THE PREVALENCE OF SECONDARY INFERTILITY AND ITS ASSOCIATED FACTORS AMONG WOMEN IN ZAMBIA

By

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DECLARATION

I, **NANCY CHOKA** hereby declare that this dissertation; represents my work, has not previously been submitted for a degree at this or any other University.

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APPROVAL

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DEDICATION

I dedicate this paper to my daughter**, Wana Nyirenda**, please work hard baby girl, the world is your oyster."

Special dedication to all women in Zambia who are of victims of secondary infertility and still suffer its consequences.

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ABSTRACT

The experience of infertility can greatly affect the couple's general health, marriage, family relationships, job performance and social interactions. Added to the emotional and physical toll exerted by infertility is the financial burden carried by some couples seeking treatment for their disease. Approximately, one in ten couples experience primary or secondary infertility. In Zambia very little is known about the status of secondary infertility and its associated factors. Therefore the objective of this study was to determine the prevalence of secondary infertility and its associated factors in Zambia using the nationally representative demographic 2013/14.

This paper used data from 2013-14 Zambia Demographic Health Survey data and adopted a cross sectional study design. A representative sample of women who have had a child before, want another child and a have not had a child in the past five years was drawn. Descriptive analysis, binary logistic regression and Chi-square analysis were conducted to describe, test associations and establish the relationship between secondary infertility and socio-economic, demographic as well as lifestyle factors. A multivariate logistic regression analysis was further conducted to ascertain the determinants of secondary infertility.

Findings from this study showed that the prevalence of secondary infertility in Zambia was 14% and the factors associated with secondary infertility were wealth index (AOR 0.47 CI: 0.223-0.975), a woman aged between 40-49 (AOR=0.46 CI: 0.208-0.856), the number of children she has had (AOR=0.55 CI 0.307-0.979), age difference between spouses (AOR=0.55 CI 0.307-0.979), living in a medium fertility belt (AOR =1.6 CI: 1.031-2.504), being HIV positive (AOR= 0.71 CI 0.578-1.042) as well as having a terminated pregnancy (1.53 CI:0.986-2.366) After adjusting for other factors (independent variables).

It is evident that secondary infertility is very high in Zambia and is influenced by socio demographic factors. Infertility is not merely an individual concern, it is a public health problem such that new interventions aimed at reducing the incidence and social implications of infertility are needed.

Key words: *Secondary infertility; socio demographic factors; Zambia*

ACRONYMS

Body Mass Index	BMI
Enumeration Areas	EA
Intrauterine Device Use	IDU
Pelvic Inflammatory Disease	PID
Reproductive Tract Infection	RTI
Sexually Transmitted Disease	STD
Sexually Transmitted Infection	STI
Zambia Demographic Health Survey	ZDHS

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CHAPTER ONE

Introduction

1.1 Background

Infertility is a special reproductive health defect that is different from other diseases. It is not life threatening, but its detrimental influence to on patients, their families and the whole society should not be underestimated (Macaluso et al., 2010). Approximately, infertility affects between 60 million and 168 million people worldwide; generally, one in ten couples experience primary or secondary infertility (Butler & Khanna, 2003; Vayena, Rowe, & Peterson, 2002). Worldwide rates of infertility vary dramatically corresponding to the incidence of preventable conditions leading to infertility, from 5 to 30% in sub-Saharan Africa (Daar & Merali, 2002; Vayena et al., 2009). A systematic analysis of infertility incidence in more than 190 countries and regions around the world showed that in 2010, women in age group 20–44 years suffered from secondary infertility with an incidence of 10.5% (Mascarehas, 2013). Furthermore, infertility prevalence was highest in south Asia, sub-Saharan Africa, North Africa and the Middle East, central and Eastern Europe, and central Asia (Ibid). The "Infertility Belt" stretching across central and southern Africa has the world's highest rates of infertility (Butler & Khanna, 2003; Van Balen & Inhorn, 2002). The highest incidence is in some areas of sub-Saharan Africa, where rates of up to 50% have been recorded.

The World Health Organization (WHO, 2004) defines infertility as the inability to conceive a child. A couple may be considered infertile if, after two years of regular sexual intercourse, and without contraceptive use, the woman has not become pregnant. Infertility primarily refers to the biological inability of a person to contribute to conception. Infertility may also refer to the state of a woman who is unable to carry a pregnancy to full term. There are many biological causes of infertility, some of which may be bypassed with medical intervention (Makar & Toth, 2002). Infertility maybe primary or secondary. Primary infertility refers to couples who have never conceived whereas secondary infertility refers to couples who are unable to conceive after one year of unprotected intercourse following previous pregnancy and not using any contraceptives (WHO, 1994). In this study secondary infertility is defined as a woman who has had a live birth before, desires to have more children, has been in a union for at least five years, has not been on contraceptives and has not had any child in the same period.

1.1.1 Consequences of secondary infertility

Infertility exerts an enormous toll on both the affected individuals and on society. Couples in their most active and productive years are distracted by the physical, financial and emotional hardships of this disease (Safarinejad, 2007). For these couples, infertility is more than a disease; it is a devastating life crisis which can greatly affect the couple's general health, marriage, family relationships, job performance and social interactions. Added to the emotional and physical toll exerted by infertility is the financial burden carried by some couples seeking treatment for their disease (Safarinejad, 2007). Infertility, whether primary or secondary, although affects couples, is an experience that strikes at the very core of a woman's life. Childlessness is found to result in perceived role failure, with social and emotional consequences for both men and women, and often has resulted in social stigmatization of the couple, particularly of the woman (Papreen et al., 2000).

Infertility places women at risk of social and familial displacement, and women clearly bear the greatest burden of infertility as motherhood is seen as a supreme achievement for a woman and demonstrates her physical and psychological adequacy (Chowdhury, 2009). In many parts of the world, including Zambia, only a woman is thought to be responsible for producing next generation and the blame for absence of desired number and sex of children is unquestioningly placed on her.

The inability to reproduce desired number and sex of children results in catastrophe that negatively impacts a woman's relationships not only with her husband but also with other family members leading to destabilization of her social status. Interactions with her husband, friends and family are altered and therefore lead to an altered experience of self loathe (Neelofar and Taeem, nd). Studies have revealed that severe emotional harassment is experienced by a large number of such women in their marital homes in the form of ostracism from family celebrations, taunting and stigmatization, negative attitude as well as beating, withholding of food and health care (Bentley and Mascie-Taylor, 2000).

The incidence of infertility in a population has important demographic and health implications as well. High infertility has a dampening effect on overall fertility and the rate of population growth and improvements in the ability to bear children may impede efforts to lower the fertility rate. For example, it has been estimated that a reduction in infertility in sub-Saharan

Africa to "normal" levels would increase fertility in the region by 15% (Frank, 1983). Similarly, Bongaarts, Frank, and Lesthaeghe (1984) found that infertility accounts for 60% of the variation in total fertility in 18 sub-Saharan countries and that fertility decreases by one birth for each increase in 9 percentage points in the proportion of women age 45 to 49 who have no children.

1.1.2 Difficulties in assessing the occurrence of secondary infertility

There are however multiple difficulties inherent in assessing the occurrence of secondary infertility. First, assessment and measurement is complicated by the fact that the condition is generally experienced by a couple, not as an individual. There is also a social bias in identifying infertility. Finally, no objective test or universally accepted definition for the condition exists. This is also compounded by inconsistencies in definitions of infertility (Bongaarts, Frank, Lesthaeghe (1984)). However, there is general consensus that rates of infertility are underestimated because of difficulty in measuring prevalence, potentially flawed methods for measurement, and cultural biases which create hidden categories of the condition (Daar & Merali, 2002).

Comparative studies of infertility are hampered by the fact that different definitions of infertility are being employed in epidemiological and demographic research. Mascarenhas et al (2012), pointed out that epidemiological definitions are oriented towards early detection of individual patients with the aim of starting treatment while the demographic definition attempts to measure infertility on a population level so that there is clear understanding of the magnitude, distribution and trends of the infertility problem.

Demographers have modified the epidemiological definition of infertility, and define infertility as the inability of a non-contracepting sexually active woman to have a live birth (Pressat, 1985). Demographers have also shifted the endpoint from conception to live births, because it is difficult to collect data about conceptions in population based studies. Furthermore, demographic analyses of infertility are often based on secondary data such as Demographic Health Surveys that contain complete birth histories but no information about miscarriages and still births (Larsen, 2000).

Larsen and Menken (1991), recommend, based on simulation, to use 7 years of exposure to measure primary infertility i.e. infertility of nulliparous women and 5 years of exposure to measure secondary infertility i.e. infertility of parous women. Demographic estimates of

infertility are based on relatively long periods of exposure (5 and 7 years) because it is difficult to assess exposure i.e. regular sexual intercourse of non-contracepting women, in population based of survey data. Estimates of primary infertility need longer periods of exposure because it is in particular difficult to assess onset of sexual activity from population based surveys. For analysis age was truncated at 25+ to circumvent the difficulties of separating adolescent's subfertility from secondary infertility (Ulla, 2009).

It should be noted that the focus of this study is on women experiencing secondary infertility as opposed to primary infertility because the estimates of the prevalence of secondary are three times higher than those of primary infertility. The psychological, social, economic, and biological trauma of secondary infertility are similar to those who experience primary infertility. In Zambia very little is known about the status of secondary infertility; however, infertility is not merely an individual concern but also a public health concern as the experience of infertility is a stressful condition itself. This study is an approach to find out the prevalence of secondary infertility and its associated factors among women aged 24-49.

1.2 Statement of the problem

In Zambia, fertility trends have been widely studied however, the prevalence of secondary infertility has not been well-documented. There is very little is known information about the status of secondary infertility and its. However, the problem is considered quite prevalent as the Government of the Republic of Zambia through the Reproductive Health Policy acknowledges that "the rates of infertility in Zambia are not known but gauging from the prevalence of Sexually Transmitted Diseases (STDs) alone, it is estimated that both primary and secondary infertility rates are of concern" (MOH, 2008). STDs are among the major risk factors of infertility and the most common contributors of impaired fertility. Impaired fertility, variously described as infertility or sub-fertility, may be due to a relative or absolute inability to conceive, or to repeated pregnancy wastage (MOH, 2008). Approximately, infertility affects between 60 million and 168 million people worldwide; generally, one in ten couples experience primary or secondary infertility (Butler & Khanna, 2003; Vayena, Rowe, & Peterson, 2002). The "Infertility Belt" stretching across central and southern Africa has the world's highest rates of infertility (Butler & Khanna, 2003; Van Balen & Inhorn, 2002). The highest incidence is in some areas of sub-Saharan Africa, where rates of up to 50% have been recorded. In 2017,

infertility was estimated at 17.8% at the University Teaching Hospital, which is the national referral centre (Munalula and Vwalika**,** 2017).

The government has made efforts to ensure the provision of appropriate services for overcoming infertility barriers to the achievement of reproductive intentions by providing preventive and curative services for couples /individuals with infertility problems. However, these efforts have been inadequate in capping infertility as evidenced by the current National Health Strategic Plan that has no direct objective, programs or intervention in addressing infertility but mentions it indirectly as a reproductive health program and is thus lumped with other reproductive health problems. Infertility has been relatively neglected as a health problem in Zambia, but is more significant in a country like Zambia where children are accepted as an integral part of the cultural and social fabric (Munalula, 2017). Infertility risk increases with reproductive age group between 15-45 years are 4.1% of 15-24 years old, 31.1% of 25-35 years old, 21.4% of 35-44 years old (Kumar, 2007). Infertility is not merely a health problem, it is a matter of social injustice and inequality for all, as they are having high levels of child and maternal mortality and morbidity. Therefore the aim of this study was to estimate the prevalence of secondary infertility and to determine its associated factors.

1.3 Significance of the Study

Infertility is more than a disease and affects both men and women alike. It is a devastating life crisis which can greatly affect the couple's general health, marriage, family relationships, job performance and social interactions. Added to the emotional and physical toll exerted by infertility is the financial burden carried by some couples seeking treatment for their disease (Safarinejad, 2007).

Infertility has been relatively neglected as both a health problem and a subject for social science research in Zambia, as well as the developing world (Safarinejad, 2007). The findings of this study are significant and relevant as it will provide information on the prevalence of secondary infertility and its associated factors as the general thrust of both programmers and research has been on the correlates of high fertility and its relation. Further the study will help in understanding the context of infertility, its causes and consequences in a pronatalist culture of Zambia where the consequences of infertility for women are devastating. This information will also be cardinal for implementing successful programmes for dealing with infertility in Zambia

that will need to include both appropriate and effective sources for treatment as well as preventive measures for infertility.

It will also attempt to estimate the prevalence of secondary infertility which still unknown in Zambia. By putting a spot light secondary infertility perhaps government and other stakeholders devise better mechanisms of identifying and addressing infertility, so e that people know some of the factors associated with secondary infertility occurs in women and where best to seek care. It can also serve as a building block that further research on infertility can be built upon.

1.4 Research Objectives

1.4.1 General objective

- To investigate the determinants of secondary infertility among women aged 25-49 in Zambia.

1.4.2 Specific objectives:

1. To determine the prevalence of secondary infertility among women aged 25-49 in Zambia.
2. To examine the influence of social, and demographic factors on secondary infertility among women aged 25- 49 in Zambia
3. To determine the effect of lifestyle factors on secondary infertility among women aged 25-49 in Zambia.

1.5 Research questions

Main research

What are the determinants of secondary infertility among women aged 25-29 in Zambia?

Specific research questions

1. What is the prevalence of secondary fertility among women aged 25-49 in Zambia?
2. What are the social, economic and demographic factors influencing secondary infertility among women aged 25-49 in Zambia?
3. What are the effects of lifestyle factors on secondary infertility among women aged 2549 in Zambia.

CHAPTER TWO

Literature review and conceptual framework

2.0 Introduction

This section provides a critical survey of literature on the studies that have been conducted on topics related to secondary infertility as well as some of the determinants and consequences of women suffering from secondary infertility. In this context, researchers have different views and ideas on what the determinants of secondary infertility are, including their consequences.

2.1. Empirical Review

The prevalence of infertility differs between regions and countries and there are many factors that could be associated with secondary infertility. However, little is known about the causes of secondary infertility and the known factors equally vary between regions due to varying social and economic situations and life styles. Therefore, secondary infertility is a possible byproduct of many factors including social, economic, demographic, psychological, biological and maternal factors. Approximately, the prevalence of secondary infertility worldwide ranges between 10% and 15%. There is very little known information about the status of secondary infertility in Zambia, therefore, the reader should note that the literature used is from other countries. Despite this limitation, the literature is sufficient to guide discussions and conclusions of this study.

2.1.1 Causes of infertility

Background characteristics: A study by (Mascarenhas, 2013) was done to ascertain trends in primary and secondary infertility prevalence since 1990-2010 through a systematic analysis of demographic and reproductive health surveys. The study found that the prevalence of secondary infertility was 10·5% (95% CI: 9.5–11.7) and infertility prevalence was highest in south Asia, sub-Saharan Africa, north Africa and the Middle East, Central and Eastern Europe, and Central Asia. Secondary infertility incidence in Suizhong County in China was 12.10% (95% CI: 11.13%-13.12%) (Cong, 2016). Similarly. A U.S. survey depicted 15,303 married women of 15–44 years old as having a 7.4% secondary infertility in 2002 (Stephen EH, 2006). In 2003, Tanzania surveyed 2019 women aged 20–44 years, and their current secondary infertility incidence was 6.9% (Geelhoed, 2002).

The current secondary infertility incidence was 14.2% in an Indian Survey. Cumulative and current secondary infertility incidences were 24.9% and 3.4%, respectively, in a study of 10,783 women in Iran in 2009 (Vahidi, 2009). In a cross-sectional study conducted in 2004 entailing a population of more than 495,000 women, the five-year secondary infertility incidence was 21.6% (Cong, 2016). Cong compared the infertility incidence among couples living in different terrains and found that the highest incidence of infertility occurred in those who live in coastal areas, followed by those who live in plains and mountainous areas (ibid). This is an indication that secondary infertility is significantly associated to region and country.

