Maternal undernutrition
The determinants and interventions in Lusaka, North western and Western Provinces, Zambia.

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51st International Course in Health Development/Master of Public Health (ICHD/MPH)

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KIT (ROYAL TROPICAL INSTITUTE)

Vrije Universiteit Amsterdam

Amsterdam, The Netherlands

Maternal undernutrition; the most important determinants and current interventions in Lusaka, North western and Western Provinces, Zambia.

A thesis submitted in partial fulfilled of the requirement for the degree of Master of Public Health

By

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Declaration

Where other people's work has been used (either from a print, internet or any other source), this has been carefully acknowledged and referenced in accordance with departmental requirements.

This thesis **maternal undernutrition; the most important determinants and current interventions in Lusaka, North western and Western Provinces, Zambia** is my own work, and I have no objection to publication of this work.

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Dedication

This study is dedicated to my wife, Maureen NC Kakoma, who accompanied me towards the end of my course in the Netherlands, my children (Simeon, Kasemuka and Ernest Jr) and Mama Lute Kakoma for their patience, love, tolerance, spiritual support and encouragement during my one year absence from home.

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Definition of terms

1. Body mass index (BMI) refers to the measure of weight divided by the square of height in meters (kg/m^2) applied to adult men and women.
2. Low birth weight refers to birth weight below 2800g whether born at full term or preterm.
3. Maternal refers to mothers especially during pregnancy, childbirth or shortly after child birth.
4. Micronutrient deficiency (also known as hidden hunger) is a form of undernutrition that occurs when intake or absorption of vitamins and minerals is too low to sustain good health and development in children and normal physical and mental function in adults.
5. Small for gestation age (SGA) refers to birth weight at full term less than <2800g.
6. Stunting refers to height for age less than < -2 Z score
7. Undernutrition refers to deficiencies in energy, protein, and/or micronutrients. Also weight below < 18.5kg/m2 (BMI) (Black et al. 2008), or <-2 score (BMIZ) and/or micronutrient deficiency while malnutrition refers to an abnormal physiological condition, typically due to eating the wrong amount and/or kinds of foods; encompasses undernutrition and overnutrition
8. Women of reproductive age (WRA) refers to women between 15 – 49 years

Sources: FAO (2013); IFPRI (2014) and von Grebmer et al. (2013)

List of abbreviations

AIDS	-	Acquired Immune Deficiency Syndrome
ANC	-	Antenatal Care
ART	-	Antiretroviral therapy
BEP	-	Balanced energy protein
BMI	-	Body mass index
BNB	-	Basic needs basket
CFR	-	Case fatality rate
CHAs	-	Community Health Assistants
CHAZ	-	Churches Association of Zambia
CHWs	-	Community Health Workers
CSO	-	Central Statistics Office
DALYs	-	Disability-adjusted life years
DES	-	Daily energy supply
DHO	-	District Health Office
FAO	-	Food and Agriculture Organisation
FP	-	Family planning
GDP	-	Gross domestic product
GNI	-	Gross National Income
GRZ	-	Government of the Republic of Zambia
HF	-	Health facility
HIV	-	Human Immunodeficiency Virus
HMIS	-	Health Management Information System
HRH	-	Human Resources for Health
IFA	-	Iron and folic acid
IMR	-	Infant mortality rate
IPTp	-	Intermittent presumptive treatment (pregnant women)
ITNs	-	Insecticide Treated Bed nets
IUGR	-	Intrauterine growth restriction
Kcal	-	Kilocalories

LCMS	-	Living Conditions Monitoring Survey
LMIS	-	Logistics Management Information System
M.I.I	-	Macro International Incorperate
MDGs	-	Millennium Development Goals
MMN	-	Multiple micronutrients
MMR	-	Maternal mortality ratio
MoH	-	Ministry of Health
NFNC	-	National Food and Nutrition Commission
NGOs	-	Non Governmental Organisations
NNM	-	neonatal mortality
NWP	-	North western Province
PHO	-	Provincial Health Office
PICT	-	Provider Initiated Counselling and Testing
PMTCT	-	Prevention of mother-to-child Treatment
PvtHE	-	Private health expenditure
SDGs	-	Sustainable Development Goals
SGA	-	Small for gestational age
SMAGs	-	Safe Motherhood Action Groups
SRHR	-	Sexual reproductive health and rights
SUN	-	Scaling Up Nutrition
TDRC	-	Tropical Diseases Researc Centre
TFR	-	Total fertility rate
THE	-	Total Health Expenditure
UHC	-	Universal health coverage
UMR	-	under five mortality rate
UNICEF	-	United Nations Children’s Fund
UNZA	-	University of Zambia
WHO	-	World Health Organisation
WRA	-	Women of reproductive age
ZDHS	-	Zambia Demographic and health Survey

Abstract

Background: Poor maternal nutrition increases the risk of both maternal and child morbidity and mortality. In Zambia, the prevalence of undernutrition among women of reproductive age (WRA) is 10.3%. The determinants and interventions have not been studied.
Objective: To explore determinants of maternal undernutrition, practices to address maternal undernutrition and recommend interventions in three provinces of Zambia.
Methodology: Literature review was conducted using the 2013 Lancet framework for maternal and child undernutrition to guide the analysis of the determinants of maternal undernutrition.
Findings: The determinants particularly affect the two rural provinces of Western and North western compared to more urban Lusaka province. They include high prevalence of poverty, early female adolescent pregnancies which affect education progression. Further, inadequate dietary diversity with high dependence on cereals and starchy roots coupled with low intake of micronutrients during pregnancy, high burden of infectious diseases like malaria in North western Province due to low insecticide treated bed nets (ITNs) distribution and high HIV prevalence in Lusaka and Western provinces. Low access to health services especially in rural provinces affects utilisation of services such as family planning, antenatal care and nutrition counselling, deworming and micronutrient supplementation receipt and adherence. Further, low access to sources of improved drinking water and sanitation in rural provinces results in increased risk of diseases, and micronutrient intake remains low due to limited dietary diversity and inadequate policies on nutrition and food fortification as only vitamin A is fortified in sugar and iodine in salt. Some interventions to address maternal undernutrition include iron-folic acid supplementation, deworming and provision of intermittent presumptive treatment of malaria including family planning for WRA. Some of the best practices to addressing maternal undernutrition include community and schools involvement.
Conclusion: Maternal undernutrition has myriad of determinants resulting in inadequate dietary intake and increased burden of infections.
Recommendations: Multisectoral approach supported by policies on nutrition and food fortification, conditional cash transfer, micronutrient supplementation for adolescent girls and pregnant women, tailored for supplementation for food insecure pregnant women, access to family planning including for adolescents, disease prevention and treatment, improved sources of drinking water and sanitation and research in nutrition and adolescents health.

Key words: Maternal, undernutrition, determinants, interventions, Zambia

Word count: 12,170

Introduction

As a Health Promotion Officer at provincial health office, my main role is to enable people and communities increase control over their determinants of health and live healthy lifestyles. In 2013, after a formative study on knowledge, attitude and practices of maternal nutrition, I discovered that pregnant women had unique nutritional needs that required special attention.

This study explores the most determinants of maternal undernutrition and proposes interventions through multisectoral and community participation to address these determinants in order to improve the nutrition status of women and children. I believe that maternal nutrition influences children's nutrition and wellbeing. Undernutrition among WRA (10.3% in Zambia) (CSO et al. 2013) increases the risk of maternal and child morbidity and mortality, foetal deprivation leading to low birth weight (LBW), increases the risk of neonatal morbidity and mortality including stunting with negative consequences of survival, healthy development, and economic productivity of the country (Black et al. 2008; 2013).

Improvement of maternal nutrition before and during pregnancy is a key component of maternal and infant survival, and child growth and development, and has positive externalities on overall development of a country. Good maternal nutrition is more than just food but focuses on all interventions that reverse maternal and infant morbidity and mortality.

This paper explores the determinants of maternal undernutrition, interventions to address maternal undernutrition and proposes interventions to address maternal undernutrition in three provinces of Zambia namely Lusaka, North Western and Western provinces. Prior to that, background information and the problem statement including justification of the study and methodology have been provided.

Chapter one

1.1. Background information

1.1.1.Geographic information

The Republic of Zambia is found in Southern Africa. It covers a total area of 752,612km^2 surrounded by eight neighbouring countries. It is a landlocked country located between latitudes 8° and 18° south and longitudes 22° and 34° east (Central Statistical Office [CSO] 2013). Administratively, Zambia is divided into ten provinces and these are Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, North western, Southern and Western provinces. Lusaka is the Capital City and seat of the government. The country has a tropical climate and three distinct seasons; the cold and dry season, the hot and dry season and the hot and wet season.

1.1.2.Demographic information

Zambia's population in 2015 is projected at 15.5 million people (CSO 2013). 50% of the population is below the age of 15 years, and approximately 23% are women of reproductive age (WRA) (CSO et al. 2014). The proportion of rural and urban population is 65.3% and 34.7% respectively with an annual population growth rate is 2.7% (CSO 2013).

1.1.3.Health status and the health system

1.1.3.1. Health status

Annex A, table A.1.1 shows that Zambia has recorded improvements in many health indicators, although the morbidity and mortality rates are still high. Maternal mortality ratio (MMR) declined by about 33% from 591/100,000 live births to 398/100,000 live births from 2007 to 2013-14 respectively (CSO et al. 2014). Though MMR declined, it was 90% higher than the global maternal mortality ratio of 210/100,000 live births in 2013-14 (CSO et al. 2014) which is far from achieving the set millennium development goals (MDGs) of reducing MMR to 162/100,000 live births by 2015 in Zambia (Zambia Ministry of Health [MoH] 2011). Infant mortality rate (IMR) reduced by approximately 36% from 70/1,000 live births in 2007 to 45/1,000 live birth by 2013-14 (CSO et al. 2014). Female average life expectancy at birth increased from 46.1 in 1990 to 53.3 in 2013-14 and total fertility rate reduced from 6.2 to 5.3 births per woman.

As shown in annex A, table A.1.1 and A.1.3, some of the major causes of morbidity and mortality are malaria, pneumonia anaemia, malnutrition and cardiovascular diseases. HIV/AIDS prevalence has reduced from 14.3% in 2007 to 13% (15% women and 11% men) in 2013-14, is still a major contributing factor for tuberculosis (TB) and cryptococcal meningitis infections which are among the top causes of mortality in Zambia (CSO et al. 2014; MoH 2015).

1.1.3.2. Health system

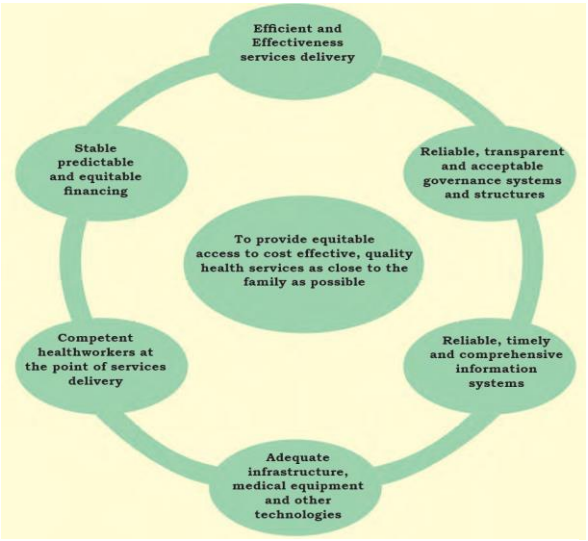


Figure 2.1: Conceptual framework of Health System building blocks in Zambia. Source: MoH 2012

Figure 1.1 shows Zambia's conceptual framework of the health system building blocks with the MoH vision in the centre.

Health services delivery: Zambia has a three tier health services delivery, with a total of 1,956 public health facilities, which included six specialised hospitals (tertiary), 19 General hospitals (secondary), and 84 District hospitals, 1,540 Urban and Rural Health Centres and 307 Health Posts (primary) (CSO 2013; MoH 2012; 2013a). 99% of urban households compared to 50% rural of counterparts have access to health facilities within 5 km distance (MoH 2011), while rural areas (50%) still experience challenges with geographical access, transport and communication, essential drugs and medicines including human resources. There are private health provider like faith-based organisations (6%) through Churches Health Association of Zambia (CHAZ) but supported by government in terms of financing and human resources, and private-for-profit health providers (13%) (MoH 2013a).

Health policy and financing: Currently, the government provides free primary health care and treatment of chronic diseases such as HIV/AIDS and tuberculosis including child and maternal health services funded from the national budgetary allocation (MoH 2011), in order to ensure universal health coverage (UHC) of health care as inscribed in the vision in figure 1.1. Secondary and tertiary health care including private health care are paid through out-of-pocket payments which is about 28% of the total health expenditure (THE) and 67% of the private health expenditure (PvtHE) including private health insurance schemes which constituted 3% of PvtHE in 2013 (WHO 2015).

Health resources for health (HRH): Zambia has HRH shortages especially for core health as seen in figure 1.2, HRH gap as at 2012. Challenges exist in terms of inequality in distribution and skills mixes, with urban areas being better served than rural areas. Zambia is constructing new hospitals and 600 health posts thus more human resources are required (MoH 2011; 2013b). Retention schemes assist in reducing HRH attrition and migration

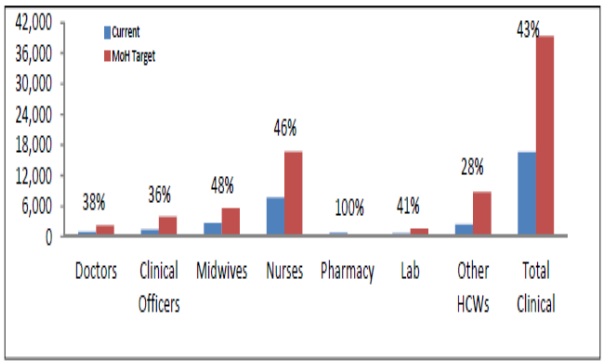


Figure 1.2: Healthcare worker gap to funded establishment, 2012. Data source: MoH 2013

including the training and recruitment of community health assistants (CHAs) who a cardinal in delivery of primary health care.

Medical products and other technologies: Medical products are managed through a logistics management information system (LMIS) using pull and push systems, both bulk supplies and essential drugs kits system. Vaccines supplies and other technologies (medical equipment) are mainly supplied through a pull system where reporting is the standard for further support. Between 2009 and 2010, drugs availability was about 80% but there is still a weak cold chain system especially in rural health facilities (MoH 2011).

Health information: There are two major sources of information; routine (health facilities) and non-routine (surveys or research). Routine is collected, aggregated, analysed and processed by the health management information system (HMIS). There HMIS flows from health centre (paper) to the district (electronic) then the province and final the national level. Non routine information is collected periodically like demographic and health surveys (MoH 2011).

Leadership and governance: The MoH has four levels which include: the MoH Head Office responsible for policy guidance and oversight, the Provincial Health Offices (PHOs) responsible for technical supportive and performance management to districts; the District Health Offices (DHOs) provides support to Health Posts, Health Centres and 1st level hospitals; and the health service delivery facilities which provides promotive, preventive and curative services to the general population (MoH 2013). However, with the decentralisation policy, all health services will be under local governments (Government of the Republic of Zambia [GRZ] 2013).

1.1.4.Lusaka, North Western and Western Provinces

Lusaka province more urbanised and the provincial capital is Lusaka, while the other two provincial capitals are more rural, both are based about 600 kilometres from Lusaka.

Lusaka province is the smallest geographically with the highest population density of above 100 people/Km^2 (CSO, 2010) and has a projected population of 2.8 million by 2015 (CSO 2013). The major economic activities include trading, manufacturing, construction, transport and agriculture. The poverty levels are relatively low (24.4%) by 2010 (CSO 2012). The capital city is cosmopolitan but the major spoken languages are Nyanja, English and Bemba and the seat of almost all the major health facilities, education institutions and administrative functions of the nation.

Solwezi is the province capital of North Western Province, the second biggest province geographically, with a projected population of 834,000 by 2015 (CSO 2013) and has the lowest population density of 6

people/Km^2 (CSO 2010). The major economic activities include mining, subsistence farming, trading and lumbering. The major ethnic groups include the Lunda, Luvale and Kaonde. Poverty levels were high (67%) in 2010 (CSO 2012).

Mongu is the province capital of Western province, the biggest province geographically, mainly sandy with a lot of flood plains, and a population of 992,000 (CSO 2013) with a population density of 9 people/Km^2 (CSO 2010). It is predominantly inhabited by the Lozi speaking people. The major economic activities include agriculture, fishing and trading with high poverty levels at 80.4% in 2010 (CSO 2012).

