiency in placental perfusion which is subsequently and probably related to preeclampsia (Gravena et al, 2012).

This finding is consistent with the study done in Ethiopia, Malaysia, and the United Kingdom (Maeruf, 2020; Rashed, 2016; Khalil, 2013). Similarly, this is corresponding with studies done by Ertuğrul Yılmaz (2016) and Abdel-Hady El-Gilany (2012) in the Middle East. The degenerative nature and other pathophysiological mechanisms peculiar to the older mothers may be the reason of the similarities between these studies. Duckitt et al (2005) also found that maternal age greater than 40 years doubles the risk of preeclampsia. In addition, Saftlas et al (1990) in a large population-based study validated that the risk of severe preeclampsia increases sharply after the age of 35.

By controlling for covariates for gestational hypertension and preeclampsia such as comorbidities, Clearly-Goldman (2005), found no link between maternal age and pre-eclampsia. Other reviews then argued that, such comorbidities are most likely caused by old age, hence they should not be adjusted for as they are intermediate variables.

However, a comparative study conducted by Kamlesh (2015) in India is at variance with this study as pregnancy-induced hypertension had no significant association with

maternal age. This notable variation might be a contribution of the sample size and socio-demographic difference between the two study areas.

Other studies (Usta et al, 2008; Jolly et al, 2000 & Wang et al, 2011) also found an increased risk of severe bleeding, both intrapartum and postpartum, in women older than 40 years. These results are rather in line with our own study findings. As a limiting factor, the authors rightfully pointed towards the study population, which consisted of patients with an already amplified risk profile. Pawde et al (2015) also found no significant surge in both intra- and postpartum bleeding in women with advanced maternal age.

This study also revealed that maternal age was found to be associated risk factor of APH. This is consistent with studies done in Jordan by Amarin (2013). Myometrial laxity from high gravidity may be a factor leading to this complication of pregnancy. Increased gravidity in advanced age mothers also makes them to be at greater risk of having abnormal placentation (placenta praevia) This fact might be the cause of the congruency of the findings. However, according to the study reports by Ertuğrul Yılmaz (2016) and Kamlesh (2015) from Turkey and India respectively, maternal age and APH have no statistically significant association. Study area differences may have contributed to this variance.

In this study, the prevalence of placenta praevia abnormalities was zero. Advancing maternal age is known to increase the risk of placenta praevia independent of other factors. A population-based, case-control study by Zhang et al (1993) showed that mothers aged 34 years or older had a two to three times higher risk of placenta praevia than mothers under the age of 20 years. In concurrence, Biro et al (2012) reported that advanced maternal age was independently associated with placenta previa (OR 2.2). Roustaei et al (2018) in a register-based cohort study however reported that

the risk of adverse maternal and neonatal outcomes for mothers with placenta previa was not substantially affected by maternal age if their different risk profiles were considered.

Advanced aged mothers had higher risk of experiencing PPH when compared to their younger counterparts. However, this was not statistically significant because of the small number of women with PPH. Preceding researches have linked advanced maternal age to PPH, but there is still no discernible consensus. This result is similar to the studies done in UK and South Korea (Khalil, 2013 & Koo, 2012) which concluded that AMA was a major risk factor for PPH. A study by Kramer et al. (2013) revealed that maternal age of 35 years (aOR, 1.5; 95% CI, 1.5–1.6) increased the risk of postpartum haemorrhage. Sheen et al (2018) prepositioned that mothers over 45 years of age were at the highest risk for postpartum haemorrhage during delivery hospitalisations.

A meta-analysis by Durmaz & Komurcu (2018), contrasted this finding as the authors concluded that there was no link between the maternal age of 35 years and postpartum haemorrhage. In line with this, studies by Maeruf et al (2013 and Amarin (2012), in Ethiopia and Jordan respectively showed that maternal age had no significant association with PPH. Interestingly, a study by Lao et al (2014) revealed that getting older protects against postpartum haemorrhage. This difference might be attributable to variations in institutions and staffing levels/quality. Caesarean section, PROM, prolonged labour, multiple gestations, induction of labour abnormal placentation, and hypertensive disorders are among the factors that have been linked to postpartum haemorrhage.

This study also discovered a link between maternal age and mode of delivery, with advanced maternal age corresponding to increasing rates of Caesarean section. The

study results showed that advanced age mothers were almost four times more likely to deliver through Caesarean section than their younger counterparts (aOR: 3.9, 95%CI: 1.52–3.78) and this was statistically significant. This odds ratio is higher than those reported by Mehari (2017) in Ethiopia (OR 2.7), by Kahveci (2018) in Turkey (OR 2.6), and Kenny (2013) in Ireland (OR 1.8). Among many other studies with similar findings, Bayrampour et al (2010), in a systematic review of twenty-one studies, discovered an increased risk of caesarean birth among mothers of advanced maternal age compared to younger mothers for both nulliparous and multiparous pregnancies.

Our findings are also consistent with the results from other studies (Lean et al, 2017; Roustaei et al, 2018; Ousmandson et al, 2016; Zapata-Masias et al, 2016; Alves et al, 2018). Pawde et al (2015) found out that there was a higher rate of Caesarean section in women older than 35 years, though not statistically significant. This outcome is also harmonious with other studies in literature (Van Katwijk & Peeters, 1998) and UK studies by Khalil et al (2013), which showed the same trajectory.

