A stunting profile of children younger than five years in selected vulnerable communities in Worcester, Breede Valley, Western Cape

by
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DECLARATION

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ABSTRACT

INTRODUCTION

Stunting is defined as a height for age z-score below minus two standard deviation, measured against the World Health Organisation (WHO) growth charts and is a significant public health priority associated with various economic consequences. In 2018 it was estimated that 150.8 million children worldwide were stunted. The WHO set a target to reduce childhood stunting with 40% by 2025 however, the prevalence of stunting in Africa continues to rise.

AIM

The study aimed to create a stunting profile of children below the age of five, living in the following vulnerable communities of Worcester, Breede Valley sub-district: Avian Park, Riverview, Roodewal and Zwelethemba.

METHODOLOGY

A descriptive, cross-sectional survey was conducted and consecutive sampling with randomised starting points was used. The data collection period spanned from 26 July 2018 to 30 October 2018, where a fieldworker-administered questionnaire was completed, and anthropometrical measurements of the mothers and their children below the age of five were taken. The main factors of stunting, determined according to the WHO conceptual framework on context, causes and consequences of childhood stunting were investigated.

RESULTS

In this study the overall prevalence of stunting was 26.27% (n=232/883). The childhood underweight, wasting, overweight and obesity prevalence was 10.18% (n=90/885), 4.11% (n=36/876), 11.41% (n=100/876) and 4.34% (n=38/876), respectively. In addition, the maternal nutritional profile was determined to be poor. A high burden of 53.23% (n=470/851) in overweight and obesity was found while 11.63% (n=99/851) of the participants were identified as underweight. The odds of stunting were higher in male children (AOR=1.58; 95% CI: 1.07, 2.35) and those born with a birthweight below 2500g (AOR=2.21; 95% CI: 1.38, 3.52). Maternal waist circumference above 88cm cut-off showed a protective effect against childhood stunting in these vulnerable communities (AOR=0.46; 95% CI: 0.30, 0.71). Lastly, a low overall dietary diversity score was significantly associated (p=0.016) with stunting in the children that formed part of this study.

CONCLUSION

Child and maternal under- and overnutrition was found to be a significant problem in the study area. The double burden of malnutrition was evident within the same households and the following key drivers of stunting were identified: being of male gender, lower weight at birth, low dietary diversity and poor maternal nutritional status. Interventions focused on improving maternal nutritional status during pregnancy and improved dietary diversity in children are essential in order to combat the prevailing stunting levels in the Breede Valley sub-district.

OPSOMMING

INLEIDING

Ingekortelengtegroei word gedefinieer as die lengte vir ouderdom z-telling onder minus twee standaard afwyking, gemeet op die Wereldgesondheidsorganisasie (WGO) groeikaarte, en is 'n beduidende publieke gesondeheids prioriteit wat met verskeie ekonomiese gevolge assosieer word. In 2018 was dit beraam dat ongeveer 150.8 miljoen kinders wêreldwyd ingekortelengtegroei het, en die WGO het 'n doelwit gestel om ingekortelengtegroei met 40% te verminder teen die jaar 2025, alhoewel die voorkoms in hiervan Afrika is steeds besig om te styg.

DOEL

Die studie het beaam om 'n ingekortelengtegroei- profiel van kinders onder die ouderdom van vyf jaar te skep, wat in die volgende selekteerde kwesbare gemeenskappe in Worcester, Breede Vallei sub-distrik woon: Avian Park, Riverview, Roodewal en Zwelethemba.

METODES

'n Beskrywende, deursnit opname was gedoen en opeenvolgende steekproefneming met ewekansige beginpunte gebruik. Die data opname het tussen 26 Julie 2018 tot 30 Oktober 2018 plaasgevind, waartydens veldwerker geadministreerde vraelyste voltooi was en antropometriese metings van moeders en hul kinders onder die ouderdom van vyf jaar, geneem was. Die hoof oorsake van ingekortelengtegroei was vasgestel deur die WGO se konseptuele raamwerk insluitende konteks, oorsake en gevolge van ingekortelengtegroei onder kinders.

RESULTATE

In die studie was die algehele verskyning van ingekortelengtegroei 26.27% (n=232/883). Kinder ondergewig, uitering, oorgewig en vetsig se voorkoms was 10.18% (n=90/885), 4.11% (n=36/876), 11.41% (n=100/876) en 4.34% (n=38/876) ondererskeidelik. Daarbenewens die antropometriese status van moeders was swak bevind. 'n Hoë las van 55.23% (n=470/851) oorgewig en vetsig was bevind, terwyl 11.63% (n=99/851) van die deelnemers ondergewig was. Die kans van ingekortelengtegroei was hoër in seuns (AOR=1.58; 95% CI: 1.07,2.35) en die wat gebore is met 'n gewig onder 2500g (AOR=2.21; 95% CI: 1.38, 3.52). Die moeders met 'n middelyfomtrek oor die 88cm afsny punt het 'n beskermende effek teenoor ingekortelengtegroei getoon in die kwesbare gemeenskappe (AOR=0.46; 95% CI: 0.30, 0.71). Laastens 'n lae dieetdiversiteitstelling was betekenisvol geassosieer (p=0.016) met ingekortelengtegroei in die kinders wat deelgeneem het in die navorsings projek.

SAMEVATTING

Kinder- en moeder ondervoeding en oorvoeding was ‘n beduidende probleem in die studie areas. Die dubbele las van wanvoeding was duidelik in dieselfde huishoudings en die volgende faktore van ingekortelengtegroei was geindentifiseer: manlike geslag, laer gewig by geboorte, lae dieetdiversiteit en die swak voedingstatus van moeders. Intervensieprogramme gefokus om moeders se voedingstatus tydens swangerskap te verbeter, asook om die dieetdiversiteit van kinders te verbeter, is noodsaaklik om die heersende ingekortelengtegroei voorkoms te bekamp in die Breede Vallei sub-distrik.

ACKNOWLEDGEMENTS

I would like to sincerely thank the Almighty Father and without mentioning any names, everyone who contributed and supported me throughout this challenging journey.

CONTRIBUTIONS BY PRINCIPAL INVESTIGATOR AND FELLOW RESEARCHERS

The study protocol was drafted by the Principle Investigator (PI), Annemie Lenhoff, in collaboration with study leaders, Prof. L.M. du Plessis and Dr. E. van Niekerk, as well as co-investigators from the Grow Great campaign, Ms. M. Konjore, Dr. K. M. Mabaso, Ms. B. Robertson and Ms. N. Eley. The protocol was finalised in a collaborative effort which included the PI, study leaders and members of the Grow Great team. The study was approved by the Health Research Ethics Committee of SU (project reference S18/05/100). Ms. Robertson, the PI and the assistant instructors of Philani- mentor- mothers were responsible for the training of the Community Health workers at Boland Hospice. These Community Health workers collected the data while the Philani- mentor- mothers assisted and supervised the process for quality control purposes. The PI was involved in all stages of the research study and the collected data was analysed by Prof. C.J. Lombard and Mr L. Mapahla, from the Stellenbosch University Biostatistics Department. Dr. E. van Niekerk and Prof. L.M. Du Plessis was continuously involved throughout the process, providing their input and revising all documents.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
CHW	Community Health Worker
CSG	Child Support Grant
DD	Dietary Diversity
DDS	Dietary Diversity Score
DGMT	DG Murray Trust
FAS	Fetal Alcohol Syndrome
HAZ	Height-for-age Z-score
HIV	Human Immunodeficiency Virus
LMIC	Low- and middle-income countries
MAM	Moderate Acute Malnutrition
MUAC	Mid-Upper Arm Circumference
NCD	Non-communicable diseases
NGOs	Non-Governmental Organisations
NIDS	National Income Dynamics Study
PI	Principal Investigator
RtHB	Road to Health Booklet
SADHS	South African Demographic and Health Survey
SAM	Severe Acute Malnutrition
SANHANES	South African National Health and Nutrition Examination Survey (1)
SES	Socio-economic status
SOP	Standard Operating Procedures
SU	Stellenbosch University
UNICEF	United Nations Children's Fund
WASH	Water Sanitation and Hygiene
WAZ	Weight-for-age Z-score
WHO	World Health Organization
WHZ	Weight-for-length/height z-score

LIST OF TERMINOLOGY

Drivers: Statistically significant factors related to childhood stunting in children between the ages of 0- 60 months in Worcester, Breede Valley.

Prevalence: The proportion of Worcester, Breede Valley children between 0 to 60 months who are stunted during the time of the study.

Stunting profile: The prevalence of stunting and the factors associated with stunting for children below the age of five in Worcester, Breede Valley.

Vulnerable communities: Communities living in Worcester, Breede Valley where the majority of children in the area live below the upper-bound poverty line and/or where some of the known key drivers/factors of stunting are higher than the national average.

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTORY REMARKS

Linear growth in young children is one of the most subtle indicators for predicting future health and well-being, especially during the first two years of life.[1] It is now the preferred indicator used to assess undernutrition, due to the impact of sub-optimal linear growth on cognitive development, morbidity and mortality risk, infectious and non-communicable disease risk later in life, as well as the impact on productivity and economic development.[2–4]

Sub-optimal linear growth is known as stunting and can be defined as a height/length-for-age below the second z-score on the World Health Organisation (WHO) growth charts median.[5,6] Stunted children thus fail to reach their linear growth potential. Stunting is one of the most dominant forms of undernutrition worldwide and has been identified as a significant public health priority, due to consequences seen later in adult life.[7]

In 2018, the global estimate of stunted children was 150.8 million[8] and projections indicate that 127 million children under the age of five will be stunted in 2025, if existing trends continue.[9] However, stunting in children below the age of five is declining on a global level yet stunting prevalence in Africa is rising. Although there was a decrease in the percentage of stunted children in Africa, the prevalence has increased due to population growth.[8] Furthermore, the South Africa Demographic and Health Survey (SADHS) 2016 key indicator report showed that 27% of children below the age of five are stunted and 10% are severely stunted.[10]

The timeframe from conception until the age of two, often referred to as the first 1,000 days of life, is a critical period for growth and development. If untreated, stunting is an irreversible result of inadequate nutrition, repeated infection episodes and poor environmental circumstances that occur during the first 1,000 days of a child's life. Nutrition during this period has implications for a child's immediate and long-term health. Multiple actions are required in order to reduce stunting, starting with relevant interventions during the critical 1,000 days window.[2,11]

1.2 RATIONALE FOR THE RESEARCH STUDY

This research project was a joint venture between Stellenbosch University's Division of Human Nutrition and the Grow Great campaign, which was initiated by the DG Murray Trust (DGMT) in 2017. DGMT is an innovative company whose main focus is to invest in the potential of South Africa and to reduce the burden of stunting with 50% by the year 2030 (https://dgmt.co.za/).

This study aimed to develop a stunting profile of children under the age of five in selected vulnerable communities in Worcester, Breede Valley, Western Cape Province.

Previous studies conducted in this area found the prevalence of malnutrition to be high for mothers and their children, with incidence of poor infant and young child feeding practices as well.[12] However, the main focus

of the previous community survey was not specifically on stunting. Since childhood stunting causes a series of adverse short- and long-term effects, and have major implications for economic development, this research project will focus on investigating the context and causal factors of stunting in Worcester.

1.3 CONCEPTUAL FRAMEWORK OF RESEARCH STUDY

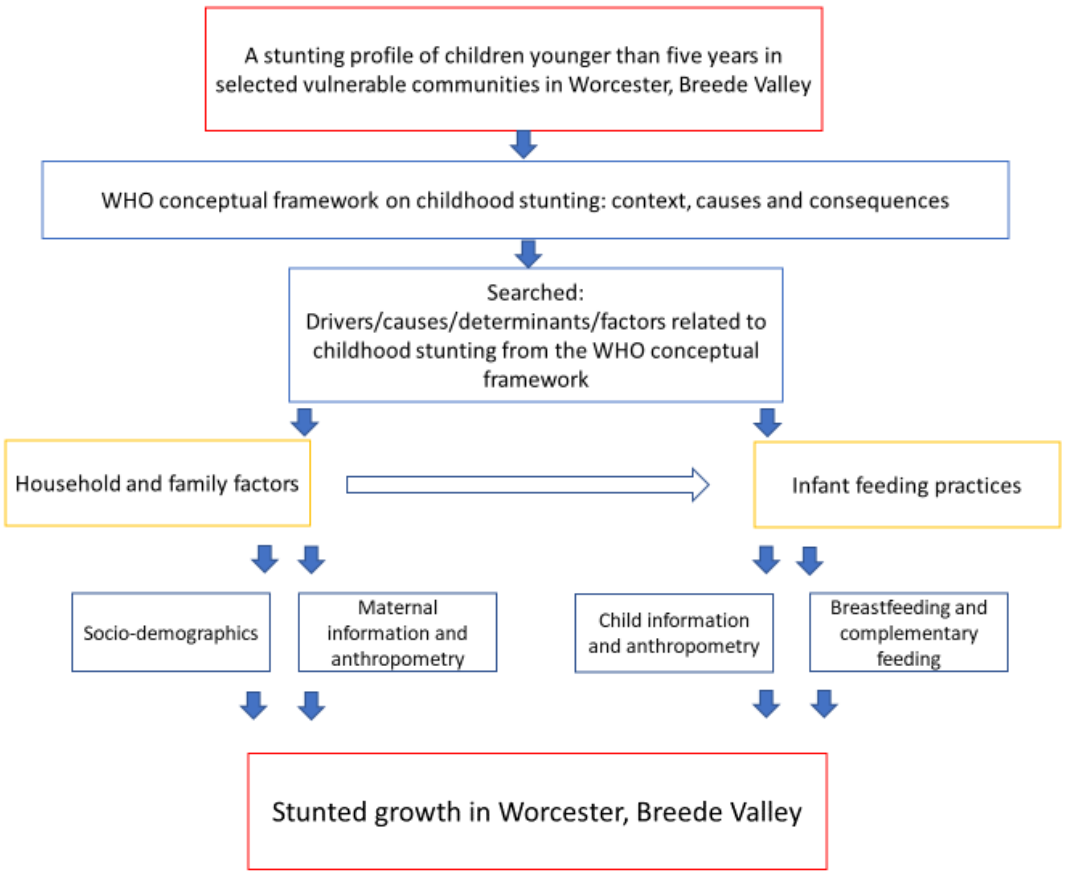


Figure 1.1 Conceptual framework of research study

1.4 RESEARCH QUESTION, AIMS AND OBJECTIVES

Research question: What does a community stunting profile for children below the age of five look like for selected vulnerable communities in Worcester, Breede Valley, Western Cape?