1.1.5.Socioeconomic status

According to 2006 – 2010 LCMS report, 60.5% of Zambians were classified as poor with 42.3% being extremely poor (CSO 2012), higher in rural areas than urban areas (78% and 27.5% respectively), among female headed households (62.4%) compared to male headed households (60.1%) and elderly headed households (those 65 or above) (80%). The country has 73 ethnic groups but major officially spoken languages are Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja and Tonga. English is the official language and medium of instruction. The major religion being Christianity, but there is freedom of worship (CSO 2013).

1.1.6.Literacy

It is estimated that 64% of women and 82% of men are literate. Literacy rates among men range from 71% in Eastern to 90% in Copperbelt province (CSO et al. 2014). Further, 83% of urban women are literate compared to 54% of their rural counterparts indicated by high literacy in Copperbelt province (84%) which is urban compared to Luapula province (48%) which is rural with the least literacy levels among women (CSO et al. 2014).

1.1.7.Nutrition status of WRA (includes LBW and under five underweight)

According to ZDHS 2013-14, 10.3% of women of reproductive age (WRA) were undernourished while 40% of under-five children were stunted, 6% wasted and 15% were underweight (CSO et al. 2014).

Chapter two

2.1. Statement of the problem, justification, objectives and methodology

This chapter describes the problem statement, justification of the study, objectives and the methodology that focus on undernutrition among WRA in the Zambia.

2.1.1.Statement of the problem

Maternal undernutrition contributes to about 3.1 million or 45% of under five children deaths due to stunting, wasting and micronutrient deficiencies of which 800,000 neonatal deaths were due to small for gestation age (SGA) births in 2011, because it determines birth outcomes which is an important determinant of undernutrition in early life (Black et al. 2008; Bhutta et al. 2013). According to Black et al. (2013), low-body mass index (<18.5kg/m^2) among women of reproductive age (WRA) which indicates maternal undernutrition is prevalent in Asia and Africa and has effects both on the course and outcome of pregnancy (Black et al. 2013).

2.1.2.Population affected

According to the Zambia Demographic and Health Survey (ZDHS) 2007, the underweight rate among WRA, was 9.1% in 1996 but increased by 13% to 10.3% by 2014 though it fluctuated upwards in 2007 (CSO et al. 2009; CSO et al. 2014). Although maternal nutrition during pregnancy has never been assessed (CSO et al. 2009; 2014), the prevalence of anaemia among pregnant women (haemoglobin [Hb] <11g/dl)) was 47% in 1999 (Luo, Mwela and Campbell 1999), categorised by World Health Organisation (WHO) as a severe public health problem[1], (WHO 2008; Fiedler, D'Agostino and Sununtnasuk 2014), and reduced to 39.1% between 2006-2008 (FAO faostat3) which is still a public health problem.

According to ZDHS 2013-14 (CSO et al. 2014, p. 176), the mean BMI for rural women was 21.9kg/m^2, compared to 23.8kg/m^2 for urban women. Undernutrition among WRA in rural areas higher than their urban counterparts (12% and 8% respectively) (CSO et al. 2014). The proportion of women with a normal BMI among WRA in rural and urban areas were 77.7% and 62.8% respectively. Among WRA, the overall prevalence of normal weight, overweight and obesity were 67%, 16.1% and 6.7% respectively. The rural to urban prevalence of overweight is 11.7% to 21.1% while for obesity is 2.9% and 10.8% respectively (CSO et al. 2014). Urban areas have a higher burden of overweight and obesity while rural areas have a higher burden of undernutrition among WRA. Variations in undernutrition rate among WRA exist in different regions.

[1] WHO categorized the prevalence of anaemia as a public health problem as follows: <5%, no public health problem; 5-19.9%, mild public health problem; 20-39.9%, moderate public health problem; ≥40%, severe public health problem

Lusaka provincial recorded constant undernutrition rate among WRA (8%) from 2007 to 2013-14, in NWP the rate reduced by nearly a third from 14% to 10% in the same period, while in Western province, the prevalence increased by about 42% from 14% to almost 20% from 2007 to 2013-14 (CSO et al. 2014).

2.1.3.Contributing factors

Women with no formal education (11.9%) are more undernourished compared to those with higher than secondary education (5.2%) (CSO et al. 2014). Economic status of women showed that the lowest quintile had high maternal undernutrition (15.7%) compared to the highest wealth quintile (7.7%) (CSO et al. 2014).

2.1.4.Effects of maternal undernutrition

The risks associated with maternal undernutrition affect both the course and outcome of pregnancy (Black et al. 2013) and increases the risk of maternal morbidity and mortality. Low pre-pregnancy BMI denotes a critical risk factor for poor birth outcomes and obstetric complications (Kramer 1987; Kramer & Victora 2001; WHO 2002), such as 60% of increased need for assisted (non-spontaneous) or caesarean deliveries and which together with iron deficiency anaemia contribute 20% of maternal mortality (Black et al. 2008)

Maternal undernutrition leads to greater deprivation of the foetus resulting in intrauterine growth restriction (IUGR), hence children are born small for gestational age (SGA) and/or low birthweight (LBW) (Black et al. 2008) or increased preterm births (Christian et al. 2013). Children also have increased risk of perinatal and neonatal morbidity, disability or death secondary to gross neurologic and developmental abnormalities (Wu et al. 2004; Osrin 2000; Black et al. 2008; 2013; UNICEF 1999; Black et al. 2013).

According to Black et al. (2013), maternal undernutrition is a major determinant of both child stunting and subsequent obesity and non-communicable diseases in adulthood (Black et al. 2013; NFNC 2011; WHO 2002; Black et al. 2008). Other long-term challenges in childhood include poor mental and cognitive development which has consequences for adulthood life, productivity and income earnings (Victora et al. 2008), which ultimately affect a country's productive and economic development (Victora et al. 2008; Thomas & Frankenberg 2002; Walker et al. 2007).

2.1.5.Some efforts to address maternal undernutrition

Zambia has recognized the importance of addressing maternal undernutrition as it plays a central role in the health status of the population and in meeting the Millennium Development Goals (MDGs) by strengthening maternal, newborn and child health (MNCH) strategies (MoH 2011). These include a strengthened Campaign for the Accelerated

Reduction of Maternal Mortality in Africa (CARMMA) strategy, and community involvement in MNCH and nutrition services (MoH 2011).

2.2. Justification for the study

Though evidence shows that maternal undernutrition has negative impact during the course and outcome of pregnancy, analysis of the determinants of maternal undernutrition, in order to plan appropriate strategies to address it have rarely been conducted. Such an analysis is undertaken for Lusaka, North Western and Western provinces of Zambia in order to better understand what the determinants are and whether approaches should be tailored for different areas or can be the same for different areas within the country. The study describes who is affected and the current interventions addressing maternal undernutrition, and proposes interventions to reduce maternal undernutrition and its consequences. The questions are; what are the immediate, underlying and basic determinants of maternal undernutrition in Zambia, particularly in North western, Western and Lusaka Provinces of Zambia? What are the interventions to address maternal undernutrition during pregnancy? What are some of the best practices to address maternal undernutrition?

2.3. General objective

The study explores the determinants of maternal undernutrition, interventions addressing undernutrition during pregnancy and proposes intervention strategies to reduce maternal undernutrition and improve birth outcomes in three provinces of Zambia.

2.3.1.Specific objectives

1. To describe the prevalence and correlation between undernutrition among WRA (using BMI) and child nutrition status (LBW and stunting) in three provinces of Zambia and over time,
2. To explore the immediate, underlying and basic determinants of poor maternal nutrition in three provinces of Zambia,
3. To identify interventions to address maternal undernutrition during pregnancy,
4. To identify some best practices to address maternal undernutrition.
5. To propose interventions strategies in order to address maternal undernutrition in three provinces of Zambia.

2.4. Methodology

2.4.1.Literature search strategy

Table 2.1: Literature search strategy

The study uses secondary literature	Source	To describe the prevalence and correlation between undernutrition among WRA (using BMI) and child nutrition status (LBW and stunting) in three provinces of Zambia and over	To explore the most important immediate, underlying and basic determinants of poor maternal nutrition in three provinces of Zambia,	To identify current interventions to address maternal undernutrition during pregnancy	To identify some best practices to address maternal undernutrition
Published peer reviewed papers	Google scholar Pubmed Vu library	Maternal AND child undernutrition low birth weight Child stunting	• Maternal AND child undernutrition • Water AND sanitation AND undernutrition "maternal" • nutrition-sensitive AND nutrition-specific	Maternal AND child undernutrition; nutrition AND interventions	Interventions AND undernutrition "maternal" best practices AND nutrition "maternal"
Grey literature	Google Institutional websites; • MoH • CSO • FAO • WHO	Low birth weight Nutrition status Body mass index	• Low birth weight • Nutrition status of women • HIV prevalence • Poverty • Food security • WHO indicators • Antenatal care	Iron supplementation Deworming medication	
Other sources	Electronic documents • Annual health statistical bulletin • Formative Research in Action		Feeding practices	Insecticide treated nets	

PubMed, google scholar and Vu Library were searched for peer reviewed literature. Used words and/or combinations as shown in table 2.1 above. Grey literature was searched from Zambian government official websites of the MOH and CSO for survey documents and health information data. I compiled all the findings using data from primary survey documents. International institutions like WHO and FAO were also searched for data. Saved electronic files were also searched for maternal nutrition information.

Literature included is from 1999 to 2015, excluded was news, editorials and commentaries that do not contain sufficient rigor of information. Literature search was conducted only in English for easy of understanding.

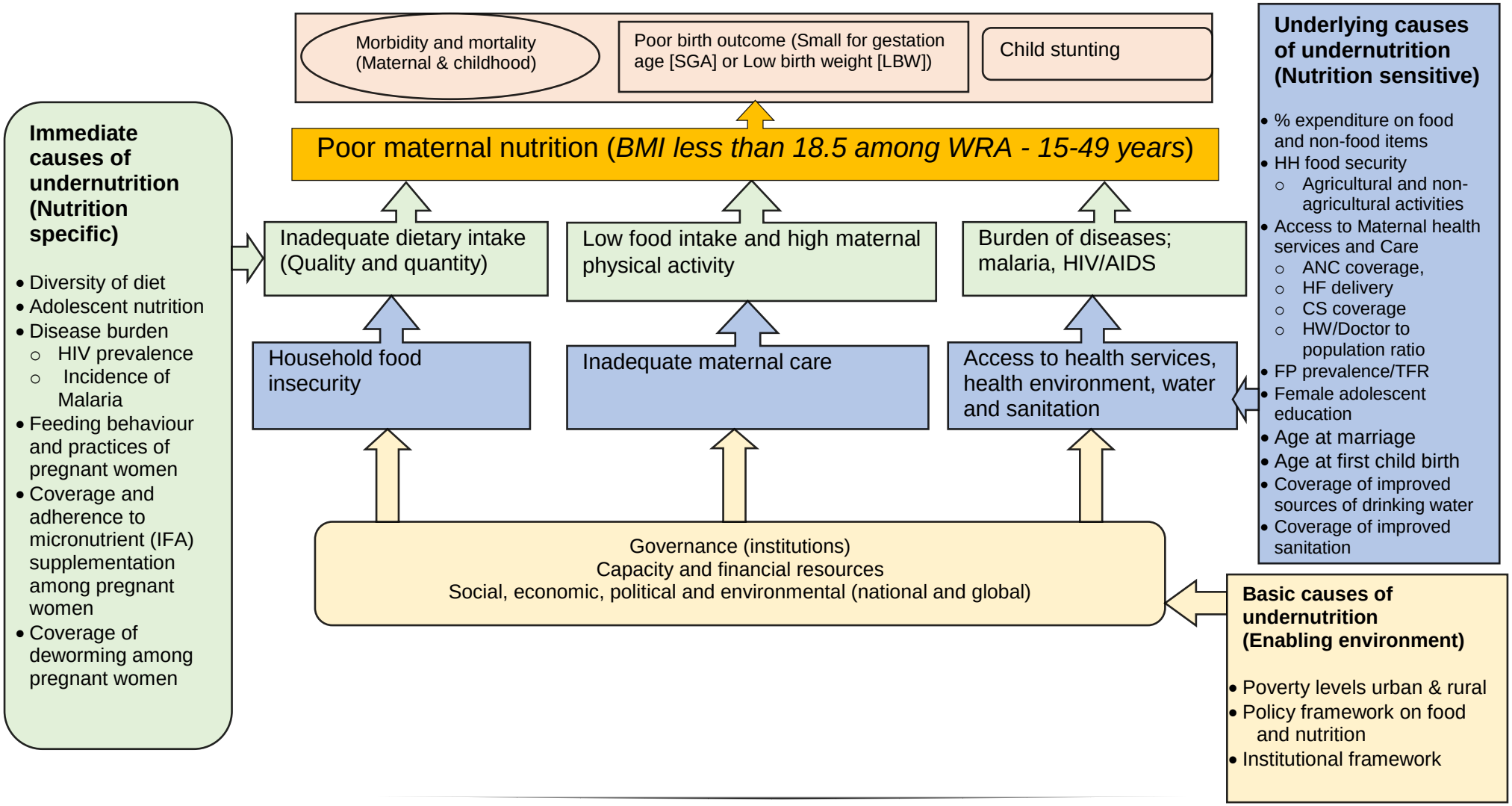
2.4.2.Conceptual framework – Lancet 2013

As shown in figure 2.1 below, the thesis adapts and modified the 2013 Lancet conceptual framework by Black and others on maternal and child undernutrition and overweight in low-income and middle-income countries (Black et al. 2013) which identifies three main intervention namely; nutrition specific, nutrition sensitive and building an enabling environment, including some of the immediate effects.

The 2013 Lancet framework was selected because it is the most recent and comprehensive framework adapted after the UNICEF framework of causes of maternal and child undernutrition. It interlinks various determinants like nutrition, behaviour and education with interventions that enhance optimum nutrition, growth and development such as food security, health care and environmental conditions. It provides a broader platform for explaining determinants of undernutrition and the interventions. It summarizes interventions as nutrition-specific (address immediate determinants), nutrition-sensitive (address underlying determinants) and enabling environment (address basic determinants) (Black et al. 2013).

However, the 2013 Lancet conceptual framework is generic and primarily focused on foetal and child growth, mainly to guide post-natal interventions to prevent and reduce child undernutrition, and does not focus on determinants of maternal undernutrition. To overcome these limitations, the author modified the framework to exclude indicators for foetal and child nutrition and replaced them with maternal nutrition indicators to analyse determinants and interventions for maternal nutrition such as improving nutrient intake or reducing disease burden; micronutrient supplementation, access to maternal health care, age at first childbirth/marriage and female adolescent education.

Figure 2.1: Adapted and modified for maternal undernutrition in Zambia from the 2013 Lancet framework for maternal and child undernutrition and overweight by the author.



2.4.3.Criteria for selection of provinces

Three provinces were selected for the study by purposive sampling. Two rural provinces and one urban province were selected. The first rural province is the working area (NWP) of the researcher and the other was the worst performing (Western) in terms of the prevalence of undernutrition among WRA according to the recent ZDHS 2013-14 report. From among the two urban provinces, Lusaka was sampled conveniently due to its urbanised setting and as the best performing province with relatively low and stable prevalence of undernutrition among WRA. It's good to make contrasts, that's why a good and a poor performing province are included as well as an intermediate and most familiar province to the researcher.

Chapter three

3.1. Findings of the study

The findings outline begins by describing the prevalence of undernutrition among WRA, the correlation between undernutrition among WRA and LBW as well as child stunting to show the levels of these different forms of undernutrition and the relationship between them in the different parts of the country. As no data were found on pregnant women, as a proxy the data of WRA, this might constitute a bias. Graphs and tables have been used to describe determinants of maternal undernutrition including the interventions to address maternal undernutrition in Zambia with emphasis on three provinces.

3.1.1. The prevalence and correlation between undernutrition among WRA (using BMI) and child nutrition status

3.1.1.1. Prevalence of undernutrition among WRA in Zambia

Table 3.1: Distribution characteristics of undernutrition among WRA denoted by BMI <18.5Kg/m^2 by age, residence, province, educational status and economic status in Zambia - 2007 and 2014.