Fetal mal-presentations, previous Caesarean section, multiple pregnancies and other complications peculiar to AMA group may also push the rates of Caesarean section upwards. Other poor obstetrical factors, including preeclampsia and fetal distress were commonly seen in advanced-age mothers. There is also a generally lower threshold for doing caesarean section on AMA primiparous mothers despite absence of co-morbidities as these are then considered precious babies. This similarity in findings can be secondary to bad obstetric history being a common/shared factor in advanced aged mothers such that this group of women then tend to choose a safe route for their babies i.e. Caesarean operation. Other morbidities found in AMA may also push the Caesarean section rates up.

The increased rate of C-section can also be attributed to non-medical factors such as increased nervousness of physicians and mothers due to advanced age and in the case of multiparous women this was due to previous birth complications as illustrated by Ritzinger et al (2011) and Utsa et al (2008). Usta et al (2008) went on further to state that, the anxiety of expectant mothers for the unborn child plays a crucial role in the delivery mode being Caesarean section. Furthermore, many studies (Wang et al, 2011 & Cleary-Goldman et al, 2005) explain the decrease of myometrial functioning with aging as a reason for the increased rate of C-section in women with advanced maternal age, as this may then lead to dysfunctional labour. Cleary-Goldman et al went on to further illustrate that the decrease in the effectiveness of myometrial gap junctions as well as numerically fewer but also less sensitive myometrial oxytocin receptors may subsequently decrease the effectiveness of labour.

In this study population, there was also a prolongation of labour in women younger than 35 years. Some studies have found no age-dependent differences in birth duration (Kramer et al, 2013; Liu et al, 2021 & Goisis, 2017). The loosening of tissues from previous births and age-related connective tissue degeneration could be the possible mechanisms in women of advanced maternal age, and more so the multiparous ones.

With respect to maternal perineal birth injuries, there was an increased rate of birth injuries in nulliparous women younger than 35 years. In a study by Hornemann et al. (2010), a proportional association between age and severity of birth injury was reported.

Furthermore, Hornemann et al (2010) and Meister et al (2016) alluded that higher birth weight and vaginal - operative deliveries are risk factors for perineal damage. Nulliparity or first birth was considered as a risk factor independent of age by Soong et al (2005). Being of a younger age, according to Ogunyemi (2006) was as a risk factor

in addition to assisted vaginal deliveries, with the authors attributing these findings to tighter and more easily torn connective tissue. In our study, we fortunately didn't observe any operative/assisted vaginal deliveries. Any damage to the perineum would then be as a result of tightness of the birth passage, fragility of tissues, amongst other causes other than instrumental deliveries.

This analysis underscores the complex interplay between maternal age and obstetric outcomes. The significant associations found with hypertension suggest that advanced maternal age poses increased risks, warranting tailored clinical interventions for older mothers. Conversely, the lack of significant relationships in other outcomes emphasizes the need for a comprehensive approach that considers a multitude of risk factors in maternal healthcare. These findings advocate for continued research to further understand the dynamics at play, ultimately contributing to improved maternal and fetal health outcomes in Bulawayo, Zimbabwe.

In terms of neonatal outcomes, advanced-age mothers had a higher rate of preterm birth, low birth weight, low Apgar scores and neonatal intensive care unit admission. The findings indicated that older women are more likely to have poor perinatal outcomes than younger females, consistent with the results of some previous studies (Yazdani, 2016 & Lisonkova, 2017).

The analysis of perinatal outcomes in relation to maternal age at Mpilo Tertiary Teaching Hospital provides key insights into the subtle but potentially important effects of advanced maternal age (AMA) on neonatal health. Despite limited statistical significance across most categorical outcomes, the findings carry clinical implications that merit attention, particularly in resource-constrained settings such as Bulawayo, Zimbabwe.

Firstly, the absence of statistically significant associations for early neonatal death (p=1.0000) and intrauterine growth restriction (IUGR) (p=0.4250) suggests that these adverse outcomes were not more prevalent among women aged 35 years and above compared to their younger counterparts in this sample. However, these results should be interpreted with caution due to the small number of events and missing data for important variables like stillbirth and NICU/SCBU admissions, which are critical indicators of perinatal morbidity and mortality.

The lack of cases in certain age-outcome combinations resulted in non-estimable odds ratios, highlighting the need for larger datasets and improved data completeness in future research. While the results are statistically non-significant, they do not rule out the clinical relevance of these outcomes and should not be used to downplay potential risks in older maternal populations.

More notably, significant differences were observed in Apgar scores at 1 and 5 minutes, with neonates born to women under 35 achieving higher mean scores than those born to women aged 35 and above. The difference at 1 minute (7.57 vs. 7.21; p=0.0450) and at 5 minutes (8.51 vs. 8.09; p=0.0457) indicates that neonates of older mothers may experience transient neonatal distress or delayed adaptation to extrauterine life. Although both groups achieved generally acceptable Apgar scores, the statistically significant differences point to a measurable impact of maternal age on immediate neonatal well-being. This may reflect underlying physiological changes associated with maternal aging, such as reduced uteroplacental perfusion or increased obstetric interventions, which can affect the newborn's condition at birth.

The implications of these findings are twofold. Clinically, they underscore the importance of vigilant intrapartum and neonatal monitoring for women of advanced

maternal age, even in the absence of overt risk factors. Slight reductions in Apgar scores may not be life-threatening but can signal the need for resuscitation efforts or closer neonatal observation, which has resource implications for hospital staffing and neonatal care units. From a public health perspective, these results support continued education and counselling for women regarding the potential risks associated with delayed childbearing, while also advocating for tailored obstetric management strategies that anticipate and mitigate these risks in AMA pregnancies.