Aim: To develop a stunting profile of children below the age of five in selected vulnerable communities of Worcester, Breede Valley.

Objectives:

1. To determine the prevalence of stunting in children below the age of five in the following four selected areas in Worcester: Avian Park, Riverview, Roodewal and Zwelethemba.
2. To determine the drivers of childhood stunting in Avian Park, Riverview, Roodewal and Zwelethemba.

Secondary Objective:

1. To describe the anthropometric profile of mothers with children below the age of five living in the selected areas in Worcester, Breede Valley.

1.5 THESIS OVERVIEW

This Master's thesis is presented in six chapters as follows:

Chapter 1: General introduction and rational for the research study.

Chapter 2: Literature overview highlighting the issue of stunting and the importance of addressing the problem, as well as a brief discussion of the key factors and determinants related to stunting found in previous studies.

Chapter 3: The methodology followed in the research study.

Chapter 4: A showcase of the results.

Chapter 5: A detailed discussion of the results and contextualising the results within previous studies.

Chapter 6: Conclusion of the thesis with a focus on recommendations for future action.

CHAPTER 2: LITERATURE REVIEW AND MOTIVATION FOR THE STUDY

2.1 STUNTING: A SIGNIFICANT PUBLIC HEALTH CONCERN AND PRIORITY

Stunting is a significant public health problem predominantly found in developing countries where poverty is the norm and a high burden of infectious diseases are evident.[13,14] It is characterised as an overall indicator of nutritional status, and provides an accurate indication of development inequalities, especially in young children.[13] Stunting is universally defined as a length/height-for-age (HAZ) score below the 2nd z-score on the World Health Organisation (WHO) growth charts, and is often referred to as linear growth failure.[15] The term thus means that the child is not growing in accordance with their potential, with regards to their length or height.[3] This is a common indication of chronic malnutrition and stunting is currently a key public health priority area, due to the immediate and long-term consequences, resulting in lifelong adverse outcomes.[16]

2.2 GLOBAL AWARENESS OF STUNTING

A global increase is seen in the prevalence of stunting resulting in the deaths of millions of children each year. Stunting is not only associated with a decreased stature but also an increased risk of morbidities, mortality and other destructive outcomes.[16,17]

The prevalence of stunting overshadowed the percentage of wasting - another growth anthropometrical outcome, known as the indicator of acute malnutrition. Wasting is defined as the weight for length z-score (WLZ) below the -2 standard deviations on the WHO growth charts.[18] In 2016, it was estimated that 22.9% of children were stunted and 7.7% were wasted worldwide,[19] thus stunting was identified as the most common form of malnutrition.[13,19] Stunting is, however, on a decreasing trend since the 2000s. In 2013, 25% (161 million) of children were estimated to be stunted of which the majority lived in South Asia and sub-Sharan Africa.[20]

In 2016, it was estimated that 156 million children below the age of five were stunted[19,21] while in 2018, the Global Nutritional Report estimated that 150.8 million children are stunted.[8] Even though the numbers are declining, significant disparities between countries still remain. The prevalence rate in developing countries, particularly countries in South Asia and sub-Saharan Africa, are increasing. Projections show by the year 2020, 64 million children below the age of five years will be stunted in Africa alone.[22] In addition, almost five million (7%) children in high income countries are burdened with compromised linear growth.[23] Consequently, stunting has become a focus area of international attention and a key global health priority.[13] As this health burden affects millions, it subsequently affects the economy as well.[16]

Consequently, a universal agreement was formed, with the aim to focus on the critical window of opportunity during the period ranging from conception up until the age of two years. During this time, known as the first 1,000 days of life, linear growth is the most sensitive to adjustable, causal factors such as infant feeding practices.[2,11,24]

2.3 THE CURRENT SITUATION IN AFRICA

A meta-analysis done between 2006-2016 specified the prevalence of stunting in various parts of Africa. The east Africa region was noted to have the highest prevalence of stunting with Malawi at 47.1 % and Burundi at 57.7%.[25] A study conducted in Tanzania indicated the prevalence was a high of 49.7% for children below the age of five[26] while the West Africa region noted a stunting prevalence in Nigeria of 36.8%, Sierra Leone 37.9%, Mali 38.9% and Niger 43.9%.[25]

Stunting is persistent in Africa. South Africa is specifically one of the World's top 20 countries with the highest burden of malnutrition and is currently in a nutritional transition. The nutritional transition is characterised by changes in the daily dietary patterns, moving from a traditional to a more westernised type of diet. These changes include a high intake of saturated fats, sugar and salt paired with decreased physical activity. As a middle-income country, South Africa is faced with the double burden of malnutrition with over- and undernutrition that co-exists, leaving South Africa with the paradox of stunted, overweight individuals.[27] Child undernutrition has been a public health concern of low- and middle-income countries (LMIC) for years. This is why the Sustainable Development Goals, which focus on reducing poverty and ensuring household food security, is of great importance.[28] Between 2014 – 2016, sub-Saharan Africa was projected to have an undernourishment rate of 23%. Nearly half the deaths among children below the age of five were attributed to poor nutrition, where one out of four of these children were stunted. However, by placing the focus on individual nutritional needs, as well as those of pregnant and breastfeeding mothers, a visible reduction in stunting is predicted by the year 2025. Furthermore, by the year 2030 the decline of hunger and malnutrition through the enhancement of accessibility to food, water and employment, is expected.[29,30]

Reports show poverty as one of the leading causes of malnutrition and the primary cause of hunger. To address the issue of poverty related malnutrition, certain African countries are implementing cost-effective strategies such as school meals and supplementation, however, a holistic approach is needed to solve this complex problem. Community level interactions are crucial to prevent stunting in South African children below the age of five and timeous interventions are critical to safeguard children in helping them reach their full potential.[31] Looking at the long-term consequences of stunting, if timeous action is not taken, these children will not reach their full potential and thus their contribution to society in adulthood, will be diminished. As South Africa is undergoing a nutritional transition, overnutrition is increasing rapidly and infectious diseases persist, therefore community-level interventions are crucial; not only to prevent stunting in young South African children but also in the rest of Africa.[30]

In 2008, 25.7% (164.8 million) of children below the age of five were stunted worldwide and 40% (56.9 million) of African children below the age of five were stunted. According to the Lancet 2013 series on Maternal and Child Nutrition, this figure was reduced to 36.5%, however, this reduction was accompanied by an increasing population which lead to a relatively static prevalence of stunting. In the 10-year period between 1990 and 2010, the prevalence of stunting among African children increased. According to the

current increasing trends, future projections show that this increasing trend would be likely to continue through to 2025, despite it being an international health priority.[2]

Due to the wide variety of factors contributing to the development of stunting, the programmes and policies that have been implemented, present multiple challenges with relatively slow progress.[32] However, certain African countries made considerable improvements: Ethiopia decreased the prevalence of stunting from 57% to 44% between 2000-2011 while Ghana showed a 5% decrease between 1993-2008 and Mauritania had a reduction from 55% to 22% between 1990-2012. Regardless of this progress, minimal improvement is anticipated if these trends continue. Alongside South-Central Asia, East (42%) and West Africa (36%) is currently estimated to have the highest prevalence of stunting. The estimated prevalence reduction in Africa is a mere 4% and the numbers of stunted individuals is set to increase from 56 million to 61 million people by 2025. These estimations were made by assuming that the major contributing factors will remain the same including; poverty, infectious diseases, illiteracy and poor infant feeding practices. [24] Up until 2025, it is estimated that Africa will show the slowest global decline in stunting.[19,33]

Since South Africa is in the midst of a nutritional transition, stunted children who have received inadequate nutrition during early developmental years, can become overweight or obese with other adverse complications, if they are in a position to access more food later in life. Therefore, over- and undernutrition can occur simultaneously.[27] This is a complex problem with multiple determinants that need to be addressed by various stakeholders in order to improve the lives of those affected and ensure their full potential is reached. More research is needed to understand the current trend and suitable intervention methods thereof.[34,35]

Even though South Africa is a middle-income country and food is secured at a national level, food insecurities exist at household level. In 2017, around 13.4 million (20%) households had inadequate access to food and around 1.6 million households experienced hunger.[36] Increased prices for daily necessities such as fuel and staple foods negatively impact the food security of households and the country. In order to reverse stunting, there will need to be drastic change in the environmental circumstances of the majority of the population.

The Roadmap for Nutrition in South Africa (2013 – 2017) includes a nutrition specific food supplementation programme aimed at children between the ages of 6-59 months in order to treat moderate malnutrition. The products include various micronutrients, enriched foods and therapeutic drinks. The programme is administered by health care professionals at primary health care level to combat undernutrition. In addition to the products provided, mothers and caregivers should be encouraged to attend the clinic regularly, breastfeed and appropriately introduce complementary foods.[37]

It is of great importance to have a clear understanding of the nutritional challenges in a specific area and how it affects the interventions aimed and implemented to prevent and treat malnutrition in South Africa.[38]

2.4 DETERMINANTS OF STUNTING

The physical growth of a child is influenced by various factors, the main determinants being the quantity and quality of the food consumed daily however, psychosocial circumstances and environmental surroundings also affect their growth. Poor nutritional intake is a result of suboptimal environmental determinants[14] where the inadequate nutritional value of foods is associated with higher incidence of stunting in children.[39] The United Nations International Children's Fund (UNICEF) conceptual framework[40] explains contributing causes of malnutrition and presents the direct and indirect pathways that result herein (Figure 1). The health burden is an outcome of a basic chain of immediate, underlying and basic causes. A child's existing dietary intake and possible infectious diseases are immediate causes of malnutrition and contributes to or worsens the issue, resulting in a decreased appetite and poor intake of essential nutrients due to malabsorption, which in turn diminishes the immune system and aids the infection.[23]

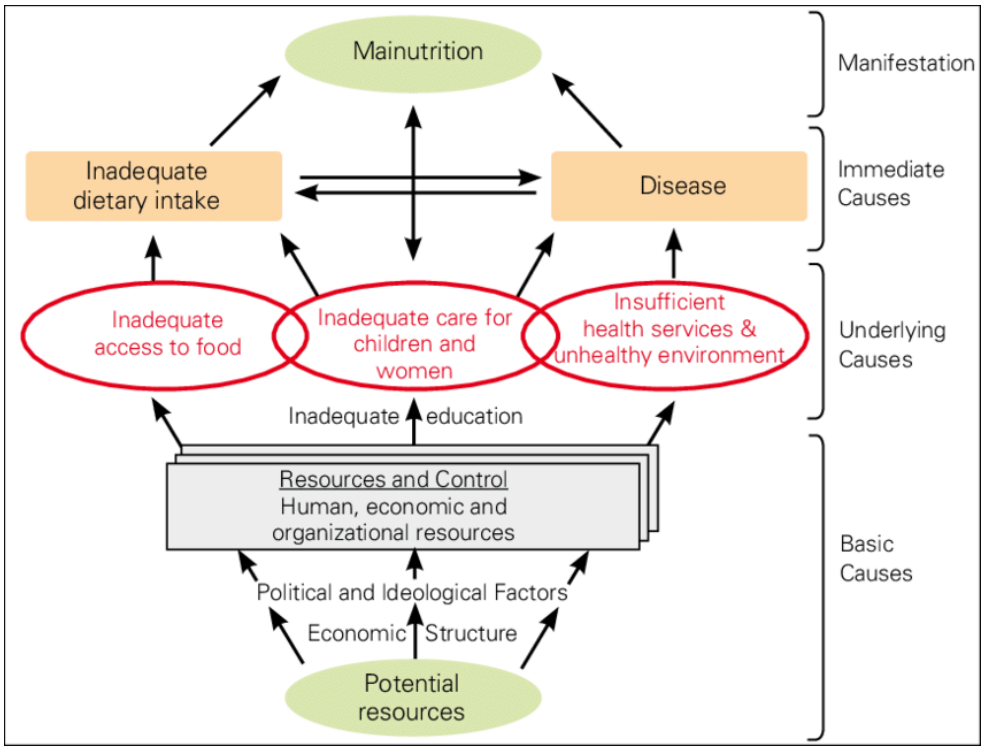


Figure 2.1 UNICEF Malnutrition conceptual framework[40]

Underlying determinants of stunting are accounted for by the environment an individual is exposed to, such as household circumstances, the availability of food and water, and the availability of adequate care. Basic causes include the economy, political structures and resources and cultural and societal beliefs.[41] The complex interaction of adverse environmental circumstances, which impairs the linear growth of an individual, is referred to as stunting syndrome.[23]

The Lancet 2013 series of Maternal and Child Nutrition framework (Figure 2.2)[2] was premised on the UNICEF framework. However, these frameworks differ in that the Lancet framework represents the means for ideal

growth and development, instead of the determinants of malnutrition seen in the UNICEF framework. The Lancet framework also focuses on the health, dietary and behavioural determinants required for optimal growth, development and nutritional intake, and the manner in which underlying determinants influence these practices. Factors such as food security, household conditions, environmental exposures and availability to care are all presented. These factors in turn are shaped by the social and economic conditions, national and global governance and resource availability. Furthermore, the Lancet framework is more focused on the potential changes that could result from implementing nutrition specific and sensitive interventions. Interventions focused on the immediate and underlying causes of malnutrition, as well as ways to create and support an enabling environment, are incorporated into the framework.