Characteristics	2007	2013-14
Age		
15-19	14.6	16.4
20-29	8.4	8.5
30-39	8.1	8
40-49	7.3	9
Province		
Central	9.3	10.5
Copperbelt	7.4	9
Eastern	6.6	7.8
Luapula	13.4	11.1
Lusaka	7.8	8.2
Muchinga[2]		14
Northern	13.1	13.5
North western	14	9.2
Southern	8.2	9.4
Western	14.3	19.9
Residence		
Rural	11.2	12
Urban	7.5	8.3
Mother's education level		
No education	11.6	11.9
Primary	10.7	11.8
Secondary	7.7	8.8
More than secondary	5.9	5.2
Wealth quintile		
Lowest	10.6	15.7
Second	12.7	13
Middle	11.5	9.9
Fourth	8.3	7.3
Highest	6.7	7.7
Total	9.6	10.3

Data source: CSO 2009 and 2014

[2] Muchinga province was created in 2011 mainly from Northern Province and partly from Eastern province, hence there is no data before that time.

In both rural and urban settings, undernutrition rate among WRA increased slightly though rural areas show a high burden of undernutrition among WRA (12%) with an increase of 7% from 2007. In urban areas, the undernutrition rate among WRA (8.3%) increased by about 11% from 2007 but remained below the national average (10.3%) by 2013-14.

Western province recorded the highest prevalence of undernutrition among WRA (19.9%) in 2014 with an increase of 39% from 2007. North western province recorded 34% reduction of undernutrition among WRA to 9.2% while Lusaka province posted a slight increase (5%) in WRA from 2007 to 2013-14.

The findings indicate that women with low education have a higher rate of undernutrition and reduces among WRA with more than secondary education. The rate of undernutrition among WRA with secondary (8.8%), primary (11.8%) and no education (11.9%) increased by 14%, 10% and 2% from 2007 to 2013-14 respectively.

Economic characteristics showed highest increase (48%) of undernutrition among WRA in the lowest wealth quintile (15.7%) from 2007 to 2013-14. Further, WRA in the highest (7.7%) and second wealth quintile (13%) recorded increase in undernutrition of 15% and 2% respectively, however among the middle and fourth wealth quintiles undernutrition rate decreased by 14% and 12% from 2007 to 2013-14 respectively.

Additionally, annex B, figure B 3.1 shows that trends in the prevalence of undernutrition among WRA fluctuated and increased by 13% in the past two decades (CSO et al. 2014), while global the trends of undernutrition among WRA declined (Black et al. 2013).

3.1.2.Correlation between maternal undernutrition and LBW

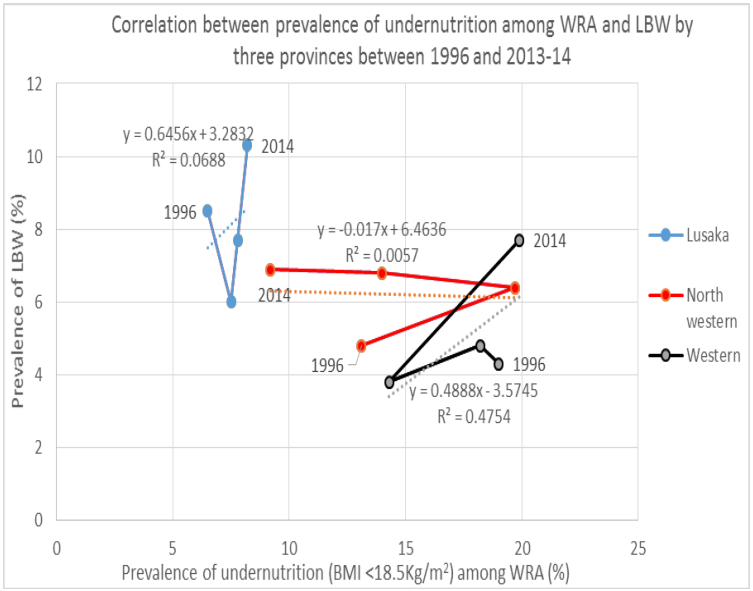


Figure 3.1: Correlation between prevalence of undernutrition among WRA and LBW by three provinces. Data source: ZDHS 1997, 2003, 2009 & 2014

Evidence shows that maternal undernutrition results in IUGR leading to SGA and/or LBW (Black et al. 2008; 2013; Bhutta et al. 2008; 2013) or increased preterm births (Christian et al. 2013).

In figure 3.1, Lusaka shows very weak correlation between the prevalence of undernutrition among WRA and LBW while Western provinces shows a moderate correlation. In NWP, the correlation is very

weak negative correlation, implying a reduction in undernutrition among WRA with a negligible increase in the rate of LBW. Whether these findings are statistically significant is not unknown. Annex B, figure B 3.2 also shows a scattergraph with data from all the provinces from 1996 to 2013-14 which shows no linear relationship at population level between the prevalence of undernutriton among WRA and the prevalence of LBW in Zambia. However, this has not been tested statistically. Annex B, table 3.1 refers for the interpretation of goodness/strength of fit using Pearson's Correlation Coefficient (r).

Lusaka province which is urban has relatively low prevalence of undernutrition among WRA (below 10%) while LBW is relatively high (above 6%). In the rural provinces, variations exist with Western province showing the highest prevalence of undernutrition among WRA (nearly 20%) but a relatively low prevalence of LBW (as low as 4%) while NWP was moderately low in both.

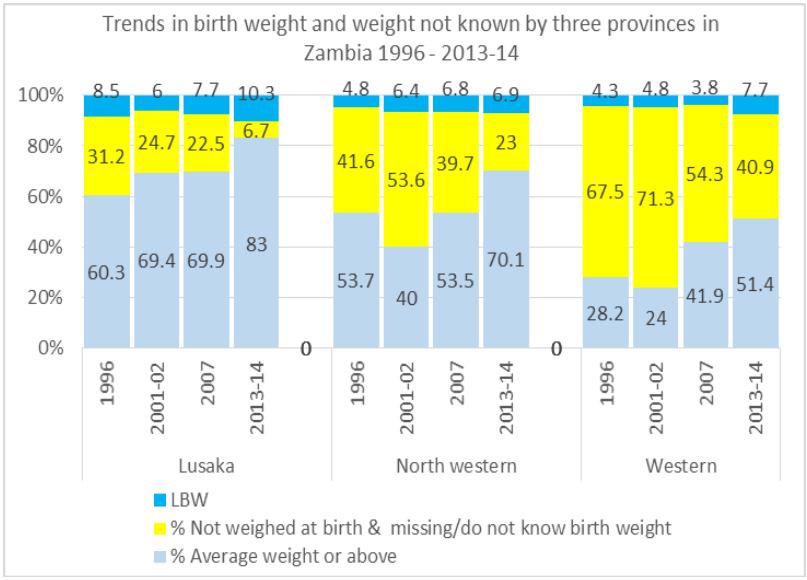


Figure 3.2: Trend of birth weight and weight not known/missing in three provinces of Zambia 1996 – 2013-14. Data source: ZDHS 1997, 2003, 2009 & 2014

Figure 3.2 explains that one reason for the lower rate of LBW in figure 3.1 and B 3.2 (Annex B) is due to poor record of birth weight data in rural provinces. Reduction in missing data/not known birth weight inversely shows an increase in the prevalence of both LBW and normal birth weight, with the highest increase (103%) of LBW recorded in Western province while the lowest (<1%) was in NWP province from 2007 to 2013-14. Both Western and North western provinces were below the national total (9.2%) of LBW prevalence rate by 2013-14 CSO et al. 2014). Annex B, figure B 3.3 shows a similar illustration of missing/not known birth weights against normal and LBW at national level from 1997 to 2014.

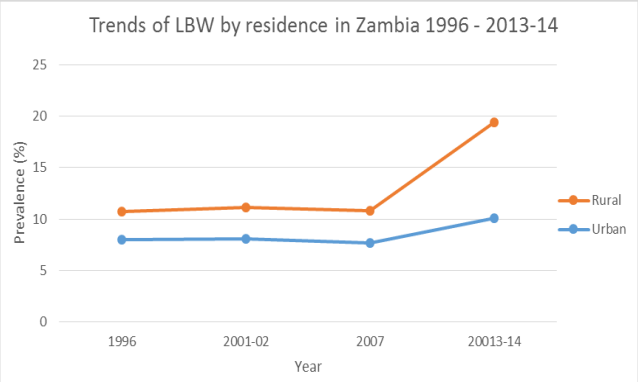


Figure 3.3: Trends of LBW by residence in Zambia. Data source: CSO 1997, 2003, 2009 & 2014

In figure 3.3, the trends of LBW in both rural and urban settings follow similar pattern despite figures 3.2 showing missing data high missing birth weight data in rural areas. In both cases, a rise in the rate of LBW was recorded between 2007 and 2013-14. Rural areas have persistently higher rate of LBW compared to urban areas since 1996.

3.1.3.Correlation between undernutrition among WRA and under five stunting

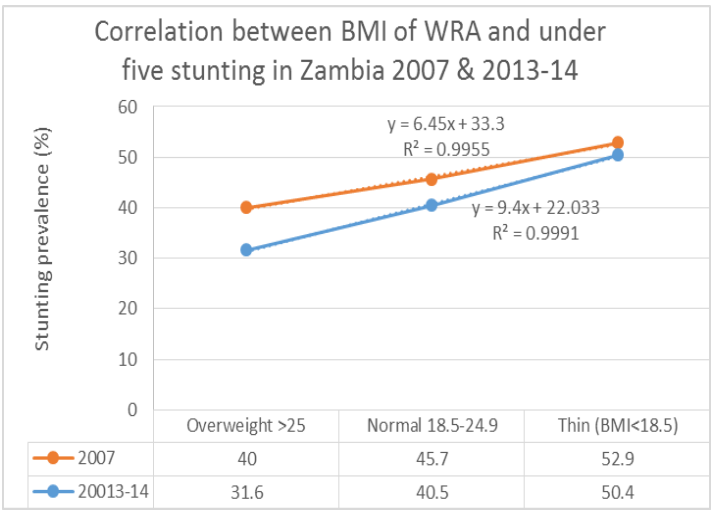


Figure 3.4: Correlation between BMI of WRA and under five stunting. Data source: ZDHS 2009 & 2014

Figure 3.4 illustrates very strong positive correlation between BMI of WRA and under five stunting in Zambia in 2007 and 2013-14, whether this is statistically significant is not known. In both years, high BMI among WRA coexists with low prevalence of under-five stunting, while lower BMI among WRA shows high rate of under-five stunting.

This reflects undernutrition at population level, therefore, under-five stunting is good indicator for predicting undernutriton prevalence at population level.

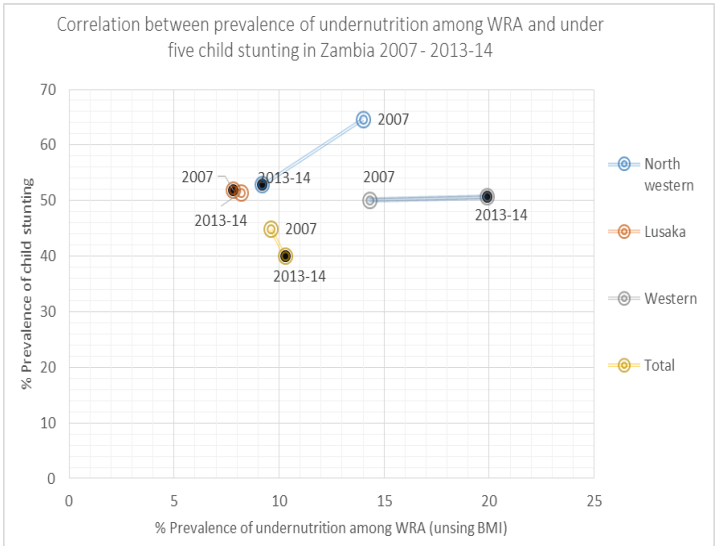


Figure 3.5: Correlation between prevalence of maternal undernutrition and child stunting in Zambia. Data source: CSO 2009 & 2014

In figure 3.5, undernutrition among WRA and under-five stunting in NWP declined while in Western province, an increase in undernutrition among WRA shows negligible increase in under five stunting from 2007 to 2013-14. In Lusaka province, the effect is negligible while at national level the graph shows little

inverse relationship with slight increase in undernutrition among WRA and slight reduction in the prevalence of stunting among under five children in same period of time.

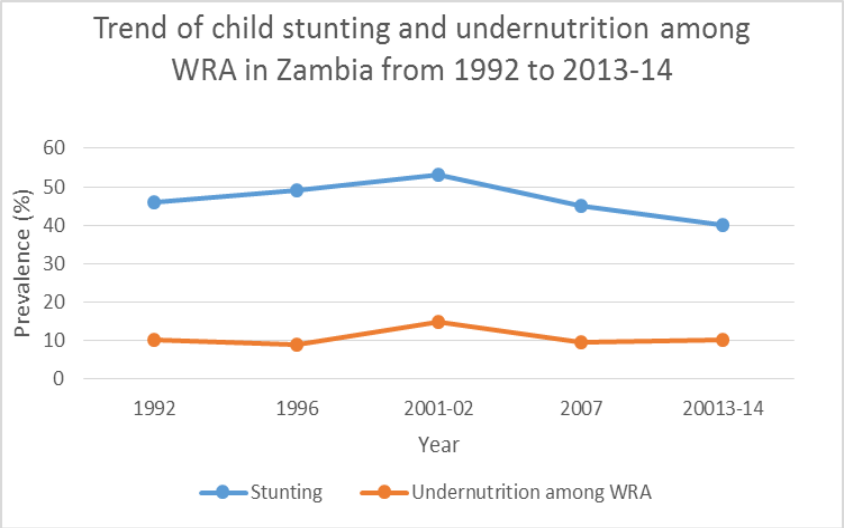


Figure 3.6: Trend of undernutrition among WRA and stunting among under five children. Data source: ZDHS 1993, 1997, 2003, 2009 & 2014

Figure 3.6 shows fluctuations in undernutrition among WRA and under five stunting from 1992 to 2013-14 in Zambia. While a steady reduction (25%) is observed for child stunting from 2001-02 to 2013-14, undernutrition among WRA remained more stable, which is likely due to the much lower prevalence and the fact that weight fluctuates more that height. Similar trends are observed for underweight and wasting as shown in Annex B, figure B 3.4.

The finding of the prevalence and correlation between undernutrition among WRA (using BMI) and child nutrition reveal high rate of undernutrition in rural areas for both. A strong correlation exists between maternal BMI and under five stunting which is not statistically tested. The low prevalence of LBW can be explained by missing/not known birth weights. However, the differences in correlation between undernutrition among WRA and under-five stunting/LBW could be explained by the methods used to collect data. While for stunting, measurements for both the mother and the child were collected at the same time, LBW was reported data as no data was available for maternal BMI during or immediately after giving birth, which reflects different times of measurements of LBW and undernutrition among WRA.

3.2. Immediate determinants of poor maternal nutrition and nutrition specific interventions

Nutrition specific interventions address immediate determinants of maternal undernutrition which include inadequate food and nutrient intake, burden of infectious diseases, adolescent and preconception nutrition, deworming medication, maternal micronutrient supplementation and food diversification.

3.2.1.Diversity of diet

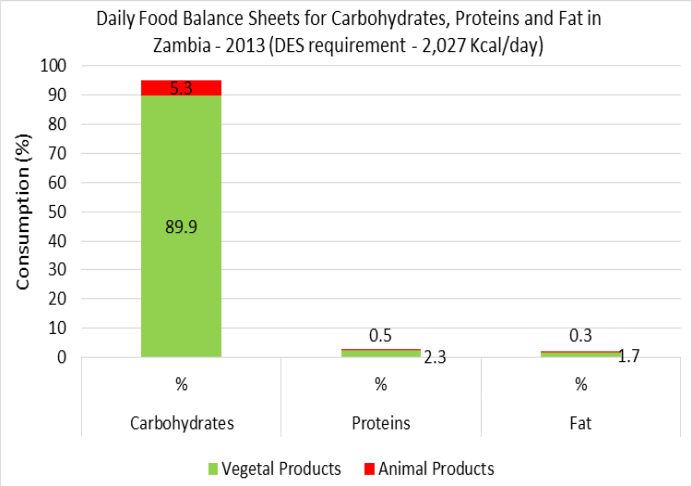


Figure 3.7: Daily food balance sheet for carbohydrates, proteins and fat in Zambia 2013. Data source: FAO faostat3

Diversity of diet is important for meeting nutrient intake recommendation and hence for health of the pregnant woman and the foetus. FAO/WHO recommends that the percentage of energy derived from protein and fat should be within 10-15% and 15-30% of the total energy supply (Kcal) respectively (FAO faostat3.). In developed countries, the share of energy intake from cereals is below 40% while in developing countries it is about 54% (http://www.fao.org/). According to Bhutta et al. (2013), to improve dietary diversity for food insecure settings, some the promising interventions to address wasting among pregnant women include provision of balanced energy and protein supplementation in order to reduce SGAs as a result of IUGR.

