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# Lifestyle Factors associated with Pregnancy Losses in Zambia: Evidence from Zambia Demographic and Health Surveys (ZDHS)

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**Abstract:** ***The study used the Zambia Demographic and Health Survey (ZDHS) data to estimate pregnancy loss rates and investigate the lifestyle factors associated with pregnancy losses. Using the Potter and Adair's, 1949 criteria for classifying period of foetal development as cited by (Woods, 2009), the study revealed that Stillbirth Rate (SBR) declined from 28.5 stillbirths per 1,000 live births in 2001-2 to 19.58 stillbirths per 1,000 live births in 2013-14. Miscarriage rate also declined from 22.14 miscarriages per 1,000 live births to 14.22 miscarriages per 1,000 live births in the same period of time. Using multinomial regression, the study revealed that underweight and overweight women, as well as those who experienced sexual violence, were associated with high risks of pregnancy losses. In this regard, the study recommends enhanced policy efforts to reduce the prevalence of violence, obesity, and undernourishment among women in Zambia.***

**Keywords:** Foetal mortality, Stillbirths, Miscarriages, Lifestyle Factors, Zambia Demographic and Health Surveys

## 1. Introduction

Mortality studies have in the recent past and still continued to be very important in enhancing and influencing policies that are related to human welfare including health, actuarial and insurance, fertility, migration, and many other specific areas. While it is true that a lot of mortality related research has been conducted, the need for continued efforts to explore this area still remains undoubtedly true. Specific areas of interest within mortality have generated much interest in the past decades and still demand further research. Some of these areas include maternal, child, neonatal, infant health and pregnancy losses. With particular interest to pregnancy losses, there is an even bigger need to explore this important area as it is one of the factors that influence maternal health.

The loss of a foetus at any stage during pregnancy is referred to as foetal mortality. According to the 2003 revised Procedures for Coding Cause of Foetal Death under the ICD-10, the World Health Organization defines foetal mortality is a death prior to the complete expulsion or extraction from its mother of the product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such a separation the foetus does not breath or show any other evidence of life such as heart beating, pulsation of the umbilical cord or definite movement of the voluntary muscles (World Health Organization, 2003). Pregnancy loss is a serious complication that in most cases has short and long term implications especially on the wellbeing of women. Some of these complications include the increased risk of experiencing anxiety and depression following the intrauterine foetal death compared to women with a live birth (Boyle, *et al.*, 1996). The risk of experiencing depression and post-traumatic stress disorder is prevalent during the next pregnancy, particularly when conception occurs soon after the loss of pregnancy (Hughes, *et al.*, 1999). Some studies have established an association between intrauterine foetal deaths with other complications like the risk of long term psychological distress in women. A three year follow up Swedish study established that women who had experienced stillbirth were twice more likely to experience frequent anxiety symptoms compared to those with a live birth (Radestad, et al., 1996). Women who go through a loss of pregnancy usually go through emotional stress, disbelief, anger, guilt and may have difficulties in concentrating. Some women also are fatigued, have trouble with sleeping and many other individual complications that come with the loss of a foetus.

There are several psychological consequences of pregnancy losses. For example, a study of suicides in Finland identified significantly higher annual suicide rates among women who had miscarried a year prior to their suicide compared to women who had live births (Gissler, *et al.*, 1996). The loss of pregnancy robs men and women an opportunity to raise a child and form an identity as a parent. The consequences of pregnancy loss at society level also involve stigma and discrimination against the person who lost a pregnancy. This, in turn, creates emotional distress and isolation from the society which may, later on, lead to severe depression. Other effects may include an increased cost of maternal health care provision due to the increase in morbidity among women, who have had an intrauterine foetal death, and also the increased demand for more resources at the household level

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to pay for health care services that come as a consequence of foetal mortality.

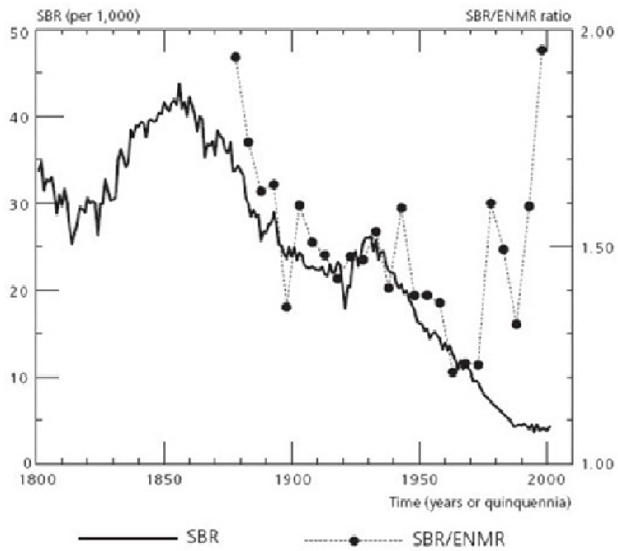


Figure 1: Stillbirth Rate (SBR), Norway, 1801-2000
Source: (Woods, 2005), based on registration data from Statistics Norway, Oslo.

Statistics on pregnancy losses were very scarce in most of the countries. However, some nations, especially in Europe, had been documenting figures on Stillbirths. For instance, Figure 1 shows the annual stillbirth rates for Norway from 1801 to 2000 and the ratio of stillbirth rate to the early-neonatal mortality rate (SBR/ENMR ratio) by quinquennia from 1876-1880 to 1996-2000. From Figure 1, stillbirth rates in Norway as in many developed countries started declining from its highest at about 43 per 1000 in 1850 while the SBR/ENMR ratio followed a U-shaped pattern (Woods, 2005).

Some European countries including Sweden, Denmark and Netherlands behaved in a similar pattern with that of Norway (Woods, *et al.*, 2006) and it was clear that late-foetal mortality declined from the 1850s to the 1930s. Outside northwest Europe, it is difficult to have a clear picture since stillbirths were not routinely registered in the civil systems (e.g. Great Britain) or a significant minority of the registered stillbirths were ‘’false stillbirths’’. However, reconstruction studies on families using ecclesiastical parish registers often provide estimates of neonatal, early neonatal, endogenous (from biometric analysis) and maternal mortality for periods before 1800. The availability of these rates encourages further estimation of late-foetal mortality (Woods, 2008).
Countries like England are an ideal case for such estimation exercises. Stillbirths were not registered in England and Wales until 1927 and not until 1939 in Scotland. The civil registration of vital events began in 1837 (1855 in Scotland) and had a strong bias towards medical statistics, especially age at death and cause of death, although there was no particular focus on early-age mortality until the 1900s. The rich supply of Anglican parish registers, some dating from the mid-sixteenth century, has inspired demographic research, much of which has been technically ingenious (Wrigley and Schofield, 1981, Wrigley, et al., 1997) as cited by Woods (2008). While the records of vital events from sources like parish registers cannot be treated uncritically, they provided a basis for estimation of foetal mortality. Woods (2005) used the variation of administrative districts in England and Wales to establish the association between the stillbirth rate and early neonatal mortality rate in 1931 in combination with the association between the stillbirth rate and the maternal mortality rate (MMR, deaths associated with pregnancy or childbirth per 10,000 deliveries). Although far from ideal, this method was at least empirically grounded and it did generate stillbirth rate estimates which were reasonable and consistent with expectations (Galley, 2008).