A study carried by (El-Nasr, 2016) a significant relationship between secondary infertility and woman background characteristics such as; a woman's age; place of residence; age at marriage and women' consanguinity relation as risk factors. A study by (Samarakoon, 2002) found that the prevalence of secondary infertility was associated to increasing age of women and their spouses, higher age at marriage of the male and low socio economic status were associated with increased prevalence. Cong 2016 found that with the increase of a woman's partner's age at one level, the risk of secondary infertility changed to 0.91 times of the original value (95% CI, 0.85–0.96; P = 0.0015). Another study by (Taha, 2013) also found that a partner's age is statistically associated with a woman's fertility. Thus, both male and female age contribute to the incidence of infertility positively.

Elhussein, Suliman (2019) found that the mean age of the female was 32.4 (7.4) years while that of the male was 37.5 (7.2) years. This is lower than the mean age of the women [34.1(4.9) year) which was previously reported in Nigeria (Ugwu et al (2012). Moreover, previous studies from Nigeria and India have reported the average age of the females and their husbands as 36.7/43.7 and 35/40 years, respectively (Aziken 2010). Elhussein et al (2019) postulates that perhaps couples have spent too much time treating infertility using conventional methods before presented to specialised centre. In Nigeria, the mean age of women was 25 (3) years (Orhue, 2008) however women presented at much higher (36.7 years) to IVF unit (Orhue, 2008). On the other hand the other reasons for presenting at advanced age include delayed marriage due to education and/or economic factors.

Another study by (Pandve, 2016) reveals that the upper middle and middle socio economic status is associated with the secondary infertility A study by (Benksim et al, 2018) that found that women with average and high income were less likely than women from low income homes to suffer from secondary infertility ($p<0.003$) . A study by (Kim, 2018) found that there

was a strong correlation between a woman socio-economic status and secondary infertility. Similarly, another study by (Tukaram Kishanrao Pandve, 2016) reveals that the upper middle and middle socio economic status is associated with the secondary infertility. Similarly, a study by (Momtaz, 2012) found that the socio-economic level of a couple can influence their type of infertility. Similarly Beskim (2019) carried out a study among 619 infertile women in Morocco and found that other main causes of infertility could be age of a couple, occupation, and socio-economic status (Beskim 2018)

A study done in Turkey found that the risk of infertility was significantly higher among older women, uneducated women and women whose age at first marriage was over 30 (Sarac, 2018). Similarly, another study by (Momtaz, 2012) found that infertility was lower in women who attended graduate or more education. Women's education levels affects infertility and fertility through its impact on women's health and their physical capacity to give birth, children's health, the number of children desired and woman's ability to control birth. Furthermore, women with higher education are equipped with knowledge and resources to seek treatment for their illness.

Maternal factors: Maternal factors have been associated with secondary infertility. These maternal factors include; maternal age, mode of delivery and maternal weight. A study by (Momtaz, 2012) found that secondary infertility was significantly associated to previous bad obstetric history ($p = 0.011$) and previous caesarean delivery ($p=0.044$). The study also found that secondary infertility was four times more in women with gynecological problems (The problems included polycystic ovary syndrome, fibroid uterus and others) than their fertile counterparts and the chance of developing secondary infertility was 2.68 times higher for women with previous caesarean delivery than normal vaginal delivery. Gravida has been associated to infertility (Momtaz, 2012). Also reported that caesarean section was associated with decreased subsequent fertility. Recent studies which have tried to explain this association suggest that this is most probably voluntary or due to some other biases or possible confounding factors, which are due to organic or psychosocial effects of an emergency caesarean section or labour preceding the caesarean delivery (Afsanch, 2007)

Cong, (2016) found that the number of pregnancies (OR = 0.63; 95% CI, 0.51–0.79) was a protective factor for infertility, while the number of abortions (OR = 2.15; 95% CI, 1.58– 2.93) was a risk factor for infertility. A history of high abortion rates among infertile couples reflect some wide spread biologic disorder. Intrauterine environmental considerations such as

recurrent miscarriage are correlated with reproductive system infections, especially pelvic infections. An early study confirmed that pelvic infection is a vital factor leading to female infertility (Cong, 2016). Female pelvic infection can cause pelvic inflammatory disease and thus the occurrence of pelvic adhesions, resulting in infertility and negative-pressure operations during abortions may also cause immune infertility (ibid).

Similarly, a study by (Dhont, 2011) in Rwanda found that; lack of prenatal care in the last pregnancy; the first pregnancy before the age of 21 years; a history of unwanted pregnancy; and an adverse pregnancy outcome (stillbirth, postpartum infection and curettage as a result of pregnancy termination) were risk factors for secondary infertility. Another study done by (El Nasr, 2016) also found that maternal characteristics such as; age at menarche; menstrual irregularities; menstrual abnormalities; number of living children; gynaecological history and number of abortion were significantly correlated with secondary infertility. Similarly, a study by Getachew discovered parity has an influence on fertility intentions because there is a tendency for the desire for additional children to decrease as the number of living children increases. In Zambia, according to (Munalula, 2017), secondary infertility was statistically significantly related to a woman's age at menarche, frequency of menses, having a pelvic procedure done, and having an MVA done.

Infections: "Reproductive system disorders, the symptoms of sexually transmitted diseases and hormonal disorders are among the infertility causes in men and women", (Deyhoul, 2017). Similar findings by (Neelofar, 2012) also show that women with secondary infertility were more likely to report current or past history of having STI symptoms (AOR=3.6, 95% CI: 2.4–5.6) and use of intra-vaginal indigenous medicines during their last post-partum period (AOR=3.1, 95% CI: 1.6–5.7).

Infections like HIV/AIDS have also been known to influence secondary infertility. Most of the research in early sub-Saharan Africa that showed that fertility was 25-40% lower in HIV positive women than uninfected women. This was a first suggestion that HIV/AIDS was associated with fertility defects (Vitaly, 2002). Decreased fertility rates in HIV infected women have been described in the United States in more recent studies (ibid). Biological alterations in reproductive physiology may account for sub fertility in HIV infected women. Systematic illness, stress, weight loss and drug abuse may impact reproductive potential (Opt Cit).

These findings are in contrast, a study by UNAIDS and DHS which aimed at exploring the link between infertility and HIV/AIDS, at population level, HIV prevalence was not significantly related to the prevalence of secondary infertility (DHS 2002, UNAIDS, 2002). "Several well done studies have found no association between HIV infection and infertility" (Cejtin, 2006). A study evaluating biologic measure of reproductive aging including FSH, inhibin B, and antiMullerian hormones in 187 HIV infected women and 76 uninfected controls found no evidence that HIV infection influences ovarian aging (Vitaly, 2002). Unique psychosocial factor in patients with HIV infection may affect reproductive outcomes. A new diagnosis of HIV is often followed by a decrease of sexual activity in that individual. Studies demonstrate decreased pregnancy and birth rates among HIV infected women by their own choice (Stephenson, 1996).

Additionally, HIV infected women are more likely to electively terminate pregnancy. Data from Britain and Ireland indicate a significant increase in pregnancy termination from 3.5 to 6.5 following a new HIV diagnosis that is consistent across age and ethnic groups (Vitaly, 2002). With the wide spread use of HAART, it is possible that behavioural factors and improvements in overall health and immune status in HIV infected women are sufficient to overcome alleged biological sub-fertility caused directly by HIV infection. Other factors unrelated to decreased fecundability may include reduced coital frequency, desire family size and increased contraceptive use including condom use (Nebie et al 2001; Gregson et al, 2002). All this points to a complex relationship between infertility and HIV/AIDs.

Infections acquired during a previous delivery were strongly associated with secondary infertility as reported by other authors. A study by Donht (2011) a history of stillbirth was strongly associated with secondary infertility. Stillbirths can contribute to infertility through several mechanisms: First, they can be a marker for perinatal or ascending infections during strenuous labour; a history of stillbirth has been associated with PID in previous research. Second, stillbirths and high infant mortality rates create a child deficit which is associated with self-reported fertility impairment (Donht, 2011).

Life style: In Western countries, obesity affects approximately half of the general population and thus is a common problem among the infertile population. Obese women have a higher prevalence of infertility compared to their lean counterparts (Ibrahim 2011). The majority of

women with an ovulatory disorder contributing to their infertility have polycystic ovary syndrome (PCOS) and a significant number of women with PCOS are obese (ibid). Momtaz (2012), also indicated that secondary infertility was significantly associated with body mass index (p=0.036). Similar findings were shown in a study by (Jimei Cong, 2016) in a rural county in China which found that the infertility incidence of underweight women (BMI <18.5 kg/m^2) was 1.5-fold higher than that of women with moderate BMI (18.5–24.9 kg/m^2). Infertility prevalence for obese women (BMI>30 kg/m^2) was up to 2.3 times greater than for the moderate BMI group which is related to abnormal metabolism caused by obesity. Obesity can cause ovarian dysfunction resulting in ovulatory disorder, eventually leading to reduced fertility incidence.

The study also revealed that infertility incidence of women with little exercise was 4 times more than that of women with regular exercise, and 2 times more than that of women with heavy exercise. Similarly, a systematic review by (Deyhoul, 2017) shows that lifestyle-related factors such as obesity, nutrition, smoking and alcohol consumption, sexual violence and anxiety were evaluated as pregnancy changers. Acharya, (2017) also found that lifestyle factors such as; frequency of intercourse, body mass index, alcohol, and tobacco consumption are significantly related to secondary infertility. Another study by (Munalula, 2017) that women who consumed alcohol had a more than 2 times risk of being infertile. The same study found that that social factors such as weight, smoking, alcohol consumption and caffeine consumptions affect fertility

2.1.2. Consequences of secondary infertility

In traditional African and South Asian countries, a woman gains prestige and security in her husband's home only after she succeeds in proving her fertility (Unisa, 2000). With the glory of childbirth is a time for celebration for the entire family. The absence of desired number and sex becomes the responsibility of the woman alone leading to a threat for her status in the society. Infertility can have serious implications on psychological, physical, economic and social well-being for both spouses, but more for women as motherhood is seen as a supreme achievement for a woman and demonstrates her physical and psychological adequacy (Ussher, 1990). In many parts of the world including Sub-Saharan Africa, only a women is thought to be responsible for producing the next generation and blame for the absence of desired number and sex of children is unquestioningly placed on her (Neelofar Sami, 2012). This is exacerbated

by patriarchal system in African countries produces a strong desire of children especially a male children for they are perceived to carry the family line.

Infertility whether primary or secondary, though affects couples, is an experience that strikes at the very core of a woman's life (Momtaz, 2012). Their inability to reproduce desired number and sex of children results in catastrophe that negatively impacts relations not only with the husband but also other family members leading to destabilisation of social status (Sami, 2006). Interactions with husbands, friends and family are altered and therefore lead to an alternated experience of self-loathing (Leiblum 1996).

Most studies have revealed that severe emotional harassment is experienced by a large number of such women in their marital homes in the form of ostracism from family celebrations, taunting and stigmatization, negative attitude as well as beating, withholding of food and health care (Bentley 2009). This has been shown by similar results in India. A study by (Sami, 2006) found that secondary infertility in women results in 67.7% in marital dissonance, threatened divorce (20%), husband's remarrying (38%) or to be returned to their parent's home (26%) by their in laws or husbands. The study also indicated that secondary infertility in women gave birth to domestic violence including women being physically and verbally abused by husbands and in-laws for being infertile. The same study also found that women who were physically and verbally abused suffered severe mental stress. According Momtaz, (2012) the inability for couples to conceive disrupts their financial and economic status through costs incurred in an attempt to treat infertility. Despite not being at risk of mortality due to secondary infertility, infertility has the potential of causing irreversible damage to couples including isolation, stigmatization and gender-based violence.

Infertility is a chronic stressor with no clear solution and often results in strong feelings of doubt and ambiguity about the future. Moreover, while receiving treatment there is continued hope by the couple that the woman will become pregnant, this if not successful, is followed by feelings of helplessness and powerlessness. This puts women under enormous pressure and the resulting anxiety and depression could be devastating and affect the physical and psychological well-being. Studies conducted in India and Thailand have shown similar results where psychological trauma resulting from infertility ended up in low self-esteem, security and self-confidence (Sami, 2006).

2.2 Deficiencies in the existing literature

The prevalence of infertility in Zambia have not been well documented and there is very little known information about the status of secondary infertility and its associated factors. All these studies reviewed did not use country representative Zambian data to estimate the prevalence of secondary infertility in Zambia. Unfortunately due to the scanty literature on the prevalence of secondary infertility and its associated factors there has been a risk of not portraying a true picture of the situation in Zambia. The study bridged the gap by using the nationally representative survey to estimate the prevalence of secondary in Zambia and also by examining data from the 2013/14 ZDHS to identify some of the predictors of secondary infertility by incorporating variables identified through literature review .

2.3 Consequences of secondary infertility

The proximate determinants (PD) of fertility are the biological and behavioral factors through which the background determinants (social, economic, and environmental variables) affect fertility. The distinguishing feature of a proximate determinant is its direct connection to fertility. If a proximate determinant, such as contraceptive use, changes, then fertility necessarily changes also (assuming the other proximate determinants remain constant). This is not necessarily true for a background determinant of fertility such as income or education. Consequently, fertility differences among populations and trends in fertility over time can always be traced to variations in one or more of the proximate determinants (Boongarts, 2015).

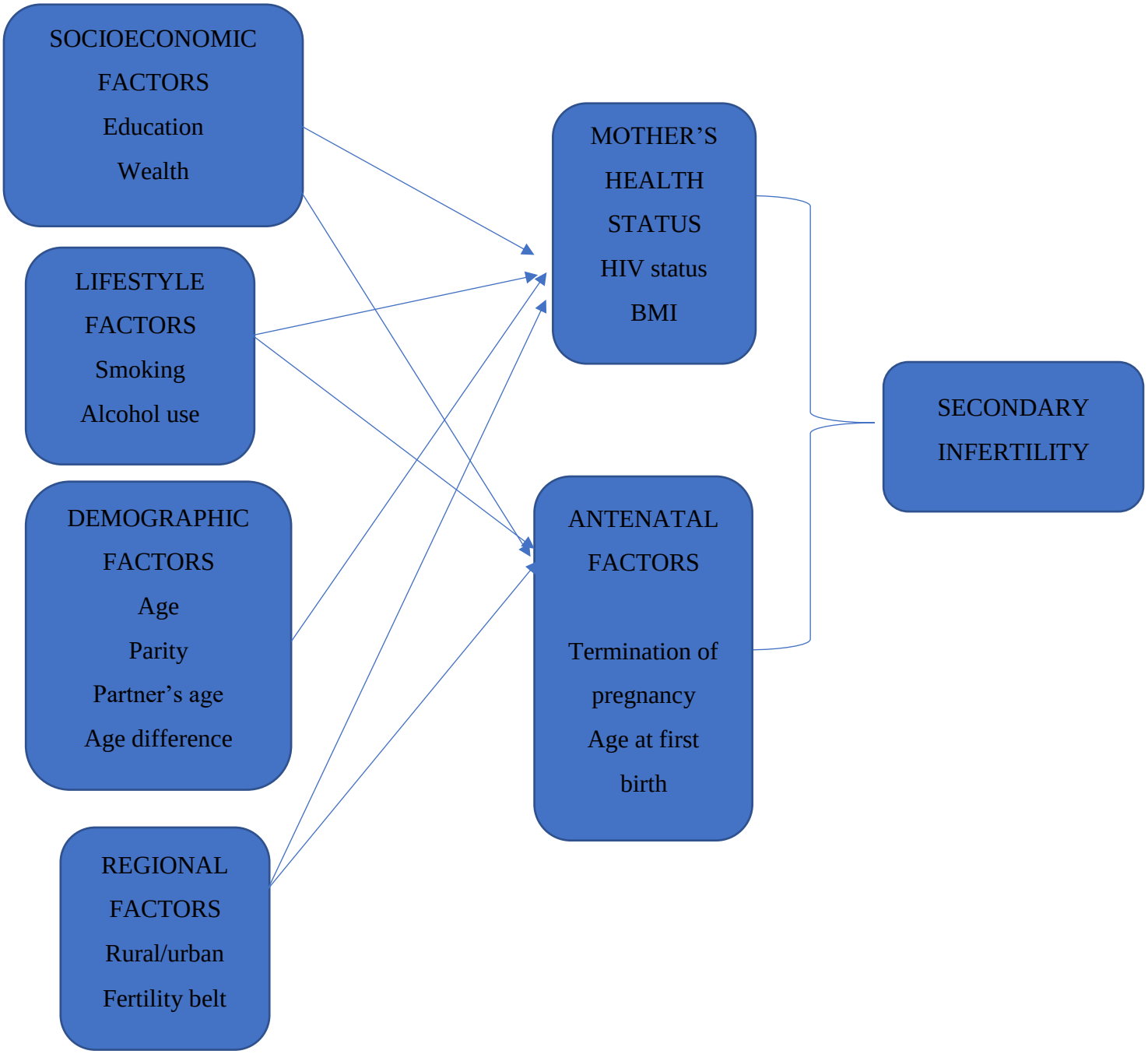
If accurately measured and modeled, the proximate determinants should explain 100% of variation in fertility. These relationships were first recognized in the mid-1950s when Kingsley Davis and Judith Blake (1956) defined a large set of proximate determinants which they called the “intermediate fertility variables.” This set was quite comprehensive and included some biological factors that differ little among populations (Boongarts, 2015). In the late 1970s Bongaarts (1978, 1982) defined a somewhat different and smaller set of proximate determinants, thus simplifying the task of constructing models of human reproduction. His analysis indicated that four proximate determinants − marriage/cohabitation, contraception, induced abortion, and postpartum infecundability − are the most important for the analysis of fertility levels and trends. The identification of this smaller set of proximate determinants (PDs) led to the development of a relatively simple model that quantifies the fertility effect of each of these PDs.