The graph (fig. 3.7) shows a median daily food balance sheet in Zambia, of which 95.2% is carbohydrates, 2.8% proteins and 2% fat. Vegetable sources constitute 94.9% of the total daily energy supply requirements while animal products provide only 6.1%.

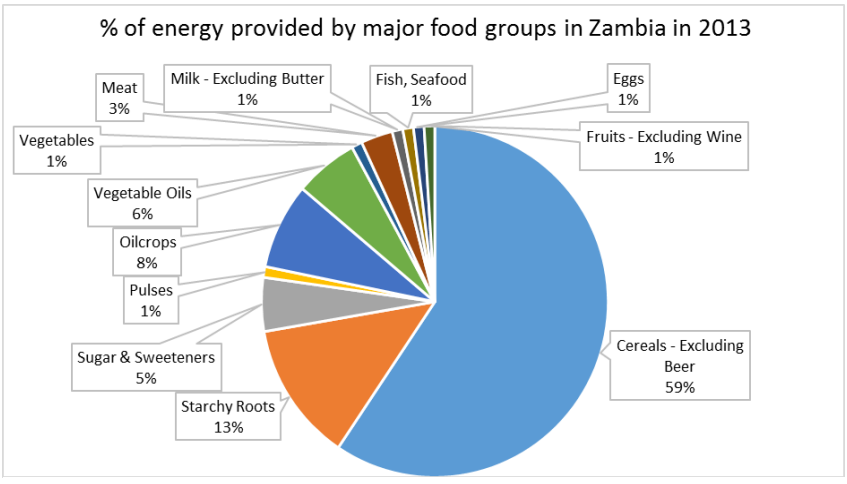


Figure 3.8: Percentage of daily energy provided by major food groups in Zambia 2013. Data source: FAO faostat3

Figure 3.8 illustrates that the highest consumed sources of energy in Zambia are derived from vegetable sources (94%) and the least are animal sources (6%) by 2013.

Figure 3.7 and 3.8 demonstrate that the share of plant source foods which are the main staples provide more carbohydrates (94%) to the daily food balance sheet.

Zambian staple foods are predominantly of cereals (maize meal) and starchy roots (cassava) with very high of carbohydrates and low in proteins and fats in micronutrients like digestible vitamin B_3 (niacin).

3.2.2.Adolescent nutrition

According to Prentice and other (2013), adolescence period is critical for height catch-up for stunting from early childhood and therefore nutrition for female adolescents is vital for health. It is a period of maturation into adulthood (Black et al. 2013). Poor female adolescent nutrition is a risk for later maternal and birth outcomes especially if it coexists with adolescent pregnancies which result in girl stunting and increased risk of maternal mortality (Black et al. 2013).

From the table 3.1 above, female adolescents (15 – 19 years) bear the highest burden of undernutrition among WRA with 14.6% in 2007 which increased to 16.4% in 2013-14 using standard BMI cut-offs. An increase (12%) in female adolescent undernutrition also reflects in a rise (7%) in national total prevalence of undernutrition among WRA (9.6% to 10.3%) from 2007 to 2013-14.

3.2.3.Disease burden

According to Horton (2008), HIV synergies with undernutrition and aggravates food insecurity. HIV infection increases susceptibility for other infections, comprising caloric and nutrient intake which leads to undernutrition (Ivers et al. 2009). A study of nutrition status of people with HIV/AIDS revealed that those with AIDS were 3.12 times malnourished compared to those with HIV while HIV co-infection showed 3.41 times higher those without co-infection implying HIV/AIDS increases demand on the nutrition status (Bassichetto et al. 2014). Black et al. (2013) reveals that infectious diseases are determinants for undernutrition particularly for malaria in pregnancy leads to IUGR and even very harmful towards full term of pregnancy (Luxemburger et al. 2001; Briand et al. 2007).

3.2.3.1. Prevalence of HIV among WRA

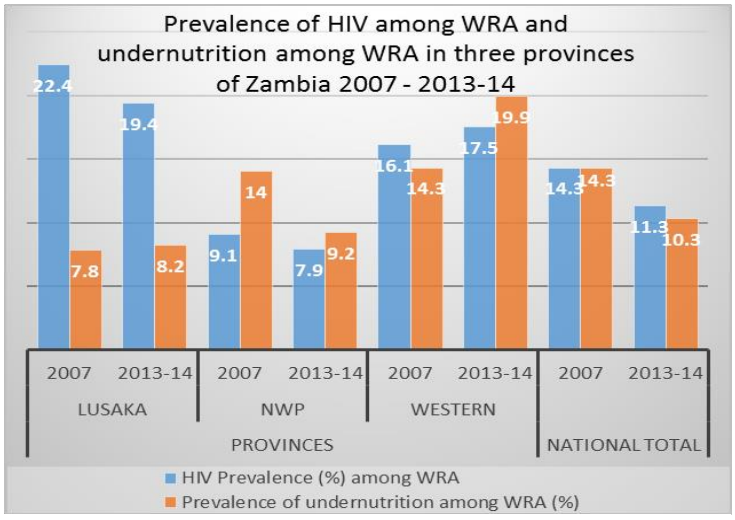


Figure 3.9: Prevalence of HIV among WRA and undernutrition among WRA in three provinces of Zambia. Data source: CSO 2009 & 2014

Figure 3.9 shows that in Western Province, increase in the prevalence of HIV among WRA co-occurs with an increase in undernutrition among WRA while in NWP, both HIV prevalence and undernutrition among WRA reduced from 2007 to 2013-14. Lusaka province, which has the highest prevalence of HIV (19.4% in 2013-14), showed a reduction in HIV prevalence among WRA, with

a slight increase in the prevalence of undernutrition among WRA from 2007 to 2013-14.

No information is available for the increase in HIV prevalence in Western province which is rural with higher prevalence of HIV than Lusaka which is urban setting.

3.2.3.2. Incidence of Malaria

In figure 3.10, NWP recorded the highest increase (103%) in incidence of malaria among all ages while Lusaka province showed a reduction (72%) from 2007 to 2013, which also has the lowest incidence (68/1,000 among all ages), lower than even the national incidence (340/1,000). Malaria incidence was much stable at national level but indicated a slight increase in Western province. Among the population five years and above, malaria incidence increased from 220/1,000 population to 337/1,000 population from 2007 to 2013.

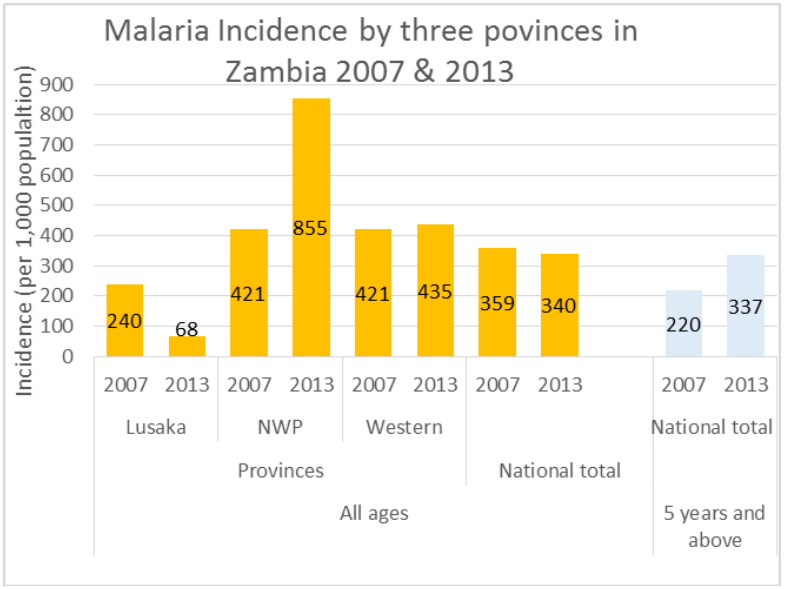


Figure 3.10: Incidence of Malaria among all ages and those 5 years & above in three provinces of Zambia 2007 & 2013. Data source: Annual Health Statistical Bulletins 2009 & 2015

Incidence rate in Zambia uses case notifications from health facility data which may either be lower than the incidence at population level. The reason for increased incidence of malaria in NWP is attributed to low distribution of insecticide treated Bed nets (ITNs) (MoH 2015). Data from the 2013 annual health statistical bulletin reveal that NWP distributed only 0.2% of ITNs of national distribution, while Lusaka had 7% and Western province had 18% in 2013 (MoH, 2015). Further, Lusaka has low malaria due to improvements in housing conditions including coverage of improved water sources and sanitation.

3.2.4.Feeding behaviour and practices of pregnant women

A previous study by the author and others in NWP, Zambia revealed that in some communities, pregnant women have restrictions on foods to eat. For instance, some communities in NWP, pregnant women are not allowed eat eggs because they believe the baby will be born without hair or eat pork meat for fear that the baby will have fits (convulsions) soon after birth (Kakoma et al. 2014). Annex B, table B 3.2 has listed some of the food myths/misconceptions during pregnancy. Similar food taboos were

also found in Lusaka urban by M'soka, Mabuza and Pretorius (2015) and in Uganda by Nabacwa and others (2015). Food craving was also common among pregnant women especially in early pregnancy which including eating soils while other pregnant women claimed they ate whatever the foetus demanded (Kakoma et al. 2014).

Eating at least three meals a day with some snacks in between meals using locally grown food that the pregnant woman could afford were some of the good practices although most of the local foods were either cereals or tubers containing high carbohydrates than proteins and fat (Kakoma et al. 2014). Financial constraints affected pregnant women's consumption of frequent meals with a variety like meat, fish, milk and cooking oils including salt and sugar which are fortified with micronutrients (Kakoma et al. 2014; NFNC 2010).

3.2.5. Coverage and adherence to micronutrients (Iron+Folic Acid [IFA]) supplementation among pregnant women

According to WHO surveys from 1993 to 2005, 43.3% of pregnant women were anaemic, 90% were from developing countries in Africa and Asia (WHO 2008; McLean, et al. 2009; Sununtnasuk, D'Agostino and Fiedler 2015). Studies have demonstrated that supplementation of IFA during pregnancy increases haemoglobin at term by 12g/L (95% confidence interval [CI] 2.93 – 21.07), reduce risk of anaemia (73%) at term (relative risk [RR] 0.27, 95% CI 0.12 – 0.56) and is associated with reduction in maternal mortality by 23% (RR 0.77), (Pena-Rosas and Viteri 2006; Bhutta et al. 2008), and reduces the risk of LBW at term by 16% (Bhutta et al. 2008). Mwangi and others (2014) study in Kenya established that Iron supplementation increased birth weight by 143g (95% CI: 58—228g) and reduced the prevalence of low birth weight (<2,500g) by 65% (95% CI: 13%—86%). The ideal coverage of IFA is 180 tablets during pregnancy, but this is hindered by adherence (Fiedler et al. 2015). While the proportion of pregnancy women who obtain iron-folic acid (IFA) during ANC is high, consumption remained lower than the ideal.

One of the effective interventions strategy is to promote micronutrient supplementation and deworming medication through schools (Bhutta et al. 2013), in order to address maternal undernutrition.

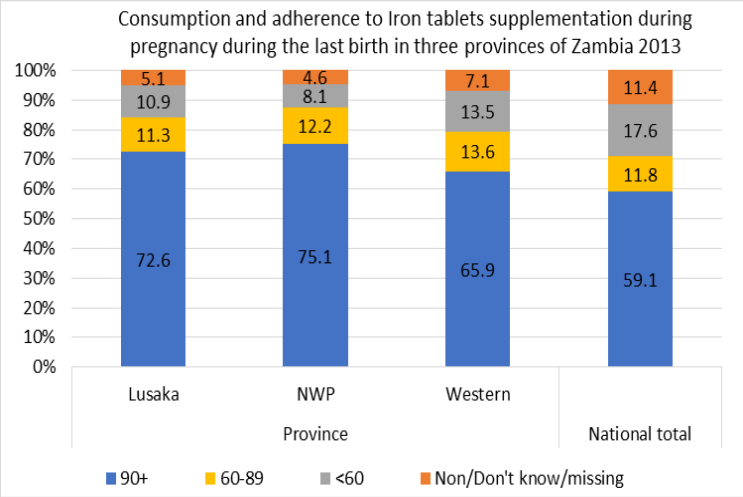


Figure 3.11: Iron supplementation and adherence during pregnancy of the last birth in the three provinces, Zambia. Data source: ZDHS 2014

Figure 3.11 reveals coverage of iron tablet supplementation and adherence. The consumption of Iron and Folic Acid (IFA) tablets during pregnancy for more than 90 days in Lusaka and NWP was over 70% in 2013-14, while Western province had 65.9% with a national coverage below 60%.

IFA are the only micronutrients given to women during pregnancy while vitamin A is administered as a postnatal supplementation in Zambia (MoH 2011; NFNC 2011). Iodine is part of mandatory salt fortification policy while zinc, calcium, vitamin D, omega-3 fatty acids and others are not part of maternal micronutrient supplementation policy in Zambia.

3.2.6. Coverage of deworming medication among pregnant women

Hotez and Whitham (2014) observed that hookworm infestation and schistosomiasis were are among the major helminthic infections that affect many WRA in Africa, with hookworm posing a greater risk of severe anaemia, higher mortality, and poor neonatal outcomes (LBW and increased infant mortality). Hotez and Whitham (2014) proposed mass drug administration to address worm infestations. Evidence from studies on administration of anti-helminthic drugs during pregnancy reveal a reduction in mean haemoglobin fall at term and a reduction of very LBW (Gyorkos et al. 2011; Passerini et al. 2012).

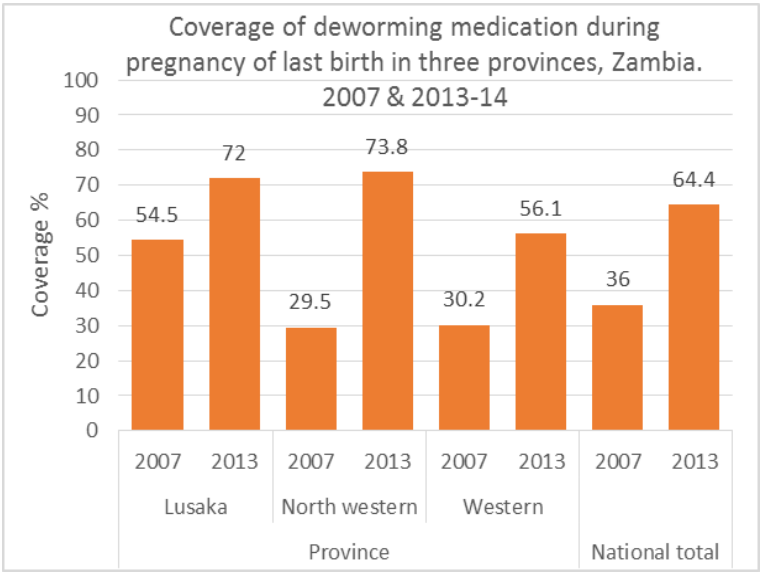


Figure 3.12: Coverage of deworming medication during pregnancy in Zambia. Data source: ZDHS 2009 & 2014

Figure 3.12 shows that the three provinces increased deworming coverage from 2007 to 2013-14. Western province falls below the national coverage (64.4%) while the other two were above 70% in 2013-14. Deworming eliminates worms and improve nutrition and health of the pregnant women.

The coverage of deworming medication during pregnancy is still low especially among rural women who are involved in activities that put them at risk of worm infestation like processing of cassava in stagnant water pods, washing clothes, rice farming especially in NWP and Western province with many flood plains (own observation) including craving for soil during pregnancy (Kakoma et al. 2014).

3.3. Underlying determinants of poor nutrition among WRA and nutrition interventions.

Nutrition sensitive interventions address underlying determinants based on complementary multisectoral efforts with agriculture, education, social welfare and health such as poverty, food insecurity, scarcity of access to resources, health care, water and sanitation services and are implemented at large scale to effectively reach out to the population (Black et al. 2013; Ruel-Bergeron et al. 2015).