The English alongside the Norwegian experience according to figure 2 shows a time series for the stillbirth rate and the stillbirth rate/early neonatal mortality ratio for England and Wales derived from registration data from 1927 and data from Norway presented in figure 1. Both the stillbirth rate and early neonatal mortality ratio follow a U-shaped pattern. Stillbirths remained high in Britain before 1940 while in northwest European countries like Norway, Sweden, and Denmark, it made a steep decline in the late nineteenth century followed by stagnation during the early decades of twentieth-century (Woods, 2008).

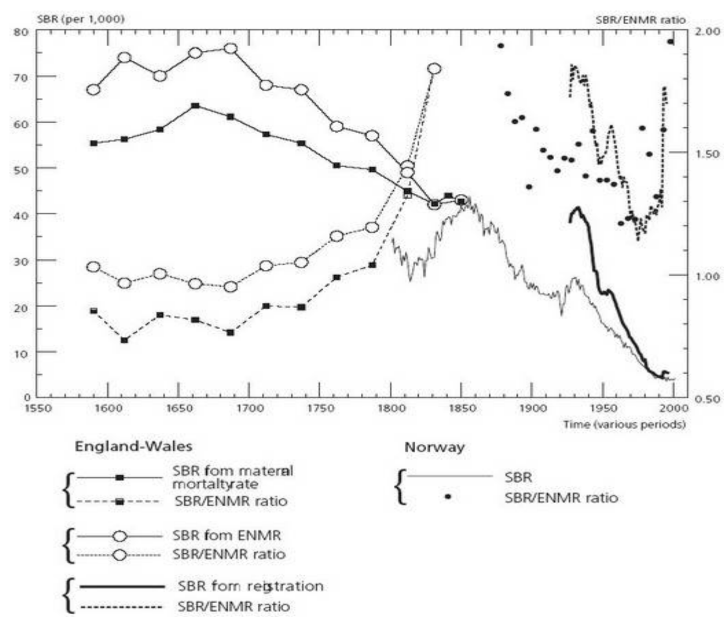


Figure 1: Estimated Foetal Mortality (Stillbirth Rate, SBR) and Ratios of Stillbirths to Early Neonatal mortality (ENNMR), England, Wales, and Norway, selected periods
*Source:* (Woods, 2005), *Table 1, p. 148; Registrar General’s Annual Statistical Reviews for England and Wales, 1927 onwards; registration data from Statistics Norway*

From figure 2, the stillbirth rate was between 60 and 70 per 1000 births in the 1600s but gradually declined to about 40 per 1000 live births around the mid-1800s in England and Wales.

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The global estimate of stillbirth rate in 2015 (as presented in Table 1) was 18.4 per 1000 live births. According to specific regions, the lowest rate of still births in 2015 in the developed region at 3.4 per 1000 live births while the highest stillbirth rate was in Sub-Saharan Africa at 28.7 per 1000 live births. Generally, stillbirth rates globally declined from 24.7 per 1000 live births in 2000 to 18.4 per 1000 live births in 2015 with the highest annual rate of reduction between 2000 and 2015 being recorded in Eastern Asia at 4.5 percent per annum and the lowest in Sub-Sahara Africa at 1.4 percent per annum.

**Table 1: Selected WHO estimates of Stillbirth rates, 2000 – 2015**

| | 2000 | | 2015 | | Annual rate of reduction in stillbirth rate 2000–15 |
|---|---|---|---|---|---|
| | Stillbirth rate per 1000 total births (uncertainty range) | Number of stillbirths (uncertainty range) | Stillbirth rate per 1000 total births (uncertainty range) | Number of stillbirths (uncertainty range) | |
| Developed region | 4·5 (4·4–4·6) | 59 000 (58 000–61 000) | 3·4 (3·4–3·5) | 47 000 (46 000–48 000) | 1·8 |
| Southern Asia | 35·5 (31·3–41·2) | 1 443 000 (1 266 000–1 684 000) | 25·5 (22·5–29·1) | 967 000 (847 000–1 104 000) | 2·2 |
| Caucasus and Central Asia | 16·8 (13·9–23·6) | 23 000 (19 000–33 000) | 11·9 (9·8–15·6) | 23 000 (19 000–31 000) | 2·3 |
| Eastern Asia | 14·3 (10·6–19·6) | 240 000 (177 000–331 000) | 7·2 (5·6–9·7) | 129 000 (100 000–175 000) | 4·5 |
| Latin America | 11·3 (10·3–12·8) | 135 000 (123 000–153 000) | 8·2 (7·5–9·2) | 91 000 (83 000–103 000) | 2·1 |
| North Africa and Middle East | 19·9 (17·7–23·6) | 156 000 (139 000–185 000) | 14·5 (12·9–17·5) | 148 000 (131 000–180 000) | 2·1 |
| Southeastern Asia | 17·0 (14·6–21·5) | 194 000 (166 000–246 000) | 12·2 (10·7–14·6) | 155 000 (135 000–186 000) | 2·2 |
| Sub-Saharan Africa | 35·6 (31·4–42·2) | 1 000 000 (879 000–1 194 000) | 28·7 (25·1–34·2) | 1 060 000 (923 000–1 271 000) | 1·4 |
| Worldwide | 24·7 (22·4–28·4) | 3 250 000 (2 931 000–3 740 000) | 18·4 (16·6–21·0) | 2 620 000 (2 359 000–2 984 000) | 2·0 |

Source: *(Blencowe, et al.,* 2016)

From Table 1, it is clear that developed regions recorded lower rates of stillbirth rates compared to the less developed ones. From figures 1 and 2 and table 1, it can be clearly seen that the global trend in the stillbirth rates in the developed regions specifically in Europe has seen a decline from as high as 60-70 per 1000 in the 17th century to as low as 4-6 per 1000 in the 21st century. This picture may represent other developed regions which do not have adequate data to make estimates from as far as the 17th century..