This study showed that advanced age mothers were more likely to deliver babies at earlier gestations as when compared with babies from younger mothers. This result is similar to studies done in South Africa (Hoque, 2012), Brazil (Nubia Karla, 2015), and South Korea (KO, 2012). Similarly, the result is in tandem with a multi-country assessment conducted by the World Health Organization (WHO, 2014). This might be as a result that complications of pregnancy are more plethoric in advanced age mothers. This finding is in contrast to studies completed in Malaysia and the UK which showed no association of maternal age with preterm delivery (Rashed, 2016 & Khalil, 2013). The difference may be an attribution of socio-economic differences, and healthcare infrastructural differences in the studies.

Some studies report increased age-related macrosomia as well as fetus with low birth weight (Jolly et al, 2000; Cleary-Goldman et al, 2005 & Jahromi et al, 2008) In contradiction, Wang et al (2011) and Seoud et al (2002) did found no maternal age-dependent differences in size or weight. In expansion, the increased incidence of low birth weight (LBW) in nulliparous women older than 40 years was attributed by Jahromi (2008) to an increased incidence of certain diseases with age.

Chronic or pre-existing hypertensive disease, for example, can result in both LBW and/or IUGR. It’s also important to note that adverse uterine vascularisation changes

that comes with senescence may lead to hypo-perfusion of the fetus, possibly leading to lower birth weight. Maternal metabolism can affect altered insulin resistance, more so at AMA, leading to an increased nutrient supply to the fetus with consequential hyperinsulinemia and augmented hypertrophic growth. Insulin resistance results in maternal hypertriglyceridemia, which leads to increased provision of free fatty acids to the fetus (Jolly et al, 2000).

As obesity arises more often in older pregnant women, this could be a reason for increased obese new-borns (Fuchs, 2018). The contradictory results of our study can be better explained by the size of our study population. Also, the treatment of high-risk women in specialised centres in some settings may make a difference in terms of outcomes.

This study revealed that maternal age was a significant predictor for a low birth weight with adjusted odds ratios (aOR) = 4.2. This is similar to an evaluation by Maeruf et al (2020) in a low-income country setting. This resemblance might be as a consequence of the majority of pregnancy-related complications being observed in advanced age mothers. This is in line with the findings by Mehari et al. (2017) where they discovered that advanced-age mothers were three times more likely to have LBW new-borns. Divergent conclusions were noted in studies by Rashed et al (2016) in Malaysia and Kahveci et al (2018) in Turkey whereby they found no link between maternal age and LBW. A positive association between advanced maternal age and the risk of LBW, may be confounded by pre-existing medical conditions, obstetrical history, and maternal social characteristics (Mehari et al, 2017 & Kahveci et al, 2018).

Iatrogenic premature delivery could complement these adverse pregnancy outcomes. However, studies by Rashed (2016) and Amarin (2012) showed no significant

association between maternal age and low birth weight. Sample size and socio-economic differences could have contributed to the dissimilarity.

According to our findings, advanced age increased the risk of preterm birth (aOR: 2.36, 95%CI: 1.65–4.83). Preterm birth is the utmost critical contributing factor of neonatal morbidity and mortality, and it has a huge and significant impact on it. However, the relationship between prematurity and advanced maternal age is mostly debatable with current literature. Confounders like hypertensive disorders, and maternal medical history, are some of the most significant influences on the risk of preterm birth. These could have distorted our findings.

A large cohort study by Fuchs et al (2018) showed a U-shaped relationship between maternal age and the risk of preterm birth even after adjustment for confounders, with the lowest risk age being 24–30 years and sharply increased risk after the age of 40 years. Contrastingly, some studies by Klemetti et al (2016) and McIntyre et al (2009) have found a higher risk of preterm birth among younger mothers (30–34 years).

Still regarding preterm birth, several studies report that women with advanced age were more likely to deliver preterm and low birth weight new-borns than younger women (Sohn, 2018; Lu, 2022 & Waldenstrom, 2017), findings of which are in line with those of our study. Retrospective data evaluation could have then assisted in ascertaining the reason for preterm birth. As far as can be determined placental dysfunction with hypertensive disorders of pregnancy could be a major factor. The more plausible explanation for increased preterm birth in AMA women is increased pregnancy complication rate. These complications then may lead to iatrogenic preterm deliveries.

In line with this study Gravena et al (2012), our study showed that the infants of older women exhibited a higher risk of presenting a five-minute Apgar score below 7 (P =

0.03). Additionally, this study revealed that new-borns from advanced age mothers were almost seven times more likely to have low fifth minute Apgar score than those from the young control group. The 5-minute Apgar may act as a proxy for fetal acidosis and birth asphyxia. In our analysis, there was statistically significant difference of the 5-minute Apgar scores between the two groups. This outcome is consistent with other studies done prior (Maeruf, 2020; Ertuğrul Yılmaz, 2016 & Nubia Karla, 2015).

Our research also aligns with that of Wen et al (2013) who found a correlation between AMA and low Apgar scores. This particular finding is inconsistent with the studies in Jordan (Rashed, 2016) and Malaysian (Amarin, 2013) that showed no significant association between low fifth minute Apgar score and AMA pregnancy. Some studies have shown no difference in Apgar score at 5 min amongst the new-borns (Usta et al, 2008 & Wang et al, 2011), though others found decreased 5-minute Apgar scores (Seoud et al, 2002; Jahromi et al, 2008; Pinheiro et al, 2019). Maisonneuve et al (2017) considered age over 35 as an independent risk factor for severe fetal acidosis.