3.3.1.Expenditure on food and non-food items

According to De pee et al. (2010), poor household who spend 50-80% of expenditure on food remain with little for other non-food essential items like medicine, education, transport and cooking fuel. High expenditure on food leads to changes that lower the quality and quantity of the dietary intake increasing the risk of undernutrition especially for pregnant women, young children and lactating mother (Brinkman et al. 2010). Studies in Bangladesh found that poor households who spend more on primary rice than non-rice had high prevalence of maternal and child undernutrition (Campbell et al. 2010).

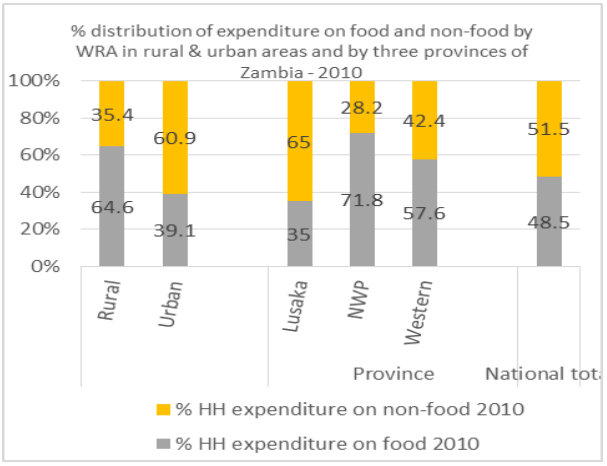


Figure 3.13: Distribution of expenditure on food and non-food by WRA in rural & urban areas and by three provinces of Zambia in 2010. Data source: 2006 - 2010 LCMS

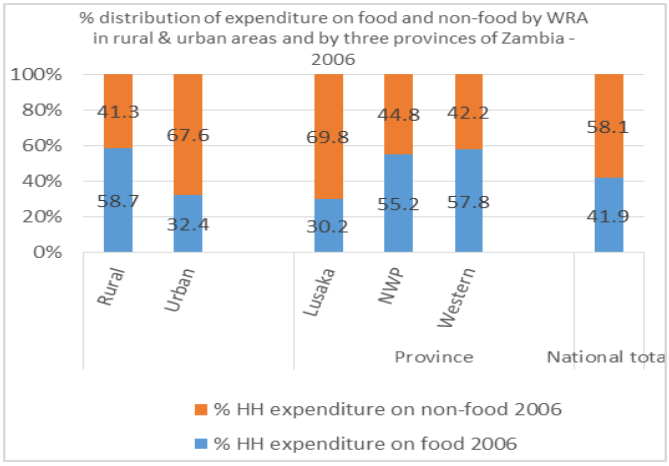


Figure 3.14: Distribution of expenditure on food and non-food by WRA in rural & urban areas and by three provinces of Zambia in 2006. Data source: 2006-2010 LCMS

From the graphs (figures 3.13 and 3.14) above, rural households spend over 60% of expenditure on food while urban areas spend similar

equivalent on non-foods items. From 2006 to 2010, the proportion of expenditure on food increased (from 41.9 to 48.5%) at national level. In 2010, NWP households spent over 70% of household income on food, followed by Western province at 58% while households in Lusaka province spend 65% on non-food items and less on food (35%).

The high expenditure among WRA households on food items (50 - 80%) reflect high poverty levels and inadequate income which result in diminished expenditure on non-food essential items like medicines, education, water and sanitation. It also entails expenditure on low quality and quantity of dietary intake which affects the health of WRA, leading to undernutrition.

3.3.2.Food security

According to Meenakshi et al. (2010), food security ensures adequate energy and essential micronutrients intake.

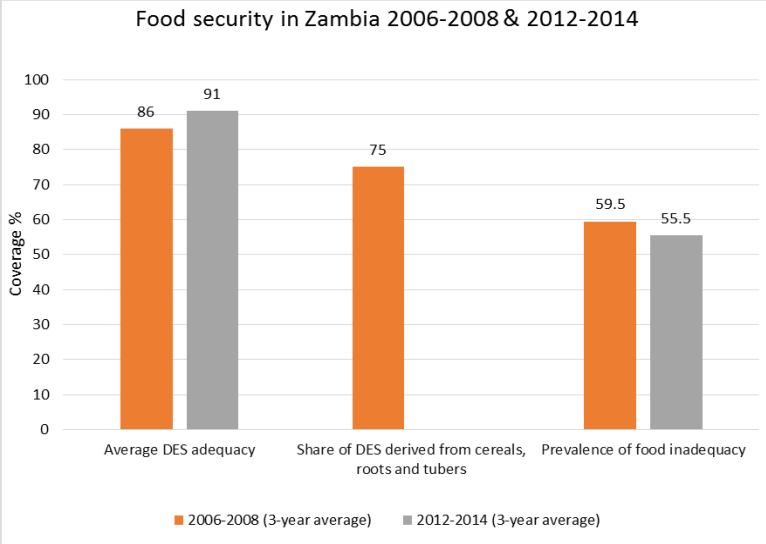


Figure 3.15: Some food security indicators, Zambia 2006 – 2008 & 2012-2014. Data source: FAO faostat3

According to the graph (fig. 3.15), even though the daily energy supply (DES) was 86% in 2006-2008, 75% is cereals, roots and tubers, with a prevalence of food inadequacy of over 50%.

The population depends mainly on staple foods like maize and cassava, which are also insufficient meet daily nutrition requirements with 91% average DES adequacy. According to FAO, adult females of reproductive age (not pregnant) need to consume a minimum of DES of 2,000 Kcal/day.

3.3.3.Access to maternal health services and care

Pregnant women who are malnourished have 60% increased need for assisted delivery (non-spontaneous), with 20% of maternal mortality due to maternal short stature and iron deficiency anaemia (Black et al. 2008). Further, WHO recommends that all pregnant women should get 100% coverage of at least four ANC visits conducted by skilled provider including skilled deliveries, with not less than 5% of caesarean section operations (WHO indicators/). According to WHO (2006), there must be at least 23 health workers (physicians, nurses and midwives) per 10 000

population to adequately attain primary health care interventions (WHO 2006). Though MMR has declined in Zambia (from 591 to 398/100,000 live births from 2007 to 2013-14), it is higher than the global MMR of 210/100,000 live births in 2013-14 (CSO et al. 2014) and far from MDGs target of 162/100,000 live births by 2015 in Zambia. According to ZDHS 2013-14 report, 55.5% attend four or more ANC visits (urban, 55.9% and rural 55.2%) (CSO et al. 2014).

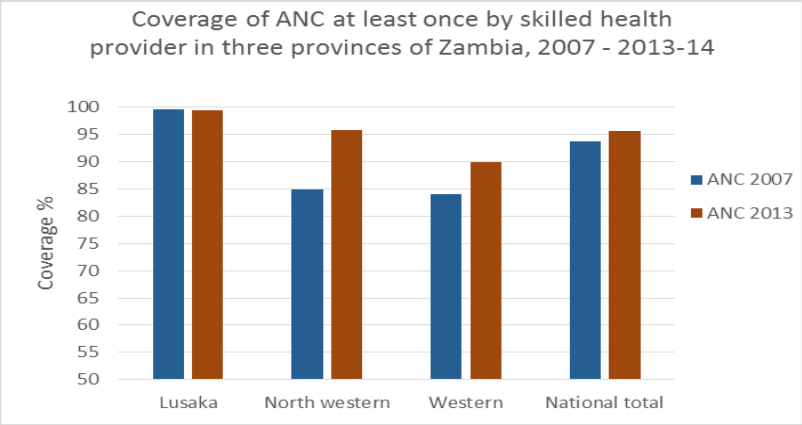


Figure 3.16: Coverage of ANC at least once by conducted by Skilled Health Provider in three provinces of Zambia. Data source: CSO 2009 and 2014

Figure 3.16 shows that the coverage of antenatal care (ANC) at least once during pregnancy by a skilled health provider (Doctor, Clinical Officer or Nurse/Midwife) was almost 100% in Lusaka and 90% and above in the other provinces in 2013-14.

In figure 3.17, access to maternal health services has improved and is higher in urban than rural areas 2007 from 2013-14. Lusaka recorded above 80% coverage of both skilled and health facility (HF) deliveries in 2013-14. Western province shows lower coverages of both skilled and HF deliveries (57% and 62%) than the national level in 2013-14. However, provision of caesarean section (CS) operations were low in Western (3.1%) and North western (5.8%) provinces in 2013-14 compared to Lusaka province (7.4%), implying that rural areas lag behind in provision of maternal health services which are cardinal for good maternal health and nutrition.

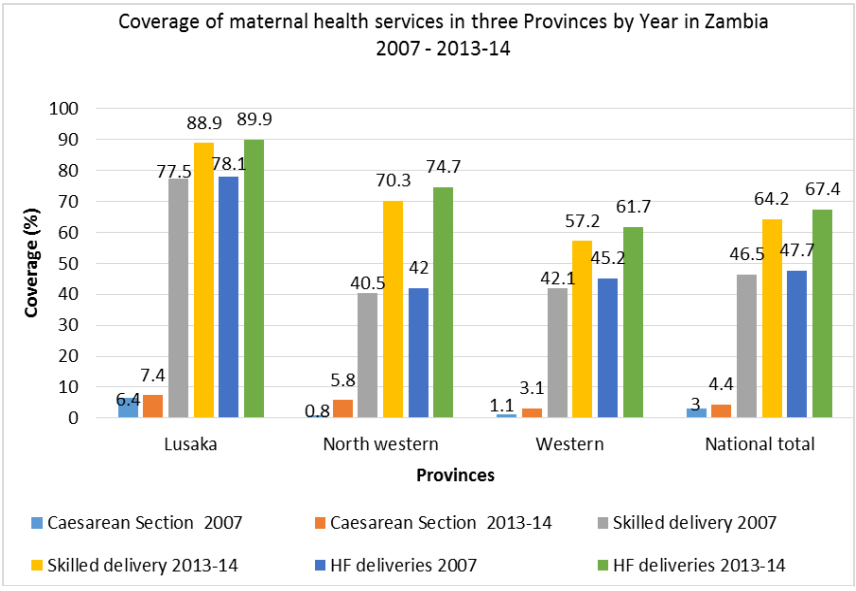


Figure 3.17: Coverage of maternal health services in three Provinces by year in Zambia. Data source: CSO 2009 & 2014

According to the MoH (2014), the health workforce gaps for nutrition workers (nutritionists) was 41% in 2013, imply that less than half nutrition interventions are conducted by trained professionals.

In figure 3.18, the ratio of health worker (Doctors, Clinical Officers, Midwives and Nurses) and Doctor to 100,000 population is low compared to that recommended by WHO (2006). In 2013, there were fewer doctors (6 doctors per 100,000 population) in rural areas (both NWP and Western province) while Lusaka province had 20 doctors for the same population size.

3.3.4.Family planning (FP) prevalence

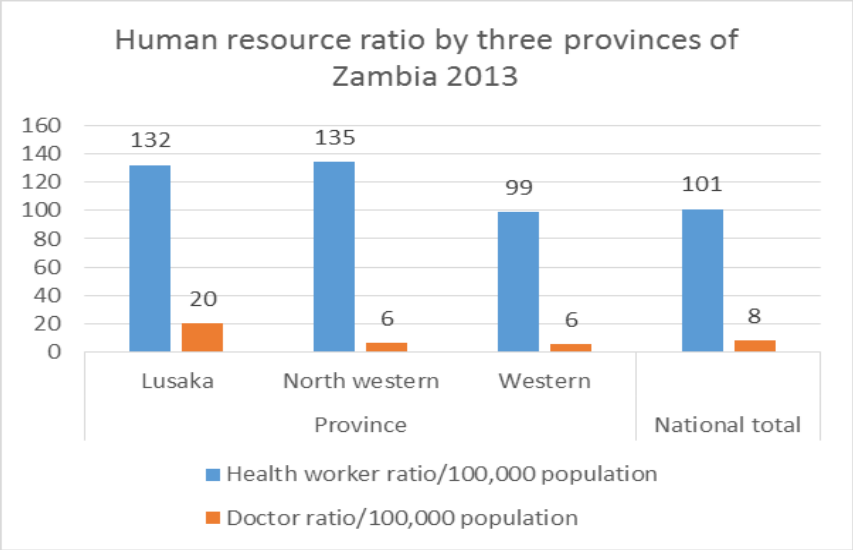


Figure 3.18: Health work/Doctor ratio per 100,000 population in three provinces, Zambia 2013. Data source: Annual Health Statistical Bulletin 2015

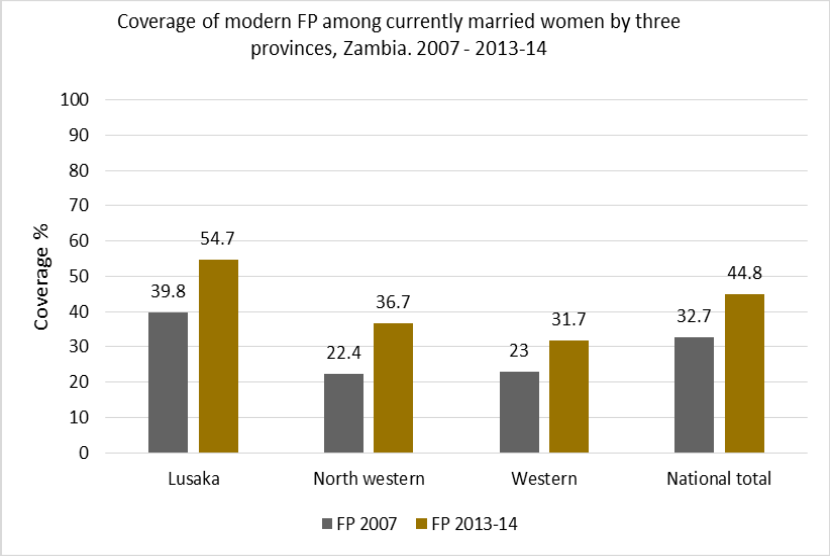


Figure 3.19: Coverage of modern family planning among currently married women by three provinces, Zambia. Data source: CSO 2009 and 2014

Studies show that modern FP contraception improves maternal nutrition and health status (Tafa et al. 2015). Zambia has 21% unmet need for family planning among married women, 14% unmet need for birth spacing and 7% for limiting births (CSO et al. 2014).

In figure 3.19, the coverage of modern FP among married women has improved in three provinces but is still lower than the national coverage in NWP and Western province. The national level is below 50%, though Lusaka province recorded above 50% coverage of FP in 2013-14.

Notably, this coverage only

focuses on married couples and does not include all WRA who are sexually active and are at risk of pregnancy, implying that the unmet need FP in the population is high.

3.3.5.Total fertility rate (TFR)

According to Conde-Agudelo et al. (2007), repeated pregnancies in a populations with high fertility rate cause maternal undernutrition and morbidity, hence FP reduces the risk of maternal undernutrition and IUGR (Bhutta et al. 2008).

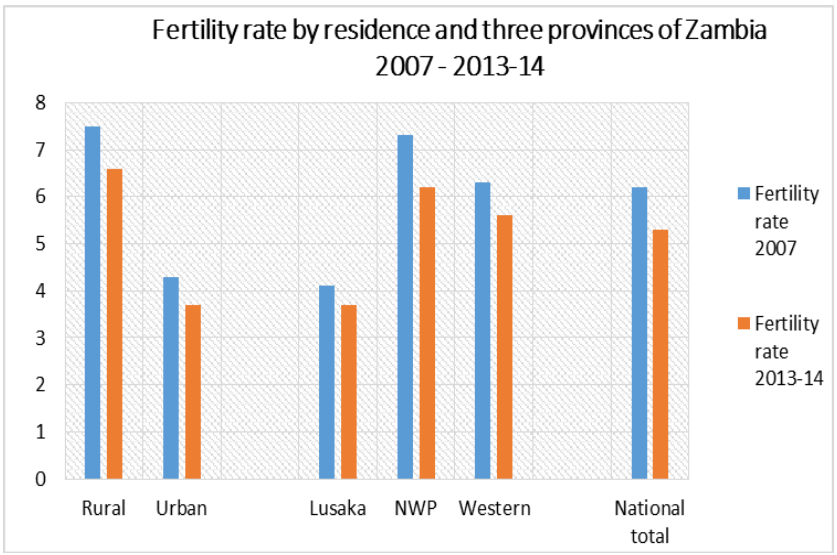


Figure 3.20: Fertility rate by residence and three provinces of Zambia. Data source: CSO 2009 and 2014

Figure 3.20 shows that fertility rate reduced from 6.2 births per woman in 2007 to 5.3 births per woman in 2013-14 in Zambia. Of the three provinces, NWP still has the highest fertility rate (6.2) compared to Western province (5.6) and Lusaka (3.7) in 2013-14. Rural areas have the highest fertility rate (7.5 and 6.6) compared to urban areas (4.3 and 3.7) although fertility rate has reduced in both rural and urban residences from 2007 and 2013-14.