This study used the framework by (Bongaarts, 1978; Bongaarts and Potter, 1983) who quantified the effect of Davis and Blake's intermediate variables and collapsing into seven, proximate determinants of fertility. The seven include; The proportion of women of reproductive age that is married; The use and effectiveness of contraception, Induced abortion Postpartum infecundability (as primarily determined by the duration and intensity of breast-feeding), The frequency of intercourse (including the effect of temporary separation and abstinence practices), The onset of permanent sterility (particularly as related to menopause) and Spontaneous intrauterine mortality.

2.3. Conceptual framework

The conceptual framework of this study was guided by the literature reviewed on possible factors of secondary infertility in various regions of the world. Therefore, secondary infertility was be explained by factors such as; maternal age, life style factors, infection in the reproductive system such as sexually transmitted infections, education, region, parity and abortions. A woman's maternal age plays a role in influencing infertility because as a women grows older, the ovarian reserve diminishes there by reducing the egg quantity and quality decreases. Complications or abnormalities of the reproductive system arising from drug use (contraceptives) and STIs have an impact on achieve a healthy pregnancy. Lifestyle Factors such weight, smoking, alcohol abuse and lack of exercise can contribute to ovulatory dysfunction in women. These factors postulated are also in line with the framework by (Bongaarts, 1978; Bongaarts and Potter, 1983) who quantified the effect of Davis and Blake's intermediate variables and collapsing into seven, proximate determinants of fertility. The seven include; the proportion of women of reproductive age that is married; the use and effectiveness of contraception, induced abortion postpartum infecundability (as primarily determined by the duration and intensity of breast-feeding), the frequency of intercourse (including the effect of temporary separation and abstinence practices), the onset of permanent sterility (particularly as related to menopause) and spontaneous intrauterine mortality.

Figure 0-1: Conceptual Framework



CHAPTER THREE

Methodology

3.0 Introduction

This chapter focuses on the methodology used in this study. It includes, description of the research design, data sources and justification. It also includes the study population, sample size and description of variables. Another important component included is the description of the data analysis procedure which involved the application of the Chi square test, bivariate and multivariate regression.

3.1 Population characteristics and setting

Zambia covers a land area of 752,612 square kilometers. The Zambia Demographic and Health Survey (ZDHS) was conducted in all of Zambia's 10 provinces. The provinces include Central, Copperbelt, Eastern, Lusaka, Southern, Luapula, Muchinga, Northern, North-Western and Western Provinces. The 2010 census reported a population of 13.1 million and a population growth rate of 3 percent per annum. The population increased steadily from 5.7 million in 1980 to 13.1 million in 2010. During the 2000-2020 intercensal period, growth rates varied by province ranging from 2 percent in Western to 5 percent in Lusaka (CSO, 2012). The population density in Zambia increased from people per square kilometer in 1980 to 17 in 2010. Average density by province in 2010 ranged from a high of 100 per square kilometer in Lusaka to a low of six people per square kilometer in North Western.

In addition to being the most densely populated provinces, Lusaka and Copperbelt are also the most urbanized. The proportion of the population living in urban areas was 40 percent in 2010, an increase from 35 percent in 2000. The proportion of urban population varies by province from 13 percent in Eastern and Western to 85 percent in Lusaka (CSO, 2012). The estimated total rate of 7.3 births per woman declined steadily to 5.9 births per woman in 2010. The 2010 census reported a life expectancy at birth of 49 years for males and 53 years for females. Overall life expectancy at birth ranged from 45 years in Luapula to 56 years in Southern province.

3.2 Data source

This study used data from the 2013/2014 Zambia Demographic Health Survey (ZDHS) which is a nationally representative sample survey of women and men of reproductive age designed to provide up-to-date information on health status and behavior, which includes fertility levels,

nuptiality, sexual activity, fertility preferences, awareness and use of family planning methods, breastfeeding practices, nutritional status of mothers and young children, early childhood mortality and maternal mortality, maternal and child health, awareness and behaviours regarding HIV/AIDS and other sexually transmitted infections (STIs), and prevalence and incidence of HIV/AIDS and other STIs by targeting men aged 15-59 and women aged 15-49 in randomly selected households across Zambia all which were used to determine the prevalence of secondary infertility and its associated factors.

This study adopted a cross sectional study design. The study was purely quantitative and was conducted through structured interviews. Three questionnaires were used, these include; the Household Questionnaire, the Woman's Questionnaire, and the Man's Questionnaire. The three instruments were based on the questionnaires developed by the Demographic and Health Surveys Program and adapted to Zambia's specific data needs. However, for this study used the female questionnaire.

3.3 Sampling

The 2013-14 ZDHS used an updated list of enumeration areas (EAs) for the 2010 Population and Housing Census as the sampling frame for the survey. The frame comprised 25,631 EAs and 2,815,897 households. An EA is a convenient geographical area with an average size of 130 households or 600 people. For each EA, information is available on its location, type of residence (rural or urban), number of households, and total population. Each EA has a cartographical map with delimited boundaries and main landmarks of the area. A 2013-14 ZDHS cluster is essentially representative of an EA. A representative sample of 18,052 households was drawn for the 2013-14 ZDHS to provide estimates at the national, provincial and regional (Rural/Urban) levels.

The survey used a two-stage stratified cluster sample design, with EAs (or clusters) selected during the first stage and households selected during the second stage. In the first stage, 722 EAs (305 in urban areas and 417 in rural areas) were selected with probability proportional to the size. The 10 provinces were stratified into 20 sampling strata and a complete list of households served as the sampling frame in the selection of households for enumeration with an average of 25 households being selected in each EA. Therefore, a random sample of 18,052 households across Zambia were selected from 722 clusters, of which 16,258 were occupied at the time of the fieldwork. Of the occupied households, 15,920 were successfully interviewed,

yielding a household response rate of 98 percent. “All women aged 15-49 and men aged 15-59 who were either permanent residents of the households or visitors present in the households on the night before the survey were eligible to be interviewed.

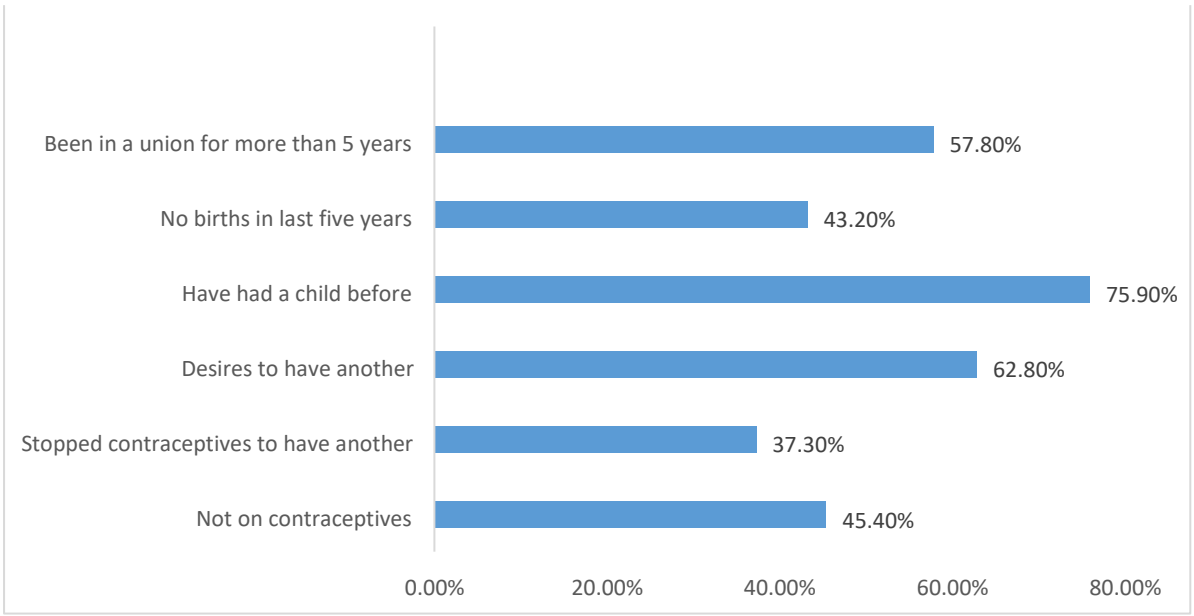
3.3.1 Sample inclusion and exclusion

The sample included a woman who has had a live birth before, desires to have more children, has been in a union for at least five years, has not been on contraceptives in the last five years and has not had any child in five years and excluded women who have never had children, those on contraceptives, stopped to have children, never been in a union and formally in a union, women that were never in a union less than 5 years and lastly women who have not had a child in the past five years.

3.3.2 Percent distribution of women in their respective categories

Figure 3-1 shows percent distribution of women in their respective categories. The results revealed that 45.4 percent (7,449) women were not on contraceptives, 37.3(1,677) women had stopped taking contraceptives to have another child. Sixty three percent (10, 268) of the women desired to another children and 43.2 percent (7, 087) have not had births in the last five years. Furthermore, the results reveal that 57.8 percent (9, 488) have been married for at least five years.

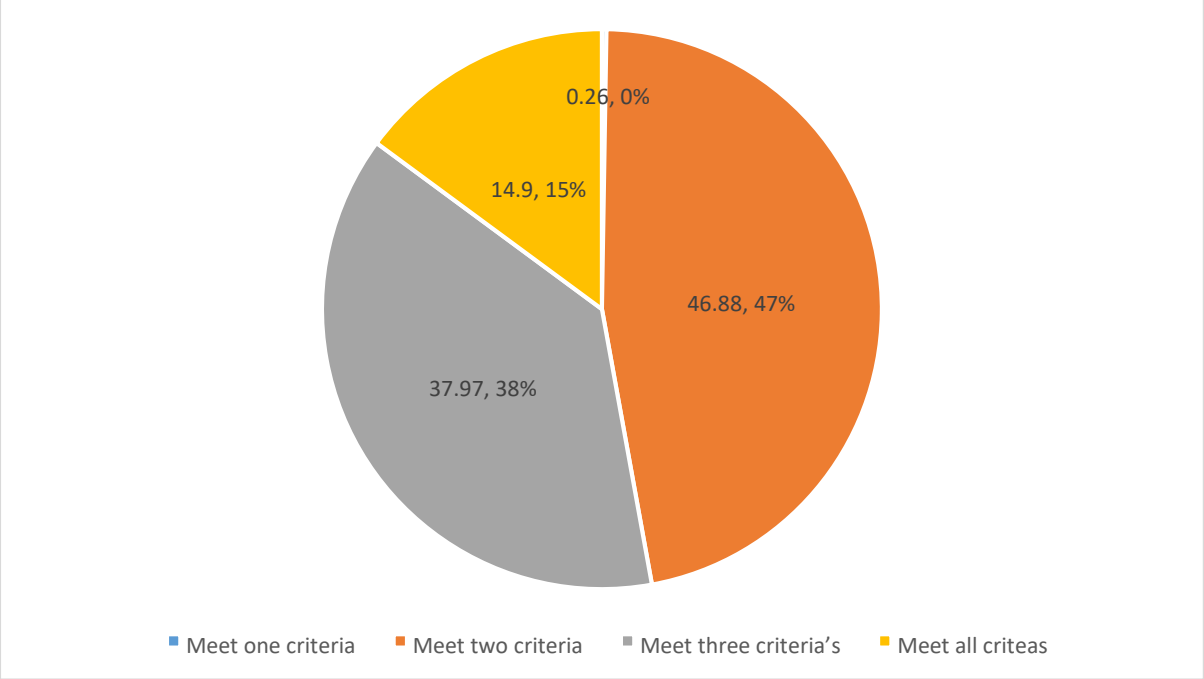
Figure 0-1: Percentage distribution of women in each category of the sample



3.3.3 Percent Distribution of women who met criteria's for secondary infertility, DHS 2013/14

Figure 3-2 shows the percent distribution of women who met only one criteria, those who met two criteria's and all four criteria. It should be noted that the population of women at risk of suffering from secondary infertility include women who have been in a union for at least five years and have had a child before. The results show that only 0.3 (n=5) percent only met one criteria, 46.9 (n= 894) percent only meet two criteria, 38.0 (n=724) percent met all three criteria's and 14.9 (n=284) percent met all four criteria's that was used to define secondary infertility.

Figure 0-1: Percentage distribution of women who met the criteria for secondary infertility, DHS 2013-14



3.4 Variables in the study

3.4.1 Dependent variable:

The outcome variable for this study was secondary infertility. It is a composite variable which is a combination of a woman who has had a live birth before (v201), desires to have more children (v602), has been in a union for at least five years (v502), has not been on contraceptives in the last five years (v302) and has not had any child in five years (v208). For

analytical purposes the respondent's responses were recorded as 1) Yes, 2) No. This variable was generated by first combing all women that have not used contraceptive and those that stopped to have another child using "gen contraception= (v320a==0| v360==2)" in Stata. All women never in a union and formally in a union were dropped using "drop if v502==0 and v502==2". A variable "union" women that were never in a union less than five years and all women in a union 5 years and more –year first cohabitation was created using the "gen union=(v513>o &v513!=. &v508<2009). All women that had no births in the last five years were dropped using "drop if v208>0" and women who were less than 25 were dropped using "drop if v013<3" .Similarly women have never had a child using "drop if v201==0" and those who didn't desire another child were dropped using "drop if v602>1". Then the variable secondary infertility was created using "gen SI= (contraception ==1 & union==1 & v28==0 & v602==1)".

3.4.2 Independent variables:

Based on the literature, below are the selected independent variables.