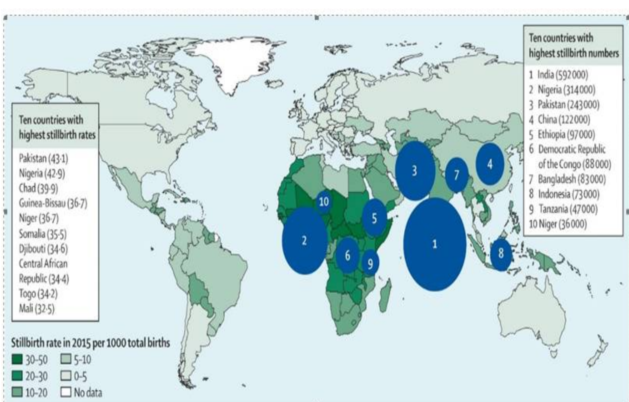


Figure 2: Estimates of Stillbirth rates in 2015.
*Source: (Blencowe , et al., 2016)*

Estimates as shown in Figure 3 show that the majority of the stillbirths occur in the less developed countries and most of these are from countries within Africa

In Zambia, the stillbirth rate in 2015 was estimated at 21 per 1000 live births and (UNICEF Zambia, 2015). In addition, study by Stringer and Vwalika (2011) in Lusaka estimated the stillbirth rate at 21 per 1000 live births.Data on miscarriages is very scanty and remains highly unreliable. While it is true that matters that relate to pregnancy losses are very key in not just enhancing maternal health but also increase chances of subsequent pregnancies being carried to full term and successful delivery, this area has remained largely underexplored in Zambia and therefore leaving a huge gap in terms of having evidence-based information that is useful in making maternal strategic health policy decisions.

In addition, Stringer and Vwalika in 2011 in a retrospective study in Lusaka estimated Stillbirth Rate (SBR) at 21 per 1,000 live births. Even if this estimate of 21 per 1,000 live births in 2011 was much lower than the Sub-Saharan average of 28.7 as at 2015 (Hannah, et al., 2016), SBR is much higher than other countries in the region like Botswana and Namibia (See Figure 3). Not only this, several demographic and socioeconomic factors have been highlighted globally by a number of studies as causes of pregnancy losses. Some of these include maternal age, gestational age, parity etc, but, some key variables that might have an influence on pregnancy losses like personal lifestyle factors (e.g. smoking, drinking, experience of violence etc) remain largely underexplored especially in Zambia. For instance, Asling-Monemi, et al., (2003), Jejeebhoy (1998) and Campbell, et al., (2004) argue that Gender Based Violence (GBV) has direct impacts on child mortality and maternal health and can have an effect on the unborn child. Intimate partner violence, particularly in pregnancy, results in increased infant and foetal death, low birth weight and under-five mortality. This study endeavoured to look into this unexplored area that relates to the personal lifestyle factors (e.g. violence, smoking and drinking habits etc.) as they influence pregnancy losses among women in Zambia.
In addition, majority of the studies in Zambia have been conducted based on data collected from health facilities like hospitals and clinics. This data may have some biasness in that it is largely based on reported cases at the facilities and

excludes pregnancy losses that occur outside health facilities and/or are not reported at the health facilities. In order to have a more refined picture of the problem, this study fills this gap by using Demographic and Health Survey data which is more representative due to the adequate research designs that were used to carry out these studies. In this regard, this study sought to estimate the pregnancy loss rate in Zambia using Demographic and Health data and to investigate the Lifestyle factors associated with Pregnancy losses in Zambia.

## 2.0 Theoretical/ Conceptual Framework

Figure 4 shows the Conceptual framework that was developed based on available literature associating lifestyle factors to pregnancy losses. For this study, the lifestyle factors which were investigated included nutritional status (measured through Body MASS Index), smoking, alcohol intake and experience of physical, sexual and emotional violence. There is evidence of several lifestyle factors accounting for pregnancy losses. For instance, Gender-Based Violence (GBV) and Sexual Violence increase the risk of foetal mortality. Asling-Monemi, et al., (2003), Jejeebhoy (1998) and Campbell, et al., (2004) argued that intimate partner violence particularly in pregnancy results in increased infant and foetal death, low birth weight and under-five mortality. GBV also leads to increased morbidity as abuse is linked to a range of gynaecological problems, chronic pain and psychological distress (Ellsberg, *et al.*, 2008). These can result in the loss of a pregnancy.

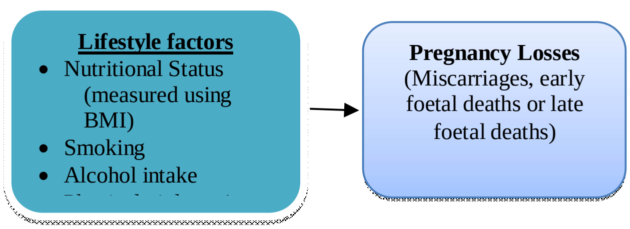


Figure 4: Conceptual Framework for the lifestyle factors associated with Pregnancy Losses
*Source: Author's construct*

Johnri, *et al.*, (2011) also revealed that the crude odds ratio (OR) of women reporting physical violence during the 12 months prior were more likely to experience miscarriage (OR = 1.83, 95% CI: 1.25 to 2.82, $p$ = 0.002). Tobacco use was another factor which was revealed as a significant predictor of miscarriages was tobacco use. There is evidence linking maternal obesity to pregnancy losses. Kristensen, et al., (2005) revealed a consistent doubling in the risk for foetal mortality in cases of maternal obesity - body mass index of at least 30. The authors further argued that the increase in body mass index of a woman increases the risk of several conditions which are known to increase the risk of stillbirth, such as diabetes, hypertensive disorders including pre-eclampsia and many others.

## 3.0 Methodology

### 3.1 Data Sources

This study used the Zambia Demographic and Health Survey (ZDHS) data of 2001-2, 2007 and 2013-14. These surveys whose target groups were men aged 15-59 years and women aged 15-49 years were designed to provide updated data on among other issues relating to the respondents' fertility levels and sexual activity among others.

### 3.2 Data Collection

In the 2001-2 ZDHS, a representative probability sample of approximately 8,000 households was selected for the ZDHS. This sample was constructed in such a manner as to allow for separate estimates for key indicators for each of the 9 provinces in Zambia. A list of Standard Enumeration Areas (SEAs) prepared for the 2000 Population Census constituted the frame for the ZDHS sample selection. A total of 320 clusters (100 urban and 220 rural) were selected from this frame. The final stage of selection involved the systematic sampling of households from a list of all households that were prepared for each of the selected SEAs. All women age 15-49 who were either permanent residents of the households in the ZDHS sample or visitors present in the household on the night before the survey were eligible to be interviewed in the survey. In addition, in a subsample of one-third of all the households selected for the ZDHS, all men age 15-59 were eligible to be interviewed if they were either permanent residents or visitors present in the household on the night before the survey (Central Statistical Office et al., 2003: 6). A total number of 8,050 households were sampled and 7,260 were found at the time of data collection and this shortfall was largely due to some structures being vacant. Out of the 7,260 existing households, 7,126 were successfully interviewed thereby having a 98 percent response rate. In the households that were interviewed, 7,944 eligible women were identified but out of this, 7,658 were interviewed thereby yielding a 96 percent response rate. A total of 2,418 eligible men were identified and 2,145 were successfully interviewed yielding a response rate of 89 percent (Central Statistical Office *et al.*, 2003).