Optimum growth is affected by numerous factors operating on different levels of causation. Proximal circumstances such as infectious diseases and the availability of food and care are all presented while distal determinants such as governance, politics, socio-economic status and environmental conditions also play a vital role. The inequality between population classes have detrimental, lasting effects on child health and wellbeing. The disparities of these distal determinants, especially in low and middle income countries, highlight the importance of the dynamic role of the bottom block in Figure 2.2 as well as the crucial need to build an enabling environment for action. [2]

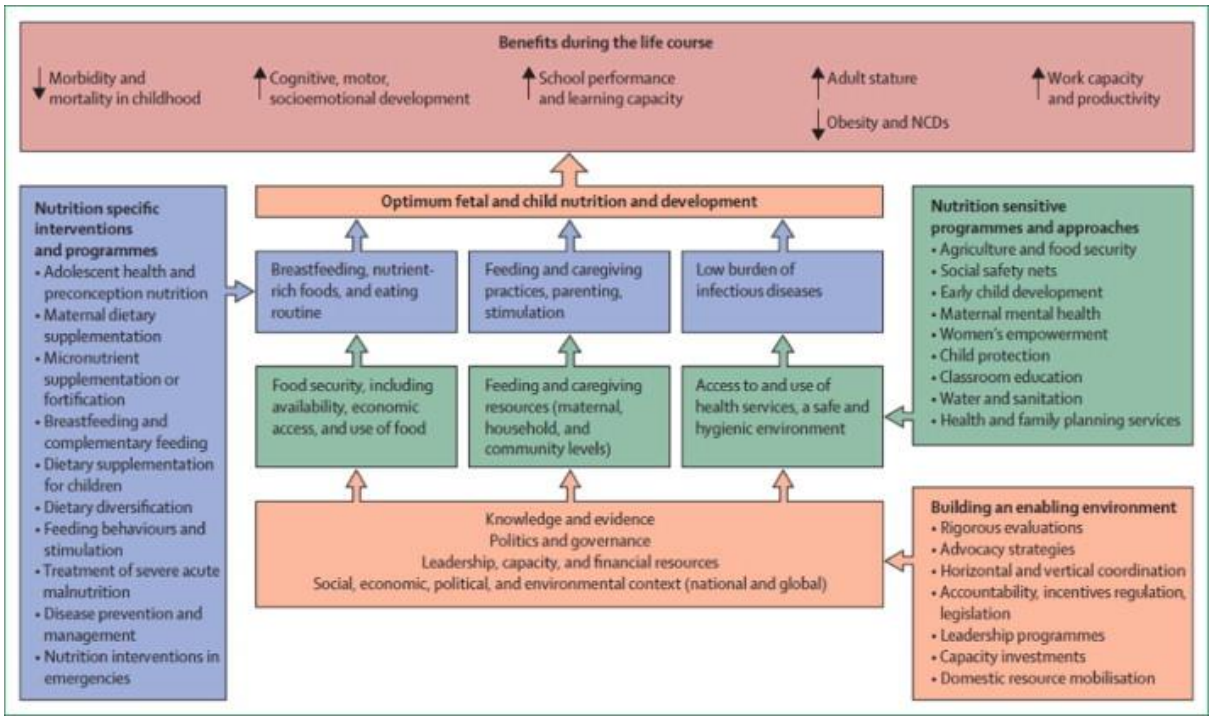


Figure 2.2 Framework to achieve optimum foetal and child nutrition and development.[2]

The WHO framework on the Context, Causes and Consequences of Childhood Stunting (Figure 2.3) was released in 2013 and is based on global data, depicting multiple contributing factors and their combined effects on stunting. It also expands on the UNICEF conceptual framework for malnutrition of women and children, in general.[42]

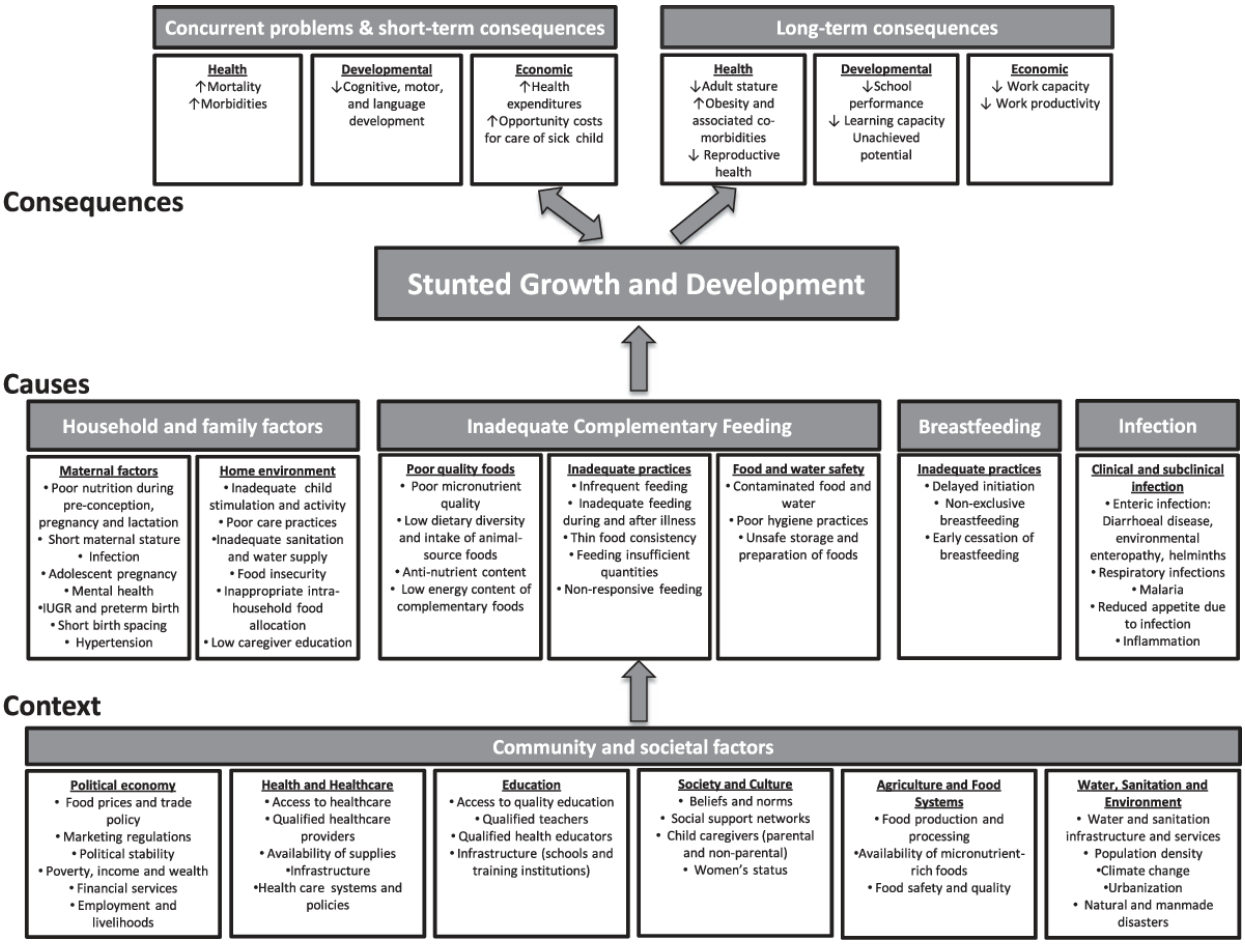


Figure 2.3 WHO conceptual framework on Childhood Stunting: Context, Causes, and Consequences, with an emphasis on complementary feeding[3]

2.5 GLOBAL TARGETS AND INTERVENTIONS

The WHO set a target to reduce stunting with 40% by 2025, but it seems unlikely that the target will be reached.[43] It is estimated that this target will be missed by 27 million children (26%).[21,24] Stunting is also highlighted in the United Nation's (UN) Sustainable Development Goals (SDGs)[28], where the WHO target is quoted, and was identified as a key developmental indicator to measure progress towards hunger reduction in the sustainable development goals.[44] In 2013, the United Kingdom-Brazilian Nutrition for Growth event made a commitment to support the exceptional attempt to decrease undernutrition, and set a target to reduce stunting to 20 million individuals worldwide by 2020. The European commission on the other hand, made a commitment to reduce the prevalence of stunting in children below the age of five with seven million

by 2025. Other initiatives specifically focused on supporting the reduction of stunting for children below the age of five, include the 1,000 days initiative and Scaling-Up-Nutrition Movement. A Zero stunted children challenge was also proposed by the United Nations Secretary General's Zero Hunger Challenge. Furthermore, the WHO and UN Food and Agriculture Organization, organised an international nutrition conference in November 2014 and ensured that countries committed to prevent malnutrition in all forms, especially stunting.[45–47]

Hoddinott et al.[48] concluded in an article titled "*The economic rationale for investing in stunting reduction*", that the significance of stunting goes beyond that which can be sized up in economic statistics and highlighted the fact that there will be noteworthy, lifelong economic benefits through the aversion of stunting. The reduction of this health burden could reduce human suffering significantly and requires a multi-sectorial response to ensure better maternal infant and young child nutrition[24,35] All stakeholders should make nutrition specific interventions one of their top priorities to invest in.[48]

However, this is a complex challenge as South Africa is a transitioning country. Stunting and its consequences, such as subsequent obesity and a rise of non-communicable diseases in adulthood[34], need to be addressed.[34] The 40% reduction in stunting for all children below the age of five has been set for 2025, however, it is troublesome that the burden of stunting has increased among African children, between 1990 - 2012.[49]

The Roadmap for Nutrition in South Africa identified key nutritional interventions that can lead to a better, healthier future for mothers and their children. The focus is mainly on the healthcare sector to implement interventions. However, underlying contributing factors and nutrition sensitive interventions play a key role and significantly contribute to the current stunting climate both in South Africa and on a global scale.[37]

A recent systematic review concluded that the combination of various different health and nutrition intervention programmes, accompanied with social safety interventions, is associated with success. Country level commitment, community engagement and adequate programme content, focused on key relevant determinants, can effectively reduce the prevalence of stunting. Commonly included interventions that are effective in low- and middle-income countries include nutrition and health education, counselling and promotion, water and sanitation, and social safety programmes. However, one specific intervention is only effective in reducing the prevalence of stunting in countries with one specific problem area.[50] Which makes the eradication of stunting and the consequences highly challenging.

More emphasis is placed on nutritional interventions prior to and during pregnancy as there is a proven correlation between maternal nutrition and foetal growth restriction, as well as short stature. The benefits of this specific focus for nutritional interventions could not only reduce pregnancy and delivery complications but also improve the development and growth of their unborn children. Since stunting is especially difficult to reverse after 36 months of age, further attention is required during pregnancy to help prevent the development prior to birth and to halt the development of stunting for those children below the age of two.[2,4]

A systematic review done by Dewey et al.[51] focused on various complementary feeding interventions and concluded that there is no universal ideal intervention. The needs of each area or community differ greatly and therefore no universal solution is available. The impact of various interventions depends on context specific factors which include, household food security, the percentage malnourished individuals and food availability in the area.

Educating mothers on child care practices, health and nutrition (such as optimal breastfeeding) and adequate complementary feeding could decrease the probability of stunting.[2] Education, or rather the lack thereof, is directly linked to poverty, diseases, poor health and - nutritional status. Thus, education plays a vital role in the prevention of malnutrition. Educating parents and caregivers on basic healthy living and sanitation, could serve as a suitable intervention in aid of reducing the burden of malnutrition.[31]

Micronutrient supplementation and the fortification of foods are nutrition specific interventions noted in Lancet Series on Maternal and Child Nutrition. Zinc was proven to show some protective effect against childhood stunting by a meta-analysis done by Imdad et al.[52] It was concluded that zinc supplementation should be included in strategies in developing countries to combat stunting in children below the age of five. This conclusion is supported by the Population Attributable Fractions (PAF), calculations done by Mosites et al., which shows 1% of stunted cases are related to zinc deficiency.[6,53] A meta-analysis was done on the effects of iron supplementation and its effect on children's growth outcomes. No significant association between these variables were observed.[53]

However, a study conducted in rural Bangladesh[54] of the association between micronutrient supplementation and stunting, forms part of the Multi-country and Multidisciplinary study known as MAL-ED, which focused on the enteric infections effect on malnutrition.[55] A plausible causal association for stunting was elusive and poor micronutrient status evident among the 12to 24 month old children that were enrolled. After adjustment for the environment they live in, Low Birth Weight (LBW) was the major risk factor detected for these children. Quality of nutrition is an imperative for optimum growth but the results indicate that it is not enough to alleviate the burden of stunting among individuals living in suboptimal conditions. Stunting in poor areas require multiple strategies and interventions to work together in order to mitigate this issue. [54] The WHO agreed that immunisation is one of the key factors to help reduce childhood illnesses and impaired growth. [56]

The results of Dewey et al.[51] showed that children included in dietary interventions grew 1.7cm taller between the age of 12-24 months, compared to those in their control groups with no dietary intervention. The effects of interventions on child growth varies widely and is often disheartening as most only have small to medium effects. That is why it is important to recognise that a child's growth is determined by various factors, and is not limited to nutritional intake. An intervention's efficiency differs for each population characteristics and immediate environment. Unfortunately, nutrition specific interventions have little or no effect on the underlying circumstances individuals find themselves in, which in many cases are the reasons

for their poor growth outcomes. Therefore, specific interventions, for example micronutrient supplementation, should be accompanied by specific circumstantial approaches such as the improvement of water and sanitation.[51] According to the Lancet 2013 series, hygiene and sanitation interventions with a 99% coverage could effectively reduce the incidence of diarrhoea by 30%, and thus in turn stunting is effectively decreased by 2.7%.[4] Clearly the nutrition sensitive programmes and approaches in Figure 2.2 remain crucial and an inevitable factor in the improvement of health and well-being.

Interventions thus range from dietary supplementation during pregnancy, to breastfeeding promotion, to complementary nourishment education and diet supplementation in infancy.[57] However, stunting is multi-causal and the prevalence of stunting persists, despite existing interventions, especially in developing countries. Therefore, combined efforts of all areas are needed for significant progress towards stunting reduction to be seen.[58]

2.6 CAUSES OF STUNTING

As mentioned before, stunting is a multi-causal and multi-factorial health burden. Figure 2.3 shows that the causes of stunting are divided in various factors, which will be further discussed in the section to follow.

2.6.1 HOUSEHOLD AND FAMILY FACTORS

Maternal factors such as nutritional status, level of education and maternal age, all have an impact on a child's development and linear height attainment. The immediate home environment relates to child caring practices, involving stimulation and play, food allocation within households, as well as water and sanitation facilities.