Pre-existing maternal diseases like hypertensive diseases, extreme preterm births and other factors may contribute to low Apgar scores. Variations in lifestyle of the study participants and sample size could have ascribed this difference.

It's vital to note that studies by Pawde et al (2015) and Jahromi et al (2008) which were reporting more complications and risks for older mothers showed similar neonatal outcomes and NICU admission rates. The difference between the results of this study and other studies may be due to no significant differences between the two groups in terms of maternal morbidities which affect the neonatal outcomes.

Advanced maternal age is an independent risk factor for stillbirth in nulliparous and multiparous mothers (Kenny et al, 2013). Reddy et al (2006) went on to state that mothers of advanced maternal age are at higher risk of stillbirth throughout gestation

with the peak risk period being between 37 to 41 weeks of gestation. Fortuitously, our study had no stillbirth – but that doesn't paint the correct picture on what's happening on the ground.

Consistent with a previous study by Kahveci et al (2018), admission to a NICU was more likely in the advanced-age mothers however this was not statistically significant. Lastly, this study exposed that there was no statistically significant association between maternal age and macrosomia and post-term pregnancy outcome variables. This finding is well-matched with a study done in the UK (Khalil, 2013), but it is discordant with the outcome from a Brazilian (Nubia Karla, 2015) study that identified that advanced age mothers were associated with new-born macrosomia and post-term pregnancy. Study designs employed and sample size differences could be the reason for this discrepancy.

Similarly, the findings of this study indicated no association between congenital anomalies and maternal age. In contrast, a study in South Korea by Koo et al (2012) showed that there is a statistically significant association. Again, the sample size effect could have created this variation.

It's important to note that although the study did not find significant associations between advanced maternal age and the more severe perinatal outcomes assessed, the differences observed in Apgar scores suggest that AMA may have subtle but important effects on neonatal condition at birth. These findings highlight the need for more comprehensive, well-powered studies and improved data collection systems to ensure accurate risk stratification and appropriate perinatal care planning for older mothers in Zimbabwe and similar contexts.

The investigation into the causal factors associated with advanced maternal age among parturient women at Mpilo Hospital reveals significant insights, albeit with notable

limitations due to insufficient data for several factors. This analysis aims to understand the motivations and circumstances that lead women to delay childbirth, which has implications for maternal and neonatal health outcomes.

Several factors contribute to women choosing to have children later in life, including prioritizing education and careers, waiting for marriage or a suitable partner, and concerns about financial situations/stability, all of which have become increasingly common over the years. The advent of birth control pills in the 1960s gave women unprecedented control over their fertility and its timing, allowing them to make informed decisions about when to have children.

This study revealed that the majority, 29.3% (n=27) had a child at older age due to seeking a certain sex of a child. This was followed by the reason of struggling to get pregnant in 22.8% (n=21) of cases. An overwhelming majority of 89% (n=82) of these pregnancies were planned and wanted. This is in contrast to a study by Maloney et al (2021) which showed that the prevalence of AMA births in their sample was 18.2 percent, with 3.4 percent of mothers giving birth at age 40 and above. The same author went on to further state that, 44.5 percent of women reported that their most recent pregnancy was wanted at the time they became pregnant with mistimed and unwanted pregnancies being higher for mothers of advanced maternal age. Women who gave birth at age 35 and above were more likely to report an unwanted pregnancy (Maloney et al, 2021), with one third of mothers in the dataset who gave birth at age 35 and above became pregnant unintentionally.

The analysis of several causal factors, including needing more children, preferences for specific child genders, contraception use, and subfertility, indicates a consistent chi-square p-value of 1.0000 across these categories. This suggests that there are no statistically significant associations between these factors and advanced maternal age

in the current dataset. For instance, the desire for more children, while a common reason for postponing childbirth, did not show a measurable impact on the age at which women become mothers in this study. Similarly, preferences for male or female children and the use of contraception also yielded no significant correlations. These findings may imply that cultural or personal preferences regarding child gender do not significantly influence the timing of childbirth among the women studied.

The issue of subfertility is also noteworthy, as it is a known factor that can lead to delayed motherhood. However, the lack of significant findings might suggest that subfertility is not a prevalent issue within this cohort, or that other underlying factors influencing advanced maternal age are at play.

Moreover, several potential causal factors, such as bereavement processes related to lost children, career advancement, remarriage, and feelings of loneliness, lacked sufficient data for analysis. This absence of information limits the ability to draw comprehensive conclusions about the various societal and personal influences on the decision to have children later in life. The implications of these gaps in data are significant; they highlight the necessity for more robust qualitative and quantitative research to explore the complexities of women's reproductive decisions in the context of advanced maternal age.

The findings underscore the need for targeted educational and healthcare interventions that address the unique concerns of women contemplating motherhood at an older age. Understanding motivations such as career advancement and personal relationships could inform healthcare providers and policymakers about the support systems necessary for these women. Additionally, addressing issues related to subfertility and

the emotional impact of previous pregnancies could be crucial in providing comprehensive care.