Social/economic factors variables included educational level, wealth index, fertility belt and region. Educational level was captured as v106 highest level of education the household member attended. This is a standardized variable providing level of education recoded in the following categories: 1) No education, 2) Primary, 3) Secondary, and 4) Higher. The wealth index was captured as v270, in the dataset was constructed by combining household asset information such as ownership of consumer items, type of dwelling, source of drinking water and availability of electricity into one asset index which was grouped in five quintiles with 1) poorest, 2) poorer, 3) middle, 4) richer and 5) richest, whereas, the variable fertility belt was generated by grouping the total fertility rates of the provinces reported in the 2013/14 DHS into three fertility belts "low fertility belt", "medium fertility belt" and "high fertility belt". Low fertility belt "Copperbelt and Lusaka Provinces (TFR<4.1)"; Medium fertility belt "Central, Eastern, Western" (TFR<6), High fertility belt "Muchinga, North-Western, Southern, Luapula, Northern" (TFR<6.77) (Namuunda & Bakibinga, 2014). Region was captured as

"V101" type of place of residence where the respondent was interviewed as either 1) urban or 2) rural.

Demographic Factors include Age, Parity, Partners age and Mode of delivery. Age "v013" ranges from 15-49 and for this study was captured as current age in 5-year groups, however for this analysis age was truncated at 25+ to circumvent the difficulties of separating adolescent's

sub-fertility from secondary infertility (Ulla, 2000) , age at first delivery is captured as age of respondent at first birth “”vV212” which was collapsed into six year age groups with 1)10-14, 2) 15-19, 3) 20-24, 4) 25-29, 5) 30-34, 6) 35-39. Parity which is the total number of children ever born “V201” in this analysis was recoded as 1) 1-2 children, 2) 3 children, 3) 4 children, 5) 5 children, 6) 6 children and 7) 7 or more children. Partner’s age was the current number of years that a woman’s partner or spouse has attained. It is recoded as 1) 20-24, 2) 25-29, 3) 3034, 4) 35-39, 5) 40-44, and 6) 45-49.

Lifestyle factors include smoking and alcohol use. In the ZDHS smoking is captured as type of tobacco the respondent currently smokes which is given by 1) Yes 2) No and alcohol use is given by 1) Yes 2) No. For this analysis smoking and alcohol use was recoded into a variable “Substance use” and the responses were grouped into 2 categories 1) Yes, 2) No. For analytical purposes smoking and drinking variables were interacted. A variable was generated by multiplying the two variables in order to carter for those that drink and smoke. It is worth noting that the variables were collapsed into this variable because of very small proportion for analysis which was deemed to distort the analysis.

Exogenous Factors in this study include HIV status, Abortion, and BMI. HIV status is whether someone has an HIV virus and was recoded as 1) HIV negative 2) HIV positive while abortion was captured whether the respondent has ever had a pregnancy that terminated or resulted into a miscarriage, abortion, or still birth, i.e., did not result in a live birth was reported as 1) Yes 2) No. The ZDHS collects continuous data on height and weight however for this study weight and height were collapsed into one variable “BMI” according to the WHO classification of below 18.5 “underweight”, 18.5-24.9 “normal weight”, 25-29.9 “overweight” and above 30 as “obese”. Thus, the variable BMI was recoded as 1) underweight, 2) normal weight, 3) overweight and 4) obese.

3.4.3 Identification of Variables

Table 1: selected Independent and Dependent variable

Variable Name	**Variable label/Description**	**Value label**
Dependent Variable	**Secondary Infertility**	
v602	Fertility preference	1. Have another child

		2. Undecided 3. No more 4. Sterilized 5. Declared infecund
v502	Currently, formerly, or never married	1. Never in a union 2. Currently in a union/living with a man 6. Formerly in a union/ living with a man
V512	Cohabitation duration (grouped)	1. Never married 2. 0-4 3. 5-9 4. 10-14 5. 15-19 6. 20-24 7. 25-29 8. 30+
v302	Ever used anything or tried to delay getting pregnant	1. No 2. Yes, used outside calendar 3. Yes, used in calendar
V208	Births in the last five years	1. 0/No births 2. 1 3. 2 4. 3 5. 4
Independent Variables		
V106	Highest education level	1. No education 2. Primary 3. Secondary 4. Higher
V201	CEB	Integer
V101	Region	1. Central

		2. Copperbelt 3. Eastern 4. Luapula 5. Lusaka 6. Muchinga 7. Northern 8. Northwestern 9. Southern 10. western
V013	Age	1. 15-19 2. 20-24 3. 25-29 4. 30-34 5. 35-39 6. 40-44 7. 45-49
V212	Age at first birth	Integer
V531	Age at first sex	Integer
V730	Husband/partners age	Integer
V212	Age at first birth	Integer
V730	Partners age	Integer
V190	Wealth Index	1. Poorest 2. Poorer 3. Middle 4. Richer 5. Richest
V228	Ever had a terminated pregnancy	1. Yes 2. No
V102	Type of residence	1. Urban 2. Rural
Substance use		

V463a **V463b** **V463c** **V463d** **S1007a**	Smokes cigarettes Smokes pipe Uses chewing tobacco Uses snuff	1. Yes 2. No
BMI **V437** **V438**	 Weight in kilograms Height in centimeter	 integer

3.5 Operational definitions

Based on the literature, below are the selected dependent and independent variables

Dependent variable:

Secondary infertility is defined as woman who has had a live birth before, desires to have more children, has been in a union for at least five years, has not been on contraceptives in the last five years and has not had any child in five years.

Independent variables:

Social/economic factors include educational level, wealth index, region and place of residence. Educational level was defined as the highest level of education the household member attended. This is a standardized variable providing level of education, whereas wealth index was defined as a composite measure of a household cumulative living standard. Region was defined as a region in which the respondent was interviewed and type of place of residence where the respondent was interviewed as either urban or rural.

Demographic factors in this study included Age, age at first delivery, husbands age, Parity and Mode of delivery. Age is defined as current age in 5-year groups, Age at first delivery is captured as age of respondent at first birth and parity which is the total number of children ever born while mode of delivery is whether child was born by caesarean section or not.

Lifestyle factors include smoking and alcohol use. Smoking is captured as type of tobacco the respondent currently smokes and alcohol use is whether the respondent partner drinks alcohol.

Exogenous Factors in this study included HIV status, Abortion, and BMI. HIV status is defined as whether the respondent has tested positive or negative for the HIV virus, while abortion is whether the respondent ever had a pregnancy that terminated in a miscarriage, abortion, or still birth, i.e., did not result in a live birth, BMI is defined as a measure of body fat based on height and weight that applies to adult women.

3.6 Data quality assessment and data management

Quality assessment of data is very important especially when dealing with secondary data. This is so because all surveys are prone to errors which include: sampling errors, omission of eligible respondents and misreporting of age due to births misreporting and omissions. Inadequacies in secondary data may lead to inaccurate reporting of the prevalence of secondary infertility and its associated factors. For this reason, it is of great importance that the Demographic and Health Survey (DHS) data being used for the study is of good quality with minimal errors such that the characteristics emerging in the data set are representative of Zambia's total population

3.6.1 Analysis of deficiencies in age data

Errors in survey data on age may arise from the following types of errors of enumeration: coverage errors, failure to record age, and misreporting of age. In order to measure the degree of digit (age) preference, the study ran kernel density test to test for normality and little variations were observed at each successive age. To counteract the age variations, age data was grouped into five year age groups.

3.7 Data analysis

Data analysis was done using Stata version 13 and the data was survey weighted to factor in population estimates because of the non-proportional allocation of the sample at different provinces and their urban and rural areas, and possible differences in the response rate ensuring representativeness of the results. The weighting process included: The primary sampling unit (v021), a sample stratum number (v022) which is province by rural-urban and a sample weight (v005) were identified. The variable for weighting the data was generated by dividing the weight by 1,000,000. The weighted data was produced by; svyset v021 [pweight=sampwt],strata (v022).

Data was analysed at three levels, univariate, bivariate and multivariate levels. For objective 1, descriptive analysis was carried out to determine prevalence of secondary infertility among women aged 25-49 in Zambia. Objective 2 and 3 descriptive analysis and Chi-square analysis was conducted at three levels in an attempt to describe and establish the relationship between HIV status and socioeconomic, lifestyle, demographic and regional factors; an association between socioeconomic, lifestyle, demographic, regional factors and mother's BMI, and an association between socioeconomic, lifestyle, demographic, regional factors and secondary infertility. Bivariate logistic regression analysis was conducted to ascertain a statistical significant relationship between secondary infertility and socio-economic, lifestyle, demographic and regional factors.

Logistic regression was the statistical technique used to predict the relationship between predictors (independent variables) and a predicted variable (the dependent variable) where the dependent variable was binary. Binary logistic regression was used because it is an appropriate statistical analysis when the purpose of research is to assess if a set of independent variables predict a dichotomous dependent variable (Stevens, 2009). The logistic regression method assumes that the outcome variable (secondary infertility) was binary/dichotomous; fertile or infertile hence binary logistic was an appropriate analysis technique to measure relationships. It also assumes that there is a linear relationship between the logit of the outcome and each predictor variables and there are no influential values (extreme values or outliers) in the continuous predictors. Lastly, there are no high intercorrelations (i.e. multicollinearity) among the predictors. Therefore, a multivariate logistic regression analysis was further conducted to ascertain the determinants of secondary infertility.

3.7.1 Modelling strategy

The modelling strategy involves categorizing the dependent variables into binary categories, women with secondary infertility denoted as 1 and women with no secondary infertility as 0. This is denoted as follows:

$$\pi = \Pr(Y = 1|X = x).$$

Variables:

Where Y was a binary response variable (Secondary infertility)

Yi = 1 (Infertile)

Yi = 0 (Not infertile)

X = (X1, X2 ..., Xk) were the explanatory variables (Socioeconomic, lifestyle, demographic and regional factors) which were categorical, discrete, continuous, or a combination. xi was the observed value of the explanatory variables for observation. Binary logistic focused on a single variable X. Model:

$\pi i=Pr(Yi=1|Xi=xi) = exp(\beta 0+\beta 1xi)/1+exp(\beta 0+\beta 1xi)$

or, $logit(\pi i) = log(\pi i/1-\pi i)$

$=\beta 0+\beta 1xi$

$=\beta 0+\beta 1xi1+\ldots+\beta kxik$

Interpretation of Parameter Estimates:

$exp(\beta 0)$ = the odds that the characteristic was present in an observation i when Xi = 0, $exp(\beta 1)$ = for every unit increase in Xi1, the odds that the characteristic was present was multiplied by $exp(\beta 1)$. This is similar to simple linear regression but instead of additive change it is a multiplicative change in rate. This is an estimated odds ratio.

$exp(\beta 0+\beta 1(xi1+1))/exp(\beta 0+\beta 1xi1) = exp(\beta 1)$

In general, the logistic model stipulates that the effect of a covariate on the chance of "success s" is linear on the log-odds scale, or multiplicative on the odds scale.

If $\beta j > 0$, then $exp(\beta j) > 1$, and the odds increase.

If $\beta j < 0$, then $exp(\beta j) < 1$, and the odds decrease.

Source: Menard, (2002)

The paper adopted hierarchical model building which refers to the process of adding or removing variables predictor variables from the regression model in steps. The model building factored in the level of significance at 90% (p=0.1), 9.5 (p=0.05) and 99% (p=0.001) confidence interval. The first involved adding the socioeconomic predictor variables into the model while controlling for other factors such as demographic, lifestyle, regional and antenatal factors. This enabled the visibility of the predictive power that socioeconomic predictor's variables had added to the model above and beyond demographic factors. The second step involved removing the predictors with a probability value above the set significance level. This process involved removing and adding back to the model to see the power added to the model after removing and or adding to the model. The process went on until the model had all predictors significant

.

3.7.2 Multicollinearity

Multicollinearity was measured using the Pearson's R correlation coefficient. The correlation matrix was used to identify the presence of multicollinearity, using the rule of thumb that is if simple correlation coefficient is greater than 0.8 or 0.9 then multicollinearity is a serious concern. The test results revealed that multicollinearity was not an issue.

3.7.3 Measure of goodness-of-fit

The Pearson goodness-of-fit test or the Hosmer–Lemeshow goodness-of-fit test was used as a measure of goodness-of-fit. The Pearson χ^2 goodness-of-fit test is a test of the observed against expected number of responses using cells defined by the covariate patterns. A small Prob > F value indicates poor fit of the model to the data whereas a large Prob > F value indicates good fit of the model to the data.

3.8 Limitation of the Study

In this study it should be noted that this analysis was based on secondary data that do not contain any information about the duration that individual women or couples have tried to conceive. Instead, inferences about secondary infertility were based on evidence of an inability to have a child (or another child) in a period of at least 5 years, desires to have more children, have been in a marriage for at least five years, not been on contraceptives for five years and contraceptive users were considered fertile at survey date. "Extensive analysis of birth histories collected in WFS and DHS surveys, as well as micro-simulation analysis of birth histories, where all the reproductive parameters are known, suggest that relatively few women have an open birth interval longer than 5 years, if they are fertile" (Larsen 1994). Hence, using a window of at least 5 years to measure whether a woman is able to conceive and carry a pregnancy to term allows for low fecundability from infrequent sexual intercourse because of, say, labour migration, polygyny or cultural proscriptions against sexual intercourse (ibid). On this background it is deemed that the estimates presented are valid and reliable measures of the prevalence of secondary infertility.

The study analysed cross-sectional data from the 2013/14 ZDHS data set and hence was prone to encounter shortcomings associated with using cross-sectional data such as inability to analyse causality and guarantee that the timing of the snapshot or rather the survey, is 100% representative of the characteristics of Zambia's population. The study was also confined to

ZDHS data which is skewed towards quantitative analysis. Qualitative data was not collected to support quantitative data. This is due to time and financial constraints as the researcher would need to conduct a nationally representative qualitative survey in order to match the quantitative survey which would not only be costly but time consuming as well. Furthermore, the study did not establish any interactions between the independent variables despite the model showing some interactions

3.9 Ethical Considerations

This study was a secondary analysis of the 2013-14 ZDHS and as such, no ethical approval was required. Considering that the Zambia Demographic and Health Survey [ZDHS] data sets are managed by Micro-International under the measure DHS, the researcher registered and requested for access to data from DHS on-line archive and received an approval to access and download de-identified DHS data files particularly for this study. Further, the researcher provided justification to measure DHS on how the data was going to be used and how the research findings will or may contribute to national development on reproductive health issues. All guidelines, including treating data as confidential and not making effort to identify individual respondents, were respected. Ethical approval was also sought from the University of Zambia, Directorate of Research and post graduate studies.

CHAPTER FOUR

PRESENTATION OF RESEARCH FINDINGS

4.0 Introduction to findings

The following chapter presents the findings of this study. It is divided into three sections. The first section presents the percentage distribution of secondary infertility in women age 25-49 by selected background characteristics (demographic, socio-economic, lifestyle and maternal) of women that may have a bearing on secondary infertility. These variables include age, children ever born, educational level, place of residence, wealth quintile, fertility belt, substance use, and BMI and pregnancy termination. The second section presents descriptive statistics as well as relationships between secondary infertility and socio-demographic characteristics. Section three and last section presents the descriptive statistics for the determinants of secondary infertility. Additionally, also the final section presents the bivariate analysis, aimed at addressing the second and third objective of the study which is to examine the influence of social, demographic as well as lifestyle on secondary infertility amongst women aged 25-49.

4.1 UNIVARIATE ANALYSIS

4.1.1 Percentage distribution of Women's Profile (25-49)

Table 4-1 below shows the percent distribution of women's profile age 25-29. The sample data was survey weighted to factor in population estimates. The weighted sample was 1995 while the unweighted was 1907. However, all the results presented represent weighted estimates. Therefore, findings reveal that the prevalence of secondary in Zambia was 14. (279) percent. Results also show that more than half (54.3%) of the women had primary education, followed by 28.8 percent who had secondary education. The results also show that education levels are generally low as slightly more than a third (34.5%) of the women had attained education higher than primary education.

Eight in ten women (84.2%) did not abuse a substance (drinking alcohol and smoking) while 15.8% of the women abused a substance (drinking and smoking).