Evidently, childhood stunting can be seen as a direct outcome of maternal malnutrition including other factors like inadequate feeding practices. Stunting can begin in-utero and growth faltering often continues after birth until the age of two and beyond for those living in underprivileged communities. Malnourished, pregnant mothers do not consume the nutrition needed in order to support their own bodily functions as well as their unborn baby's growth and development. Therefore, their infants are predisposed to stunting prior to being born; evident from an estimate that 20% of stunting cases are initiated whilst the mother is still pregnant.[49,59]

A range of negative consequences impact on the foetal growth of undernourished mothers, ranging from neonatal death to prolonged stunting. Nutritional status during pregnancy is an important predictor for linear growth and consequently, obesity and NCD later in life. At the other end of the spectrum, maternal overnutrition is slowly increasing and has surpassed the prevalence of undernutrition.[2] Maternal anthropometry during pregnancy is largely related to their offspring's growth outcomes. Childhood undernutrition is associated with a decreased maternal Body Mass Index (BMI) and is influenced by various

factors such as a mother's nutritional intake. Therefore, proper and adequate nutrition during pregnancy, as well as postnatally, is of utmost importance to their children's growth. Poor foetal growth is linked to poor maternal nutritional status and leads to Intrauterine Growth Restriction (IUGR) and low birthweight.(LBW)[41,60]

Small for Gestational Age (SGA) newborns are at an increased risk for growth faltering within their first two years. Estimations suggest that foetal growth restriction may be the cause of 20% of the stunted cases as mentioned previously.[2] SGA babies, born at term, was shown to have a 2.4 times increased odds of becoming stunted compared to babies born to a normal weight for gestational age.[59] In addition, low birth weight is associated with childhood undernutrition,[41] and was reported as the most dominant predictor of stunting in a study conducted in Indonesia.[61] Furthermore, a Zimbabwean study also confirmed that LBW babies' growth and development are slower compared to those with normal weight at birth. Significant length discrepancies were visible at 12 months, between LBW babies and those born with a normal weight. Thus, growth faltering from the start of life significantly increases the risk of stunting in early developmental years and in time affects later adult life.[62] A child's linear growth attainment however, is predisposed by their birthweight. IUGR or preterm delivery could be the cause of LBW babies. There are multiple factors related to LBW such as significant relationships between mother's nutritional status and weight gain during pregnancy.[61,63] Linear growth attainment is thus restricted by the intrauterine period and birth outcomes.

Maternal short stature was proven to be inversely associated with childhood mortality, underweight and stunting. An analysis using a cross-sectional sample of 109 demographic and health surveys, in 54 different countries showed that a 1 cm increased difference in maternal height, was significantly associated with a decrease risk for childhood stunting.[64] A Systematic Review and meta-analysis revealed that maternal depression in developing countries has a significant association with poor growth in their offspring. The results show children whose mothers suffer from depression have an increased risk of being stunted and underweight,[65] especially during the first year of life.[66]

Adolescent pregnancies also increases the risk of stunting and is widespread throughout the world, with approximately 16 million young women between the age of 15-19 giving birth each year, more than half of which live in low- to middle income countries.[67] Globally the first-borns of young adolescent mothers, below the age of 18, has a 38% increased risk of childhood stunting due to competing demands for nutrients.[68,69] Thus young maternal age is also a considerable risk factor of childhood stunting. After a study was conducted using data collected from 153 demographic and health surveys, it concluded that older maternal age and child birth spacing has significant potential to reduce the prevalence of stunting and in effect, improve growth and development of their offspring in developing countries. Thus, in the mentioned study, the stunting risk was the highest for mothers below the age of 18 and gradually declined up until the age of 27.[68] Furthermore, short birth intervals are a known risk factor for poor linear growth. Births less than 12 months apart proved

to have the highest risk for stunted growth and a steady reduction in risk was depicted for wider birth spaces.[68]

A systematic review of factors associated with stunting in sub-Saharan Africa, found that the following maternal factors were consistently associated with this issue: poor social circumstances, a low level of education, maternal age and low BMI (BMI<18.5). Children's gender, age, diarrhoea episodes and birthweight was also frequently connected with stunting. Visible household factors included: rural residences and the source of drinking water, while additional factors of the absence of health care as well as lack of immunisations and inappropriate feeding practices were also reported. Prolonged duration of breastfeeding, longer than 12 months, was another consistent factor associated with stunting in children.[41]

As far as environmental factors pertaining to the household are concerned, one of the main causes of stunting is attributed to inadequate household hygiene, water and sanitation (WASH). The correlation between water, sanitation and stunting is presented in multiple frameworks involving malnutrition.[3,40]

Mounting evidence shows that child growth and development are severely affected by poor WASH, due to continuous exposure to enteric pathogens.[70] Improved WASH can bring significant advances in the attempt to address childhood undernutrition, whether from an economical perspective or the reduced exposure to pathogens. Therefore, unhygienic practices and poor sanitation has a direct impact on child undernutrition.

A meta-analysis concluded that access to community level sanitation is associated with a decreased chance of stunting and anaemia, even if there aren't any sanitation facilities within a household. However, children who do have a sanitation facility in their household, their risk of diarrhoea decreased as well. The associations found in this meta-analysis supports the results found by J. Humphry; that child health and nutritional status is significantly affected by environmental enteropathy. These findings agree that oral transmissions of different pathogens impact the health of a child and universal provision of sanitation may help to protect children from unwanted pathogens, even though only a slight decrease in stunting was noted.[71,72]

On the other hand, a cluster-randomised, community-based, 2 × 2 factorial trial tested the individual effects of WASH and IYCF (Infant and Yong Child Feeding), as well as a combination intervention. Contrary to past results Humphrey et al.[73] showed that the WASH interventions that were implemented in rural communities, were least likely not reduce stunting. In addition, the implementation of WASH, along with infant and young child feeding interventions, were unlikely to lighten the burden more when compared to IYCF interventions alone. Cumming et al.[74] concluded that global efforts to reduce stunting requires WASH programmes and interventions, even though WASH alone will not eliminate stunting, it remains a critical aspect to include in strategies.

Furthermore, Akombi et al.[41] concluded in a systematic review the low educational accomplishments of parents is also a consistent factor relating to child undernutrition. This is due to the fact that uneducated parents usually have low or no income, which results in less money for nutritional foods, adequate care and household facilities leading to growth failure due to suboptimal conditions.

Socioeconomic status (SES) and household circumstances are well known determinants of stunting however, there is a lack of knowledge in its effects on the stunting age relationship. Larger stunting rates are observed between 6 to 20 months of age with fewer noticeable differences between the rich and poor communities depicted within the first five months of infancy. The older age group is inclined to have a higher stunting rate, that is more evident in the poorer households. The impact of the noticeable differences between relatively wealthy and poor households, cannot be explained by simply focusing on nutrition specific interventions. Nutrition sensitive interventions are strongly related and its' absence or presence can be of major consequence. According to Bommer et al.[75] more emphasis should be placed on the health and living circumstances that occur at different developmental stages within the two years of life, instead of treating this window as one uniform stage for focused interventions.

2.6.2 INFECTION

It is well known that infectious diseases are a crucial public health dilemma caused by a variety of contributing factors, such as poor hygiene and sanitation. Infections, whether acute or chronic, have a substantial affect on the growth of children, especially where infections related to the gastrointestinal tract are concerned. Cumulative effects of certain infections can significantly impair linear growth and could lead to decreased food consumptions which in turn causes micronutrient deficiencies.[76] Diarrhoea has been reported as the single greatest cause of stunting for certain studies / areas. Repeated diarrhoea infections significantly contribute to impaired linear growth, due to the loss of nutrients and higher metabolic demand. Even though child mortality as a result of diarrhoea has significantly decreased in the past decade, mild diarrhoea remains a potential threat and contributor of impaired child growth, as well as delayed long-term development.[53] Episodes of diarrhoea reported in childhood, is associated with decreased linear height attainment however, after an episode, it is possible to catch up on growth. Yet, persistent diarrhoea results in persistent growth deficits and inevitably prevents catch up growth in the first years of life, which can sooner be attained with prolonged periods of no diarrhoea. Unfortunately, when living in developing countries diarrhoea usually occurs in conjunction with other diseases, paired with nutrient deficiencies and thus resulting in children's inability to achieve catch up growth.[77]

A meta-analysis of data prospectively collected from nine cohorts in five different countries, support the hypothesis that an increasing burden of diarrhoea negatively impacts the nutritional status of young children in their early developmental years. The results showed that diarrhoea is one of the most important determinants that affect stunting. A statistically significant, dose-response relationship exists between prevalence of diarrhoea and stunting below the age of two years. Stunting risk at the age of two years

increased with 2.5 % per diarrhoea episode and 25% of stunting cases were credited to five previous diarrhoea manifestations.[78]

Intestinal permeability has been proven to effect infant height and weight attainment. Data strongly suggests an association between growth failure and intestinal disease for infants living in suboptimal hygiene and sanitary conditions. The intestinal mucosa is an important crossing point for the outside environment into the body and this phenomenon can result in growth faltering, due to tissue damage and hazardous material entering the body. On the other hand, the argument can be reversed to state that mucosal damage and poor growth is a result of nutritionally inadequate diets and nutrient deficiencies.[79] Furthermore a review of Harper et al.[80] found that there is a connection between systemic and intestinal inflammation and stunting; conversely there was limited evidence suggesting the association between either intestinal damage and permeability or intestinal damage and stunting. These results indicate a need to investigate alternative options of the effect these intestinal and systematic inflammation have on the growth of children.

A prospective case control study in Brazil concluded that well-nourished children had a significantly better systemic response, based on their systemic immune-related inflammatory biomarkers, when compared to malnourished children. Higher plasma concentrations of Intestinal-type fatty acid binding protein (I-FABP) and more Enteroaggregative Escherichia coli was observed in malnourished children when compared to their healthy counterparts. This suggests some form of epithelial damage. Results from the malnourished group suggested that there was damage to the intestinal barrier function and that bacterial translocation was present. Raised enteric inflammatory markers in both groups suggests environmental enteropathy.[81] Another study from rural Bangladesh back the notion that environmental enteropathy, a subclinical disorder of the small intestine, could be a contributing factor of impaired growth in certain contaminated, environmental settings.[70] Other studies have reported it as a key contributor of undernutrition in childhood.[4] Environmental enteropathy is branded by decreases intestinal absorptive capacity, changed barrier integrity and inflammation of mucosa, especially for children living in unhygienic conditions. Researchers proclaim that this may have detrimental outcomes on growth predictors, however, these altered intestinal outcomes could be a result of inadequate nutrition in early life.[2] It is further hypothesized that the prevention of tropical enteropathy, also known as environmental enteropathy, is crucial in aid of child growth in developing countries.[72]

A Stop Stunting Conference inspired an article describing the manner in which WASH can aid the elimination of stunting. It was noted that WASH has well-known recognisable health benefits with evidence suggesting that by investing in WASH, a significant progress can be made in eradicating childhood undernutrition. Regardless as to the reasons, inadequate WASH is closely related to the growth and development of an individual yet, WASH unaccompanied by other interventions will not eliminate stunting but only has the potential to improve progress.[74]

Dewey et al.[82] concluded infection is a significant contributing factor in children not achieving adequate growth. Diarrheal infection is one major avoidable risk for childhood stunting and the visible interaction between infection and nutrition cannot be ignored.

Furthermore, child undernutrition is associated with increased age. This could be explained by increased exposure to different environments where older children play, resulting in more contact with childhood illnesses, eating and sharing contaminated foods and drinking and playing in unsafe water.[41]

2.6.3 INFANT AND YOUNG CHILD FEEDING

Global nutritional data indicate that only 41% of babies are exclusively breastfed for six months and the latest statistics show 16% of children in the complementary feeding period (6 to 23 months of age), has a minimally acceptable diet. Furthermore, a trend of the increased intake of refined, sugary foods and beverages paired with the decreased intake of fruit and vegetables can be seen in all countries, across all settings.[8] Growth and development in early infancy is a direct result of infant feeding practices and therefore, South Africa supports the WHO's exclusive breastfeeding recommendation. As previously mentioned, impaired linear growth starts in utero, and the age where linear growth faltering peaks is between 6 to 24 months of age, when complementary foods are introduced.[83]

2.6.3.1 BREASTFEEDING

South Africa is one of the countries with the lowest exclusive breastfeeding rates in the world. South Africa National Health and Nutrition Examination Survey (SANHANES-1) indicated in 2012 that the exclusive breastfeeding rate was 7.4% for babies below the age of 6 months [84] Even though exclusive breastfeeding rates are low, breastfeeding initiation rates were high at 81.5% yet, breastfeeding continuation was only 11.8%. The benefits of breastfeeding are well documented and the global nutrition community has recognised the best manner in which to combat stunting, is by concentrating on the first 1,000 days of life period.[85]

Infants who were exclusively breastfed show lower gastrointestinal tract infections, as well as respiratory infection, rates. Following the birth of a child, the first milk that appears is known as colostrum which is a very rich source of nutrients and essential antibodies that play an important role in the development of a new-born's immune system and microbiota. The exclusive breastfeeding of a child for the first six months of infancy is of great importance, especially in developing countries where stunting is predominant, as it is associated with improved growth outcomes. Therefore, breastfeeding promotion and suitable public messages, is encouraged as an intervention to reduce stunting. The WHO defines exclusive breastfeeding as a child receiving only breastmilk from their mother with the exclusion of all else from the infant's diet. During this critical period the premature introduction of other liquids or foods in the diet, can make children more susceptible to gastrointestinal diseases which in turn aids growth delay and micronutrient deficiencies, weakening the children's immune system and making them more vulnerable to infectious diseases.[18]

Breastfeeding initiation after one hour of birth after birth has been documented to have a statistically significant association with stunting. A study conducted showed that children who received breastmilk more than an hour after birth were five times more likely to be stunted compared to those who received breastmilk within the first hour.[49]

The duration of exclusive breastfeeding also has significant implications on child growth. The probability of stunting is considerably higher in those who were exclusively breastfed for less or for longer than the recommended six month period.[86] Early cessation of breastfeeding negatively impacts growth and development because it potentially leads to inadequate energy intake, a decrease in nutrients and the exclusion of important immunity benefits that breastmilk contain.[3]

A systematic review done by Akombi et al.[41] of sub-Saharan Africa reported that prolonged breastfeeding over the age of 12 months was associated with childhood undernutrition. Past the age of 6 months, breastmilk is nutritionally insufficient and safe, appropriate complementary foods need to be introduced in the child's diet, whilst breastfeeding continues for up to two years of age. Nutritionally inadequate complementary foods and prolonged breastfeeding places the child at risk for growth faltering which results in insufficient nutrient intake that affects their growth and development. This association is mostly seen in poorer communities where mothers are likely to continue breastfeeding, without providing their children with the sufficient complementary foods needed for them to thrive.