The sampling frame that was used for the 2007 ZDHS was the Census of Population and Housing of 2000 which consisted of 16,757 Standard Enumeration Areas (SEAs). A representative sample of 8,000 households was selected which was a stratified sample selected in two stages from the sampling frame. This stratification was done by separating each province into urban and rural, therefore having 18 sampling strata from the 9 provinces. A two-stage selection was used to select samples from each stratum, implicit stratification was proportional allocation was achieved at each of the lower geographical/administrative levels by sorting the sampling frame according to geographical/administrative order and by using probability proportional to size selection at the first sampling stage (Central Statistical Office *et al.*, 2009). A total of 320 SEAs were selected in the first stage using probability proportional to the SEA size and the household listing operation was conducted in all SEA, with the resulting lists of households serving as a sampling frame for the selection of households in the second stage. The SEAs which were selected and had more than 300 households were segmented, with only one segment selected for the survey with probability proportional to the size. The listing of households was conducted only in selected segments. The ZDHS 2007 cluster was either an SEA or a segment of an SEA. An average number of 25 households were selected in every cluster using equal probability systematic sampling in the second stage (Central Statistical Office *et al.*, 2009). All women aged 15-49 years and men aged 15-59 years 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. The sample included 7,146 women aged 15-49 years and 6,500 men aged 15-59 years from urban and rural areas.

The 2013-14 ZDHS which was designed to provide estimates at national and provincial levels including urban and rural used an updated list of Enumeration Areas (EAs) for the 2010 Census of Population and Housing as the sampling frame. 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 were selected with probability proportional to size, 305 in urban areas and 417 in rural areas. Prior to selection, EAs were stratified by province and then into urban and rural. A complete listing of households in each selected cluster, along with a mapping exercise, was conducted from November 2012 to January 2013 by listers and mappers. Geographic coordinates were recorded for each sampled cluster by the listing teams using global positioning system (GPS) receivers (Central Statistical Office, 2015). In the second stage, the complete list of households was used as a sampling frame for the selection of households for enumeration. In each EA, an average of 25 households was selected and during this second stage, a representative sample of 18,052 households was selected. All women aged 15-49 years and men aged 15-59 years 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 (Central Statistical Office, 2015: 2).

## 3.3 Data Quality

One of the shortcomings of any survey is that of possible errors and these errors may affect the interpretation of the survey results. Large scale surveys like the ZDHS may have sampling errors, omissions, coverage and misreporting of events. In terms of age, there can be misreporting of the age of eligible women for the survey due to several factors including digit preference of 0, 2 and 5. In some cases, there is the distortion of the age distribution of women by the interviewers themselves and also with regard to eligibility (Lukama, 2014). In other cases, the interviewers may attempt to reduce the workload by not interviewing the eligible women or may push some eligible women in the age groups either beyond 49 years or below 15 years just in order to reduce on the workload of interviewing. These shortcomings may distort the true picture of the information about the estimates. Therefore, it was important to ensure that the data which was used in this study was of good quality; the estimates in the sample survey (e.g. ZDHS) represented those of the population in order to allow make good inferences. There are several ways of ensuring that the data being used from a sample survey is consistent with the population estimates, one of which was to use external consistency checks. In this study, the data for women in the reproductive age group was checked for consistencies with other sources. Table 2 shows the results:

**Table 2: Percent distribution of women aged 15-49 years**

| Age | Census (1990) | ZDHS (1992) | ZDHS (1996) | Census (2000) | ZDHS (2001-2) | ZDHS (2007) | Census (2010) | ZDHS (2013-14) | Census Projections (2014) |
|---|---|---|---|---|---|---|---|---|---|
| 15-19 | 12.9 | 12.3 | 11.0 | 11.7 | 10.5 | 9.2 | 11.7 | 11 | 12.1 |
| 20-24 | 10.2 | 8.9 | 10.1 | 10.4 | 9.6 | 8.3 | 10.4 | 9 | 10.3 |
| 25-29 | 7.6 | 7.2 | 7.1 | 7.9 | 7.9 | 8.0 | 7.9 | 8.5 | 8.4 |
| 30-34 | 5.9 | 5.6 | 6.0 | 5.8 | 5.6 | 6.2 | 5.8 | 7.5 | 7.1 |
| 35-39 | 4.0 | 4.0 | 4.2 | 4.6 | 4.4 | 4.4 | 4.6 | 6 | 5.2 |
| 40-44 | 3.7 | 3.1 | 3.1 | 3.5 | 3.5 | 3.3 | 3.4 | 4.5 | 4.0 |
| 45-49 | 2.9 | 2.4 | 2.7 | 2.6 | 2.6 | 2.7 | 2.6 | 3 | 2.8 |

The percent distribution of the women revealed a consistency between the surveys and census data. This revelation provided a higher level of confidence that the sample data was a good representation of the population data. Slight notable inconsistencies were observed between 2007 ZDHS and 2010 census data and to a lower extent between 2013-14 ZDHS and 2014 population projections data for the 15-19 years age category. These inconsistencies may be due to factors like under-reporting for this age group in the ZDHS data or even age shifting to the higher age group (20-24 years). It is however clear that the general consistencies between the survey and census data gave a greater level of confidence to permit analysis.

### 3.4: Data Processing, Estimation and Analysis Model

#### 3.4.1: Data Processing

IBM SPSS statistics version 22 was used to analyse the data. Before the data was analysed, weights were applied on the numbers of women in each category as Kalton, (1989) argues that incorporating weights in descriptive or inferential analysis is important in order to compensate for the unequal probability of selection, non response and non coverage and post-stratification and is often the easiest way to deal with disproportionate sampling. Performing data weights was key in achieving non-biased parameter estimates in order to produce estimates that are representative of the population. The weighted and unweighted data did not reveal any significant differences (See Table 3) and therefore all analysis used unweighted data.