About 3 in 10 (28.2% %) of the women were aged 45-49 and were the majority by category. There was a direct relationship between age and sample size: the older the age group, the higher the proportional representation. By parity, 27.5 percent of the women had seven or more children. . Furthermore, results showed that 39.3 percent of the women had a spouse who was

1-5 years older while only 7.5 percent of the women had a spouse who was less than or equal to their age. More than half had their first sex between 15-19 years and lived in an urban area (62.6% and 52.3% respectively).

As mentioned in the methodology section the variable fertility belt was generated by grouping the total fertility rates of the provinces reported in the 2013/14 DHS into three fertility belts "low fertility belt", "medium fertility belt" and "high fertility belt". Low fertility belt "Copper belt and Lusaka Provinces (TFR<4.1)"; Medium fertility belt "Central, Eastern, Western" High fertility belt "Muchinga, North-Western, Southern, Luapula, Northern" (TFR<6.7). Four in ten (44%) lived in a high fertility belt (Muchinga, North-Western, Southern, Northern, Laupula) compared to 31 percent who lived in a high fertility belt.

The study found that nearly three quarters (74.8%) of the women were HIV negative and a quarter were HIV positive. Half (51.4%) of the women had normal weight, 2 in 10 (20.3%) of the women had terminated pregnancy and about two thirds (61.8%) had their first birth at 15-19 years old.

Further, a quarter (25%) of the women were HIV positive and 2 in 10 (20.8%) had eve7 terminated a pregnancy.

Table 0-1: Percentage distribution of women's profile (25-29), ZDHS 2013/14

Background Characteristics	Weighted Percent	Weighted Number	Unweighted Percent	Unweighted Number
Secondary Infertility				
Fertile	86	1715	85.1	1623
Infertile	14	279	14.9	284
Socio-economic Factors				
Highest Educational Level				
No education	11.3	225	10.9	207
Primary	54.3	1,082	54.1	1031
Secondary	28.8	574	28.7	547
Higher	5.7	113	6.4	122
Wealth Index				
Poorest	10.4	208	10.5	201
Poorer	14.2	284	15	286
Middle	18.6	371	21	400
Richer	26.9	537	26.7	509

Richest	29.8	595	26.8	511
Lifestyle Factors				
Substance use				
Non-User	84.2	1,680	85	1621
User	15.8	315	15	286
Demographic Factors				
Age				
25-29	9	180	9.1	173
30-34	15.8	316	15.3	291
35-39	21.7	433	20.8	396
40-44	25.2	502	24.9	475
45-49	28.2	563	30	572
CEB				
2	21.9	437	21.2	405
3	14.5	290	14.2	271
4	14.3	285	13.1	250
5	11.6	232	11.9	226
6	10.1	202	11.2	213
7	27.5	549	28.4	542
Age difference between spouses				
Less than or equal age with partner	7.5	148	7.8	147
Partner is older by 1-5 years	39.2	770	39.2	736
Partner is older by 6-10 years	33.5	658	33.4	627
Partner is older by 1-5 years	19.8	389	19.6	367
Age at first Sex				
10-14	15.5	308	16.5	313
15-19	62.6	1,247	62.3	1184
20-24	8.8	175	8.6	163
25-29	1	19	1	19
30-34	0.1	2	0.2	3
Regional Factors				
Residence				
Urban	52.3	1,042	52.2	996
Rural	47.7	952	47.8	911
Fertility Belt				
Low fertility belt	44	878	26.8	511
Medium fertility belt	24.9	496	29.5	562
High fertility belt	31.1	621	43.7	834
Maternal Health Status				

HIV status				
HIV negative	74.8	1,369	75.2	1328
HIV positive	25.2	462	24.8	438
BMI				
Underweight	8.4	166	8.2	155
Normal weight	51.4	1,023	53.2	1011
Overweight	25.5	508	24.8	472
Obese	14.7	292	13.8	263
Antenatal Factors				
Terminated pregnancy				
No	79.7	1,589	79.2	1510
Yes	20.3	405	20.8	396
Age of respondent at 1st birth				
10-14	6.3	125	6.2	119
15-19	61.8	1,232	62.2	1187
20-24	25.9	518	25.8	492
25-29	5	100	4.5	86
30-34	0.8	17	1.1	21
40-45	0.2	4	0.1	2
Total	**100**	**1,995**	**100**	**1907**

4.2 BIVARIATE ANALYSIS

4.2.1 Chi Square Analysis (Mother's Health Status).

This section presents findings on chi square analysis of mothers health status and socioeconomic, lifestyle, demographic, regional factors. HIV status and BMI were indicative of the health status of a woman.

4.2.1.1 Association between socioeconomic, life style, demographic, regional factors and mother's HIV status.

Table 4-2 below shows an association between socioeconomic, lifestyle, demographic, regional and mother' HIV status. The results show that there was a statistical significant association between mothers HIV status and; socioeconomic factors (i.e. a woman's education level (P<0.001), wealth index (P=0.001)); lifestyle factors (i.e. substance use (P<0.001)); demographic factors (i.e. children ever born P<0.001), partners age (p=0.003), age difference between spouses (P<0.001), age at first sex (p<0.001); regional factors (i.e. residence (P<0.001), fertility belt P<0.001)).

Therefore, women's HIV positive status was increasing with education and wealth index. HIV was more (36.1%) prevalent in women who abused a substance as compare to women who did not abuse a substance. The results also showed that two thirds of women aged 30-39 were HIV positive and HIV positive status decreased with the increasing number of children a woman has had. Further, more than half (51.5%) of the women's partners aged 25-29 were HIV positive and 40 percent were less than or of equal age with their partners. Almost half (49.7%) of the women who had their first sex at 30-34 were HIV positive. A third (32.2%) of women in urban areas were HIV positive compared to 17.9 percent in rural areas. The study also found that almost a third (30.4%) of the women living in a low fertility were HIV positive compared to the 20.7 percent living in a high fertility belt.

Table 0-2: Percentage distribution of HIV status by socioeconomic, lifestyle, demographic, and regional factors, ZDHS 2013/14

Factor	HIV Negative		HIV Positive			
	%	CI	%	%	n	P-value
Socio-economic Factors						
Highest educational level						
No education	79.3	[72.0-85.0]	20.7	[15.0-28.0]	205	
Primary	78.4	[75.3-81.3]	21.6	[18.7-24.7]	1,013	P<0.001
Secondary	67.1	[60.8-72.7]	32.9	[27.3-39.2]	518	
Higher	68.2	[57.4-77.3]	31.8	[22.7-42.6]	95	
Wealth Index						
Poorest	82.8	[75.7-88.2]	17.2	[11.8-24.3]	195	
Poorer	82.7	[76.6-87.4]	17.3	[12.6-23.4]	267	
Middle	77.7	[72.7-82.0]	22.3	[18.0-27.3]	351	P=0.001
Richer	70.2	[64.9-75.0]	29.8	[25.0-35.1]	502	
Richest	70.1	[63.8-75.7]	29.9	[24.3-36.2]	517	
Lifestyle Factors						
Substance Use						
Non-User	76.8	[74.0-79.4]	23.2	[20.6-26.0]	1,541	
User	63.9	[57.3-70.1]	36.1	[29.9-42.7]	290	P<0.001
Demographic Factors						
Age						
25-29	72.4	[61.9-80.9]	27.6	[19.1-38.1]	171	
30-34	65.5	[57.6-72.7]	34.5	[27.3-42.4]	287	
35-39	69.6	[63.0-75.5]	30.4	[24.5-37.0]	390	P<0.001
40-44	76.1	[71.3-80.3]	23.9	[19.7-28.7]	461	
45-49	83.4	[79.4-86.7]	16.6	[13.3-20.6]	522	
CEB						

2	61.6	[55.3-67.5]	38.4	[32.5-44.7]	403	
3	66.9	[58.9-74.0]	33.1	[26.0-41.1]	253	
4	70.3	[63.6-76.2]	29.7	[23.8-36.4]	264	P<0.001
5	75	[65.8-82.3]	25	[17.7-34.2]	212	
6	85.3	[78.2-90.4]	14.7	[9.6-21.8]	184	
7	87.4	[83.5-90.4]	12.6	[9.6-16.5]	516	
Partners age						
20-24	84.8	[25.8-98.9]	15.2	[1.1-74.2]	3	
25-29	48.5	[24.0-73.8]	51.5	[26.2-76.0]	23	
30-34	70.1	[59.6-78.9]	29.9	[21.1-40.4]	150	
35-39	71.4	[63.9-77.9]	28.6	[22.1-36.1]	246	P=0.003
40-45	71.7	[66.1-76.7]	28.3	[23.3-33.9]	435	
45-49	73	[66.8-78.4]	27	[21.6-33.2]	299	
50+	81.4	[77.6-84.7]	18.6	[15.3-22.4]	649	
Age difference						
Less than or equal age with partner	59.6	[49.2-69.2]	40.4	[30.8-50.8]	139	
Partner is older by 1-5 years	76.2	[72.0-79.9]	23.8	[20.1-28.0]	704	
Partner is older by 6-10 years	79.5	[75.4-83.1]	20.5	[16.9-24.6]	595	P<0.001
Partner is older by 1-5 years	71.1	[65.0-76.5]	28.9	[23.5-35.0]	367	
Age at first sex						
10-14	72.6	[66.4-78.0]	27.4	[22.0-33.6]	291	
15-19	75.2	[72.0-78.2]	24.8	[21.8-28.0]	1,148	
20-24	79.6	[69.8-86.8]	20.4	[13.2-30.2]	152	
25-29	89.4	[64.0-97.6]	10.6	[2.4-36.0]	19	P=0.338
30-34	50.3	[8.1-92.1]	49.7	[7.9-91.9]	2	
50+	70.7	[62.6-77.6]	29.3	[22.4-37.4]	216	
Regional Factors						
Residence						
Urban	67.7	[63.4-71.8]	32.3	[28.2-36.6]	933	
Rural	82.1	[79.4-84.5]	17.9	[15.5-20.6]	898	P<0.001
Fertility Belt						
Low fertility belt	69.6	[64.5-74.2]	30.4	[25.8-35.5]	781	
Medium fertility belt	77.8	[73.9-81.2]	22.2	[18.8-26.1]	461	P=0.001
High fertility belt	79.3	[76.0-82.3]	20.7	[17.7-24.0]	589	
Antenatal Factors						
Terminated pregnancy						
No	75.7	[72.6-78.6]	24.3	[21.4-27.4]	1,452	
Yes	71.2	[65.7-76.1]	28.8	[23.9-34.3]	379	P=0.154
Age of respondent at 1st birth						
10-14	73.3	[62.0-82.1]	26.7	[17.9-38.0]	112	

15-19	74.7	[71.3-77.8]	25.3	[22.2-28.7]	1,153	
20-24	76.9	[71.5-81.5]	23.1	[18.5-28.5]	458	P=0.563
25-29	66.2	[53.4-76.9]	33.8	[23.1-46.6]	91	
30-34	75.8	[49.4-91.0]	24.2	[9.0-50.6]	14	
40-45	100		0		4	
Total	**74.8**	**[72.2-77.2]**	**25.2**	**[22.8-27.8]**	**1,831**	

4.2.1.2 Association between socioeconomic, life style, demographic, regional factors and mother's BMI

Table 4-3 below shows an association between socioeconomic, lifestyle, demographic, regional and mother' BMI. The results show that there was a statistical significant association between mothers BMI and; socioeconomic factors (i.e. a woman's education level (P<0.001), wealth index (P=0.001)); demographic factors (i.e. children ever born P=0.044), age difference between spouses (P=0.03), age at first sex (p=0.013); regional factors (i.e. residence (P<0.001), fertility belt P<0.001)); maternal health status (i.e. HIV status (P=0.005)).

Therefore, the study found that women's obesity was increasing with education level and wealth index compared to women who were underweight who were decreasing education level and wealth index. Almost quarter (24.2%) of the women who abused substance were overweight compared, 47.6 percent were of normal weight, 11.1 percent were underweight and 17.1 percent were obese. More than half of the women with 7 or more children had normal weight, 23.4 percent were overweight, 12.4 percent were obese and 9 percent were under weight. This pattern was similar across all women with 2 to 6 children. Findings also showed of the women who had a spouse who was less than or equal to their age 16.1 percent were underweight, 18.2 percent were overweight and 6.1 percent were obese. Two thirds (65.7%) of women who were obese had their first sex at 25-29, compared 14.4 percent who were of normal weight. .Eleven percent of women in rural areas were underweight compared to 5.5 percent of women in rural areas. Of the women who were overweight, 2 in 10 lived in a high fertility belt, 23.6 percent of the women lived in a medium fertility belt and 30 percent lived in a low fertility belt. Sixteen percent of women who were obese were HIV negative and 24.1 percent had their first birth at 30-34 years.

Table 0-3 Percentage distribution of BMI by socioeconomic, lifestyle, demographic, and regional factors, ZDHS 2013/14

	Underweight	Normal weight	Overweight	Obese

	%	CI	%	CI	%	CI	%	CI	n	P-Value
Socio-economic Factor										
Highest educational level										
No education	16.2	[11.2-22.9]	54.4	[46.1-62.5]	23.3	[16.4-32.1]	6.1	[3.2-11.3]	223	
Primary	9.2	[7.4-11.3]	54.5	[50.4-58.4]	23.2	[20.4-26.2]	13.2	[10.2-16.8]	1,080	P<0.001
Secondary	4.5	[2.9-7.1]	47.4	[41.9-52.9]	28.6	[24.3-33.3]	19.5	[15.4-24.3]	573	
Higher	4.7	[1.6-13.5]	36.8	[24.9-50.6]	36.4	[25.4-49.0]	22.1	[13.9-33.3]	113	
Wealth index										
Poorest	16.1	[11.4-22.4]	72.2	[65.1-78.4]	9.9	[6.2-15.4]	1.8	[0.5-6.5]	206	
Poorer	16.2	[12.1-21.4]	63	[57.2-68.5]	15.1	[10.9-20.5]	5.7	[3.5-9.2]	284	
Middle	9.2	[6.4-13.2]	59.5	[54.0-64.8]	23.2	[19.0-28.0]	8.1	[5.4-11.9]	371	P<0.001
Richer	6.4	[4.2-9.7]	50.5	[44.4-56.6]	25.7	[21.5-30.4]	17.4	[12.3-24.1]	535	
Richest	3.2	[1.8-5.6]	34.4	[29.4-39.8]	37.3	[32.5-42.4]	25.1	[20.7-30.1]	594	
Lifestyle Factors										
Substance use										
Non-User	7.8	[6.4-9.5]	52.1	[49.0-55.2]	25.8	[23.2-28.5]	14.2	[11.9-17.0]	1,675	P=0.231
User	11.1	[7.7-15.8]	47.6	[41.3-54.0]	24.2	[19.2-30.0]	17.1	[12.6-22.8]	315	
Demographic Factors										
Age										
25-29	6.3	[3.0-12.5]	51.2	[41.9-60.5]	28.6	[20.4-38.5]	13.9	[8.2-22.5]	180	
30-34	6.4	[3.7-10.6]	54.6	[47.5-61.6]	23.3	[18.2-29.4]	15.7	[11.0-22.0]	314	
35-39	6.4	[4.0-9.9]	53.8	[47.8-59.7]	25.9	[21.6-30.7]	14	[10.3-18.7]	433	p=0.561
40-44	11.5	[8.5-15.5]	48.2	[43.0-53.5]	24.3	[19.9-29.2]	16	[12.5-20.2]	500	
45-49	8.9	[6.6-11.8]	50.6	[45.9-55.4]	26.7	[22.5-31.3]	13.8	[10.7-17.7]	562	
CEB										
2	6.7	[4.4-10.1]	55	[49.2-60.7]	28.3	[22.8-34.5]	10	[6.8-14.6]	436	
3	6.5	[3.7-11.1]	48.3	[40.6-56.1]	23.3	[18.1-29.6]	21.9	[16.4-28.6]	289	
4	11.4	[7.3-17.3]	46.3	[38.0-54.8]	22.8	[16.4-30.8]	19.5	[11.2-31.7]	284	P=0.044
5	6.8	[3.8-11.8]	53.6	[45.5-61.6]	25	[18.9-32.4]	14.5	[9.6-21.2]	232	
6	10.5	[6.3-17.0]	42.4	[34.8-50.3]	32.9	[25.6-41.1]	14.2	[9.5-20.9]	199	
7	9	[6.6-12.0]	55.2	[50.3-59.9]	23.4	[19.7-27.7]	12.4	[9.4-16.1]	549	
Partner's age										
20-24	0		100		0		0		3	
25-29	11.3	[2.0-44.1]	61.5	[34.4-82.9]	25.4	[8.9-54.4]	1.8	[0.2-12.6]	24	
30-34	2.6	[1.0-6.5]	59.7	[48.7-69.9]	22.3	[14.5-32.7]	15.4	[8.4-26.6]	153	
35-39	10	[6.2-15.7]	49.8	[43.2-56.4]	25.2	[19.0-32.7]	15	[9.2-23.6]	275	P=0.694
40-45	6.6	[4.3-10.0]	52	[46.8-57.0]	26.6	[22.4-31.3]	14.9	[11.3-19.4]	494	
45-49	11.2	[7.6-16.0]	48.8	[42.5-55.2]	26.8	[21.2-33.3]	13.2	[9.3-18.4]	320	
50+	8.8	[6.7-11.4]	51	[46.6-55.4]	24.9	[21.5-28.7]	15.3	[12.2-18.9]	695	
Age difference between spouses										
Less than or equal age with partner	16.1	[9.8-25.4]	59.6	[50.2-68.4]	18.2	[12.2-26.2]	6.1	[2.9-12.4]	148	
Partner is older by 1-5 years	6.6	[4.9-9.0]	50.9	[46.5-55.3]	27.5	[23.8-31.5]	14.9	[11.9-18.5]	767	P=0.025