Breastfeeding comprises of complex features that may protect against stunting and therefore the significance of breastmilk should be distinguished as a pivotal factor in curbing adverse health risks and the life-saving effect it could hold for developing countries.[53] However, certain randomised control trials focussed on breastfeeding promotion and nutritional status outcomes showed no effects on the weight and length of infants.[87] The transition from exclusive breastfeeding to complementary foods is challenging and could be a possible explanation for the reason a child's age was reported to frequently be associated with undernutrition in the Akumbi et al.[41] review conducted in Sub-Saharan Africa.

2.6.3.2 COMPLEMENTARY FEEDING

Stunting peaks in the first 1,000 days after birth, especially when complementary foods are introduced. This could be attributed to children no longer being breastfed and not consuming an adequate diet paired with frequent and recurring infections.[45] One of the fundamental pillars that support healthy growth and development is adequate complementary foods. [3] The nutritional needs of infants and young children evolve as they grow. At the at age of six months breast milk alone is no longer sufficient in fulfilling a child's growing nutritional needs and suboptimal feeding during the weaning process, is one of the main attributing factors of childhood malnutrition.[88,89] Currently, complementary feeding practices are far from optimal, especially in developing countries such as South Africa. The infants at risk of developing stunting have little diversity in daily meals and the frequency of their meals are not enough to sustain healthy growth. [89] Sub-optimal complementary feeding in terms of quantity, quality and frequency engenders growth faltering.[88] Dietary

Diversity Score (DDS) is associated with children's nutrition status and was shown to be an effective, quick, simple indictor of micronutrient adequacy in one's diet.[90] Thus, a diverse diet can be viewed as a representation of macro- and micronutrient adequacy and the complementary foods that are frequently consumed tend to be cereal based, mostly deficient in the necessary micronutrients. These deficiencies aid the continuous cycle of malnutrition and infection which in turn links to the high prevalence of stunting seen in the under-five age group in South Africa.[91] Smithers et al.[92] established that dietary patterns start developing from early infancy, and are associated with socio-demographics. With the rising prevalence of overweight and obesity, this emphasises the importance of appropriate infant feeding practices even more.

A study regarding the risk of stunting and dietary associations showed that an increase in animal source foods was associated with a decrease in stunting. In general, animal food sources play a protective role against stunting.[89] Nutrient intakes from good quality animal products thus ensure better growth outcomes. The WHO recommends a daily intake of either meat, poultry, fish or eggs,[93] but more research is needed to understand the effects of these foods both on stunting as well as diet diversification. Continuous investment is needed to promote the inclusion of animal source foods, specifically for infants and young children. [89] An analysis done by Aguayo et al.[94] on the determinants of stunting found that a decreased consumption of eggs, dairy, fruit and vegetables as well as reduced feeding frequency, was associated with stunting in the age group of 6-23 month olds. Appropriate and adequate complementary feeding practices are well associated with height and a decreased risk for stunting.

A recent systematic review done by Lassi et al.[95] on the potential impact of complementary feeding interventions on stunted children growth and development, concluded that the inclusion of education and the provision of food can improve the nutritional status of young lives living in the developing world. Further research is required to assess the potential effects on the growth outcomes of such interventions. Therefore, programmes and interventions relating to the adequate complementary feeding have the potential to decrease the under-five mortality rate.[89] The WHO have implemented various interventions to prevent stunting including education, food fortification and the provision of complementary food.[24]

Thus, addressing complementary feeding practices has the potential to decrease the child malnutrition as well as the burden of non-communicable diseases later in life.[35,88] The daily inclusion of meat, chicken, fish, liver or eggs, from six months of age, is a suggested guideline to be tested as one of the messages from the food based dietary guidelines (FBDG) for paediatrics in South Africa.[93] However, these guidelines need to be aligned with interventions and locally available foods. Furthermore, additional research and implementation of evidence regarding suitable guidelines and recommendations is required.[89] Complementary feeding should also be addressed in combination with exclusive breastfeeding for six months and continuing for up until two years of age.[3]

2.7 CONSEQUENCES OF STUNTING

Stunting has short- and long-term effects not only on the individual but on the community as well.[6] Decreased linear height is associated with increased morbidity and mortality. It has been shown that severely stunted children have a 5.5 times higher risk of morality compared to their non-stunted counterparts and moderately stunted children are 2.3 times more likely to perish.[96]

A study conducted between 2012 - 2013 by Steenkamp et al.[38] concluded that severe stunting has been revealed to be a greater health concern than moderate wasting. Stunting was also reported to be a bigger driver of underweight -for- age than wasting and if no action is taken to highlight the importance of wasting and stunting, most healthcare professionals may remain ignorant about the drivers, identification and treatment of the burdened children.

2.7.1 CONCURRENT AND SHORT-TERM ADVERSE EFFECTS

Stunting at birth is associated with a decreased survival rate as mentioned above.[96] Poor cognitive development in early infancy can have detrimental effects on long-term neurodevelopment therefore, interventions during the critical window of the first 1,000 days of life, is a crucial time period.[23,97,98] Impaired development during the early time period in life result in poorer school outcomes.[14] In Jamaica, stunted children's math and reading abilities were a standard deviation of 0.78 below those who were not identified as stunted.[99] If catch up growth can be achieved by means of targeted interventions, the question remains whether growth later in life can undo the damage done within the first 1,000 days. Foundation development processes require enormous amounts of energy, and the lack thereof predisposes these infants to a range of negative consequences, especially relating to brain development including hearing abilities, speech and further brain function.[97]

The Birth to 20 study (Bt20) was a longitudinal cohort conducted in South Africa. Casale et al.[97] made use of this data to examine the influence of recovery from stunting on cognitive abilities. It was concluded that children who achieved catch up growth and recovered from stunting still performed poorly in cognitive assessments when compared to children who were never stunted. Furthermore, children who recovered from stunting performed better than children with persistent stunting.

Jones et al.[100] did a study in nine different countries, including Africa, and concluded that suboptimal linear growth is established in the early years of life.[94,100] Interventions targeted at the critical window of opportunity within the first 1,000 days of life, are believed to have maximum impact in achieving global targets.[45]

A technical report of chronic malnutrition trends in Guatemala concluded that new-born babies with an average length of 2cm shorter than standard reference population, eventually showed an increased difference of up to 9cm by the age of 2 years.[101]

A study conducted in Gauteng and Mpumalanga determined that stunted children are also more likely to be obese. There was a significant association between BMI and HAZ, where more overweight children were stunted when compared to normal and underweight children. The cause of this phenomena in these children could not be determined but the effects of the nutritional transition could be a major contributing factor.[102] The short term health risks of childhood obesity include increased risk for developing type II diabetes, cardiovascular disease, impaired social and psychological functioning, hepatic steatosis, reflux, gallstones and increased respiratory illnesses.[103]

Stunting in children thus increases the risk of becoming obese and have other detrimental health effects in the long run.[102]

2.7.2 LONG-TERM ADVERSE EFFECTS

In the long-term, stunted children who never achieved catch up growth will live an impaired adult life. Suboptimal brain development and poor learning outcomes in school, result in lower wages and decreased productivity. [16,24,35] It is estimated that stunted adults' loss in income, without living in poverty, is 22.2%. This increases with an additional 7.9% loss for stunted adults living in poverty.[17]

Various studies conducted in low income communities proved the direct association between stunting and an individual's cognitive ability. Stunted children show deficits in comprehension and reasoning which in turn affects their school performance outcomes and result in intellectual discrepancies. Examples hereof include verbal and language comprehension, memory and performance abilities, problem solving skills, executive function and general cognition, all of which affects their everyday life.[104]

The following pathways explain how short stature affects the cognitive outcomes of a stunted individual. Firstly, the lack of adequate nutrition and sufficient nutrient intake can damage or slow brain development. This results in malnourished children with an insufficient amount of energy to participate and interact in their environment which affects their learning abilities. Often the smaller, younger looking children receive less attention and stimulation than larger children, affecting their development negatively. Reasoning skills among the early grades are affected in stunted children and is associated with or leads to longer term cognitive deficits.[104,105]

Risk of developing metabolic syndrome and other non-communicable diseases also increases with impaired linear growth and decreased productivity. This further creates social and economic challenges in certain vulnerable communities.[41] Stunting, left untreated, results in decreased adult stature and the intergenerational effects continues the cycle.[106,107] Mothers with a short stature will have an increased risk for poor reproductive health outcomes[14,16,23]. Maternal stunting is a well-known risk factor associated with perinatal mortality. A study concluded that children born to stunted mothers had a nearly 60% increased risk of neonatal mortality when compared to mothers with a stature higher than 160cm.[3] Poor growth outcomes due to prenatal causes can be addressed during the postnatal period by ensuring mothers practice

appropriate feeding practices. However, other factors such as environmental circumstances also need to be addressed.[41]

Undernutrition can be passed on to the following generation. The Lancet Maternal and Child Undernutrition series established that undernutrition could be traced to the last three generations.[16]

2.7.3 DOUDBLE BURDERN OF MALNUTRITION

Overweight and obesity is becoming a major problem in developed and developing countries alike. The South Africa Demographic and Health Survey 2016, revealed the prevalence of stunting was 27%, underweight was 6%, wasting was 3% and overweight and obesity was 13% altogether.[10]

From 1990 - 2016 childhood overweight increased from 4.9% to 6.0%.[108] There is a growing awareness of the concurrent existence of overweight and obesity in conjunction with stunting. In Limpopo, South Africa it was shown that 31% of children below the age of three were identified as both stunted and overweight, whilst 40% of the children classified as overweight overall were also stunted.[109]

Overnutrition in itself has short- and long-term risks to health outcomes. As mentioned above, metabolic abnormalities develop and infants are faced with chronic conditions such as type II diabetes, high blood pressure and cholesterol abnormalities. According to Lancet 2013 series, childhood overnutrition is strongly associated with the current environmental circumstances, but the main contributors include inappropriate diets and lack of physical activity.[2]

There is a complex relationship between adult disease risk and body mass index in childhood as well as adolescence. A systematic review in 2012 made the following three conclusions: firstly, obese children who grow up to be obese adults have an increased risk for developing NCD (non-communicable diseases) in their adult life. Secondly, obese children who grow up to have a normal BMI did not have a greater risk for developing CVD (cardiovascular disease) in their adult life. Lastly, the children who range at the bottom end of BMI and who became obese, appeared to be the most susceptible to obesity risk later in life. Undernutrition in the first 1,000 days period, paired with rapid weight gain during childhood, was associated with increased risk of chronic conditions associated with nutrition. The relationship between undernutrition in early childhood and obesity later in life is well established and interventions are needed to curb both.[102]

2.8 RATIONALE FOR THE STUDY

Previous research conducted in Breede Valley, showed the malnutrition burden to be high and the coexistence of maternal overnutrition paired with childhood under- and overnutrition. Suboptimal infant feeding practices in these areas place the growth and development of the children within the district at risk. High prevalence of stunting was observed.[12] Therefore, seeing as childhood stunting causes a series of adverse short- and long-term effects, and has significant implications on economic development, this research project used the World Health Organization framework on context and causes of childhood stunting,

to investigate stunting prevalence and drivers in Worcester, Breede Valley. The framework theorises that the complex development of stunting is a result of biological, social and environmental determinants.

This study was a collaboration between the Stellenbosch University, Division of Human Nutrition and the Grow Great campaign DG Murry Trust (DGMT). DGMTs' main focus is to invest in the potential of South Africa by reducing the burden of childhood stunting with 50% by the year 2030.

The aim of this study was to develop a stunting profile of children under the age of five in selected vulnerable communities in Worcester, Breede Valley, Western Cape Province, by using community level primary data collected by Community Health Workers (CHWs).

In order to position stunting as a nationwide imperative in South Africa, quality data of stunting prevalence and the key drivers known to aid this burden, is required. In India, Maharashtra stunting was reduced from 39% to 24% in six years, arguably due to obtaining high quality data that triggered multi-sectorial responses, including state involvements.[110]

The identification of the key drivers of stunting in Worcester, Breede Valley would help design the course of action for stunting reduction interventions, programmes and policies, specific to the area. It is of great importance to have a clear understanding of the nutritional challenges in order to implement appropriate and effective, content specific interventions.

2.9 SUMMARY

In summary, the most noteworthy predictors for stunting in children below the age of two, includes maternal nutritional status during pregnancy, infant birth weight, complementary feeding practices and the immediate household environment, i.e. water and sanitation.[94] Even though stunting is the most prevalent form of malnutrition and there is a universal consensus regarding the manner in which to detect and measure it, this condition often goes unrecognised, especially where short stature is the general norm is concerned.[13] However, due to the fact that stunting influenced millions of children worldwide and burdened them with short- and long-term consequences, this epidemic has a higher level of awareness and received international attention. There is a global agreement both on how stunting is defined and also that the first 1,000 days play the most important contributing role to the reduction of this issue, requiring a multi-sectorial response.[13,24]

There is an increased global awareness surrounding stunting and commitments have been made in order to reduce stunting with 25% by 2025. Linear growth in the first five years of life, but especially the first two years, is one of the most delicate indicators representing health and well-being.[1] In fact it has been described as the main indicator for undernutrition due extreme global prevalence of various developing countries.[2] The period from conception up until the age of two is a critical period and a multi-sectorial approach is needed to implement targeted interventions, specifically with regards to nutrition. Nutrition is the key in the first 1,000 days of life and has substantial implications for a child's immediate and long-term health.[88,111]

Despite previous efforts, ranging from nutrition sensitive to specific interventions, stunting remains difficult to prevent and treat in developing countries. The 2013 Lancet series did a comprehensive update and noted that stunting will only be reduced with 20%, if there is 90% coverage on various interventions. [57] Due to the multifactorial determinants of childhood stunting, this key health issue is most likely to continue despite the presence of aforementioned interventions, policies and programmes. Therefore, it is of great importance to define the most important contributors and calculate the level of effect each will have on stunting risk in order to advance and reduce stunting prevalence.[53] In order to successfully decrease stunting a multi-sectorial response is required between non-governmental, governmental and national sectors whilst delivering content specific interventions by means of community involvement. [50] This study aimed to, as far as possible, engage the mentioned sectors in order to obtain quality data to address stunting in Worcester.

CHAPTER 3: METHODOLOGY

3. INTRODUCTION

This chapter states the research question, aim and objectives, while also detailing the methods used for data collection**.**

The DGMT Grow Great campaign staff negotiated with Department of Health, Breede Valley sub-district office to gain assistance from Community Health Workers (CHWs), employed by Boland Hospice. Boland Hospice is a non-governmental organization (NGO), focusing on community care (https://www.bolandhospice.org/). Department of Health funds Boland Hospice and in turn CHWs serve the community, as well as certain health facilities within Worcester. The CHWs were trained to act as field workers for the study. In addition, Philani- mentor-mothers, employed by the NGO Philani in Khayelitsha, were asked to provide assistance to help train and supervise CHWs throughout the research study as a measure of quality assurance. (see Section 3.3.7 Methods)

3.1 RESEARCH QUESTION

What does a community stunting profile for children below the age of five look like for selected vulnerable communities in Worcester, Breede Valley, Western Cape?