#### 3.4.2Estimation of Pregnancy Losses

There are different definitions of pregnancy losses from different sectors and researchers. However, the estimation of pregnancy losses in this study used Potter and Adair's (1949) criteria for classifying period of foetal development. This criterion is based on three main parameters which include gestational age, weight, and length. The criteria categorises abortions as those with a gestational age of less than 154 days from the last menstrual period, pre-viable which is from 155 to 195 gestational age and viable with gestational age 196 to 265 days from the last menstrual period (Woods, 2009). Based on this information, the following were the

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estimates of the Pregnancy losses in months since this information in the Demographic and Health Surveys is collected in months:

(a) Abortions or Miscarriages: 154 days was estimated to be about 5 months. Therefore Miscarriages were estimated to be any pregnancies lost from 0 to 5 months gestational period;

(b) Pre-viable losses of between 155 and 195 days were categorized as early foetal deaths and estimated to be about 6 months of gestational period; and
(c) Viable losses of 196 to 265 days were classified as Stillbirths and estimated to be about 7 month's gestational period and above.

The estimations may not have been exact because the pregnancy losses are actually measured in gestational weeks while the Demographic and Health Survey data reports in months. However, these estimations are close to other standards including the Royal Statistical Society and the Obstetrics and Gynaecology Protocols and Guidelines of the University Teaching Hospital in Zambia. For instance, the Royal Statistical Society states that a Stillborn is a child born after a period of gestation of not less than 7 lunar months (28 weeks) and whose heart has seized to function before the whole of a body of such a child has been completely extracted from the body of the mother (Woods, 2009). In addition, the University Teaching Hospital in Zambia recommends an Intrauterine Foetal Demise (IUFD) as a death of the foetus > 24 weeks gestation while in utero (The University of Zambia School of Medicine, Department of Obstetrics and Gnynaecology, 2014).

Based on this information, the following were the classifications of Pregnancy losses used in this study based on months of the loss of pregnancy:

(a) Miscarriages: Pregnancies lost from the month of 0 to 5 gestational period;
(b) Early Foetal Deaths: Pregnancies lost in the 6th month of gestational period; and
(c) Late Foetal deaths: Pregnancies lost from the 7th month of gestational period.

Note: "***The combination of early and late foetal deaths in this study is what has been referred to as Stillbirths in the analysis e.g. in Figure 6***".

In addition, pregnancy losses reported as "Miscarriages" in this study did not distinguish between induced and spontaneous abortions because this data was not available. The classification was only based on the following variables extracted from the data:
(a) Ever had a terminated pregnancy? And
(b) Month pregnancy ended (for those who had a terminated pregnancy).

Based on the months when the pregnancy was ended, the classifications whether it was a miscarriage or foetal death were done.

### 3.4.3The Analysis Model

In order to investigate the Lifestyle factors associated with Pregnancy losses, multinomial logistic regression analysis was done. This was because the multinomial regression allows for a dependent variable with more than two possible outcomes. In this case, this analysis method was very applicable to pregnancy losses because of three possible outcomes namely miscarriages, early foetal and late foetal deaths. Multinomial regression also allows for nominal and/or continuous independent variables, a condition which was appropriate for the variables used in this study. Furthermore, the data met the other conditions of performing a multinomial regression. For instance, the dependent variable (Pregnancy loss) was measured at a nominal level in that it had mutually exclusive and exhaustive categories namely miscarriages, early foetal and late foetal deaths. In order to test for the Independence of Irrelevant Alternatives (IIA) assumption on the multinomial model, stata 15 was used. This test was important in ensuring that the alternative choices did not impact the relative probabilities of choosing others.

**Table 3: Distribution of women and Pregnancy losses**

| Age | Women* | Women** | Live births | Pregnancy Losses | | | |
|---|---|---|---|---|---|---|---|
| | | | | Miscarriages | Early foetal | Late foetal | Total |
| **2001-2** | | | | | | | |
| 15-19 | 1,806 | 1,811 | 572 | 37 | 12 | 28 | 77 |
| 20-24 | 1,648 | 1,664 | 2,568 | 86 | 22 | 85 | 193 |
| 25-29 | 1,361 | 1,376 | 4,045 | 91 | 25 | 91 | 207 |
| 30-34 | 972 | 972 | 4,303 | 104 | 32 | 93 | 229 |
| 35-39 | 778 | 766 | 4,499 | 95 | 29 | 99 | 223 |
| 40-44 | 606 | 601 | 4,179 | 67 | 24 | 72 | 163 |
| 45-49 | 487 | 467 | 3,639 | 59 | 19 | 60 | 138 |
| Total | **7,658** | **7,657** | **23,805** | **539** | **163** | **528** | **1,230** |
| **2007** | | | | | | | |
| 15-19 | 1,598 | 1,574 | 422 | 16 | 5 | 13 | 34 |
| 20-24 | 1,405 | 1,370 | 2,171 | 43 | 19 | 54 | 116 |
| 25-29 | 1,374 | 1,363 | 3,915 | 74 | 20 | 80 | 174 |
| 30-34 | 1,042 | 1,056 | 4,376 | 72 | 18 | 69 | 159 |
| 35-39 | 732 | 747 | 4,026 | 72 | 29 | 60 | 161 |
| 40-44 | 533 | 561 | 3,354 | 43 | 22 | 53 | 118 |
| 45-49 | 462 | 475 | 3,102 | 50 | 12 | 39 | 101 |
| Total | **7,146** | **7,146** | **21,366** | **370** | **125** | **368** | **863** |
| **2013-14** | | | | | | | |
| 15-19 | 3,686 | 3,625 | 971 | 25 | 5 | 30 | 60 |
| 20-24 | 3,040 | 3,006 | 4,124 | 85 | 31 | 90 | 206 |
| 25-29 | 2,789 | 2,813 | 7,932 | 120 | 39 | 141 | 300 |
| 30-34 | 2,435 | 2,475 | 9,988 | 124 | 41 | 153 | 318 |
| 35-39 | 1,975 | 2,009 | 10,382 | 127 | 36 | 138 | 301 |
| 40-44 | 1,466 | 1,464 | 8,959 | 130 | 32 | 117 | 279 |
| 45-49 | 1,020 | 1,018 | 6,851 | 99 | 26 | 85 | 210 |
| Total | **16,411** | **16,410** | **49,207** | **710** | **210** | **754** | **1,674** |

***Source:*** *Author's calculations (ZDHS 2001, 2007 and 2013/14 data)* ***Note:*** *** = weighted, * = unweighted*

## 4.0 Findings and Discussion

### 4.1 Findings

Figure 5 shows the pregnancy loss rates over the period 2001 to 2014. The losses had reduced over the period of study. The miscarriage rate reduced from 22.14 to miscarriages per 14.22 miscarriages per 1,000 live births from 2001-2 to 2013-14. Stillbirth rate (sum of early and late foetal death rates) dropped from 28.5 to 19.58 stillbirths per 1,000 live births from 2001-2 to 2013-14 (See Figure 6).