Partner is older by 6-10 years	7.8	[5.7-10.7]	49.9	[45.2-54.6]	25.5	[21.6-29.9]	16.7	[12.4-22.2]	658	
Partner is older by 1-5 years	9.5	[6.6-13.4]	52.7	[46.1-59.2]	24.1	[19.0-30.1]	13.7	[10.0-18.5]	389	
Age at first sex										
10-14	9.9	[6.5-14.7]	52.7	[45.1-60.2]	22.9	[17.5-29.3]	14.5	[9.7-21.1]	307	
15-19	9.3	[7.5-11.3]	52.5	[49.1-55.9]	23.6	[20.9-26.6]	14.6	[12.1-17.5]	1,243	
20-24	6.8	[3.4-13.2]	45.3	[36.6-54.3]	33.8	[25.1-43.7]	14.1	[9.1-21.2]	175	P=0.013
25-29	0.7	[0.1-4.8]	14.4	[4.7-36.3]	65.7	[40.1-84.6]	19.2	[6.1-46.6]	19	
30-34	0		82.2	[29.0-98.1]	17.8	[1.9-71.0]	0		2	
50+	3.7	[1.9-7.0]	50.6	[43.4-57.8]	29.7	[23.5-36.7]	16	[10.9-22.9]	239	
Regional Factors										
Residence										
Urban	5.5	[3.9-7.7]	42.5	[38.0-47.2]	30.6	[27.0-34.6]	21.3	[17.7-25.5]	1,039	P<0.001
Rural	11.4	[9.4-13.8]	61.1	[57.8-64.3]	20	[17.4-22.8]	7.5	[5.9-9.5]	950	
Fertility Belt										
Low fertility belt	6.2	[4.3-8.9]	42.4	[37.2-47.9]	30	[25.9-34.5]	21.4	[17.2-26.2]	875	
Medium fertility belt	10.3	[7.9-13.4]	56.5	[51.7-61.2]	23.6	[20.0-27.6]	9.6	[7.3-12.5]	495	P<0.001
High fertility belt	9.8	[7.6-12.6]	60	[56.3-63.6]	20.8	[17.6-24.5]	9.4	[7.3-12.0]	620	
Maternal health Status										
HIV Status										
HIV Negative	7.2	[5.8-8.9]	49.8	[46.6-53.1]	26.6	[23.9-29.6]	16.3	[14.0-19.0]	1,367	P=0.005
HIV Positive	8.8	[6.0-12.5]	59.3	[53.3-65.0]	22.2	[17.6-27.6]	9.7	[6.6-14.1]	462	
Antenatal Factors										
No	8.1	[6.6-9.9]	52.3	[49.2-55.4]	25.3	[22.5-28.2]	14.4	[12.0-17.2]	1,584	
Yes	9.5	[6.6-13.4]	47.9	[41.8-54.0]	26.7	[21.6-32.5]	16	[11.4-21.9]	405	P=0.659
Age at 1st birth										
10-14	5.2	[2.4-11.0]	51.1	[40.4-61.7]	32.1	[22.2-43.9]	11.6	[6.3-20.5]	125	
15-19	7.9	[6.3-9.9]	52.7	[49.0-56.4]	23.4	[20.8-26.3]	15.9	[12.9-19.5]	1,230	
20-24	11.1	[8.2-14.9]	47.4	[42.0-52.8]	28.6	[23.5-34.3]	12.9	[9.6-17.3]	515	P=0.244
25-29	4.5	[1.3-15.1]	52.7	[41.4-63.8]	30.8	[21.3-42.2]	11.9	[6.0-22.3]	100	
30-34	2.7	[0.4-17.4]	62.9	[36.1-83.5]	10.4	[3.4-27.4]	24.1	[7.1-56.7]	17	
40-45	0		100		0		0		4	
Total	**8.4**	**[7.0-9.9]**	**51.4**	**[48.5-54.3]**	**25.5**	**[23.3-28.0]**	**14.7**	**[12.6-17.1]**	**1,990**	

4.2.1.3 Association between socioeconomic, life style, demographic, regional factors and Secondary Infertility

Table 4-4 below shows cross tabulations of secondary infertility by socioeconomic, lifestyle, demographic and regional factors. The results show that there was a statistical significant association between secondary infertility and; demographic factors (i.e. a woman's age ($p<0.001$); her partner's age ($p<0.001$), the number of children a woman has had ($p<0.001$) , the age difference between spouses ($P=0.05$)), maternal health status (i.e. HIV status (($P=0.04$)) as well as antenatal factors (i.e. having a terminated a pregnancy ($p=0.019$)).

Therefore, 15.1 percent of the woman who had secondary infertility had secondary education compared to 10.3 percent of women who had no education. The study further found that secondary was the highest at 18.9 percent in the poorest women and 15.6 percent in women who abused a substance. Secondary infertility was highly prevalent (33.5%) in the age group 25-29, as compared to 5.7 percent women age in the age group 45-49. The results reveal that secondary infertility decreased with increasing age. Similarly, women with 1-2 children had the highest percentage (57.7%) of secondary infertility. Therefore, the study reveals that secondary infertility reduces with the increasing number of children a woman has had. Three in ten women who had a partner aged 25-29 had secondary infertility while 5.5 percent of women who had a partner aged 50+ has secondary infertility. Similarly, 22.3 percent of women who were had a partner less than or equal to their age had secondary infertility. Overall the results showed that secondary infertility in women decreased with an increase in the age difference between spouses. According to maternal health status 16 percent of HIV positive women had secondary infertility. The results further showed that 18.5 percent of the women who had secondary fertility ever had terminated a pregnancy.

Table 0-4: Percentage distribution of secondary infertility by socioeconomic, lifestyle, demographic, and regional factors, ZDHS 2013/14

	Fertile		Infertile			
	%	CI	%	CI	n	P-Value
Socio-economic Factors						
Highest educational level						
No education	89.7	[84.3-93.3]	10.3	[6.7-15.7]	225	
Primary	85.4	[82.9-87.6]	14.6	[12.4-17.1]	1,082	P=0.320

Secondary	84.9	[80.4-88.5]	15.1	[11.5-19.6]	574	
Higher	89.8	[82.1-94.5]	10.2	[5.5-17.9]	113	
Wealth Index						
Poorest	81.1	[74.4-86.3]	18.9	[13.7-25.6]	208	
Poorer	88.3	[83.8-91.7]	11.7	[8.3-16.2]	284	
Middle	86.1	[81.5-89.7]	13.9	[10.3-18.5]	371	P=0.432
Richer	86.1	[82.3-89.2]	13.9	[10.8-17.7]	537	
Richest	86.4	[81.7-90.1]	13.6	[9.9-18.3]	595	
Lifestyle Factors						
Substance use						
Non-User	86.3	[84.3-88.1]	13.7	[11.9-15.7]	1,680	P=0.478
User	84.4	[78.7-88.8]	15.6	[11.2-21.3]	315	
Demographic Factors						
Age						
25-29	66.5	[58.8-73.5]	33.5	[26.5-41.2]	180	
30-34	76.7	[70.3-82.0]	23.3	[18.0-29.7]	316	
35-39	83.2	[78.2-87.2]	16.8	[12.8-21.8]	433	
40-44	91.9	[88.7-94.3]	8.1	[5.7-11.3]	502	P<0.001
45-49	94.3	[91.8-96.2]	5.7	[3.8-8.2]	563	
CEB						
1-2	63.1	[57.3-68.5]	36.9	[31.5-42.7]	437	
3	82.8	[76.6-87.7]	17.2	[12.3-23.4]	290	
4	92.4	[88.4-95.1]	7.6	[4.9-11.6]	285	
5	93.7	[89.5-96.3]	6.3	[3.7-10.5]	232	P<0.001
6	89.7	[83.1-93.9]	10.3	[6.1-16.9]	202	
7	98	[96.1-98.9]	2	[1.1-3.9]	549	
Partners Age						
20-24	0		100		3	
25-29	78	[52.9-91.8]	22	[8.2-47.1]	24	
30-34	68.1	[59.1-75.9]	31.9	[24.1-40.9]	153	P<0.001
35-39	75.2	[68.4-81.0]	24.8	[19.0-31.6]	275	
40-45	83	[78.2-86.9]	17	[13.1-21.8]	494	
45-49	90.6	[86.5-93.6]	9.4	[6.4-13.5]	322	
50+	94.5	[92.1-96.2]	5.5	[3.8-7.9]	695	
Age difference between spouses						
Less than or equal age with partner	77.7	[69.0-84.5]	22.3	[15.5-31.0]	148	
Partner is older by 1-5 years	85	[81.8-87.7]	15	[12.3-18.2]	770	
Partner is older by 6-10 years	87.6	[83.9-90.5]	12.4	[9.5-16.1]	658	P=0.05
Partner is older by 15-20+ years	87.8	[83.5-91.2]	12.2	[8.8-16.5]	389	
Age at first Sex						
10-14	85.8	[80.8-89.6]	14.2	[10.4-19.2]	308	

15-19	86.6	[84.1-88.8]	13.4	[11.2-15.9]	1,247	
20-24	85.4	[77.9-90.6]	14.6	[9.4-22.1]	175	P=0.811
25-29	77.3	[51.7-91.5]	22.7	[8.5-48.3]	19	
30-34	100		0		2	
50+	84	[77.5-88.8]	16	[11.2-22.5]	239	
Regional Factors						
Residence						
Urban	86.3	[83.5-88.8]	13.7	[11.2-16.5]	1,042	
Rural	85.6	[83.0-87.9]	14.4	[12.1-17.0]	952	P=0.693
Fertility Belt						
Low fertility belt	86.9	[83.6-89.7]	13.1	[10.3-16.4]	878	
Medium fertility belt	83.5	[79.7-86.7]	16.5	[13.3-20.3]	496	P=0.273
High fertility belt	86.6	[83.6-89.1]	13.4	[10.9-16.4]	621	
Maternal Health Status						
HIV Status						
HIV Negative	85.9	[83.6-88.0]	14.1	[12.0-16.4]	1,369	
HIV Positive	84	[79.5-87.6]	16	[12.4-20.5]	462	P=0.0386
BMI						
Underweight	85.9	[78.7-91.0]	14.1	[9.0-21.3]	166	
Normal weight	84.5	[81.6-86.9]	15.5	[13.1-18.4]	1,023	
Overweight	86.4	[82.2-89.7]	13.6	[10.3-17.8]	508	P=0.166
Obese	90.8	[85.6-94.2]	9.2	[5.8-14.4]	292	
Antenatal Factors						
Terminated pregnancy						
No	87.1	[85.0-89.0]	12.9	[11.0-15.0]	1,589	
Yes	81.5	[76.5-85.6]	18.5	[14.4-23.5]	405	P=0.019
Age at first birth						
10-14	90.8	[82.5-95.4]	9.2	[4.6-17.5]	125	
15-19	85.9	[83.4-88.1]	14.1	[11.9-16.6]	1,232	
20-24	86.2	[82.0-89.5]	13.8	[10.5-18.0]	518	P=0.559
25-29	82.3	[72.4-89.1]	17.7	[10.9-27.6]	100	
30-34	75.8	[46.4-91.9]	24.2	[8.1-53.6]	17	
40-45	74	[15.1-97.9]	26	[2.1-84.9]	4	
Total	**86**	**[84.1-87.7]**	**14**	**[12.3-15.9]**	**1,995**	

4.2.2 Binary logistic regression

Relationship between socioeconomic, life style, demographic, regional factors and Secondary Infertility

After conducting binary logistic regression to ascertain relationships between secondary infertility and social-economic, lifestyle, demographic, regional factors. Table 4.5 shows findings of unadjusted regression outputs. Therefore, logistic regression findings reveal that there was statistical significant relationship between secondary infertility and; wealth index, age, children ever born, partners age, age difference between spouses as well as having a terminated pregnancy. The unadjusted odds ratios indicate that 56 percent of women from poorer homes had lower odds of suffering from secondary infertility as compared to women from poorest homes. Women in the age group 30-34, 35-39, 40-44 and 45-49 had lower odds (OR=0.61 CI: 0.374 - 0.981, OR=0.40 CI: 0.247-0.656, OR=0.17 CI: 0.105-0.291, OR=0.12 CI: 0.071-0.201) of having secondary infertility compared to women in age group 25-29 respectively. The odds of having secondary infertility reduced with increasing age from 39% in age group 30-34 to 88% in age group 45-49.

Similarly unadjusted odds ratios indicate that women with 1-2 children, 3 children, 4 children, 5 children, 6 children and 7+ children had lower odds (OR=0.35 CI: 0.226- 0.554, OR=0.14 CI: 0.081-0.244, OR=0.12 CI: 0.062-0.213, OR=0.20 CI: 0.106-0.367, OR=0.04 CI: 0.0180.072) of having secondary infertility compared to women in age group 25-29 respectively. The odds of having secondary infertility reduced with increasing number of children from 65% in women with 1-2 children to 96% in women with over 7 children. The findings also show that women with partners age 25-29, 30-34, 35-39, 40-45, 45-49 had higher odds (OR=4.81 CI: 1.378 – 16.783, OR=8.02 CI: 4.804 -13.391, OR=5.63 CI=3.420 – 9.268, OR 3.51 CI: 2.144 -5.736, OR 1.77 (0.997 - 3.133) of having secondary infertility compared to women with partners age 20-24 years. Similarly women with partners who were older by 1-5 years, partner is older by 6-10 years and 15-20 years had lower odds (OR=0.62 CI=0.378-1.001, 0.50 CI=0.283 – 0.867, 0.48 CI=0.268-0.866) of suffering from secondary infertility compared to women who had a partner who was younger or equal to them respectively. Furthermore, the results show that the odds of having secondary infertility was 1.54 (CI: 1.073 - 2.210) times higher in women who have ever terminated a pregnancy compared to those who had never terminated a pregnancy.