Ultimately the delayed and late childbirth may not be intentional for a significant group of older mothers. This in not in line with the popular assumptions that women delay childbearing in favour of career aspirations (Maloney et al, 2021), the majority of AMA mothers had reasons of seeking a certain sex of a child or contraceptive failure or seeking a certain sex of a child or just wanting more children. The findings in this paper hence suggests that multiple factors predict AMA births especially in low-income countries like Zimbabwe.

The hypothesis that increasing maternal age has a continuum rather than a threshold effect on adverse pregnancy outcomes suggests that risks associated with maternal age increase progressively rather than being triggered at a specific age. This perspective challenges the conventional classification of "advanced maternal age" (typically defined as 35 years or older) as a distinct threshold for heightened risk.

Research on maternal age often highlights its association with various adverse pregnancy outcomes, including preterm delivery, low birth weight, hypertensive disorders, and increased rates of caesarean delivery. The continuum hypothesis implies that these risks are not confined to women over 35 but may begin earlier and escalate gradually as maternal age increases. This has significant implications for clinical practice and public health policies:

Continuous Risk Assessment: If maternal age operates on a continuum, healthcare providers should consider individualized risk assessments across all reproductive ages rather than focusing solely on women above a specific age threshold. For example,

women in their late twenties or early thirties may already exhibit subtle increases in risk factors.

Preventive Strategies: Policies aimed at mitigating adverse outcomes should be tailored to address the progressive nature of risk. This could include earlier interventions such as preconception counselling, closer monitoring during pregnancy, and targeted education about lifestyle factors that can influence pregnancy outcomes.

Resource Allocation: Hospitals and clinics may need to adjust resource allocation to ensure adequate support for pregnant women across a broader range of ages. This could involve expanding access to specialized care for younger women who may not traditionally be considered high-risk.

Research Implications: The continuum model calls for more nuanced research designs that analyse maternal age as a continuous variable rather than categorizing it into discrete groups (e.g., <35 vs. ≥35). Such studies could provide deeper insights into how risks evolve with age and identify critical inflection points where interventions might be most effective.

Public Health Messaging: Public health campaigns should emphasize that risks associated with maternal age are not confined to older mothers but can emerge progressively. This messaging could encourage women of all reproductive ages to seek timely prenatal care and adopt healthy behaviours. These figures underscore the importance of adopting a continuum-based approach to maternal care rather than relying on arbitrary thresholds. By recognizing the progressive nature of risk associated with maternal age, healthcare systems can better address the needs of pregnant women across all ages, ultimately improving outcomes for mothers and their babies.

The analysis demonstrates that advanced maternal age significantly impacts several pregnancy-related factors, including age, parity, gravida, partner characteristics, and some health conditions. Advanced maternal age is associated with higher risks for complications such as hypertension, gestational diabetes, and other conditions, which in turn affect perinatal outcomes like Apgar scores. These findings highlight the importance of increased monitoring and management of pregnancies in older women, especially considering their higher likelihood of requiring interventions for hypertension and other pregnancy complications. Moreover, the differences in socioeconomic and health factors underscore the multifactorial nature of pregnancy outcomes and the need for individualized care for women of advanced maternal age.

5.3 Strength and Limitations

This research paper is characterised by both strengths and limitations of this study. The large number of women and registered births over and above the minimum sample size is a key strength. Large population sizes give room for more accurate assessment of the various adverse outcomes among the maternal age groups and the many associated risk factors. The prospective nature of the study gave the author room to control certain variables of interest. The other strength of the study was evaluating the ANC booking and contacts information as this has a relation to quality and quantity of pregnancy care.

There were many limitations to this study. A prospective cohort study would have been the most ideal study design as it would have allowed observation of rare risk factors and outcomes. Important factors like diabetes and serum lipids were not possible to measure due to resource constraints, though they are important risk factors for pregnancy outcomes. Factors like religion and distance from the hospital are important variables and could have been included in the current study data but such limitations

are expected. Only quantitative method was used in the present study, which was a handicap in some respect as it is clear from the literature AMA is a dilemma for many stakeholders. Therefore, a qualitative study and mixed methods (both quantitative and qualitative) should ideally provide an enhanced explanation for such an understudied but vital topic.

5.4 Conclusion

This study affirmed that advanced maternal age is an independent predictor of pregnancy-induced hypertension, antepartum haemorrhage, PROM, and postpartum haemorrhage adverse maternal outcomes. Caesarean delivery was also tremendously increased in those older mothers. On top of this, advanced maternal age pregnancy was also found to be a major risk factor for preterm delivery, low birth-weight, low 1-minute Apgar scores and low fifth minute Apgar score. Therefore, the investigators recommend that the healthcare providers especially obstetricians, planners, and the policy-makers, use the result of this study in guiding evidence-based decision-making regarding decreasing adverse obstetrical and perinatal outcomes.

Therefore, it is better for health care providers to counsel couples, who seek to have a child in their later ages, about the risks of advanced maternal age pregnancy. Also, these results might be used to give guidance to spouses on choosing the right ages to conceive and carry the pregnancy. In addition, health care workers need to give emphasis on how to improve advanced age mothers' health through the utilization of contraception in order to reduce pregnancy in this age group. In sum, the association between maternal age and pregnancy outcomes reflects a complex set of interactions between health and social processes. It hastens to say that early identification of women at an increased risk for adverse outcomes would help to facilitate surveillance and intervention.