3.2 AIM AND OBJECTIVES

3.2.1 AIM

To develop a stunting profile of children below the age of five in selected vulnerable communities in Worcester.

3.2.2 OBJECTIVES

- To determine the prevalence of stunting in children below the age of five in the following four selected areas in Worcester: Avian Park, Riverview, Roodewal and Zwelethemba.
- To determine the drivers of childhood stunting in Avian Park, Riverview, Roodewal and Zwelethemba.

3.2.2.1 SECONDARY OBJECTIVES

- To describe the anthropometric profile of mothers with children below the age of five living in the selected areas in Worcester.

3.3 STUDY PLAN

3.3.1 STUDY DESIGN

A descriptive cross-sectional study was conducted in Breede Valley, Worcester.

3.3.2 STUDY SETTING

The study was conducted in four areas in Worcester, Breede Vally, Western Cape. These were Avian Park, River view, Roodewal and Zwelethemba.

3.3.3 STUDY POPULATION AND CHARACTERISTICS

The population of Worcester is 166,825, 63.3% of which are of mixed ancestry, 24.3% are black African, 10.7% are Caucasian, with the other population groups making up the remaining 1.7%. For children 0-4 years old, girls make up 4.9% (n=8174) and boys 5.1% (n=8508) of the total population.[112]

(http://www.statssa.gov.za/?page_id=993&id=breede-valley-municipality

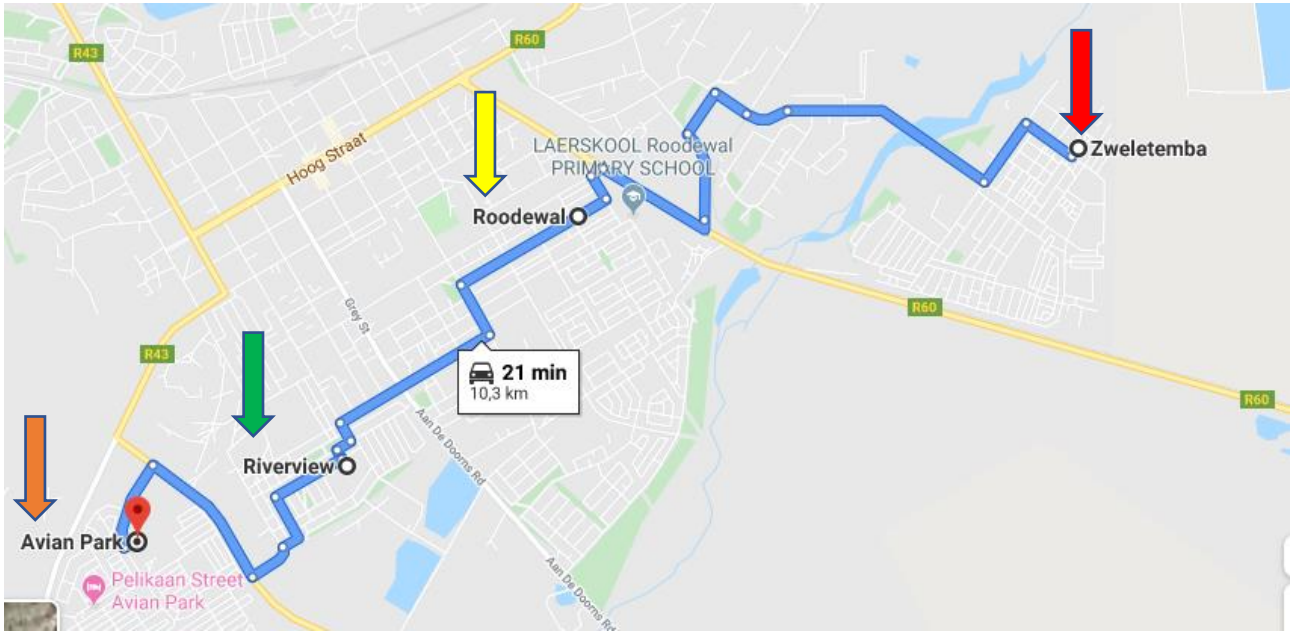
Areas that were considered for the survey include those where children experience a significant amount of vulnerability, such as where the majority of children in the area live below the upper bound poverty line[113]and/or where some of the known key drivers of stunting are higher than the national average. Among these key drivers are low birth weight, poor access to water and sanitation, and high levels of Foetal Alcohol Syndrome (FAS).[112]

Figure 3.1 shows the map of the Cape Winelands district and Figure 3.2 shows the geographical distance from Zwelethemba to Roodewal, Riverview and Avian Park

Source: https://municipalities.co.za/map/1207/breede-valley-local-municipality

Figure 3.1 Map of Cape Winelands district.

Yellow arrow indicates Breede Valley sub-district and green arrow indicates Worcester.



Source:
https://www.google.com/maps/dir/zwelethemba/roodewal/Riverview,+Worcester/Avian+Park,+Worcester/@-33.6509991,19.4460545,13.75z/data=!4m26!4m25!1m5!1m1!1s0x1dcd81e74ef262bf:0x23560630fcb5847!2m2!1d19.4969341!2d-33.6430835!1m5!1m1!1s0x1dcd8205dec11c23:0x5485e016b90a30a1!2m2!1d19.4630948!2d-33.6469234!1m5!1m1!1s0x1dcd826c9ec43cd3:0x740f001d1d8613d0!2m2!1d19.4474774!2d-33.6608992!1m5!1m1!1s0x1dcd8266efb0e405:0x3ee4c8ba00869df4!2m2!1d19.4333478!2d-33.6652172!3e0

Figure 3.2 Map of geographical distance from Zwelethemba to Avian Park in Worcester, Breede Vally.

According to google maps the distance from Zwelethemba to Roodewal is 5 km. From Roodewal to Riverview is a further 2.6 km and from Riverview to Avian Park is 2.7 km drive. The red arrow indicates the starting point namely Zwelethemba. The yellow, green and orange arrow indicates Roodewal, Riverview and Avian Park respectively.

3.3.4 SAMPLING STRATEGY

The study made use of consecutive sampling with randomised starting points for all four areas namely Avian Park, Riverview, Roodewal and Zwelethemba.

The following procedure was followed for sampling:

1. Maps of the four study areas were obtained. The principle investigator (PI) randomly selected a street for each of these study areas where data collection commenced.

   Starting points at each street were selected at random to ensure that starting points differed from street to street (Figure 3.2). Also, the direction of approach between streets were alternated (ascending and descending). A spreadsheet listing all the houses that fall within each of the designated study areas in

each street, was compiled by the PI based on the maps. Using the random selection function in Excel, the PI randomly selected the starting households. For the four study areas, there were starting households selected for each CHW team for each area, respectively. The CHWs worked in teams of two and each study area had ± 5 teams that collected data during the time of the study.

Households that complied with the inclusion criteria was included consecutively. Households were continuously included until the total number of houses for each street was selected. If not enough households within a street qualified for inclusion, another street was selected at random and those households were approached for participation. In situations where more than one household lived at an address and both households had qualifying mother-and-child pairs, both were approached for participation. In situations where more than one mother lived in a household and both had qualifying children, both were approached for participation.

All included households were meant to be marked off the CHWs maps for their specified areas. However, due to poor quality maps the PI enlarged maps and marked it off herself while capturing data.

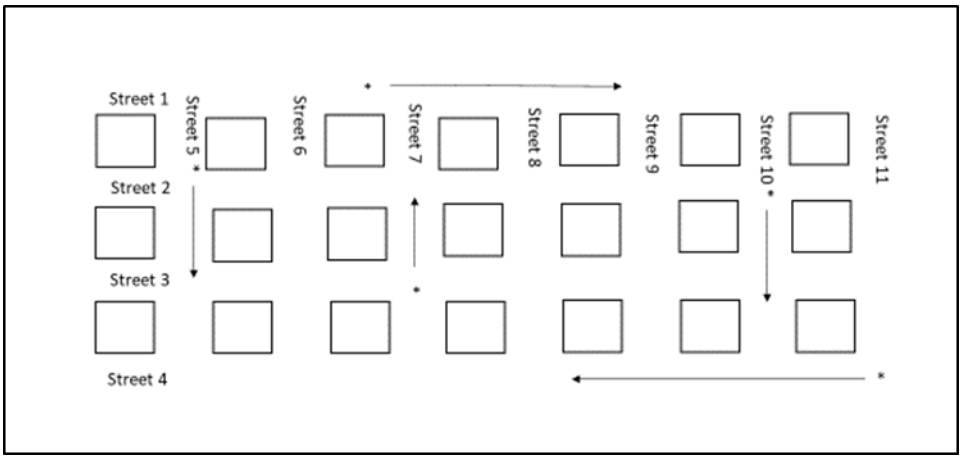


Figure 3.3 Schematic description of sampling strategy for the study

* Random selected starting point and direction (ascending or descending) of selection

3.3.5 SAMPLE SIZE

The suggested sample size was 1320 households and was determined as follows:

Forty CHWs was meant to be paired to form 20 teams. The aim was to assess three children per day per team. Each team would have collected data for 22 days, every day from 8:30-13:00.

Calculation:

20 x 3 x 22 = 1320 households.

Of the 1320 households, it was anticipated that at least one mother-child pair would have been assessed, resulting in a sample size of 1320 mother-child pairs.

The sample size calculation proved to be too ambitious and was not reached due to logistical challenges. A total of 885 mother-child pairs were assessed.

3.3.6 INCLUSION AND EXCLUSION CRITERIA

The following inclusion and exclusion criteria were applied:

3.3.6.1 INCLUSION CRITERIA

- Inclusion criteria for households
  Households with infants or children between the ages of 0 - 60 months.
- Inclusion criteria for children
  All children between the ages of 0-60 months who reside in a household in the four selected areas for at least 27 weeks of the year.
- Inclusion criteria for mothers
  Mothers of children included in the study, who reside with the child in a household in the four selected areas for at least 27 weeks of the year.

3.3.6.2 EXCLUSION CRITERIA

- Households without children between the ages 0-60 months.
- Households where mothers do not provide consent.
- Families who lived in the area for less than 6 months

3.3.7 METHODS

3.3.7.1 DATA COLLECTION PROCEDURE

Data collection took more or less three months to complete. The first day of data collection was on the 26th July 2018 and ended on the 30th October 2018.

During the course of the study CHWs and study investigators worked together to collect the data. Please see Addendum A for protocol logistics and roles and responsibilities of PI, Grow Great investigator, Philani-mentor-mothers and CHWS.

STUDY INVESTIGATORS ROLES AND RESPONSIBILITIES

The PI's main role was to supervise all steps during data collection. The Grow Great study investigator, and the Philani-mentor-mothers assisted with supervision and quality control.

Each morning, every area had a Philani-mentor-mother assisting different CHW teams throughout the week. The PI was responsible to train the Philani-mentor-mothers on the Drivers of stunting questionnaire as well as the process of informed consent, SOPs and the equipment.

Every morning at drop off time, queries from each area were discussed, and if further assistance was required, the PI instructed the Philani-mentor-mother to assist with the problem in the field.

A WhatsApp group was made, which included the PI, study investigators, CHWs and Boland Hospice supervisors for the duration of the survey. This served as an easy access platform to keep CHWs and related parties informed on the progress of the study, and to answer questions relating to the study or to report potential problems experience in the field. (Each CHW received a R10 airtime voucher for the week sponsored by the Grow Great Campaign to ensure constant communication.)

The PI investigator posted regular questions and answers on the group, as well as general reminders about the inclusion criteria. If repeated mistakes were noted from the data collection forms, the errors were communicated on the WhatsApp group as well as in debriefing sessions for all areas.

All important points, (for example common mistakes made such as including children older than the age of five and regular questions) that were discussed at any time during the data collection period were, posted on the WhatsApp group by the PI, throughout the data collection procedure. This way the CHWs could reflect back, in case of any doubts related to sampled households, inclusion criteria, equipment errors etc.

After each day of data collection, the PI checked the data to ensure questionnaires were completed without missing data. The PI numbered all the forms and the data was captured on an Excel spreadsheet continuously throughout data collection procedure. When the questionnaire was not complete, the CHW team who conducted the visit to the specific household, were required to go back the following day and fill in the missing information.

The principle investigator held debriefing sessions with the Philani-mentor-mothers in the afternoons to discuss queries and challenges in the field, and worked together to help improve the experience for all.

Field visits and spot checks were conducted by the PI and the Philani-mentor-mothers, for each area throughout the data collection process. Anthropometric measurements were redone by either the PI, Grow Great investigator or Philani-mentor-mothers to ensure accuracy and reliability. If the measurements differed, the main investigators explored the reason therefore. CHWs were retrained and errors were thoroughly discussed in the debriefing sessions. CHW teams were retrained in the field based on their performance in the households that were included.

The Philani-mentor-mothers did 113 spot checks that were signed for while the study took place. The Principle investigator retrained the CHWs once at their monthly meeting at Boland Hospice. Retraining on equipment was done during debriefing sessions every time the CHWs had a question or WHO Anthro (version 3.2.2) software (StatSoft, 2013, USA) rejected the measurements.

Boland Hospice and the Department of Health requested regular feedback and meetings, which the PI attended throughout the data collections period.

Every week debriefings were held by the PI for each area, to recap and discuss the progress, difficulties and errors. The PI visited at least one area per day for discussion sessions and to answer specific questions.

The debriefing schedule differed on a weekly basis due to CHWs other Department of Heath responsibilities and therefore could not be pre-planned. Often the PI would arrive at the areas to find the CHWs busy with their other responsibilities. Times for debriefing were discussed with the Boland Hospice management team, but no set times could be set due to CHWs unknown schedules and time dependency of other government responsibilities. CHWs departmental schedule was mostly unknown and in-prompt work halted the study on multiple occasions. Debriefings were thus held whenever CHWs were present at meeting points. Often not all of the CHWs attended these meetings.