3.1.1. Female adolescent education and school enrolments and progression

Table 3.2: Educational attainment of the female household population by residence and the three provinces of Zambia including the national total for men aged 15 – 49 years in 2007 and 2013-14.

Characteristics		No education		Some primary		Completed primary		Some secondary		Completed secondary		More than Secondary		Median years completed		% literate	
		2007	2013-14	2007	2013-14	2007	2013-14	2007	2013-14	2007	2013-14	2007	2013-14	2007	2013-14	2007	2013-14
Residence	Urban	3.2	8.3	19.7	35.9	17.3	12.1	37.7	28.4	10.7	8.5	11.3	6.5	8	6.4	81.3	82.8
	Rural	15.6	21.3	46.8	53.3	20.3	10.6	15	11.9	1.5	1.4	0.8	0.8	4.9	3	50.8	54.3
Province	Lusaka	4.4	9.5	24.5	34.7	17.3	13.5	31.9	27.3	9.4	8.4	12.5	6.3	7.3	6.4	74.1	80.1
	NWP	15.4	21.6	48.2	48.9	14.5	8	17.3	15.2	3.3	3.7	1.3	2.1	4.8	3.2	46.6	60.9
	Western	22.2	24.8	36.4	46.7	18.8	10.2	17.5	13	3.1	3.3	1.9	1.8	5.2	3.1	57.4	65.8
National total		10.4	16	35.4	46.2	19	11.2	24.5	18.7	5.4	4.3	5.2	3.1	6.2	4.3	63.7	67.5
National total Men: 15-49 years		4.5	12.7	27	42.7	19.3	10.6	31.9	20.7	10	7.9	7.4	4.8	6.7	5.1	81.5	82.7

Data source: CSO 2009 and 2014

Evidence has educed that maternal education determines undernutrition. Studies in Brazil showed that for every year of education completed by mothers, the odds of child stunting reduced by 17% (OR = 0.83; 95% CI 0.70, 0.97) (Barrios & Hoffman 2014). A long term study follow up maternal made showed that at least secondary school or more of maternal education was a protective factor for child undernutrition in Bangladesh and recommended promotion of women's education at least up to secondary school level (Hasan et al. 2015).

Table 3.2 shows decline in the education attainment by the female population from primary to more than secondary levels from 2007 to 2013-14. Literacy levels of the female household population increased by 6% from 63.7% in 2007 to 67.5% in 2013-14 compared to that of their male counterparts which increased by about 1% from 81.5% in 2007 to 82.7% in 2013-14. Females who attain some primary school (35.4% and 46.2%) and some secondary school education were generally higher than those who completed (19% and 11.2% for primary and 5.4% and 4.3% for secondary) and who attained more than secondary school (5.2% and 3.1) from 2007 to 2013-14 respectively. Generally, females that completed secondary education tend to be almost half (5.4% and 4.3%) compared to their male counterparts (10% and 7.9%).

Females in rural areas have far lower secondary school completion rates than their urban counterparts, a ratio of 1:7 and 1:6 in 2007 and 2013-14 respectively. Female education attainment of more than secondary education for urban (11.3% to 6.5%) reduced further while rural areas (0.8%) remained low but stable from 2007 to 2013-14. The rates of completion of secondary education and attainment of more than secondary education have dwindled from 2007 to 2013-14 especially in urban areas. The median years of schooling has reduced for both females and males from 6.2 to 4.3 and from 6.7 to 5.1 from 2007 to 2013-14 respectively.

Further, Lusaka province shows two-to-three times higher progression rate from secondary education to more than secondary education than the other two provinces. Of instance, in 2013-14, the progression in Lusaka province for some secondary (27.3%), completed secondary (8.4%) and more than secondary was (6.3%) while the other two provinces attained half or less in the same period. Generally, there is drastic drop in progression of education attainments. This may be as a result of adolescent girls dropping out of school due to early pregnancies or marriages including financial constraints. Even though the literacy rate is high, the median years of education completion are too long which substantiates high dropout rate in both rural and urban areas.

3.3.6.Age at first child birth and marriage

According to WHO, females adolescents childbirth has risk of complications or even death of the mother or the child and long term effects of exclusion from socioeconomic opportunities, further education and employment (WHO indicators/). Early female adolescent pregnancies mostly result from inadequate access to sexual reproductive health and rights (SRHR) such as FP services. Studies have documented inappropriate SRHR services for adolescents health challenges (Bearinger, et al. 2007). According to Woog et al. (2015), 40% of female adolescents in most developing countries have unmet need for contraception due to lack of access, health concerns and worry about side effects and normally they obtain care from a source other than a health facility, hence they experience unplanned pregnancies and they seek abortions from untrained providers or have a self-induced one.

Evidence reveals that supporting adolescent SRHR and FP reduce unwanted pregnancies and optimise age at first pregnancy (Bhutta et al. 2013), interventions can be done at community level and school-based education platform

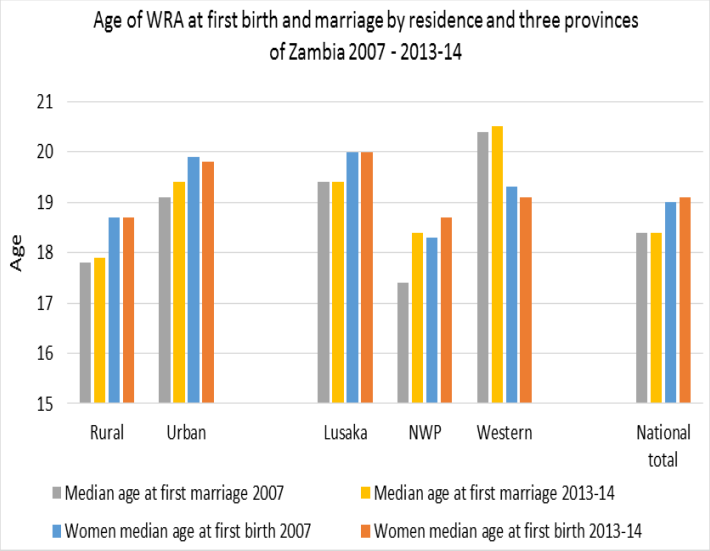


Figure 3.21: Age of WRA at first birth and marriage by residence and three provinces of Zambia. Data source: CSO 2009 and 2014

Figure 3.21 shows that the median age of women aged 20 – 49 years who begin childbirth is 19.1 and for first marriage is 18.4 in 2013-14. Rural areas have low median age at first marriage (17.9 years) and first childbirth (18.7 years) compared to urban areas (19.8 and 19.4years) in 2013-14. NWP has the lowest median age (18.7 and 17.4 years) at first marriage and first childbirth while Western province has lower median age at first childbirth (19.1 years) and higher first marriage (20.5 years) in 2013-14. Western province results indicate that majority of the WRA begin childbirth (19.1 years) before marriage at 20.5 years. The median age at first marriage and first birth have remained relatively stable in Lusaka at 19.4 and 20 years in 2007 and 2013-14 respectively. Median age for first child birth is declining in urban areas and Western provinces, however has not increased much in NWP compared to increase in median age at first marriage from 2007 to 2013-14.

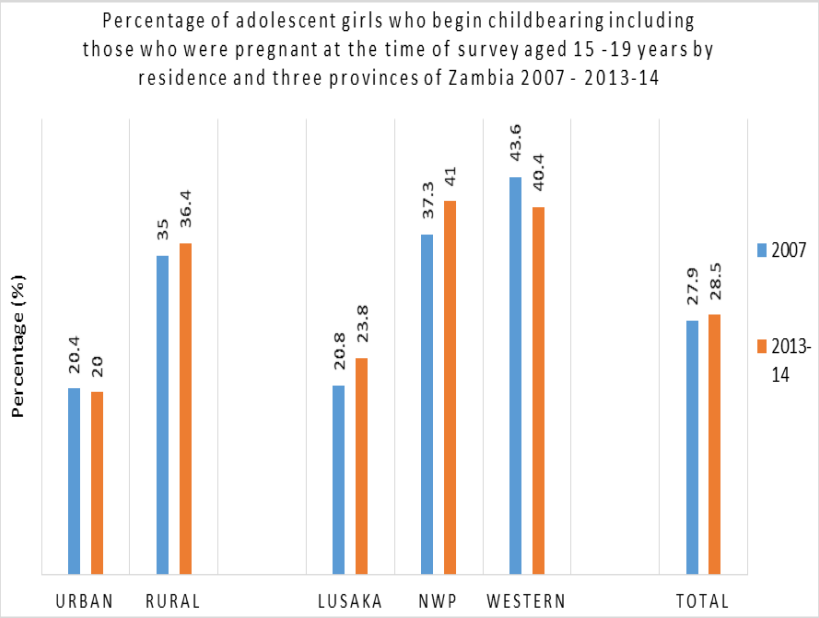


Figure 3.22: Percentage of adolescent girls who begin childbearing including those who were pregnant at the time of survey aged 15 -19 years by residence and three provinces of Zambia. Data source: CSO 2009 and 2014

Figure 3.22 shows that the proportion of female adolescents (15 – 19 years) who begin childbearing in rural areas increased slightly from 35% to 36.4% while in urban areas it remained relatively stable at 20% from 2007 to 2013-14. The rate also increased by about 10% in NWP (41%) while it reduced by 7% in Western province (40.4%) from 2007 to 2013-14, regardless, it remained high in both provinces. According to ZDHS (CSO et al. 2014), adolescents have high unmet need for FP (25%). This could be due to scarcity of adolescent-friendly reproductive health services.

3.3.7. Coverage of improved sources of drinking water and sanitation

Studies in India and Malawi revealed that access to improved sources of drinking water, sanitation and hygiene was associated with reduced prevalence of stunting (Rah 2015). Other studies showed that handwashing counselling which can reduce the risk of diarrhoea by 30% (RR 0.70, 0.56 – 0.89) (Bhutta et al. 2008; Curtis and Cairncross 2003; Fewtrel et al. 2005). Meta-analysis studies by Campbell et al. (2015) demonstrate several risk factors of poor water, sanitation and hygiene on maternal and reproductive health outcomes through exposure to inorganic contamination and infections, including behaviours such as carrying heavy water loads or disposing of faeces. In Zambia, the 2006-2010 LCMS found that only about 28% of the population reported drinking treated or boiled water (CSO 2010). According to Bhutta and others, hand washing with soap coupled with improved water quality, and with good excreta disposal significantly reduced the risk of diarrhoea (RR 0.52, 95% CI 0.34–0.65). Research shows that reduction in open defecation reduces 20% stunting of children (Cairncross et al. 2010; Spears 2013).

Low access to improve sources of drinking water and sanitation is a risk factor for communicable diseases such as diarrhoea, worm infestation,

malaria, eye diseases and skin infections which also contribute to poor nutrition of the population (Mara et al. 2010).

From the graph (fig. 3.23) above, about 60% of households had access to improved sources of drinking water while about 40% had access to improved sanitation in Zambia in 2013-14. Rural households experience low coverage of both improved sources of drinking water and sanitation (47% and 19%) compared to urban areas (90% and 35%) respectively in 2013-14.

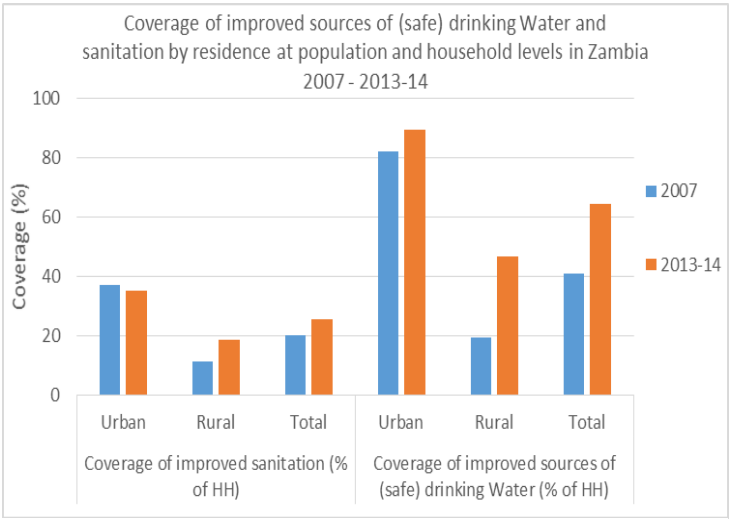


Figure 3.23: Coverage of improved sources of drinking water and sanitation at household level by residence, Zambia. Data source: ZDHS

Rural areas still have challenges with access to improved drinking water and sanitation, which results in high disease burden.

3.4. Basic determinants of poor nutrition among WRA and enabling environment interventions

Enabling environment interventions address basic determinants of health which are broader issues of governance and indicators that are measured at higher level to compare countries in terms of financial resources for nutrition, legislation, policy and institutional transformation (International Food Policy Research Institute 2014). In this paper, focus is on poverty, policy and institutional frameworks for food and nutrition.

3.4.1.Poverty levels

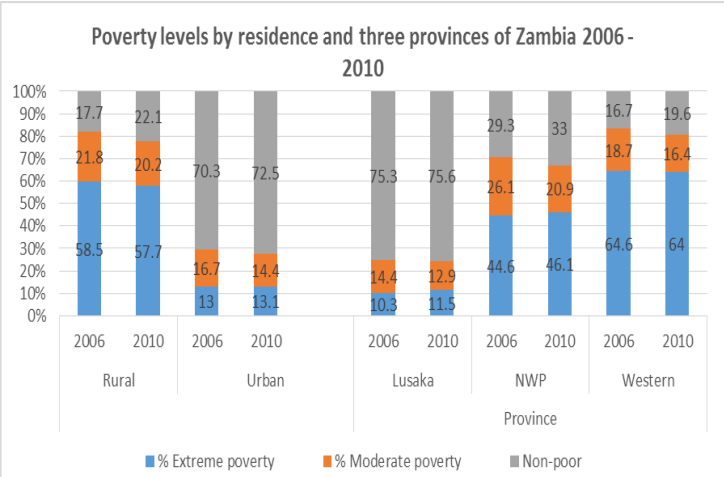


Figure 3.24: Poverty levels by residence and three provinces of Zambia. Data source: CSO 2012

According to the National Food and Nutrition Commission (NFNC 2010), many pregnant women in Lusaka were unable to afford nutritional diet because of financial constraints. Studies have shown that conditional financial incentives improve population health and nutrition outcomes by reducing financial barriers and poverty (Bhutta et al. 2013; Gillespie et al. 2013). In Zambia, among WRA with no

formal education, poverty levels are high (87%) of which 77% are extremely poor (CSO 2012).

The graph (fig. 3.24) above shows that poverty levels in the country are high, with rural areas bearing the heaviest burden at 80.3% and 77.9% with extreme poverty at 58.5% and 57.7% in 2006 and 2010 respectively. Rural poverty level declined slightly by about 3% while urban poverty levels have remained more stable similar to findings in Lusaka province from 2006 to 2010. In Western province, poverty remains above 80% while NWP recorded a slight reduction of 4% from 2006 to 2010.

High poverty levels among WRA negatively impacts on the nutrition of WRA in terms of access to food and nutrition.

3.4.2.Policy framework on food and nutrition

Zambia provided a legal framework through statutory Instrument No. 155 of 1998 that supports mandatory fortification of sugar with vitamin A after the repeal of the regulations on fortified iodized salt, pursuant to part 4, section 22 and 23 of the Food and Drugs Act (Cap 303). So far, only these two food items are mandated by law to be fortified, while rest are voluntary fortifications.

The legal framework obliges domestic and imported sugar to be fortified and establishes a uniform standard for the content of fortified sugar across the nation (Serlemitsos and Fusco 2001).