5.5 Implications

Advanced maternal age is a risk factor for multiple abnormal new-born conditions, possible congenital anomalies, low birthweight, low 5-minute Apgar score and preterm pregnancies. Targeted approaches and educational proponents for family planning, particularly for women who plan to delay childbearing, are of crucial importance. In this study, the association of some adverse outcomes were noted in women of age 30 years and over. Perhaps we should begin assessing high-risk pregnancies as starting at a younger age versus the de facto standard of 35.

5.6 Recommendations

From the findings of the study several key recommendations have been elucidated in order to improve the pregnancy outcomes in women of advanced maternal age at Mpilo Hospital, Bulawayo. The author feels that the same recommendations can be generalised to the wider Zimbabwean population and even beyond:

Table 21: Recommendations

RECOMMENDATION	TIME FRAME	RESPONSIBLE PERSON or AUTHORITY
Need to draft guidelines for the management of AMA women	0 - 1 year	MoHCC
Ensure that every woman of AMA book early	0 - 3 months	Community Health Worker and/or Social Worker
Make sure that AMA women have regular and more intense ANC contacts	0 - 3 months	Sister in charge ANC
Check that every AMA woman is provided/prescribed low-dose Aspirin and Calcium tablets to reduce chances of adverse pregnancy outcomes.	0 - 1 month	Sister in charge ANC
Education and other relevant information should be relayed to women in the community about getting pregnant,	0 - 6 months	Health Promotion Officers and/or Social Worker

carrying pregnancy and delivering at AMA.		
Provide adequate and well-equipped personnel to manage women of AMA in antenatal, intra-partum and postpartum periods.	0 - 1 year	Hospital Clinical Director
Formulate national policies that seek to educate all women on the disadvantages and advantages of having babies at older age. These can also be taught in schools.	0 - 1 year	MoHCC and the two Ministries of Education.

5.7 Suggestion for Further Research

This study was carried out in only one hospital of the country, hence there is need to conduct a nation-wide study to improve the generalisability of the findings.

A cohort study would be ideal to follow up on the women throughout their pregnancies and the 42 days of the post-partum period.

Further research is also recommended to overcome the above-mentioned limitations aiming to explore the complexity of AMA, including dwelling into its social determinants.

Furthermore, it is worth emphasising that future research involves more concerned parties, including health, social, religious and cultural aspects to better understand AMA issues.

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APPENDICES

APPENDIX 1: Questionnaire Survey Instrument *(Adapted from Asefa & Ayele, 2020)*

Section A. Administrative Information

1. Form completion date (dd/mm/yyyy) ___/___/___

2. Unique patient ID .....Entered By:……

3. Date of Delivery .....

Section B. Personal Information

1. Age……..
2. Weight…….. Height……..
3. Partner's age……Partner's level of Education……..
4. Residence – □urban □ rural
5. Employment status: Participant's……Partner's……..
6. Marital status……
7. Household Income (SES)……/month

Section C. Obstetric History

1. Parity…….Para……Gravida
2. Booking GA…….
3. ANC contacts……..
4. Last Delivery Interval……..

Section D: Medical History

1. Diabetes…….Y/N……..Treatment……

2. Hypertension……..Y/N……Treatment……..
3. HIV status: Negative……Positive……Unknown…
4. Other conditions (state)…….
5. Medications in pregnancy…….
6. Haemoglobin or Haematocrit levels…….

Section E: Causal Factors of or Reasons for Advanced Maternal Age

1. Contraception…….……..……Y/N
2. Advancement of career……..…….……..Y/N
3. Subfertility……..……..Y/N
4. Preference for a male/female child……Y/N
5. Delayed marriage ……..Y/N
6. Re-marriage…….Y/N
7. Others (state)……

Section F: Maternal Outcomes (tick)

1. Mode of delivery (tick)
    a. NVD……..
    b. AVD…….
    c. C/S……Reason for C/S……
2. Hypertension in pregnancy (tick).
    a. Gestational Hypertension……
    b. Chronic Hypertension…….
    c. Preeclampsia …….
    d. Eclampsia……
3. DM…….

4. Abruptio Placenta……..
5. APH……..
6. Abruptio Placentae……
7. Placentae Praevia……..
8. PPH……
9. Preterm labour and birth……
10. Postdates pregnancy……..
11. Post-term Pregnancy…….
12. PPROM…….
13. Prolonged ROM……..

Section G: Perinatal Outcomes

1. Stillbirth……Y/N……Possible Cause…….
2. Early neonatal death. Y/N……Possible Cause…….
3. APGAR score: at 1min……at 5mins……
4. Gestational Age at Delivery…….
5. IUGR……Y/N……..Bwt = ……
6. LBW……..Y/N…….Bwt = ……
7. NICU/SCBU admission……..Y/N…….Reasson =……

APPENDIX 2: Data Collection Tools

Unique Code	Age	Parity	Gravidity	Booking GA	Antenatal Contacts	Current delivery Interval	Employment Status	Monthly Income

Residence	Paternal Age	Marital Status	HIV Status	Medical conditions	Reasons for AMA	Maternal Outcomes	Perinatal Outcomes

APPENDIX 3: Consent Form for Participants

My name is Elton Sengurayi, a final year Master of Public Health student from Africa University. I am carrying out a research study on the effect of advanced maternal age on pregnancy outcomes here at Mpilo Hospital. I am kindly asking you to participate in this study by responding to my questionnaire through an interview face to face with a healthcare worker.