Table 0-1 logistic regression: relationship between secondary infertility and socioeconomic, lifestyle, demographic, regional factors, ZDHS 2013/14

Factor	Category	Odds Ratio	CI
Socio-demographic factor			
Wealth Index	**Poorest (RC)**	1	
	Poorer	0.56**	0.323 - 0.986
	Middle	0.69	0.409 - 1.161
	Richer	0.69	0.427 - 1.123
	Richest	0.67	0.397 - 1.136
Education			
	No education (RC)	1	
	Primary	1.48	0.883 - 2.475
	Secondary	1.55	0.891 - 2.680
	Higher	0.98	0.434 - 2.206
Lifestyle Factors			
Substance Use			
	Non User (RC)	1	
	User	1.16	0.768 - 1.756
Demographic Factors			
Age			
	25-29 (RC)	1	
	30-34	0.61**	0.374 - 0.981
	35-39	0.40***	0.247 - 0.656
	40-44	0.17***	0.105 - 0.291
	45-49	0.12***	0.071 - 0.201
CEB	**1-2 (RC)**	1	
	3	0.35***	0.226 - 0.554
	4	0.14***	0.081 - 0.244
	5	0.12***	0.062 - 0.213
	6	0.20***	0.106 - 0.367
	7	0.04***	0.018 - 0.072
Partners Age	**20-24 (RC)**	1	
	25-29	4.81**	1.378 - 16.783
	30-34	8.02***	4.804 - 13.391
	35-39	5.63***	3.420 - 9.268
	40-45	3.51***	2.144 - 5.736
	45-49	1.77*	0.997 - 3.133
Age Difference between spouses			
	>=. Partner (RC)	1	
	Partner Is Older By 1-5 Years	0.62*	0.378 - 1.001
	Partner Is Older By 6-10 Years	0.50**	0.283 - 0.867
	Partner Is Older By 15-205 Years	0.48**	0.268 - 0.866
Age at first sex	**10-14 (RC)**	1	
	15-19	0.93	0.613 - 1.420
	20-24	1.03	0.566 - 1.874

	25-29	1.77	0.523 - 6.000
	30-34	1.58	0.502 - 5.002
	35-39	0.88	0.098 - 7.835
Regional Factors			
Residence	**Urban (RC)**	1	
	Rural	1.06	0.787 - 1.435
Fertility Belt	**Low Fertility Belt (RC)**	1	
	Medium Fertility Belt	1.32	0.909 - 1.906
	High Fertility Belt	1.03	0.717 - 1.472
Maternal Factors			
HIV Status	**HIV Negative (RC)**	1	
	HIV Positive	1.17	0.823 - 1.655
BMI	**Under Weight (RC)**	1	
	Normal Weight	1.12	0.656 - 1.928
	Overweight	0.96	0.522 - 1.776
	Obese	0.62	0.314 - 1.217
Antenatal factors			
Ever terminated a pregnancy	**No (RC)**	1	
	Yes	1.54**	1.073 - 2.210
Age at first birth	**10-14**	1	
	15-19	1.62	0.753 - 3.487
	20-24	1.59	0.719 - 3.501
	25-29	2.13	0.839 - 5.403
	30-34	3.15	0.702 - 14.100
	40-45	3.47	0.197 - 60.892
	Constant		

CI in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.3 MULTIVARIATE ANALYSIS

Table 6 shows findings of adjusted regression outputs. Therefore, in model 6 logistic regression findings reveal that there was statistical significant relationship between secondary infertility and; wealth index , a woman aged between 40-49, the number of children she has had, age difference between spouses, living in a medium fertility belt, being HIV positive as well as having a terminated pregnancy after adjusting for other factors (independent variables). Women from poorer, richer and richest backgrounds had lower odds (AOR 0.47 CI: 0.223-0.975, AOR=0.43 CI; 0.231- 0.783, AOR=0.38 CI: 0.193-0.740) of suffering from secondary infertility as compared to women from poorest background after adjusting for education, substance use, children ever born, a woman's age, age difference between spouses, age at first

sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth. Results also show that women in the age group 40-44 and 45-49 had lower odds (AOR=0.46 CI: 0.208-0.856) and AOR=0.42 CI: 0.208 - 0.856) of having secondary infertility compared to women in age group 25-29 after adjusting for t for wealth index, education, substance use, children ever born, age difference between spouses, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth.

The results further show the odds of having secondary infertility was lower with increasing number of children after adjusting for education, substance use, a woman's age, age difference between spouses, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth. Women who had spouses that were 1-5 years older, 6-10 years older and 15-20 years older had lower odds (AOR=0.55 CI 0.307-0.979, AOR=0.50 CI=0.251-0.984, AOR =0.49 CI=0.248-0.970) of suffering from secondary infertility compared to women with spouses who were younger or the same age after adjusting for education, substance use, children ever born, a woman's age, wealth index, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth. Women in the medium fertility belt were 70% more likely to suffer from secondary infertility compared to women in the low fertility belt after adjusting wealth index, education, substance use, children ever born, a woman's age, age difference between spouses, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth.

HIV positive women were 30% less likely than HIV negative women to have secondary infertility after adjusting for wealth, education, substance use, children ever born, a woman's age, age difference between spouses, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth.. In addition women who had terminated a pregnancy were 54% more likely to have secondary infertility as compared to women who have not terminated a pregnancy before after adjusting for wealth education, substance use, children ever born, a woman's age, age difference between spouses, age at first sex, residence, fertility belt, HIV status, BMI, terminated a pregnancy and age at birth..

Table 0-6: Multivariate analysis of Predictors of Secondary Infertility, ZDHS 2013/14

		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		AOR	AOR	AOR	AOR	AOR	AOR
Factor	**Category**	**(CI)**	**(C1)**	**(CI)**	**(CI)**	**(CI)**	**(CI)**
Socio-economic Factors							
Education	**No education (RC)**	1	1	1			
	Primary	1.56	1.62	1.62			
		(0.830 - 2.948)	(0.864 - 3.025)	(0.863 - 3.028)			
	Secondary	1.25	1.28	1.27			
		(0.619 - 2.518)	(0.643 - 2.533)	(0.640 - 2.529)			
	Higher	0.49	0.48	0.49			
		(0.167 - 1.414)	(0.173 - 1.339)	(0.176 - 1.354)			
Wealth Index	**Poorest (RC)**	1	1	1			
	Poorer	0.41**	0.45**	0.45**	0.47**	0.46**	0.47**
		(0.193 - 0.874)	(0.213 - 0.951)	(0.212 - 0.947)	(0.225 - 0.987)	(0.222 - 0.970)	(0.223 - 0.975)
	Middle	0.76	0.78	0.76	0.79	0.77	0.76
		(0.396 - 1.457)	(0.409 - 1.497)	(0.399 - 1.444)	(0.425 - 1.452)	(0.417 - 1.412)	(0.413 - 1.417)
	Richer	0.48*	0.50*	0.46**	0.45**	0.44***	0.43***
		(0.222 - 1.020)	(0.244 - 1.026)	(0.242 - 0.879)	(0.243 - 0.831)	(0.240 - 0.801)	(0.231 - 0.783)
	Richest	0.52	0.52	0.47**	0.39***	0.38***	0.38***
		(0.214 - 1.276)	(0.227 - 1.199)	(0.229 - 0.969)	(0.198 - 0.750)	(0.195 - 0.737)	(0.193 - 0.740)
Lifestyle Factors	**Substance Use**						
	Non-User (RC)	1	1	1	1		
	User	1.23	1.22	1.22	1.18		
		(0.758 - 2.009)	(0.775 - 1.932)	(0.772 - 1.922)	(0.749 - 1.861)		
Demographic Factors							
Age	**25-29 (RC)**	1	1	1	1	1	1
	30-34	1.12	0.98	0.99	0.96	0.97	0.96
		(0.616 - 2.046)	(0.570 - 1.697)	(0.572 - 1.708)	(0.559 - 1.666)	(0.561 - 1.668)	(0.558 - 1.645)
	35-39	0.91	0.81	0.81	0.81	0.81	0.81
		(0.468 - 1.770)	(0.453 - 1.437)	(0.456 - 1.442)	(0.456 - 1.453)	(0.454 - 1.454)	(0.452 - 1.444)
	40-44	0.55*	0.47**	0.48**	0.47**	0.47**	0.46**
		(0.277 - 1.086)	(0.254 - 0.885)	(0.256 - 0.895)	(0.251 - 0.875)	(0.255 - 0.880)	(0.248 - 0.856)
	45-49	0.46**	0.42**	0.43**	0.42**	0.42**	0.42**
		(0.209 - 0.991)	(0.208 - 0.853)	(0.211 - 0.864)	(0.211 - 0.835)	(0.211 - 0.841)	(0.208 - 0.834)

CEB	**2 (RC)**	1	1	1	1	1	1
	3	0.28***	0.31***	0.31***	0.35***	0.35***	0.36***
		(0.172 - 0.462)	(0.193 - 0.509)	(0.193 - 0.508)	(0.218 - 0.560)	(0.219 - 0.565)	(0.225 - 0.584)
	4	0.11***	0.13***	0.13***	0.14***	0.14***	0.14***
		(0.057 - 0.212)	(0.071 - 0.237)	(0.070 - 0.236)	(0.077 - 0.256)	(0.078 - 0.256)	(0.079 - 0.259)
	5	0.09***	0.11***	0.11***	0.12***	0.12***	0.12***
		(0.044 - 0.204)	(0.054 - 0.216)	(0.054 - 0.217)	(0.058 - 0.233)	(0.058 - 0.234)	(0.059 - 0.239)
	6	0.17***	0.20***	0.20***	0.23***	0.23***	0.23***
		(0.081 - 0.364)	(0.098 - 0.425)	(0.098 - 0.425)	(0.109 - 0.469)	(0.109 - 0.468)	(0.109 - 0.468)
	7	0.03***	0.04***	0.04***	0.04***	0.04***	0.04***
		(0.011 - 0.071)	(0.015 - 0.083)	(0.015 - 0.083)	(0.017 - 0.090)	(0.017 - 0.091)	(0.017 - 0.091)
Age difference between spouses	**>=. Partner (RC)**	1	1	1	1	1	1
	Partner Is Older By 1-5 Years	0.51**	0.55**	0.55**	0.55**	0.54**	0.55**
		(0.275 - 0.935)	(0.313 - 0.968)	(0.311 - 0.964)	(0.312 - 0.966)	(0.305 - 0.955)	(0.307 - 0.979)
	Partner Is Older By 6-10 Years	0.49**	0.51**	0.51**	0.50**	0.49**	0.50**
		(0.245 - 0.971)	(0.261 - 0.992)	(0.260 - 0.991)	(0.257 - 0.980)	(0.250 - 0.967)	(0.251 - 0.984)
	Partner Is Older By 15-20 Years	0.44**	0.49**	0.49**	0.49**	0.48**	0.49**
		(0.216 - 0.892)	(0.253 - 0.952)	(0.253 - 0.951)	(0.251 - 0.947)	(0.245 - 0.934)	(0.248 - 0.970)
Age at sex	**10-14 (RC)**	**1**					
	15-19	0.82					
		(0.413 - 1.613)					
	20-24	1.20					
		(0.497 - 2.906)					
	25-29	2.19					
		(0.315 - 15.190)					
	30-34	1.80					
Regional factors							
Residence							
	Urban (RC)	1	1				
	Rural	1.13	1.16				
		(0.702 - 1.808)	(0.726 - 1.838)				
Fertility Belt							
	Low Fertility (RC)	1	1	1	1	1	1
	Medium Fertility belt	1.67**	1.65**	1.73**	1.62**	1.61**	1.60**
		(1.070 - 2.600)	(1.078 - 2.538)	(1.105 - 2.695)	(1.037 - 2.529)	(1.031 - 2.504)	(1.021 - 2.511)
	High Fertility belt	1.33	1.35	1.40	1.31	1.28	1.29

		(0.872 - 2.031)	(0.896 - 2.024)	(0.914 - 2.131)	(0.871 - 1.982)	(0.851 - 1.928)	(0.854 - 1.959)
Maternal Factors							
HIV status	**HIV Negative (RC)**	1	1	1	1	1	1
	HIV Positive	0.65**	0.70*	0.69*	0.70*	0.71*	0.70*
		(0.431 - 0.990)	(0.477 - 1.033)	(0.470 - 1.024)	(0.474 - 1.020)	(0.479 - 1.042)	(0.474 - 1.036)
BMI							
	Under Weight (RC)	1					
	Normal Weight	0.89					
		(0.427 - 1.857)					
	Overweight	0.82					
		(0.355 - 1.896)					
	Obese	0.57					
		(0.240 - 1.371)					
Antenatal Factors							
Terminated Pregnancy							
	Yes (RC)	1	1	1	1	1	1
	No	1.58**	1.48*	1.49*	1.50*	1.53*	1.55**
		(1.019 - 2.463)	(0.958 - 2.292)	(0.961 - 2.296)	(0.972 - 2.327)	(0.986 - 2.366)	(1.001 - 2.405)
Age at birth	**10-14 (RC)**	1					
	15-19	1.66					
		(0.489 - 5.610)					
	20-24	1.27					
		(0.344 - 4.696)					
	25-29	0.92					
		(0.184 - 4.621)					
	30-34	1.76					
		(0.276 - 11.235)					
	35-39	2.60					
		(0.173 - 39.196)					
Constant		**1.44**	**1.54**	**1.71**	**2.42***	**2.56****	**2.58****
		(0.345 - 6.027)	(0.523 - 4.534)	(0.628 - 4.655)	(0.964 - 6.055)	(1.025 - 6.403)	(1.023 - 6.526)
CI in parentheses (*** p<0.01, ** p<0.05, * p<0.1)							

4.4 Post Estimation Measure

Post estimation measure were undertaken to test the goodness of fit of the data, the Hosmer-Lemeshow goodness of fit was conducted-after fitting the final logistic regression model taking the survey sampling design into account, the F-adjusted test statistic (0.469) and Prob > F (0.896) goodness-of-fit residual test was applied and suggested no evidence of lack of fit.

4.5 Summary of findings

At univariate analysis the results also show that education levels are generally low as slightly more than a third (34.5%) of the women had attained education higher than primary education. There was a direct relationship between age and sample size: the older the age group, the higher the proportional representation. By parity, 27.5 percent of the women had seven or more children. The study found that nearly three quarters (74.8%) of the women were HIV negative and a quarter were HIV positive. Half (51.4%) of the women had normal weight, 2 in 10 (20.3%) of the women had terminated pregnancy and about two thirds (61.8%) had their first birth at 15-19 years old.

At bivariate level, there was a statistical significant association between mothers HIV status and; socioeconomic factors (i.e. a woman's education level (P<0.001), wealth index (P=0.001)); lifestyle factors (i.e. substance use (P<0.001)); demographic factors (i.e. children ever born P<0.001), partners age (p=0.003), age difference between spouses (P<0.001), age at first sex (p<0.001); regional factors (i.e. residence (P<0.001), fertility belt P<0.001)). Further, the results show that there was a statistical significant association between mothers BMI and; socioeconomic factors (i.e. a woman's education level (P<0.001), wealth index (P=0.001)); demographic factors (i.e. children ever born P=0.044), age difference between spouses (P=0.03), age at first sex (p=0.013); regional factors (i.e. residence (P<0.001), fertility belt P<0.001)); maternal health status (i.e. HIV status (P=0.005)). Lastly the results show that there was a statistical significant association between secondary infertility and; demographic factors (i.e. a woman's age (p<0.001); her partner's age (p<0.001), the number of children a woman has had (p<0.001) , the age difference between spouses (P=0.05)), maternal health status (i.e. HIV status ((P=0.04)) as well as antenatal factors (i.e. having a terminated a pregnancy (p=0.019)).

At multi variate analysis, in model 6 logistic regression findings reveal that there was statistical significant relationship between secondary infertility and; wealth index, a woman aged between 40-49, the number of children she has had, age difference between spouses, living in a medium fertility belt, being HIV positive as well as having a terminated pregnancy after adjusting for other factors (independent variables).