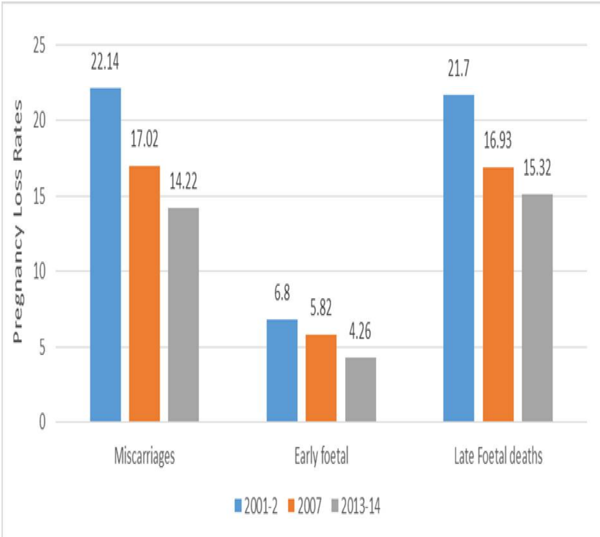


Figure 5: Pregnancy Loss Rates (Miscarriages, Early and Late Foetal deaths): 2001-2014

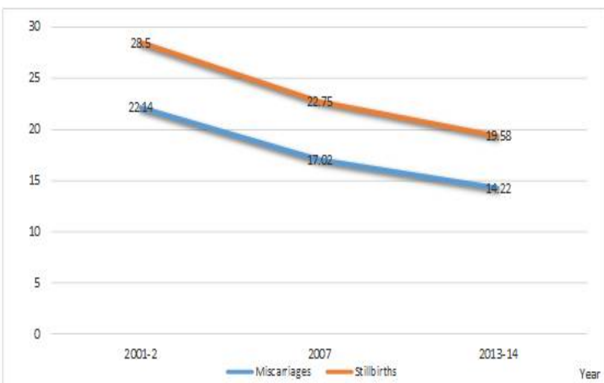


Figure 6: Estimates of Miscarriage and Stillbirth rates in Zambia from 2001 to 2014.

For the second objective, Table 4 shows the regression results of pregnancy losses with lifestyle factors. The model did not include smoking because the number of women who were smoking cigarettes were less than 1 percent and this caused challenges with the initial model which included the variable "smoking cigarettes". In addition, the test for the underlying assumption of Irrespective of Irrelevant Alternative (IIA) was conducted for all the data using the Hausman Test (Hausman and McFadden, 1984).

**Table 4: 2001-2 Parameter estimates of Lifestyle factors – model 2 (without smoking cigarettes)**

| Pregnancy Losses[a] | | | B | Std. Error | Wald | df | Sig. | Exp(B) | 95% C.I. for Exp(B) Lower Bound | 95% C.I. for Exp(B) Upper Bound |
|---|---|---|---|---|---|---|---|---|---|---|
| Miscarriages | | Intercept | .354 | .499 | .504 | 1 | .478 | | | |
| | Body Mass Index | Underweight | -.414 | .474 | .762 | 1 | .383 | .661 | .261 | 1.674 |
| | | Normal | -.382 | .438 | .762 | 1 | .383 | .682 | .289 | 1.609 |
| | | Overweight | -.463 | .487 | .904 | 1 | .342 | .630 | .243 | 1.634 |
| | | Obese | $0^b$ | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | .140 | .239 | .344 | 1 | .558 | 1.150 | .720 | 1.838 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced physical violence | No | .101 | .150 | .449 | 1 | .503 | 1.106 | .824 | 1.485 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | -.123 | .207 | .351 | 1 | .553 | .884 | .589 | 1.328 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| Early Foetal deaths | | Intercept | -1.678 | .877 | 3.659 | 1 | .056 | | | |
| | Body Mass Index | Underweight | .145 | .844 | .030 | 1 | .863 | 1.156 | .221 | 6.044 |
| | | Normal | .348 | .794 | .193 | 1 | .661 | 1.417 | .299 | 6.711 |
| | | Overweight | .145 | .860 | .028 | 1 | .866 | 1.156 | .214 | 6.240 |
| | | Obese | $0^b$ | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | .134 | .360 | .139 | 1 | .709 | 1.144 | .565 | 2.318 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced physical violence | No | .017 | .223 | .006 | 1 | .940 | 1.017 | .657 | 1.573 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | .068 | .319 | .045 | 1 | .832 | 1.070 | .573 | 2.000 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |

| Goodness-of-Fit | Chi-Square | Df | Sig. |
|---|---|---|---|
| Pearson | 43.927 | 42 | .390 |
| Deviance | 50.930 | 42 | .162 |

| Pseudo R-Square | |
|---|---|
| Cox and Snell | .004 |
| Nagelkerke | .005 |
| McFadden | .002 |

a. The reference category is: Late foetal deaths. b. This parameter is set to zero because it is redundant. ***=p<0.01,**=p<0.05, *=p<0.1

The women who were underweight, normal weight and overweight compared with those who were obese were all less likely to have miscarriages relative to late foetal deaths by 33.9 percent, 31.8 percent, and 37 percent respectively. In addition, the women who were not drinking alcohol and those who did not experience physical violence compared to those who were drinking were about 15 percent and about 10 percent more likely to have miscarriages relative to late foetal deaths respectively. This, however, was not statistically significant. Furthermore, women who did not experience sexual violence compared to those who experienced sexual violence were 11.6 percent less likely to have miscarriages relative to early foetal deaths and this was also not significant. For early foetal deaths, underweight, normal and overweight women compared to the obese ones were all more likely to have early foetal deaths relative to late foetal deaths by 15.6 percent, 41.7 percent, and 15.6 percent respectively. Similar to miscarriages, the women who were drinking alcohol compared to those who were not drinking were 14.4 percent more likely to have early foetal deaths relative to late foetal deaths. In addition, the women who experienced physical violence compared to those who did not experience physical and emotional violence were 1.7 percent and 7 percent more likely to have early foetal deaths relative to late foetal deaths. These results, however, were all not statistically significant. For the 2001-2 model, the Pearson chi-square (p = 0.390) and deviance (0.162) suggest the regression model with the predictor variables had a good fit because these values were greater than 0.05. The model further revealed a variation of 0.4 percent (Cox and Snell $R^2$: 0.004) in pregnancy losses was explained by the model and the Nagelkerke R-square indicated that 0.5 percent of the total variations in pregnancy losses occurred due to the variations among the predictor variables.

Table 5 shows the results of the 2007 regression of lifestyle factors with pregnancy losses. The variables “smoking cigarettes” and “physical violence” were omitted in model 2. The data revealed a statistically significant (p<0.1) risk of having miscarriages relative to late foetal deaths among women who were underweight. These compared to the women who were obese were more than 2.3 times more likely to have miscarriages relative to late foetal deaths. The others (normal and overweight) compared to the obese women were also more likely to have miscarriages relative to late foetal deaths though this result was not statistically significant. In terms of drinking alcohol, women who were drinking alcohol compared to those who were not drinking alcohol were 2.8 percent more likely to have miscarriages relative to late foetal deaths though this was not statistically significant.