Principal Investigator: Elton Sengurayi

Phone Number: 263773487907

Purpose: You are being kindly requested to be a participant in a research study the effect of advanced maternal age on pregnancy outcomes. The purpose of the study is to establish how maternal age and some of its contributory can affect maternal and perinatal outcomes, if at all. The various factors that contribute to advanced maternal age are going to be assessed. Questions that may be put across to you include but not limited to; number of previous pregnancies, marital status, level of education, use of alcohol/tobacco, and medical history. We are glad that you were selected as a possible participant in this study because you fit into the age group of interest of women for this interesting project. You are mature enough to comment on various issues we are interested in. This research is exclusively for those 18 years or above hence you are legally an adult and eligible to comment on various issues in this research without anyone's extra consent. We require 196 women to be participating in this study which we feel is going to alter the policy on pregnancy, peripartum and reproductive health of older mothers.

Procedures and Duration: If you willingly decide to participate, of which we will be grateful, you will go through a questionnaire that will require you to answer questions

about advanced maternal age in parturient women. This once-off questionnaire is likely to last about 10 minutes. To enhance privacy, this will be done in a closed room where you will be alone with the interviewer, and without any surveillance.

Risks and Discomforts: There are unlikely to be any physical harm in filling the provided form. In case of physical discomfort, the research team will be readily available to help you. A psychologist will be at your service nearby, in case of mental/psychological anguish. You can discontinue being a participant if the situation is unbearable to you, without any repercussions or loss of certain benefits.

Benefits and/or Compensation: We cannot and do not give assurance or promise that you will receive any extra financial or material benefits from this study other than what you would have utilised. Transport expenses, if you incurred any, may be reimbursed and food provided when necessary. In short you will only be compensated for the expenses you incurred, including a small fee for loss of time or opportunity costs where applicable.

Confidentiality: We will not disclose your identity before, during and after the study. We will create a unique code for you, hence you will be known by this code, and no one will ever know any names of participants in this study. All confidential information that is obtained in connection with this study and that can be identified with you will not be disclosed without your written permission. The only people who may be able to access your information are my supervisors and my counterparts in this study. The researcher is not immune to legal subpoena about illegal activities. Although it is very unlikely, if law enforcement officials asked to see my data, I would have to comply with that request. This research has been reviewed and approved by the Africa University Ethics Review Committee (AUREC), AU Institutional Review Board and

conforms to the standards of the Medical Research Council of Zimbabwe (MRCZ) Research and Ethics guidelines. Under some circumstances, the MRCZ may need to review patient records for compliance audits. You should be rest assured that the above mentioned have the same obligations to secure and maintain your confidential information.

Additional Costs: As alluded to under Benefits and/or Compensation where you encounter reasonable expenses in order to participate in this study you will be compensated accordingly. In order not to inconvenience too much, you are not expected to bear any extra costs in this study.

Voluntary Participation: This exercise in on your free will hence you can freely opt in and out of this study without any obvious or hidden consequences. If you are a student in a class or employee in a company, your decision to stop participating will not negatively affect a grade or performance evaluation. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, Africa University, its affiliates, or any other group associated with this project. In the event you withdraw from the study, all associated data collected will be destroyed immediately wherever possible.

Offer to Answer Questions: You should only sign this form after fully understanding it. Please take all the time you need to have a full grasp of this consent form. For any areas or procedures which are not clear, please come back to us and we will be very willing to offer clarification. If you have questions about the research in general or about your role in the study, please feel free to contact the principal researcher either by telephone 263773487907at or sengurayie@africau.edu.

Authorisation: You are voluntarily deciding on whether or not to participate in this particular study. By appending or putting your signature it indicates that you have read and understood the information provided above, have had all your burning questions answered, and you have decided to participate in the study. You are not waiving any of your legal rights by signing this form. Your signature below indicates your voluntary consent.