Table 3.1 Schedule for debriefings during data collection

STUDY SITE	*SUGGESTED TIME	VENUE	DISCUSSION LEAD BY
Avian park	14:00 Mondays	Ukwanda container	Principal investigator and team
Zwelethemba	14:00 Tuesdays	Container at community hall	Principal investigator and team
Roodewal	14:00 Wednesdays	Kibbutz	Principal investigator and team
Riverview	14:00 Thursdays	VGK creche	Principal investigator and team

PHILANI-MENTOR-MOTHER ROLES AND RESPONSIBILITIES

In order to ensure high quality data, NGO Philani was asked to assist the PI and Grow Great investigator with supervising the CHWs. The Philani-mentor-mothers assisted the study investigators with area visits. Each area had a Philani-mentor-mother to work alongside them throughout the data collection procedure.

The Philani-mentor-mothers walked alongside a different CHW team for each day, in their allocated area i.e. Avian Park, Riverview, Roodewal and Zwelethemba, in order to ensure the protocol was followed.

The Philani-mentor-mothers for each area, conducted daily informal discussions with their CHW teams while assisting the study investigators to check the forms. Philani-mentor-mothers assisted with retraining CHWs in the field if mistakes were noted.

Spot checks were also conducted by the Philani-mentor-mothers throughout the data collection procedure. All households that were spot checked by the Philani-mentor-mothers was signed by them as proof that the measurements were checked and in fact correct.

Often the PI had very limited time available in each area the meeting points were far apart and required the Philani-mentor-mothers to discuss mistakes on CHWs forms, and assist them in returning to the specific households. All mistakes were discussed with the Philani-mentor-mothers the previous afternoon or the morning before.

CHWS ROLES AND RESPONSIBILITIES

All the CHWs were required to complete a standard training package (Addendum B) before data collection could commence. The Grow Great Campaign trained the CHWs on a previous occasion and focused on the first 1,000 days window period.

The standard tracking package covered the following main topics:

- Introduction to the community stunting survey.
- Growth monitoring and how to classify a child's growth by means of WHO growth charts and RtHB.
- Practical topics: How to calculate a child's age.
- Standard operating procedures for growth monitoring.
- Practical exercises on how to monitor a child's growth.

Two CHWs worked as a team in order to sample qualifying households and collect necessary data.

Before the start of each data collection day, all CHW teams ensured that the instruments, forms, materials and equipment were ready to start the data collection process. Each team completed the structured paper-based data collection questionnaire (see Addendum C) by interviewing the mother, as well as completing an anthropometric assessment for herself and the qualifying child/children in households after obtaining informed consent (Addendum D). The child's weight, height/length, head circumference and mid- upper arm

circumference (MUAC), as well as the mothers' weight, height and waist circumference, were accurately measured. Standard operating procedures (SOPs) were developed to clearly outline how measurements were meant to be taken (Addendum E).

The CHWs approached the household by first introducing themselves and the study. The willingness of the potential participants was assessed prior to obtaining informed consent.

While the team was completing the questionnaire and anthropometrical assessments, they were required to assess children for potential health danger signs and make the necessary referrals. A SOP was available to assist CHWs with the screening and referral paths (Addendum F). Referrals were made for the following circumstances:

If the child showed one of the following eight danger signs, referrals were made to the nearest Primary Health Care Clinic:

- The child was coughing and breathing fast (more than 50 breaths per minute).
- A child under two months had a fever and struggled to feed.
- The child was vomiting everything up.
- Child had diarrhoea, sunken eyes, sunken forehead.
- The child was shaking (convulsion).
- The child had signs of severe acute malnutrition (swollen ankles and feet).
- Child was lethargic or unconscious.
- The mother was unable to breastfeed.

Additionally, referrals were made for the following:

- If the child did not have a RtHB, referrals were made to the Primary Health Care Clinic.
- If the child's immunizations were not up to date, referrals were made to the Primary Health Care Clinic.
- If the child did not have a birth certificate, referrals were made to Department of Home Affairs.
- If the child did not receive a child support grant, referrals were made to Department of Social Development.
- If the child was disabled referrals were made to Department of Social Development.

After the completion of a household, the next potential household was identified and approached to participate in the study.

If the RtHB was not available in the household during the time of data collection, the CHWs asked the questions and clearly indicated on the questionnaire that the RtHB was not used to verify and complete the information. If the child did not have a RtHB or the mother had lost it, she was referred to the Primary Health Care Clinic to get a new book.

The following forms and equipment were provided to each team of CHWs

- Grow Great trolley containing:
- 1x scale
- 1x portable stadiometer
- 1x electronic length board
- 2x measuring tapes
- 2x rulers
- 2x pens/pencils/erasers/staplers
- Set of extra batteries for scale and electronic length board

Forms required for each household:

- 1x questionnaire (Addendum C)
- 2x consent forms (Addendum D)
- 2 WHO growth charts per child, weight-for-age and length/height-for-age (to identify children who needs to be referred)

CHWs received the following to keep on hand to assist during data collection:

- SOPs (Addendum E)
- Danger signs identification and referral pathways (Addendum F)
- CHWs checklist (Addendum G)

3.3.7.2 DATA COLLECTION TOOLS

3.3.7.2.1 DRIVERS OF STUNTING QUESTIONNAIRE (ADDENDUM C)

The mother of the eligible child was interviewed after the CHWs obtained written informed consent (Addendum D). The questionnaire aimed to obtain information regarding the key drivers of stunting.

The questionnaire consisted of the following 6 sub-sections:

Section 1: Household Socio-Demographic information.

Section 2: Water and Sanitation.

Section 3: Information on the Mother.

Section 4: Information on the child.

Section 5: Breastfeeding and Complementary feeding practices.

Section 6: Dietary Diversity of the child.

The questionnaire was formulated from the previous CNSP research project conducted in Worcester, Breede Valley.[12] Additional information was added with regards to social demographic information of mothers and their children 0- 60 months, additional maternal and child anthropometrical measurements were added, as well as sections relating to the RtHB i.e. immunizations, vitamin A and deworming. This questionnaire was developed further from relevant literature and the WHO Conceptual framework on stunting served as base.[3]

Section 5 and section 6 was based on the WHO indicators for assessing infant and young child feeding practices Part 1 definitions[114], and questions were taken from the previous CNSP research project. Questions were based on recall information.

Section 6: Dietary diversity of the child included the following food groups

- Grains, roots and tubers: e.g. bread, cereal, porridge
- Legumes and nuts
- Dairy products (excluding breastmilk)
- Meat, fish, poultry and liver/organ meat
- Eggs
- Vitamin A rich fruit and vegetables: e.g. sweet potato, carrots, pumpkin, butternut
- Other fruit and vegetables

3.3.7.2.2 ANTHROPOMETRIC MEASUREMENTS AND EQUIPMENT

CHWs performed and recorded the following anthropometric measurements of all children between the ages 0-60 months, and their mothers who agreed to participate in the study. All measurements were recorded on the data collection sheet.

The measurements were conducted according to WHO standard procedures.[115,116]

The following anthropometric measurements were taken for each child between the ages 0-60 months:

- Height / Length (cm): measured to the nearest 0.1 cm.
- Weight (kg): Measured to the nearest 0.1 kg.
- Head circumference (cm): measured to the nearest 0.1 cm.

The following measurement was taken for each child between the ages 6-60 months:

- Mid-upper arm circumference (cm): measured to the nearest 0.1 cm.

In the case where there is more than one child between the ages 0-60 months, anthropometric assessments were performed and both results were documented.

The following measurements were taken for mothers of the children participating in the study:

- Height (cm): measure to the nearest 0.1 cm.
- Weight (kg): measured to the nearest 0.1 kg.
- Waist circumference (cm): measured to the nearest 0.1 cm.
- Mid-upper arm circumference (cm) measured to the nearest 0.1 cm.

In the case where there is more than one mother in a household with children between the ages 0-60 months, both were approached for participation and anthropometric assessments were performed and both were documented.

3.3.7.2.2.1 WEIGHT

- Weight was measured by means of an electronic scale. (A&D UC-321 health scale, manufactured in Japan)
- Scales were calibrated by using a 2.5 kg weight before they were awarded to the CHWs. (done by the PI)
- CHW pairs made use of the same scale throughout the data collection. Two CHWs scales broke and needed to be replaced.
- If the child was too small to stand or unable to stand the mother was asked to assist the CHWs. The mother's weight was taken alone and thereafter whist holding the child and the scale made the deduction equation.

3.3.7.2.2.2 LENGTH/ HEIGHT

- For children aged two and below the age of two, an electronic length board (Charder HM80D DigiStad, manufactured in Taiwan) was used to measure length.
- For children above the age of two (who could stand unassisted) and for mothers, a portable stadiometer (Charder HM200P Portstad, manufactured in Taiwan) was used to measure their height,

3.3.7.2.2.3 MUAC, WAIST CIRCUMFERENCE AND HEAD CIRCUMFERENCE

- A non-stretchable ad flexible measuring tape (KKYJIA tape measure, manufactured in China) was used to measure the head circumference of children, maternal MUAC and maternal waist circumference.
- A non-stretchable, colour coded MUAC measuring tape (Fhi360, Department of Health, REBUBLIC OF SOUTH AFRICA) was used to measure child MUAC.

3.3.7.2.2.4 STANDARDISATION OF ANTHROPOMETRIC MEASUREMENTS

- Anthropometric training consisted of theoretical and practical training of CHWs.
- SOPs (Addendum E) were developed and handed out to all CHWs as well as Philani-mentor-mothers.
- PI personally calibrated the electronic scales for the CHWs. (A&D UC-321 health scale, manufactured in Japan).
- During the pilot study the PI and Grow Great investigator worked alongside CHWs.

- During data collection, CHWs and Philani-mentor-mothers had continuous contact with the PI.
- Philani-mentor-mothers severed as area supervisors to assist when problems presented during data collection.
- Debriefings and discussions were held every day in one or more areas during data collection by the PI and Grow Great investigator.
- Informal discussion was held every day in one or more areas during data collection by the Philani-mentor-mothers.
- The completed questionnaires were checked on a daily basis by the PI and Philani-mentor-mothers assisted with this task during data collection. Questionnaires were returned in case of missing data.
- Each CHW team had their own set of equipment.
- Anthropometric assessments were conducted by two CHWs.
- CHWs were accompanied during data collection on a regular basis by the PI, Grow Great investigator and Philani-mentor-mothers.
- Spot checks was conducted during data collection on a regular basis by PI, Grow Great investigator and Philani-mentor-mothers.
- CHWs were retrained during data collection by PI and Philani-mentor-mothers if spot checks did not correspond to the CHWs.
- The average of two anthropometric measurements were used.
- If measurements differed with more than 0.5 cm, the CHWs were required to take a third measurement. Questionnaires were returned the following day if measurements differed by more than 0.5 cm.

3.3.7.3 TRAINING AND STANDARDISATION

The PI assigned each household with a number. This number was written on every form of the required household. CHWs wrote their names and surnames on each form, as well as the address of the participating household, in order to ensure they will be able to find the mother-child pair in the case of missing information.

After a household was identified that fitted the inclusion criteria, written informed consent was obtained after the study was thoroughly explained.

The questionnaire was completed and the RtHB was used to gather necessary data thereafter, the CHWs worked together to take the anthropometric measurements of the mother and child.

CHWs teams studied the RtHB for the children included in the study to ensure that vitamin A supplementation and deworming was up to date. If not, the children were supplemented on site as the CHWs are fully equipped and trained to do so. In the case where CHWs did not have the necessary products the

children were referred to a primary health care facility, as identified by the Department of Health, for each area. Deworming and vitamin A supplementation were not done in cases where there was no RtHB available.

Prior to this study, all CHWs were trained the Boland Hospice training room in Worcester, who also made transport arrangements for them to get to and from the workshop. The CHWs were divided into two training groups to ensure that all receive adequate support and attention.

The professional nurse trainer from Philani Maternal, Child Health and Nutrition Trust (Philani) as well as two assistant trainers per group, provided the training. The assistant trainers are Philani-mentor-mothers (CHWs) who have attended training for assistant trainers. The principal investigator, as well as the Grow Great Campaign CHW master trainer, attended training for both groups for quality assurance purposes.

The following topics were covered during CHWs training:

- The first 1,000 days
- Normal growth and development
- Growth monitoring: tools needed to monitor growth, how often one should monitor growth
- The growth charts and what they measure
- Malnutrition: definition, causes, types, effects, prevention, what to do as CHW
- Stunting: definition, the impact of stunting, the drivers of stunting

Practical topics that were covered:

- Calculating age
- Weighing baby and child
- Measuring length/ height
- Measuring MUAC
- Giving Vitamin A and deworming
- Plotting on the growth charts

Exercises included the following:

- The first 1,000 days
- Growth charts plotting
- Connecting the dots
- Causes of malnutrition
- SAM: comparing severe wasting and oedematous malnutrition
- Prevention of malnutrition in children
- Calculating age
- Checking MUAC

3.3.7.3.1 TRAINING STATIONERY AND SUPPLIES

The pilot study was conducted on the 18th and 23rd of July 2018. The CHWs received training organised and supervised by the study investigators (including the PI, Philani-mentor-mothers and multiple investigators of the Grow Great team) prior to the start of the pilot study.

During the pilot, the PI and Grow Great investigator worked alongside CHWs to help identify potential errors and problems. This continued for the first week of the survey to provide guidance to those who needed additional support.

3.3.8 PILOT STUDY

The pilot study was conducted on the 18 July and the 23rd of July 2018. The CHWs received training organised and supervised by the study investigators (including the PI, Philani-mentor-mothers and multiple investigators of the Grow Great team) prior to the start of the pilot study.

During the pilot the PI and Grow Great investigator worked alongside CHWs to help identify potential errors and problems. This continued for the first week of the survey to provide guidance to those who needed additional support.

3.3.8.1 AIM OF PILOT STUDY

- Ensure all CHWs understand the sampling process and establish the average time needed to complete one households' questionnaire and participants' measurements.
- The pilot study formed part of the CHW training process and the anthropometric measurements taken, was checked on site by the PI, a trained dietitian, Grow great investigator and Philani-mentor-mothers. At the end of each day all CHWs had the opportunity to ask questions and discuss errors they experienced in the field.
- Test data capturing forms, questionnaires, consent forms.
- Test data capturing sheets.
- Help identify potential practical difficulties during the data collection day and discuss with the
- CHW in advance to minimise logistical difficulties.
- Establish a general meeting point for weekly discussions.