In addition, women who did not experience sexual violence compared to those who experienced sexual violence were 45 percent less likely to have miscarriages relative to late foetal deaths and this was statistically significant (p<0.05). For emotional violence, the women who did not go through emotional violence compared to those who went through emotional violence were about 76 percent more likely to have miscarriages relative to late foetal deaths and this was statistically significant (p<0.01). The risk of having early foetal deaths relative to late foetal deaths was higher among underweight and overweight women though this was not statistically significant. Underweight women, normal women, and overweight women compared to obese women were 89.6 percent, 14.1 percent and 28.2 percent more likely to have early foetal deaths relative to late foetal deaths respectively. Those who were not drinking alcohol compared to the women who were drinking alcohol were more likely to have early foetal deaths relative to late foetal deaths though this was not statistically significant. This observation was similar to women who did not experience emotional violence.

**Table 5: 2007 Estimates of Lifestyle factors with pregnancy losses – model 2[1] (without “smoking cigarettes” and “physical violence”)**

| Pregnancy Losses[a] | | | B | Std. Error | Wald | df | Sig. | Exp(B) | 95% C.I. for Exp(B) Lower Bound | Upper Bound |
|---|---|---|---|---|---|---|---|---|---|---|
| Miscarriages | | Intercept | -.253 | .447 | .320 | 1 | .572 | | | |
| | Body Mass Index | Underweight | .847 | .485 | 3.050 | 1 | .081* | 2.332 | .902 | 6.033 |
| | | Normal | .440 | .371 | 1.409 | 1 | .235 | 1.553 | .751 | 3.212 |
| | | Overweight | .150 | .415 | .130 | 1 | .719 | 1.161 | .515 | 2.619 |
| | | Obese | 0[b] | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | .027 | .240 | .013 | 1 | .909 | 1.028 | .643 | 1.644 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | -.598 | .237 | 6.360 | 1 | .012** | .550 | .346 | .875 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |
| | Experienced emotional violence | No | .564 | .206 | 7.466 | 1 | .006*** | 1.758 | 1.173 | 2.634 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |
| Early Foetal deaths | | Intercept | -1.444 | .625 | 5.335 | 1 | .021 | | | |
| | Body Mass Index | Underweight | .640 | .636 | 1.013 | 1 | .314 | 1.896 | .546 | 6.589 |
| | | Normal | .131 | .495 | .071 | 1 | .790 | 1.141 | .433 | 3.006 |
| | | Overweight | .248 | .543 | .209 | 1 | .648 | 1.282 | .442 | 3.716 |
| | | Obese | 0[b] | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | .530 | .376 | 1.988 | 1 | .159 | 1.699 | .813 | 3.552 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | -.593 | .312 | 3.616 | 1 | .057* | .553 | .300 | 1.018 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |
| | Experienced emotional violence | No | .465 | .282 | 2.713 | 1 | .100 | 1.591 | .916 | 2.765 |
| | | Yes | 0[b] | . | . | 0 | . | . | . | . |

| Goodness-of-Fit | Chi-Square | Df | Sig. |
|---|---|---|---|
| Pearson | 45.010 | 46 | .514 |
| Deviance | 50.594 | 46 | .297 |

| Pseudo R-Square | |
|---|---|
| Cox and Snell | .031 |
| Nagelkerke | .036 |
| McFadden | .016 |

a. The reference category is: Late foetal deaths.
b. This parameter is set to zero because it is redundant. ***=p<0.01,**=p<0.05, *=p<0.1

The women who did not experience sexual violence compared to those who experienced sexual violence were 40.9 percent less likely to have early foetal deaths relative to late foetal deaths and this was statistically significant at 0.1. For the 2007 model, the Pearson chi-square (p = 0.514) and deviance (0.297) suggest the regression model with the predictor variables had a good fit because these values were greater than 0.05. The model further revealed a variation of 3.1 percent (Cox and Snell $R^2$: 0.031) in pregnancy losses was explained by the model and the Nagelkerke R-square indicated that 3.6 percent of the total variations in pregnancy losses occurred due to the variations among the predictor variables.

The 2013-14 final model, model 2 in Table 6 also did not include the two variables namely smoking cigarettes and physical violence because of the same reasons given for the other years. The analysis revealed that the underweight women compared to the obese ones were more likely to have miscarriages relative to late foetal deaths by 8.8 percent. In addition, the normal and overweight women compared to the ones who were obese were less likely to have miscarriages relative to late foetal deaths by 12.7 percent and 18 percent respectively. These results were however not statistically significant. In terms of drinking alcohol, the women who were not drinking alcohol compared to those were drinking alcohol were 20.5 percent less likely to have miscarriages relative to late foetal deaths while those who did not experience sexual violence compared to the women who experienced sexual violence were 10.5 percent more likely to have miscarriages relative to late foetal deaths. Higher odds

[1] Smoking and Physical Violence were omitted in the 2nd model because the percentages were too small.

(by 6.4 percent) of miscarriages relative to late foetal deaths were further recorded among women who did not experience emotional violence. These results were however not statistically significant.

For early foetal deaths, the women who were underweight compared to those who were overweight were more than 3 times more likely to have early foetal deaths relative to late foetal deaths and this was statistically significant at 0.05 ($p<0.05$). Those who were of normal weight compared to the women who were obese were about 82 percent more likely to have early foetal deaths relative to late foetal deaths. In addition, the women who were overweight compared to those who were obese were more than 2.3 times more likely to have early foetal deaths relative to late foetal deaths and this was statistically significant at 0.1 ($p<0.1$). Further, the women who were not drinking alcohol compared to those who were drinking alcohol were 17.6 percent less likely to have early foetal deaths relative to late foetal deaths while those who experienced sexual violence compared to those who did not were 46 percent more likely to have early foetal deaths relative to late foetal deaths. Women who did not experience emotional violence were associated with a less risk of having early foetal deaths relative to late foetal deaths by 0.9 percent. This, however, was not statistically significant. For the 2013-14 model, the Pearson chi-square ($p = 0.477$) and deviance (0.207) suggest the regression model with the predictor variables had a good fit because these values were greater than 0.05. The model further revealed a variation of 1 percent (Cox and Snell $R^2$: 0.010) in pregnancy losses was explained by the model and the Nagelkerke R-square indicated that 1.1 percent of the total variations in pregnancy losses occurred due to the variations among the predictor variables.