Name of Research Participant (*please print*)_____

Signature of Participant_____Date_____Time_____

Name of Staff Obtaining Consent_____

Signature_____Date_____

Name of Witness (*if required, Print*)_____-

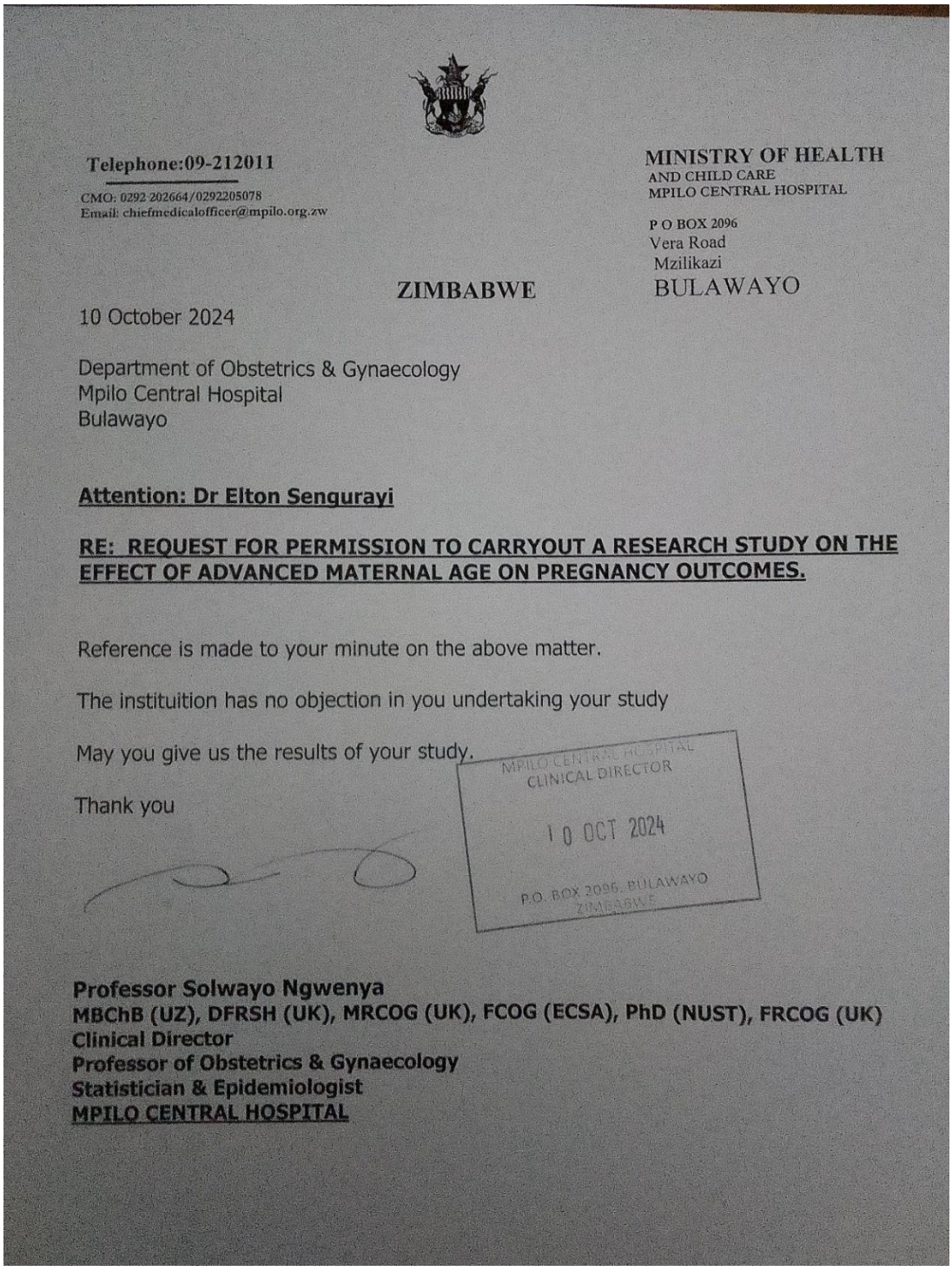
Signature_____Date_____

YOU WILL BE OFFERED A COPY OF THIS CONSENT FORM TO KEEP.

For any questions or grievances on this study, please feel free to contact the Medical Research Council of Zimbabwe (MRCZ) on telephone (024)2791792. The MRCZ Offices are located at the National Institute of Health Research premises at Corner Josiah Tongogara and Mazowe Avenue in Harare.

----------END----------

Appendix 4: Approval Letter from MoHCC



Telephone:09-212011

CMO: 0292-202664/0292205078
Email: chiefmedicalofficer@mpilo.org.zw

MINISTRY OF HEALTH
AND CHILD CARE
MPILO CENTRAL HOSPITAL

P O BOX 2096
Vera Road
Mzilikazi
BULAWAYO

ZIMBABWE

10 October 2024

Department of Obstetrics & Gynaecology
Mpilo Central Hospital
Bulawayo

Attention: Dr Elton Sengurayi

RE: REQUEST FOR PERMISSION TO CARRYOUT A RESEARCH STUDY ON THE EFFECT OF ADVANCED MATERNAL AGE ON PREGNANCY OUTCOMES.

Reference is made to your minute on the above matter.

The instituition has no objection in you undertaking your study

May you give us the results of your study.

Thank you

MPILO CENTRAL HOSPITAL
CLINICAL DIRECTOR
10 OCT 2024
P.O. BOX 2096, BULAWAYO
ZIMBABWE

Professor Solwayo Ngwenya
MBChB (UZ), DFRSH (UK), MRCOG (UK), FCOG (ECSA), PhD (NUST), FRCOG (UK)
Clinical Director
Professor of Obstetrics & Gynaecology
Statistician & Epidemiologist
MPILO CENTRAL HOSPITAL

APPENDIX 5: AUREC Approval Letter

"Investing in Africa's future"

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3480/24 10 October, 2024

ELTON SENGURAYI
C/O Africa University
Box 1320
MUTARE

RE: **EFFECT OF ADVANCED MATERNAL AGE ON PREGNANCY OUTCOMES: A CASE CONTROL STUDY AT MPILO TERTIARY TEACHING HOSPITAL**

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 3480/24
  This number should be used on all correspondences, consent forms, and appropriate document
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** October 15, 2024
- **EXPIRATION DATE** October 15, 2025
- **TYPE OF MEETING**: Expedited
  After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

Yours Faithfully

MARY CHINZOU
ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE

APPENDIX 6: BUDGET

Item	US$
Stationery	**150**
Transport	**400**
Food	**250**
TOTAL	**800**

Justification of the budget

Average transport distance has been calculated at US$ 0.20 per kilometre. Questionnaires for participants will be printed. Stationery will be needed for data capture. The findings from the study will also be disseminated to hospital management, maternity staff and participants.

APPENDIX 7: TIMEFRAME

	Aug - Sep 2024	Oct	Nov	Dec	Jan 2025	Feb	Mar
Research Proposal							
Protocol Completion							
Submission to AUREC							
Defense of Proposal							
Data collection and analysis							
Report writing and submission							