Food fortification (maize) delivers micronutrients to populations especially on maternal and child micronutrient status (Bhutta et al. 2008). According to Bhutta et al. (2008), estimates of the effect of interventions to prevent iron-deficiency anaemia at different periods showed that food fortification with iron increased haemoglobin by 6-9g/L (95% CI, 2.74-11.06). Finding in hard to reach emergency settings revealed a maize fortification with iron decrease in anaemia in children by 23·4% ($P < 0{\cdot}001$) and a decrease in vitamin A deficiency in adolescents (Seal et al. 2008; Van den Briel, et al. 2007).

According to Meenakshi et al. (2010), another way to deliver micronutrients is through biofortification which is a tool for combating micronutrient malnutrition at population level. Micronutrients like zinc, calcium, vitamin A, iodine and iron fortified in staple foods can contribute to reduction of micronutrient deficiencies which contribute to approximately 7% of the global disease burden annually and the top ten causes of death among children and pregnant women, and because they have covert clinical symptoms, they are termed 'hidden hunger' (Ezzati et al. 2004; Muthayya et al. 2013). In August 2015, Zambia launched vitamin A biofortified staple food (maize) while in Bangladesh, a high zinc

content rice is made available through biofortification (http://www.harvestplus.org/).

3.4.3.Institutional frameworks

As part of good governance, the government of the Republic of Zambia recognised the need to have institutional frameworks to address undernutrition in the country, hence the creation of the National Food and Nutrition Commission (NFNC) which a member of the global board Scaling-Up Nutrition (SUN).

3.4.3.1. National Food and Nutrition Commission (NFNC)

Established in 1967 by an Act of Parliament of 1967, NFNC coordinates, monitors and evaluates the implementation of the national multisectoral response to malnutrition with a national commitment to food and nutrition policies, strategies and programmes in Zambia (NFNC 2011).

NFNC conducts regular survey on nutrition in the country to provide evidence-based information for decision making, accountability reporting to stakeholders including policy makers and donors. However, the author did come across a few published research by the organisation including the national nutrition policy 2006 and national food and nutritional strategy plan 2011-2015 (NFNC 2011). This could be attributed to insufficient financial and human resource capacity to conduct rigorous studies especially that the commission does not have regional offices (own observation). This constrains the organisation to conducted interventions to address undernutrition except for child health week campaigns and a few surveys periodically (NFNC 2011; www.usaid.gov).

3.4.3.2. Scaling Up Nutrition (SUN)

Zambia is a member of SUN, a collaborative movement which began in 2009 to push the global agenda to stimulate and reinforce political interest in nutrition by national governments and development partners. The movement is premised on the principles of countries-led efforts with external support which are demand-driven. SUN plays a uniting role among civil societies, governments, United Nations, businesses and donors to end undernutrition through advocacy, awareness raising and resources mobilisation, including actions and investments to improve maternal and child nutrition among the 54 member countries (SUN 2015). One of the essential strategies of SUN is to work on nutrition-specific and nutrition-sensitive interventions, and involve different stakeholders across the aforementioned categories, including from health, education, agriculture, social safety nets and others (SUN 2015).

An analysis such as the one in this thesis will be very valuable to identify where action is required and to then plan next steps by different stakeholders that address different basic, underlying and immediate causes of undernutrition among WRA

3.5. Current interventions to address maternal undernutrition.

Studies have documented evidence-informed interventions to address maternal undernutrition which include micronutrient supplementation (IFA and calcium) including multiple micronutrient supplementation (MMS), ensuring iodine supplementation, malaria prevention and deworming (Bhutta et al. 2013). Adolescent preconception interventions include FP, delayed age at first pregnancy and long interval between pregnancies, abortion and psychosocial care (Bhutta et al. 2013). There is evidence that IFA increases maternal haemoglobin level at term, birth weight of the baby and reduced maternal and infant mortality (Pena-Rosas and Viteri 2006; Bhutta et al. 2008, Mwangi et al. 2014).

According to (Akter et al. 2012), providing nutrition education to pregnant women during the third trimester improves weight gain of pregnancy women and reduces 78% of low birth weight. Bryce et al. (2008) recommended that health interventions should be accompanied by economic and social policies to reduce poverty such conditional cash transfers.

In Zambia, routine interventions to address maternal undernutrition include IFA supplementation (figures 3.11) and deworming medication (figure 3.12) which provide opportunities to the pregnant women and the unborn baby to have sufficient nutrients for health growth. However, the coverage of IFA and deworming are still below the required target by about 30%, especially in Western province where undernutrition among WRA is high. Further, prevention of mother-to-child transmission (PMTCT) of HIV and intermittent presumptive treatment of malaria in pregnancy (IPTp) provide further opportunities to reduce diseases and improve nutrition and health status of pregnant women and unborn babies. No data was available at the time of writing the thesis.

Some nutrition sensitive interventions with long term effects among WRA include provision of modern FP (figure 3.19) to reduce unwanted/unplanned pregnancies and to increase child spacing, attendance at ANC (figure 3.16) which is an opportunity for nutrition education and counselling and screening for anaemia and other conditions which impact on maternal and child nutrition and morbidity and mortality.

Other behavioural interventions include nutritional education and counselling done at maternal and child health (MCH) clinics though this is mainly done by health workers who are less qualified nutrition such as

nurses and midwives (Kakoma et al. 2014). Involvement of safe motherhood action groups (SMAGs) at community level to reach out to women (Ensor et al. 2014; Green et al. 2015; Nabacwa et al. 2015).

However, there is no evidence of supplementation of MMS, balanced energy proteins (BEP) or calcium supplementation in Zambia which have been proved to be effective interventions during pregnancy in both developed and developing countries (Bhutta et al. 2013).

3.6. Some best practices in addressing maternal undernutrition

Involvement of community members and leaders especially grandmothers have positive effects on improving maternal nutrition. Studies in Senegal on involvement of grandmothers showed increase in nutritional knowledge and in their advice to WRA, in the nutrition-related practices of younger women. 87% advised pregnant women to decrease their workload with 91% of WRA in villages with the grandmother strategy reported having decreased their workload during their last pregnancy (Aubel 2004). This is one programme worthy integrated in the package of maternal and child health (MCH) services. According to Bhutta et al. (2008), delivery strategies of maternal undernutrition and micronutrient deficiencies should use community engagement to reach poor segments of the population at greatest risk and make a great difference. The combination of prioritising reduced physical activity and food intake (diet) is a best practice in line with nutrition specific intervention (Bhutta et al. 2013) and especially with support from people living with pregnant women.

According to Bhutta et al. (2013), some best practices for improving maternal nutrition include interventions for adolescents, WRA and for pregnancy. Evidence shows that interventions that support female adolescents FP reduce unwanted pregnancies which is cardinal to reducing the risk of SGA births in a population including micronutrient supplementation through communities and schools (Bhutta et al. 2013; WHO 2007; 2012; UNFPA 2012). Among WRA and during pregnancy, folic acid supplementation to reduce neural tube defects, IFA supplementation both intermittent and daily during pregnancy to reduce anaemia and LBW, MMN supplementation, calcium supplementation to reduce pre-eclampsia and targeted balanced energy protein (BEP) supplementation to reduce SGA, stillbirths and LBW (Imdad and Bhutta 2012; Vaidya et al. 2008; Hofmeyr et al. 2010; Ota et al. 2012; Ortolano et al. 2003).

Chapter four

4.0. Discussion of findings

Globally, trends show that maternal undernutrition has declined in the past two decades (Black et al. 2013). However, undernutrition among WRA in Zambia shows an increased of 13% (annex B, figure 3.1) in the same period of time (CSO et al. 2014).

The prevalence of undernutrition among WRA is 10.3% (using BMI) (CSO et al. 2014), with micronutrient deficiencies such as anaemia among pregnant women (47%) (Luo, Mwela and Campbell 1999) which is categorised as a severe public health problem by WHO (WHO 2008) and a high prevalence of child stunting (40%) (CSO et al. 2014).

The correlation between undernutrition among WRA and under five stunting indicates a stong positive correlation. This explains cumulative effects of poor nutrition and a high burden of infections at population level. There is no observed correlation between the prevalence of undernutrition among WRA and LBWs at population level. However, these findings many not be statistically significance. Among provinces, Western province has high prevalence of both undernutrition among WRA and LBW while Lusaka provinces indicated low prevalence of maternal undernutrition with high LBW. However, the high rate of missing/not known birthweights especially among rural provinces may explain the lower rates of LBW even when undernutrition among women is high compared to urban areas.

Among the determinants of maternal undernutrition, poverty ranks high. WRA in the lowest and second wealth quintiles have the highest (28.7%) undernutrition prevalence. Poverty affects rural provinces like Western province and NWP more than urban areas like Lusaka province. The high poverty levels (figure 3.25) in rural areas (80.4% in Western, 67% in NW provinces and 77.9% in rural) contribute to reduced capacity of the population to afford adequate diversity of the diet, hence majority of the population survive on a basic food items. For some WRA, even basic foods are inadequate in quality and quantities reflected by the low dietary diversity and food insecurity. High expenditure on food items in NWP and Western province reduce the capacity of the population to provide other non-food essential items like education, health, water and sanitation which are equally important determinants of undernutrition.

Another determinants is age of female adolescents at first pregnancy and childbirth aggrevated by early marriages, hence the high prevalence of undernutrition among female adolescents. Early adolescent pregnancies increases the risk of adolescent stunting (Gibbs et al. 2012; Rah et al. 2008) and failure of catch-up growth (Prentice et al. 2013; Black et al. 2013). NWP province provinces has the lowest median age at first pregnancy, childbirth and marriages compared to Western and Lusaka

provinces which also diminish oppurtunities for education progression and employment including income.

Low education attainments is another determinant of maternal undernutrition as observed in rural provinces (NWP and Western province) which have the lowest progression rates compared to urban areas (Lusaka province). Among WRA with no or primary education, the prevalence of undernutriton is high (23.7%). No and low education reduce opportunities for employment and income including health literacy skills to manage basic health and nutrition. Although the literacy rate may be high, the mediam years completed is too low to warrant attainment of sufficient livelihood skills, which puts WRA at high risk of diseases, poor nutrition and increase morbidity and mortality. Provision of modern FP through communities and schools can ameliorate early pregnancy among adolescents, improve birth spacing and education attainments for WRA.

Other determinants include the poor nutrition with inadequate dietary diversification reflected by high levels of food inadequacy. High dependence on carbohydrates with staple foods like cereals (maize) and starchy roots (cassava) which low content of micronutrients. Data on dietary diversification between provinces in Zambia is scarce, however, rural areas depend heavily on cereals and starchy roots (nshima) that they cultivate compared to urban areas with a variety of commercially available foods. Further, the low coverage of consumption of micronutrients increase the risk of undernutrtition among WRA especially in Western province where the need is more. Micronutrient supplementation improves maternal nutrition during the course and outcome of pregnancy to prevent diseases, disability and mortality to both the mother and the child. For instance, IFA are given in order to achieve optimal requirements to prevent anaemia in women during pregnancy, delivery and postnatal care and improves maternal and birth outcomes (birth weight) (WHO 2012).

Poor access to maternal health services is another determinant of undernutrition among WRA. Western province and NWP have low coverage of access to health services by WRA attributed to long distances to health facilities and inadequate qualified health workers. Attendance at ANC provides WRA an opportunity for nutritional interventions like nutrition education and counselling, deworming and IFA supplementation including checking for anaemia, provision of IPTp including distribution of ITNs. Further, inadequate access to health services in NWP and Western province, evidenced by low FP especially among adolescents results in high fertility rate. Low access to health services predisposes WRA to poor health and nutrition due to diseases and unwanted pregnancies.

Disease burden is another determinant of maternal undernutrition. Communicable diseases like HIV/AIDS, Malaria and worm infestations

cause considerable morbidity especially among pregnant women. NWP province has the highest incidence of Malaria which as a result of low distribution of ITNs. Lusaka province has low incidence of malaria and prevalence of undernatrition among WRA which are linked to better housing conditions, but has a high HIV prevalence which could imply good health care resulting in HIV infected perons living longer and/or it mean an increase in new infections. Western province has a double burden of high HIV prevalence and the incidence of malaria including a high prevalance of undernutrition among WRA. The high malaria incidence in NWP and Western province could be attributed to low ITNs distribution and poor environmental conditions including poor housing.

Inadequate access to improved sources of drinking water and sanitation is another determinant of undernutrition among WRA. In rural areas, more than half of households (54.4%) have no access to improved sources of drinking water while 82% had no access to improved sanitation (CSO et al. 2014). NWP and Western provinces have low coverages of both improved sources of drinking water and sanitation compared to Lusaka provinces which also reflects high prevalence of undernutrition among WRA. Poor access to improved sources of drinking water and sanitation, coupled with poor hygiene increases the risk of morbidity and mortality (WHO 2002). WRA bear the greatest burden of inadequate access to improved sources of drinking water and sanitation more so in rural areas.

Inadequate national nutrition and food policies is another determinant of undernutrition among WRA. In Zambia, the only micronutrient fortifications mandatory by law are vitamin A fortified sugar and iodine in salt. Challenges with food fortification exist in that the poor people who are the particular target for micronutrients are normally unable to afford such foods and hence they benefit people that can afford to have diversity of diet. Consideration of policies on biofortification of staple crops like maize, cassava, sweet potatoes, beans, sorghum and millet with vitamin A, Iron, Zinc and amino acids can help ameliorate micronutrient deficiencies, including support to institutions like the NFNC with capacity to provide strategic evidence-informed nutritional policy direction.

The current interventions to address undernutrition which include IFA supplementation and deworming have low coverages in rural provinces. Best practices for addressing maternal undernutrition require involvement of communities and school in nutrition including reduction of food myths during pregnancy.

The framework has assisted me analyse the most important determinants and interventions for addressing maternal undernutrition in Zambia. Due to lack of robust indicators for maternal undernutrition, I used proximal indicators to identify the determinants and interventions.

Chapter five

5.0. Conclusion and recommendations

Several nutrition specific and nutrition sensitive factors including the enabling environment interact to determine maternal nutrition. Improving maternal nutrition from adolescence provides opportunities to reduce the consequences of undernutrition, improve the health of both the mothers and children with benefits to the country.

5.1. Conclusion

Form the study stunting among under five children has a direct relationship with undernutrition among WRA and could be used to predict undernutrition at population level as it reflects cumulative effect of poor nutrition, infections and poor environmental conditions.

Among the determinants of maternal undernutrition in Zambia, poverty contributes significantly to high prevalence of maternal undernutrition especially among the rural women. Western and North western provinces show higher rates of poverty compared to Lusaka province which forces WRA to spend more on food with low nutritional value and with limited dietary diversity.

In rural provinces, early pregnancies and child birth coupled with early marriage are determinants of maternal undernutrition. In Western province, most WRA have child birth first prior to marriage which may be explained as a result of sociocultural exposure or pressures including high economic challenges. Early pregnancies have negative consequences for exclusion from education progression and opportunities for income. Further, early pregnancies, child birth and marriage deprive adolescent of nutrients necessary for optimum growth and development, which also leads to adolescent stunting, a risk factors for maternal morbidity and mortality.

The high burden of infectious diseases like malaria in NWP and high prevalence of HIV/AIDS in Lusaka and Western Provinces increase odds of maternal undernutrition. This is coupled with inadequate access to health services in the rural produces which reduces women's chances of exposure to health and nutrition interventions.

Further, adequate improvement in water and sanitation including hand hygiene reduces the risk of infectious diseases and reduces environmental contamination through open defaecation. Rural areas like NWP and Western province have the lowest coverage of improved sources of drinking water and sanitation hence they are replete with a high burden of infectious diseases which result in maternal undernutrition.

Government policies and institutional frameworks to support and monitor population nutrition are important determinant for maternal nutrition.

However, the only micronutrients that are mandatory fortified are vitamin A and Iodine. Further, governance institutions like NFNC and SUN are vital to support population nutrition but require strengthening.

The study also identifies best practices that include involvement of elderly women in maternal nutrition and the use of communities and schools to deliver nutritional interventions to the targeted populations.

In Zambia, urgent emphasis should focus on delivering nutrition specific interventions for pregnant women including female adolescents and long term measures to address determinants of maternal undernutrition should be directed on nutrition sensitive intervention and poverty reduction.

5.2. Recommendations

As the paradigm shifts to ensuring attainment of the sustainable development goals (SDGs) 2015 – 2025, good maternal nutrition should focus a combination of effective nutrition specific, nutrition sensitive and enabling environment interventions that are cardinal to the socioeconomic growth and development of the country.