**Table 6: 2013-14 Estimates of Lifestyle factors with pregnancy losses – model 2 (without "smoking cigarettes" and "physical violence")**

| Pregnancy Losses$^a$ | | | B | Std. Error | Wald | df | Sig. | Exp(B) | 95% C.I. for Exp(B) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Lower Bound | Upper Bound |
| Miscarriages | | Intercept | .167 | .343 | .236 | 1 | .627 | | | |
| | Body Mass Index | Underweight | .085 | .309 | .075 | 1 | .785 | 1.088 | .593 | 1.996 |
| | | Normal | -.135 | .221 | .372 | 1 | .542 | .874 | .567 | 1.348 |
| | | Overweight | -.198 | .257 | .595 | 1 | .440 | .820 | .496 | 1.357 |
| | | Obese | $0^b$ | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | -.229 | .179 | 1.646 | 1 | .200 | .795 | .560 | 1.129 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | .100 | .237 | .176 | 1 | .675 | 1.105 | .694 | 1.759 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced emotional violence | No | .062 | .136 | .210 | 1 | .647 | 1.064 | .816 | 1.388 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| Early Foetal deaths | | Intercept | -2.021 | .590 | 11.726 | 1 | .001 | | | |
| | Body Mass Index | Underweight | 1.123 | .503 | 4.977 | 1 | .026** | 3.074 | 1.146 | 8.245 |
| | | Normal | .601 | .422 | 2.026 | 1 | .155 | 1.823 | .797 | 4.169 |
| | | Overweight | .845 | .454 | 3.463 | 1 | .063* | 2.327 | .956 | 5.666 |
| | | Obese | $0^b$ | . | . | 0 | . | . | . | . |
| | Drinks alcohol | No | -.194 | .258 | .562 | 1 | .453 | .824 | .497 | 1.367 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced sexual violence | No | .379 | .383 | .979 | 1 | .323 | 1.460 | .690 | 3.093 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |
| | Experienced emotional violence | No | -.009 | .197 | .002 | 1 | .962 | .991 | .674 | 1.457 |
| | | Yes | $0^b$ | . | . | 0 | . | . | . | . |

| Goodness-of-Fit | | | |
|---|---|---|---|
| | Chi-Square | Df | Sig. |
| Pearson | 45.896 | 46 | .477 |
| Deviance | 53.564 | 46 | .207 |
| **Pseudo R-Square** | | | |
| Cox and Snell | .010 | | |
| Nagelkerke | .011 | | |
| McFadden | .005 | | |

a. The reference category is: Late foetal deaths. b. This parameter is set to zero because it is redundant. ***=p<0.01,**=p<0.05, *=p<0.1

## 4.2 Discussion

The results highlighted in Tables 4, 5 and 6 generally show the overall models not to be significant. This clearly is an indication that most lifestyle factors may not be associated with pregnancy losses. Most literature has identified biological problems as being highly associated with the losses of pregnancies, and these were not included in this study. For instance, Elisabeth et al., 2013 in the study of the new insights into mechanisms behind miscarriages argued that recurrent miscarriage was thought to have multiple etiologies, including parental chromosomal anomalies, maternal thrombotic disorders, immune dysfunction and various endocrine disturbances. They further argued, "that epidemiological and genetic studies suggest a multifactorial background where immunological dysregulation in pregnancy in pregnancy may play a role, as well as lifestyle factors and sperm DNA integrity". Based on such arguments, it is clear that that in as much as literature identifies biological and medical challenges as being the major factors behind pregnancy losses, some lifestyle factors could potentially be risk factors.

Despite having the overall multinomial models not being significant, the results clearly identified that women who were underweight and overweight were associated with higher risks of pregnancy losses. This confirmed some literature which links Body Mass Index (BMI) with pregnancy outcomes. For instance, one study aimed at conducting a systematic review and meta-analysis of cohort studies of maternal BMI and the risk of foetal death, stillbirth and infant death. This study used data from cohort studies reporting adjusted relative risk estimates for foetal death, stillbirth and infant death by at least 3 maternal BMI. The study concluded that increases in maternal BMI were associated with increased risk of pregnancy loss, neonatal, perinatal and infant mortality (Dagfinn, et al., 2014). The evidence generated from this study as well as the literature clearly cements the argument that underweight and overweight as well as obesity are clear risk factors for pregnancy losses. Further, the benefits of addressing such negative lifestyle factors are huge and such benefits include the reduction in the costs of healthcare for the women who have complications arising from pregnancy losses. For instance, a study at three large hospitals in Michigan that used data collected over a period of 10 years (1996-2006) revealed that the average hospital costs for women with stillbirths were more than $750 higher than women with live births (Katherine et al., 2016).

In addition, this study revealed lower odds of pregnancy losses among women who did not experience sexual violence. In the 2007 results for example, the study revealed that the women who did not experience sexual violence compared to those who experienced sexual violence were 44.7 percent less likely to have miscarriages relative to late foetal deaths and these results were statistically significant at $p<0.1$. This is in line with a lot of literature that links sexual violence to loss of pregnancies. According to a study published in 2009 revealed that women who go through spousal abuse were at substantially increased risk of losing at least one pregnancy. Those who had experienced domestic abuse of any kind were 50 percent more likely to have had a single or repeated stillbirth or spontaneous abortion and sexual abuse had the strongest effect on foetal losses while emotional abuse had the strongest association with multiple stillbirths (Alio, et al., 2009).

## 5.0 Conclusion and Recommendations

Based on these findings, there are key lessons that can be drawn in order to promote healthy pregnancies for women. These include among others encouraging multi-sectoral programs that promote health lifestyles among women with the focus on nutrition for women, encourage physical exercises and many others in order to help curtail the prevalence of underweight and overweight among women of reproductive age and enhance girl and women empowerment programs, stiffen legislation, enforcement and multi-sectoral mechanisms that intended to eliminate incidences and prevalence of violence among women. This to some extent is happening though more effort is needed. The Government of the Republic of Zambia for instance enacted the Anti-Gender Based Violence Act, No. 1 of 2011 whose primary purpose was to provide for the protection of victims of gender-based violence, constitute for the Anti-Gender Based Violence Committee and establish the Anti-Gender Based Violence Fund among other things (Government of the Republic of Zambia, 2011). This legislation saw the strengthening of several policies including the revision of the National Gender Policy of 2000. This action was as a result of the limited understanding of gender mainstreaming among implementing institutions and inadequate Monitoring, Evaluation and Implementation Framework in the 2000 Gender Policy (Ministry of Gender and Child Development, 2014). Such efforts have been and remain key in addressing some of the challenges highlighted in this paper in order to mitigate the risk of pregnancy losses among Zambian women. Going forward, it is important that targeting of reproductive health interventions such as those centered around maternal and child health should take a multi-sectoral and be enshrined within appropriate policies.

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