CHAPTER FIVE

Discussion, Conclusion and Recommendations

5.0 Overview

Secondary infertility does not only reflect the burden on women's inability to have the desired number of children, it also has negative effects on woman's social, economic and psychological lives. This study aimed at investigating the prevalence of secondary infertility and to determine its associated factors. The predictors of secondary infertility are discussed around identified as major variables in the study. The prevalence of secondary infertility found in this study validates the Government of Zambia's assertion that primary and secondary infertility are highly prevalent and of concern gauging from the prevalence of Sexually Transmitted Diseases (STDs) (MoH, 2008).

5.1 Prevalence of Secondary Infertility

The study observed that secondary infertility was prevalent in Zambia. Regional variations in secondary infertility was noted in this study evident from the high prevalence in regions of medium fertility belt. The study findings are in line with global literature where the prevalence of secondary infertility worldwide ranges between 10% and 15% (Janisch, 1991). Further, the study findings concur with findings by Mascarenhas who conducted a systematic analysis of infertility incidence in more than 190 countries and regions around the world that showed that the incidence of secondary infertility was 10.5% % (95% CI: 9.5–11.7) and infertility prevalence was highest in south Asia, sub-Saharan Africa, north Africa and the Middle East, central and eastern Europe, and central Asia. Similarly, Cong (2016) found that secondary infertility incidence in Suizhong County in China was 12.10% (95% CI: 11.13%-13.12%). A U.S. survey depicted 15,303 married women as having a 7.4% secondary infertility in 2002 (Stephen EH, 2006). In Tanzania, the incidence of secondary infertility among women was 6.9% (Geelhoed, 2002).

Furthermore, the study findings are similar to a study by (Vahidi, 2009) who found that secondary infertility incidence was 14.2% in an Indian Survey. Cumulative and current secondary infertility incidences were 24.9% and 3.4%, respectively, in a study of 10,783 women in Iran in 2009 (Vahidi, 2009). In a cross-sectional study conducted in 2004 entailing a population of more than 495,000 women, the five-year secondary infertility incidence was

21.6% (Jimei Cong, 2016). Cong compared the infertility incidence among couples living in different terrains and found that the highest incidence of infertility occurred in those who live in coastal areas, followed by those who live in plains and mountainous areas (ibid). This is an indication that secondary infertility is significantly associated to region and country. In Zambia, secondary infertility is high, and this may be explained by the fact that medical conditions continue to be lagged behind in Zambia, especially in rural areas, self-care for women is relatively poor, and women are more prone to suffer from the secondary infertility. The higher abortion and sexual transmitted infections incidence in Zambia may also a primary reason for the high secondary infertility incidence.

5.2 Determinants of Secondary Infertility

Age is among the many factors that are significantly associated with secondary infertility. The findings of this study revealed that younger women had a higher risk of secondary infertility. These findings are similar to a study by (Nirmalya, 2014) who found that most infertile females (56.54%) belonged to the age group of 25-34 years, which is quite a young age and comprehensive services are needed to be aimed at evaluation and management for infertility for a positive and fruitful result. Another study by (Jimei Cong, 2016) found that the increase of the female age reduces the odds of secondary infertility by 0.92 (95% CI, 0.87–0.97; P = 0.0028). However, these findings are different from most domestic and foreign reports have revealed a positive correlation between the prevalence of infertility and age. A study done in Turkey found that the risk of infertility was significantly higher among older women (Melike, 2018), and a study by (Samarakoon, 2002) found that the prevalence of secondary infertility was associated to increasing age of women. A woman's fertility peaks in the early and midtwenties, after which it starts to decline, with this decline being accelerated after the age of 35 and reduce severely around 40 (Cruz, 1999).

Therefore, the exact estimates of the chances of a woman to conceive after a certain age are not clear, with research giving differing results. However, the differences in these studies could be true because in this study there is a strong association between age and parity. Evidence from a study led by Getachew in 2010 also discovered parity to have an influence on fertility intentions because there is a tendency for the desire for additional children to decrease as the number of living children increases.

The secondary analysis of the 2013-14 ZDHS, reveal that there was a secondary infertility was associated with her husband/partners age. These results concur with findings from a study by (Samarakoon, 2002) who found that secondary infertility was associated to the increasing age of her partner. Similarly, (Taha, 2013) also found that a partner's age is statistically associated with a woman's age. This result can be explained by the advanced age and exposure to urogenital infections affecting the quantity and the quality sperms. In Africa, the sperm abnormalities were estimated at 68 percent for the age 31-40 years (Kumar, 2015).

Findings in this study also showed that the prevalence of secondary infertility reduces with the number of children. Women with more children are less likely to suffer from infertility because there is an association between number of children and parity. The findings of study reflect the findings by a (El-Nasr, 2016) who also found that number of living children were significantly correlated with secondary infertility. A study by Getachew discovered parity has an influence on fertility intentions because there is a tendency for the desire for additional children to decrease as the number of living children increases. The study findings also revealed there was a statistical significant relationship between a having a higher education and secondary infertility. These findings conform to a study by (Momtaz, 2012) who found that infertility was lower in women who attended graduate or more education. A study done in Turkey found that the risk of infertility was significantly higher among uneducated women (Melike, 2018). This negative relationship is strong and varies at different education levels. This could be because educated women generally have fewer children than uneducated women. Women's education levels affect infertility and fertility through its impact on women's health and their physical capacity to give birth, children's health, the number of children desired and woman's ability to control birth. Furthermore, women with higher education are equipped with knowledge and resources to seek treatment for their illness.

The study also found that women from rich, richer and richest backgrounds have lower odds of suffering from secondary infertility compared to women from poor backgrounds. These study findings conform to a study by (Benksim et al, 2018) that found that women with average and high income were less likely than women from low income homes to suffer from secondary infertility ($p<0.003$) . A study by (Kim, 2018) found that there was a strong correlation between a woman socio-economic status and secondary infertility. Similarly, another study by (Tukaram Kishanrao Pandve, 2016) reveals that lower socio-economic status is associated with

the secondary infertility. (Momtaz, 2012) Found that the socio-economic level of a couple can influence their type of infertility. (Kim, 2018) Postulates that this could be because of the relatively higher incomes and the income forgone due to children bearing leads them to want to have few children. The better care these women give increases their children's human capital and reduces the economic and need for more children; the positive health impact of high income on both women and their children mean women are better able to give birth and children's higher survival rate reduces the desire for more children. Further, these women are able to seek comprehensive treatment of their illness, hence reducing the chance of them suffering from secondary infertility.

Maternal factors like having terminated a pregnancy before been associated with secondary infertility. These study findings concur with a study by (Momtaz, 2012) found that secondary infertility was significantly associated to previous bad obstetric history (ever terminated a pregnancy) ($p = 0.011$) and Jimei Cong, (2016) found that found that the number of pregnancies (OR = 0.63; 95% CI, 0.51–0.79) was a protective factor for infertility and the number of abortions (OR = 2.15; 95% CI, 1.58– 2.93) was a risk factor for infertility. Similarly, a study by (Dhont, 2011) in Rwanda found that an adverse pregnancy outcome (stillbirth, curettage as a result of pregnancy termination) were risk factors for secondary infertility. Another study done by (El-Nasr, 2016) also found that maternal characteristics such a; gynaecological history and number of abortions were significantly correlated with secondary infertility. While a study by (Manna, 2014) found that higher abortion rates before infertility were associated with secondary infertility.

A history of high abortion rates among infertile couples reflect some wide spread biologic disorder. Intrauterine environmental considerations such as recurrent miscarriage are correlated with reproductive system infections, especially pelvic infections. An early study confirmed that pelvic infection is a vital factor leading to female infertility (Jimei Cong, 2016). Female pelvic infection can cause pelvic inflammatory disease and thus the occurrence of pelvic adhesions, resulting in infertility and negative-pressure operations during abortions may also cause immune infertility (ibid). Therefore, in order to reduce the incidence of infertility, there is need to expand knowledge and access to contraception so as to avoid the occurrence of unwanted pregnancy and pay greater attention to the dangers of abortion and to advocate overall safe medical treatment.

The study findings also revealed that HIV positive women were less likely to suffer from secondary infertility as compared to HIV negative women. This is in contrast with what most in early sub-Saharan African research that showed that fertility was 25-40% lower in HIV positive women than uninfected women. This was the first suggestion that HIV/AIDS was associated with fertility defects (Vitaly, 2002). However, to explore the link between infertility and HIV/AIDS, at population level, HIV prevalence was not significantly related to the prevalence of secondary infertility (DHS 2002, UNAIDS, 2002). "Several well-done studies have found no association between HIV infection and infertility" (Cejtin, 2006).

Unique psychosocial factor in patients with HIV infection may affect reproductive outcomes. A new diagnosis of HIV is often followed by a decrease of sexual activity in that individual. Studies demonstrate decreased pregnancy and birth rates among HIV infected women by their own choice (Stephenson, 1996). Additionally, HIV infected women are more likely to electively terminate pregnancy. Data from Britain and Ireland indicate a significant increase in pregnancy termination from 3.5 to 6.5 following a new HIV diagnosis that is consistent across age and ethnic groups (Vitaly, 2002). With the wide spread use of HAART, it is possible that behavioural factors and improvements in overall health and immune status in HIV infected women are sufficient to overcome alleged biological sub fertility caused directly by HIV infection. Other factors unrelated to decreased fecundability may include reduced coital frequency, desire family size and increased contraceptive use including condom use (Nebie et al 2001; Gregson et al, 2002). All this points to a complex relationship between infertility and HIV/AIDs.

Interestingly, the study found there was no association between secondary infertility BMI, status, woman's age at first birth, as well as her drinking alcohol or smoking cigarettes or both. These results are in contrast with a study by (Dhont, 2011) in Rwanda found that; the first pregnancy before the age of 21 years is a risk factor for secondary infertility. Momtaz, (2012), also indicated that secondary infertility was significantly associated with body mass index ($p=0.036$). Similar findings were shown in a study by Cong, 2016) in a rural county in China which found that the infertility incidence of underweight women (BMI <18.5 kg/m^2) was 1.5fold higher than that of women with moderate BMI (18.5–24.9 kg/m^2). Similarly, a systematic review by (Deyhoul, 2017) shows that lifestyle-related factors such as obesity,

nutrition, smoking and alcohol consumption, were evaluated as pregnancy changers. Shilpa, (2017) also found that lifestyle factors such as; body mass index, alcohol, and tobacco consumption are significantly related to secondary infertility.

The study found there was a statistical significant relationship between secondary infertility and; wealth index, women aged between 40-49, the number of children she has had, age difference between spouses, living in a medium fertility belt, being HIV positive as well as having a terminated pregnancy after adjusting for other factors (independent variables). These findings are in line with the conceptual framework that postulated that secondary infertility can be explained by socioeconomic factors such as wealth, demographic factors like age, parity and age difference between spouses, regional factors such as living in a medium fertility belt and intermediate factors like ever terminated a pregnancy.

5.3 Implications

Secondary infertility does not only reflect the burden on women's inability to have the desired number of children, it also has negative effects on woman's social, economic and psychological lives. A study by (Sami, 2006) found that secondary infertility in women results in marital dissonance, threatened divorce, husband's remarrying or to be returned to their parent's home (26%) by their in laws or husbands. The study also indicated that secondary infertility in women gave birth to domestic violence including women being physically and verbally abused by husbands and in-laws for being infertile. According Momtaz, (2012) the inability for couples to conceive disrupts their financial and economic status through costs incurred in an attempt to treat infertility. Despite not being at risk of mortality due to secondary infertility, infertility has the potential of causing irreversible damage to couples including isolation, stigmatization and gender-based violence.

5.4 Conclusion

The experience of infertility can greatly affect the couple's general health, marriage, family relationships, job performance and social interactions. Added to the emotional and physical toll exerted by infertility is the financial burden carried by some couples seeking treatment for their disease. Despite both the man and a woman suffering from infertility, in our society, only a woman is being considered responsible for child bearing and bears the brunt of being infertile. This irrespective of with whom the cause of infertility lies. Her inability to reproduce subjects her not only to contempt and exploitation but also results in severe psychological and physical

trauma affecting her physical, mental and social health. Therefore, the objective of this study was to determine the prevalence of secondary infertility and its associated factors in Zambia using the nationally representative demographic 2013/14.

Findings from this study showed that the prevalence of secondary infertility in Zambia was 14.89 % and the factors associated with secondary infertility are children ever born, residence, age, partners age, wealth index, medium fertility belt, education, being HIV positive and ever terminated a pregnancy. Therefore, the odds of having secondary infertility was lower with increasing number of children and this was statistically significant (<0.001). Similarly, women in the age group 40-44 and 45-49 were less likely (OR 0.48; p-value 0.016; CI (0.265-0.870)) and (OR 0.40; P-value 0.009; CI (0.197-0.769) to suffer from secondary infertility respectively. However, the odds of having secondary infertility was 1.6 (p-value 0.026) times higher for women who were in the medium fertility belt and was 1.5 (0.026) times higher in rural areas. Women from poorer, richer and richest backgrounds had lower odds (OR: 0.40 CI: 0.198 0.831, OR: 0.46 CI: 0.217-0.957 and OR=0.43 CI: 0.180-1.029) of having secondary infertility. HIV positive women were 30% less likely than HIV positive women to have secondary infertility.

The prevalence of secondary infertility found in this study validates the Government of Zambia's assertion that primary and secondary infertility are highly prevalent and of concern gauging from the prevalence of Sexually Transmitted Diseases. The study findings are in line with global literature where the prevalence of secondary infertility worldwide ranges between 10% and 15% (Janisch, 1991). Furthermore, these results are similar to a study carried by (ElNasr, 2016) who found a significant relationship between secondary infertility and woman background characteristics such as a woman`s age and place of residence. A study by (Samarakoon, 2002) found that the prevalence of secondary infertility was associated to increasing age of women and their spouses; and low socio-economic status were associated with increased prevalence. Maternal factors like having terminated a pregnancy before have been associated with secondary infertility. A study by (Momtaz, 2012) found that secondary infertility was significantly associated to previous bad obstetric history (ever terminated a pregnancy) (p = 0.011) and Cong, (2016) found that found that the number of pregnancies (OR = 0.63; 95% CI, 0.51–0.79) was a protective factor for infertility and the number of abortions (OR = 2.15; 95% CI, 1.58– 2.93) was a risk factor for infertility.

5.5 Recommendations

From the findings of the study, the following are the recommendations:

- Successful strategies to define and reach target groups (such as individuals at risk of developing infertility, or infertile patients) require the development and promotion of improved protocols, guidelines, and evidence-based practices, as well as rigorous evaluation of demonstration projects. It is incumbent upon policy makers, program planners, and consumers facing infertility to ensure the translation and application of research findings and population-based implementation of best practices nationwide.
- There is need to develop a national comprehensive public health plan for infertility prevention, detection and management so as to reduce the burden of infertility in Zambia by promoting behaviours that maintain fertility and promoting prevention, early detection, and treatment of infections (such as chlamydia) and other medical conditions that lead to infertility.
- A coalition of public and private sector organizations working together needs to identify opportunities and set priorities for reducing the burden of infertility in Zambia. The development of a comprehensive plan requires a coordinated, multidisciplinary approach to address infertility, from primary prevention to treatment and support.
- Policies and strategic plans must be developed that focus on cubing secondary infertility as it is prominent and an issue of concern. The provision of legislative frameworks will be a pillar for programming and implementation of secondary infertility matters.

- Programmes should be developed that focus on providing and disseminating comprehensive information on factors and determinants of secondary information at community level.

- Secondary infertility must be an integral component of maternal health programmes especially in antenatal and postnatal services. Information on determinants of secondary infertility must be disseminated to pregnant and postnatal mothers.

- Fertility clinics and counselling centers must be developed and/ strengthened to providing services related to secondary infertility

Future prospects

- Owing to the finding of secondary infertility, further research must be conducted that assesses the lived experiences of women suffering from secondary infertility. Infertility has been known to be associated psychological distress and trauma.
- While this study only looked at secondary infertility in women, it is recommended that future research should also attempt to measure the prevalence of secondary infertility in men as this the condition that men and women experience as a couple.

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Appendix