Recommended interventions to policy makers:-

- Conditional cash transfer coupled with provision of specific food supplements (BEP supplies) using a voucher system targeted at food insecure and/or malnourished pregnant women through ANC working with community welfare committees under the Ministry of Community Development, Mother and Child Health (MCDMCH) in NWP and Western Province.
- The government in collaboration with NFNC and SUN should provide a policy framework for mandatory micronutrients fortification (including vitamin A, iron, folic acid, zinc, iodine and calcium) of foods such as maize meal, bread flour, cassava flour and cooking oil including biofortification of staples. This will benefit all provinces.

Recommendations to implementers of maternal health and nutrition programmes:-

- Conduct behaviour change communication (BCC) programmes with involvements of community health workers (CHWs) and SMAGs to emphasise both nutrition-sensitive and specific interventions where there is dependence on home grown staple foods to encourage dietary diversity and reduce food misconceptions in rural provinces.
- Target WRA including female adolescents for the biannual intermittent micronutrient supplementations and deworming medication through community level and schools, and continue strengthening the routine IFA supplementation and deworming medication at ANC for pregnant women countrywide.

- Increase access to adolescent friendly sexual reproductive health services (SRHR) with emphasis on delaying age at first pregnancy using modern FP through community health workers and school level in all the provinces.
- SUN and NFNC should raise awareness about the issue of maternal undernutrition, its determinants and consequences for the next generation, among non-health sectors to emphasize the importance of nutrition-sensitive interventions in the areas of agriculture, education, community development and social welfare so that these sectors can also start playing a bigger role to enhance poverty alleviation dietary diversity in the country, with more emphasis in rural areas.
- Promotion of personal hygiene through handwashing especially with soap and reduce open defaecation in the communities and schools in rural provinces (NWP and Western province).

Recommendations to researchers:-

- Research (quantitative and qualitative) to determine the prevalence of maternal undernutrition and its determinants in different provinces which can be done through MCH clinic and schools.
- Research to determine the exposures and consequences of adolescent pregnancies in schools and communities in NWP and Western province.
- Conduct a survey to determine minimum acceptable diet from local foods and modelling to measure dietary diversity by the NFNC.

A focus on effective interventions with political-will and commitment provide a stepping stone to reducing maternal undernutrition which is vital to contribute to improved socioeconomic growth and development of the country.

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Annex A: Health status

Table A. 1.1. Some MDGs Indicators, major communicable and non-communicable diseases, Zambia.

Some Indicators	**Period in Year**					
Diseases	**2011**	**2012**	**2013**			
Notifiable diseases				Data source: The 2013 Annual Health Statistical Bulletin, 2015.		
TB notification rate (cases per 100,000 population/year)	372	321	314			
TB treatment completion rate (%)	5.3	5.8	4.1			
TB Cure rate (%)	82	83	84			
TB treatment success rate (%)	88	88	88			
Non-communicable diseases	**2011**	**2012**	**2013**			
Hypertension (cases per 1,000 population/year)	10.3	12.4	13.5			
Number of epilepsy cases	43,326	43,835	44,207			
Number of patients with diabetes	26,967	34,552	33,280			
Some maternal and Child Health indicators	**1992**	**1996**	**2001-02**	**2007**	**2013-14**	Data source: CSO et al. 1993, 1997, 2002, 2009 and 2014
Neonatal mortality (NNM) rate per 1,000 live births/year	43	35	37	34	24	
Infant mortality rate (IMR) per 1,000 live births/year	107	109	95	70	45	
Under five mortality rate (UMR) per 1,000 live births/year	191	197	168	119	75	
Maternal mortality ratio (MMR) per 100,000 live births	N/A	649	729	591	398	
HIV/AIDS						
HIV prevalence (%)	N/A	N/A	15.6	14.3	13.3	

Table A.1.2: Ten (10) Major causes of morbidity for the age group 5 years and below, the age group 5 years and above and all ages, 2013

(Under 5) - 2013	
Disease Name	Incidence/ 1,000 pop.
Malaria	845.6
Respiratory Infection: non-pneumonia	799.1
Diarrhoea (non-bloody)	283.9
Respiratory Infection: pneumonia	98.6
Eye diseases (infectious)	66.4
Digestive system: (not infectious)	45.9
Skin Diseases (not infectious)	39.7
Trauma: Other Injuries, wounds	38.8
Skin Diseases (infectious)	31.0
Nose Diseases	23.2

(over 5) - 2013	
Disease Name	Incidence per 1,000 pop
Malaria	336.6
Respiratory Infection: non-pneumonia	266.1
Muscular skeletal and connective tissue (not trauma)	80.0
Diarrhoea (non-bloody)	48.4
Digestive system: (not infectious)	44.5
Trauma: Other Injuries, wounds	39.2
Dental Carries	30.0
Respiratory Infection: pneumonia	20.6
Throat Diseases	19.9
Skin Diseases (not infectious)	18.2

(All ages) – 2013	
Disease Name	Incidence per 1,000 pop
Respiratory Infection: non-pneumonia	382
Malaria	370
Diarrhoea (non-bloody)	96
Muscular skeletal and connective tissue (not trauma)	66
Digestive system: (not infectious)	45
Trauma: Other Injuries, wounds	39
Respiratory Infection: pneumonia	36
Skin Diseases (not infectious)	26
Eye diseases (infectious)	26
Dental Carries	25

Data Source: The 2013 Annual Health Statistical Bulletin, 2015

Table A. 1.3: Ten (10) major causes of death in health facilities (for all ages combined), Zambia, 2013

(All ages) – 2012				
Disease Name	Admins All ages	Death (All ages)	Mortality proportion (%)	CFR
Malaria	160,885	3,954	17	24.6
Respiratory Infection: pneumonia	43,360	2,520	11	58.1
Anaemia	25,107	2,153	10	85.8
Tuberculosis (TB)	13,748	1,992	9	144.9
Severe malnutrition (new case)	8,260	1,314	6	159.1
Cardio-vascular diseases	7,952	1,195	5	150.3
Respiratory Infection: non-pneumonia	39,168	909	4	23.2
Cryptococcal meningitis	2,028	755	3	372.3
Digestive system: (not infectious)	15,371	595	3	38.7
Severe Diarrhoea with dehydration	7,350	595	3	81.0

Data Source: The 2013 Annual Health Statistical Bulletin, 2015

Annex B: Findings

Figure B 3.1: Trends in the prevalence of undernutrition among WRA in Zambia 1996 – 2013-14

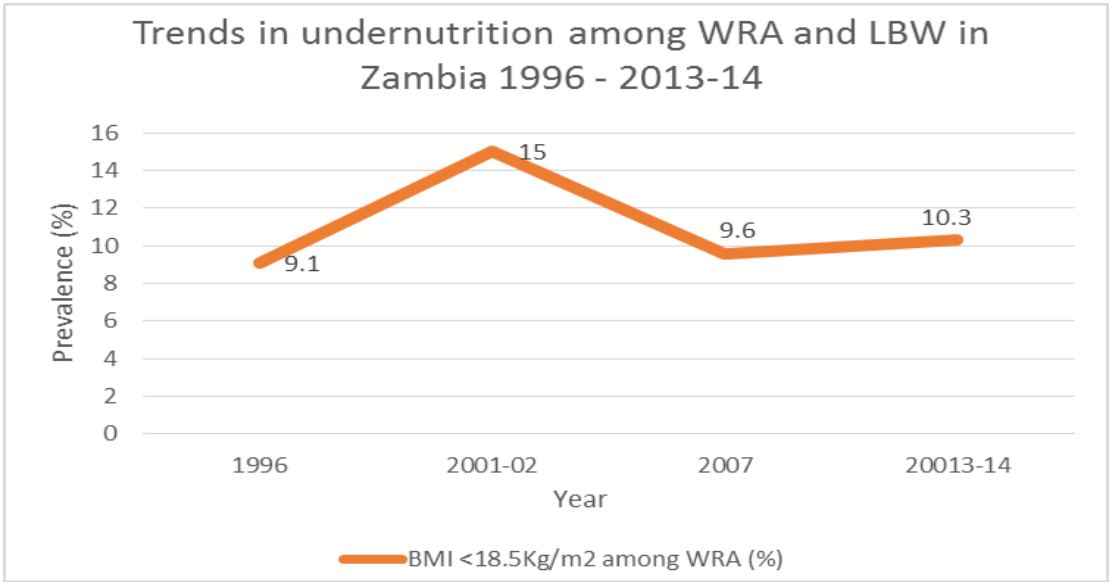
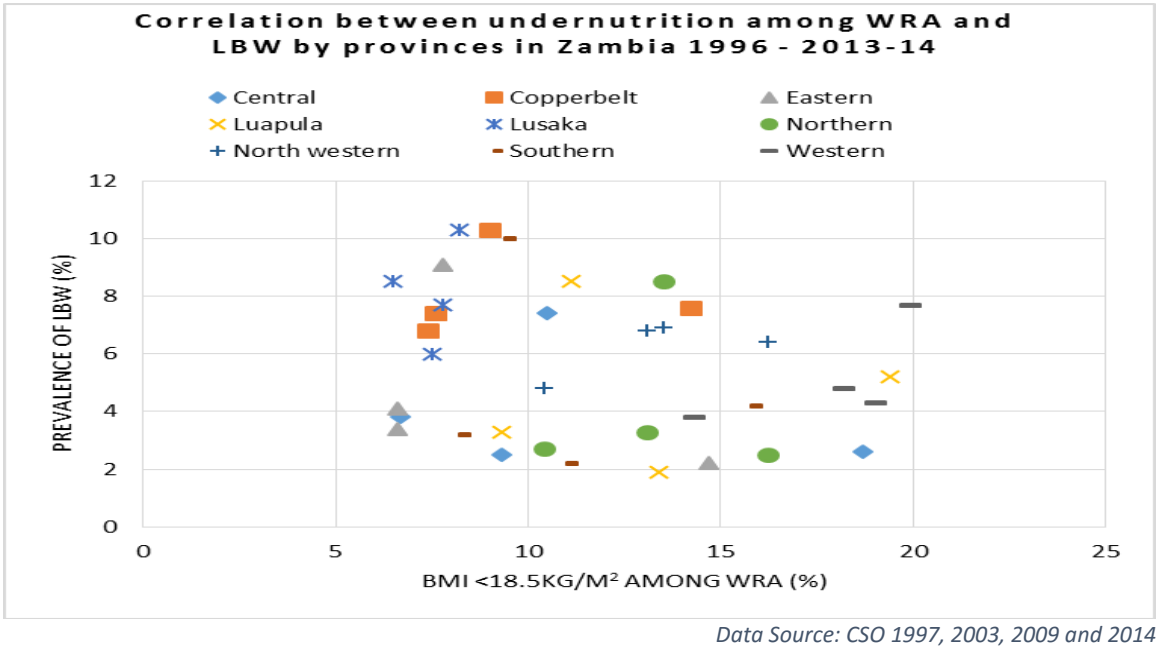


Figure 4: Trends in undernutrition among WRA and LBW in Zambia 1997 - 2014: Data Source: CSO 1997, 2003, 2009 & 2014

Figure B 3.2: Correlation between prevalence of undernutrition among WRA and LBW by Provinces in Zambia from 1997 to 2014



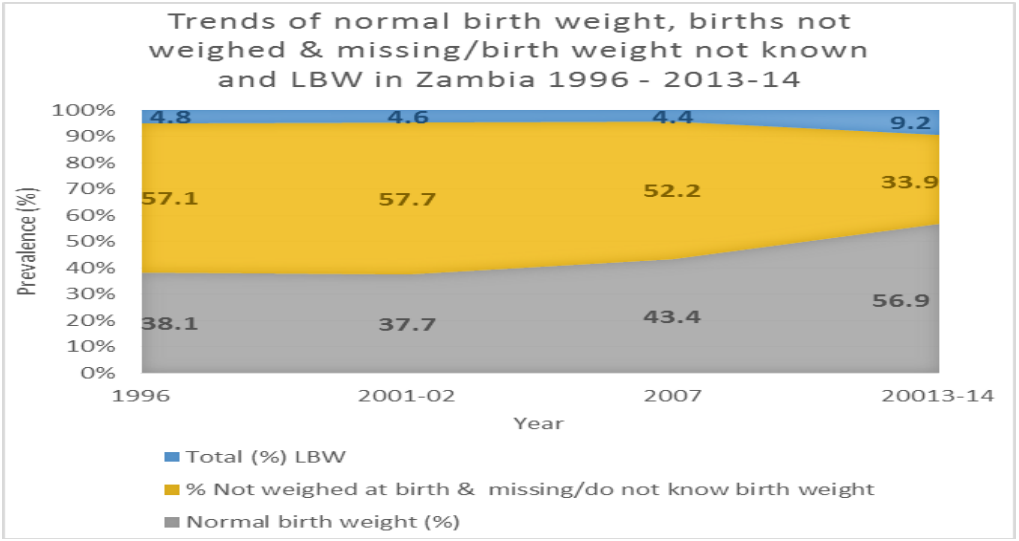
Data Source: CSO 1997, 2003, 2009 and 2014

Table B 3.1. Pearson Coefficient correlation: r^2 represents the % variation in Y that can be explained by X (goodness/strength of fit).

Strength	Interpretation (r^2)
No correlation	0
Very Weak	0 <= r <= 0.20
Weak	0.21 <= r <= 0.4
Moderate	0.41 <= r <= 0.6
Strong	0.61 <= r <= 0.80
Very Strong	0.81 <= r <= 1
Perfect	1

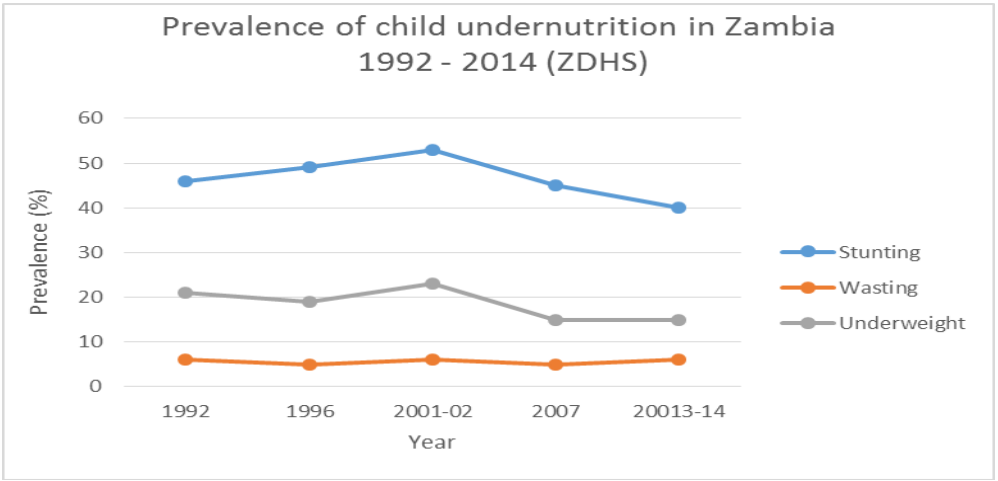
Source: Class notes, Epistat 2, ICHD 2014_2015_3.4; p.9

Figure B 3.3. Trends of birth weight & births not weighed & missing/birth weight not known.



Data source: CSO 1997, 2003, 2009 & 2014

Figure B 3.4: Trends in prevalence of child undernutrition in Zambia from 1992 to 2013-14



Data source: CSO 1993, 1997, 2003, 2009 & 2014

Table B 3.2: Food myths and misconceptions for pregnant women (NWP, Solwezi and Chavuma, Zambia)

SN	Myths and misconceptions about eating:	Reasons for prohibition during pregnancy
1	• Okra (vegetable)	• leads to the baby being born weak;
2	• Katolo (lumanda) (vegetable)	• causes prolonged labour;
3	• Eggs (Proteins)	• causes baby to be born without hair;
4	• Pork or warthog (Proteins)	• causes baby to have fits or convulsions soon after birth;
5	• Pork and goat (Proteins)	• causes baby to start to behave like a pig or a goat when it is born;
6	• Chilli and related spices	• causes baby to be born with sore lips (red lips);
7	• Foods such as bicarbonate of soda	• causes cancer, and cause the child to be born with measles;
8	• Leftover food	• causes difficulties for mother during labour;
9	• Animals that died on their own or died with a foetus (Proteins)	• causes maternal and/or foetal death;
10	• "Too much" food during pregnancy	• resulting in a big baby and have a difficult delivery;
11	• Eggplant (vegetable)	• Causes the baby to have six fingers or some other disability.

Source: Kakoma et al. 2014 Formative research in Action.