Challenges noted from the pilot:

- The CHWs seemed to forget about the inclusion criteria. Children who were above the age of five were included as well as mothers and children who stayed in the area for less than 27 weeks.
- The printed maps were problematic due to small print and blurriness when enlarged. The numbers on the maps did not always correspond with the street addresses and often the numbers on the map was non-existent in some areas. Therefore, the sampling was a challenging process.
- Houses often had two addresses which confused the CHWs and numerous phone calls were made expressing confusion of where to go and what to do.
- Due to the random sampling, CHWs were often presented with street names they don't recognise. Seeing as the maps did not help the CHWs, the PI took a picture of the A0 maps of the specific area and send it via a WhatsApp group chat.
- The CHWs required data in order to continuously ask questions and stay in communication.
- The CHWs had predefined specified areas where they usually worked, that was drawn on the A0 maps. Some of the streets were cut off from the map, specially the informal shacks areas. The flats in Roodewal and Riverview presented another problem as there are no street names. The flats were divided in blocks and the blocks were randomly selected.
- There were challenges with regards to the sampling procedure, please see Chapter 5, section 5.6.2 of Limitations.

3.3.8.2 FINDINGS OF THE PILOT

During the two days of the pilot, the CHWs, with the help of Grow Great investigator and the PI, managed to complete 71 households. However, the CHWs included not only mother-child pairs but also caregiver-child pairs in the sample, which mostly included their grandmothers. The caregiver-child data was discarded as most of the questionnaire could not be answered and no anthropometrical measurements were taken.

The data from the pilot study was included in the total, as there were no changes to the research methodology and data collection tools.

3.4 DATA HANDLING AND ANALYSIS

The data collection period spanned a three-month period, from 26th July 2018 to 30th October 2018.

Children's ages, weights and heights were used to calculate length/height-for age z-scores (HAZ), weight-for-age z-scores (WAZ) and weight-for-length/height z-scores (WHZ) using WHO Anthro (version 3.2.2) software (StatSoft, 2013, USA). Data were interpreted using WHO child growth standards[115–117] and cut-off values as indicated in Table 3.2 and Table 3.5.

Table 3. 3 indicates the MUAC cut-off values used to classify Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) and Table 3.4 indicates birthweight classifications.

Data was entered in Excel, cleaned, transferred and analysed with IBM SPSS version 26. Means and standard deviations were used to express continuous variables and percentages for categorical data. Descriptive statistics are presented by means of texts, figures and tables while Pearson Chi square tests were used to determine associations between key factors of stunting and child stunting data. Statistical significance was indicated if $p<0.05$ and, both bivariate and multivariate logistic regression models were used to identify key factors of stunting in Worcester. The strength of association was measured by means of odd ratios, both crude and adjusted, with 95% confidence interval (CI). P-values of <0.05 were classified as statistically significant.

Table 3.2 WHO classification using z-scores[115,117]

Z-SCORE	CLASSIFICATION
LENGTH/HEIGHT-FOR-AGE (HAZ/LAZ)	
< -2 z-score	Stunted*
< -3 z-score	Severely stunted
WEIGHT-FOR-AGE (WAZ)	
< -2 z-score	Underweight**
<-3 z-score	Severely underweight
WEIGHT-FOR-LENGTH/HEIGHT (WHZ/WLZ)	
> 3 z-score	Obese
> 2 z-score	Overweight
< -2 z-score	Wasted***
< -3 z-score	Severely wasted

*Stunted refers to all children below the -2 z-score, this includes all children below the -3 z-score.

**Underweight refers to all children below the <-2 z-score, this includes all children below the -3 z-score.

***Wasted refers to all children below the < -2 z-score, this includes all children below the -3 z-score.

For ease of reference WHZ and HAZ will be used to describe WLZ and LAZ throughout the document for all children between the ages 0-60 months.

Table 3.3 Mid-upper arm circumference classifications[118]

MID -UPPER ARM CIRCUMFERENCE (MUAC)	CLASSIFICATION
<12.5 cm	MAM
<11.5 cm	SAM

MAM- Moderate Acute Malnutrition; SAM- Severe acute malnutrition

Table 3.4 Birth weight classifications[119]

BIRTHWEIGHT	CLASSIFICATION
<2500g	Low birthweight
<1500g	Very low birthweight
<1000g	Extremely low birthweight

Table 3.5 Head circumference classification[115,120]

HEAD CIRCUMFERENCE CUT-OFFS	CLASSIFICATION
+2 SD score	Large head
-2 SD score	Small head

Adult women's BMI (weight [in kg]/ height (in m^2) were interpreted using the WHO Consultation on Obesity classifications (1999), see Table 3.6 below, as well as the cut-off for waist circumference, maternal short stature and maternal MUAC. (Table 3.6, Table 3.7, Table 3.8 and Table 3.9)

Table 3.6 Adult women BMI [in kg/height(in m2)] classification[116]

BMI	CLASSIFICATION
<18,5 kg/m^2	Underweight
18.5-24.99 kg/m^2	Normal weight
25-29.99kg/m^2	Overweight
≥30 kg/m^2	Obese

Table 3.7 Cut-off for maternal short stature[121]

HEIGHT CUT-OFF	CLASSIFICATION
< 1.45m	Maternal short stature
≥ 1.45	Normal

Table 3.8 Waist circumference cut-off for increased risk of metabolic disease[122]

WAIST CIRCUMFERENCE	CLASSIFICATION
≥88cm	Increased risk for metabolic complications.
<88cm	No increased risk for metabolic complications

Table 3.9 Maternal mid-upper arm circumference cut-off values[123]

MATERNAL MUAC	CLASSIFICATION
≤ 23 cm	Possibly at risk for undernutrition
> 23 cm	Normal

MUAC-Mid-upper arm circumference

The following WHO definitions were used to calculate infant feeding practices for the research study and dietary data was described and dietary diversity score (DDS) was calculated. The sum total of the different food groups consumed were calculated as well. Please see Table 3.10 and Table 3.11 for infant feeding calculations and DDS classification.

Table 3.10 Definitions and calculations for assessing infant feeding practices[114]

WHO INDICATORS DEFINITIONS	CALCULATION
Exclusive breastfeeding under 6 months: Proportion of infants 0 - 5 months of age who are fed exclusively with breastmilk.	Infants 0-5 months of age who received only breastmilk up to the day of the survey / Infants 0-5 months of age
Continued breastfeeding at 1 year: Proportion of children 12-15 months of age who are fed breastmilk.	Children 12-15 months of age who received breastmilk up to the day of the survey / Children 12-15 months of age
Introduction of complementary foods: Proportion of infants 6-8 months of age who received solid, semi-solid or soft foods.	Infants 6-8 months of age who received solid, semi-solid or soft foods / Infants 6-8 months
Minimum dietary diversity: Proportion of children 6- 23 months of age who received foods from 4 or more food groups.	Children 6-23 months of age who received foods from 4 or more food groups during the previous day of the survey / Children 6-23 months of age
Continued breastfeeding at 2 years: Proportion of children 20-23 months of age who are fed breastmilk.	Children 20-23 months of age who received breastmilk up until the day of the survey / Children 20-23 months of age

Table 3.11 Dietary Diversity score classification[114]

DIETARY DIVERSITY SCORE	CLASSIFICATION
≤ 3 food groups	Low
4-5 food groups	Medium
≥ 6 food groups	High

Children between the ages 0-60 months were grouped into the following age categories shown below:

- 0-5 months
- 6-11 months
- 12-23 months
- 24-35 months
- 36-60 months

3.5 ETHICAL CONSIDERATIONS

3.5.1 GENERAL

The research proposal was submitted to the Human Research Ethics committee (HREC) of Stellenbosch University on the 16th of May 2018.

Ethical approval (Reference no **#** S18/05/100) was granted by the HREC on the 5th July 2018. (Addendum H)

3.5.2 POTENTIAL RISKS AND RISK MANAGEMENT

The study posed minimal risk to participants. Nonetheless, it was important to identify any possible risks and how they would be managed. One source of risk in the study of participants was that participants may find some of the questions sensitive. To address this, careful steps were taken in the design of instruments to minimise the potential discomfort of participants. If any participant(s) were uncomfortable responding to certain question(s), he/she had the right to decline to do so. Consent forms and data collection questionnaires emphasised that participants did not have to answer any questions they do not wish to and that they can withdraw from the study at any time.

In addition, CHWs were trained to observe signs of distress and stopped the interview in cases where the participant showed such signs. CHWs were further provided with information regarding local referral pathways (see Addendum F for referral pathway information card) so that any children that were identified as acutely unwell or requiring medical attention, could be referred timeously and appropriately.

3.5.3 BENEFIT SHARING

Households that participated in data collection benefitted from receiving reading materials for the young children in their homes. In addition, stunting profiles will still be shared with the community through a '*community imbizo'* to which community members, local leaders, businesses, non-governmental organisations (NGOs), government departments and elected officials will be invited. The results will also be shared through community radio stations with messages promoting healthy early childhood development.

Children received vitamin A supplementation and deworming tablets when necessary, as CHWs were equipped to supplement according to national protocols. If CHWs did not have the necessary supplements, they were referred to a predefined clinic and, in the cases, where supplementation and deworming were provided, it was documented in their RtHB.

The participants did not receive financial compensation by taking part in this study, as there was no cost involved to them (e.g. Transport). Each child received reading material (a booklet) as a token of appreciation for the mothers' time to participate in the study.

3.5.4 CONFIDENTIALITY RISKS AND STEPS TO MINIMISE RISK

Protecting and respecting the confidentiality and privacy of study participants was a critical consideration throughout the conduct of the study. All the study team members received appropriate training on research ethics, emphasising the importance of informed consent and confidentiality. Team members were informed that any breach of confidentiality was unacceptable and data collection took place during routine working hours, in the private homes of participants.

The study team ensured that all study materials were stored securely and all personal identifiers were anonymised as only main investigators had access to forms. Data presented back to the community is aggregated to ensure responses cannot be traced back to individual participants.

Anthropometric measurements were done in a private area, if available, to ensure privacy.

Furthermore, no personal data was captured (apart from an address) to ensure confidentiality and households were assigned a number corresponding with the consent forms.

3.5.5 INFORMED CONSENT

All households in the sample frame was approached to participate in the study and if they refused, the community health workers proceeded to the household next in line.

Individual written consent (Addendum D) was obtained prior to commencing with data collection and since the participants were minors, consent was obtained from the mother, who was interviewed on behalf of the minor. No accent was required as all children included was below the age of five. Potential study participants were provided with information about the study before consent was sought and participants were also informed about the requirements for participating in the study. Information was read to the illiterate participants who were requested to sign by placing a cross on the signature line on the informed consent form.

Participants received the following information during the consent process:

- Aim of the study and methods used.
- Institutional affiliations of the study.
- Potential risks of the study.
- Anticipated benefits.
- Right to abstain from participating in the study, or to withdraw from it at any time, without reprisal.
- Measures to ensure confidentiality of information provided.
- Contact details of the study's PI and co-investigators for any questions or concerns.
- Contact details of the ethical review body for any questions regarding participation in the study.

Consent forms were available in the three main languages of the area namely: Afrikaans, English and isiXhosa. The participants therefore had the option of providing consent in their home language.

3.6 REPORT

- The agreement between the Stellenbosch University researchers and the Grow Great Campaign are that the M. Nutrition student has first option to use the data for her thesis and to publish the data in scientific journals. All collaborators are listed as co-authors and have insight in all academic presentations and publications emanating from the Worcester area research, excluding the thesis and graduation timelines.
- Results will be reported back to the community through a '*community imbizo*' by the Grow Great Campaign in order to create awareness about stunting and, manners in which to prevent and appropriately treat the condition. Community members, local leaders, businesses, non-governmental organisations (NGOs), government departments and elected officials will be invited.
- Results will also be shared through community radio stations with messages promoting healthy early childhood development.
- Study findings will be reported at appropriate conferences and published in peer-reviewed journals.

CHAPTER 4: RESULTS

This chapter presents data on anthropometric measurements of mothers and children, as captured from the questionnaires, as well as data analysis pertaining to the drivers of stunting.

Although a total of 912 questionnaires were completed, 27 of these were excluded. After exclusion n=885 questionnaires remained and were included. Details are provided in Figure 4.1.

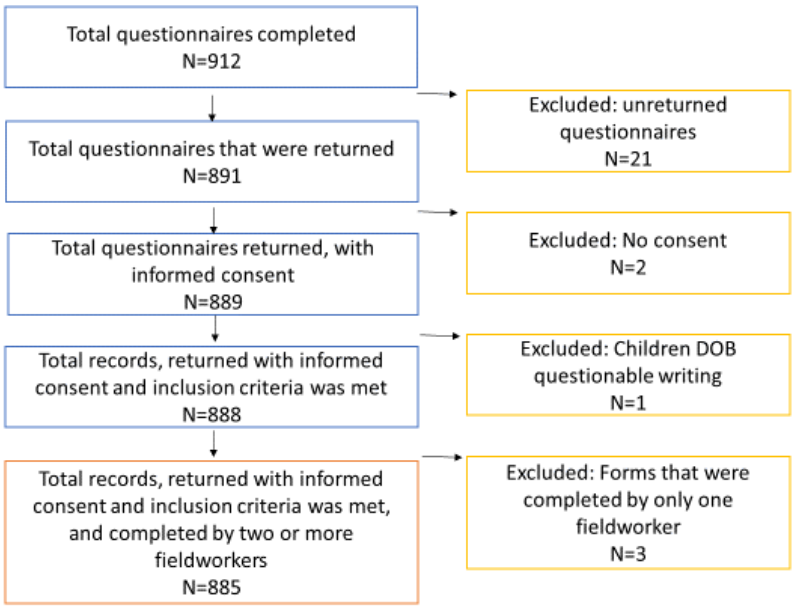


Figure 4.1 Diagrammatical representation of included and excluded mother-child pairs questionnaire

4.1 STUDY POPULATION OF MOTHER-CHILD PAIRS IN WORCESTER, BREEDE VALLEY

Of the n=885 questionnaires, information for a total of n=790 mothers and n=885 children were complete and could be included in the study. For mothers who had more than one child between 0-60 months, all children were eligible for inclusion. A total of 709 households were included in this research project, located in the following four geographic areas: Avian Park, River View, Roodewal and Zwelethemba. The study population for the included children was n=201 for Avian Park, n= 217 for River View, n=192 for Roodewal and n=275 for Zwelethemba respectively, further detailed in Figure 4.2.

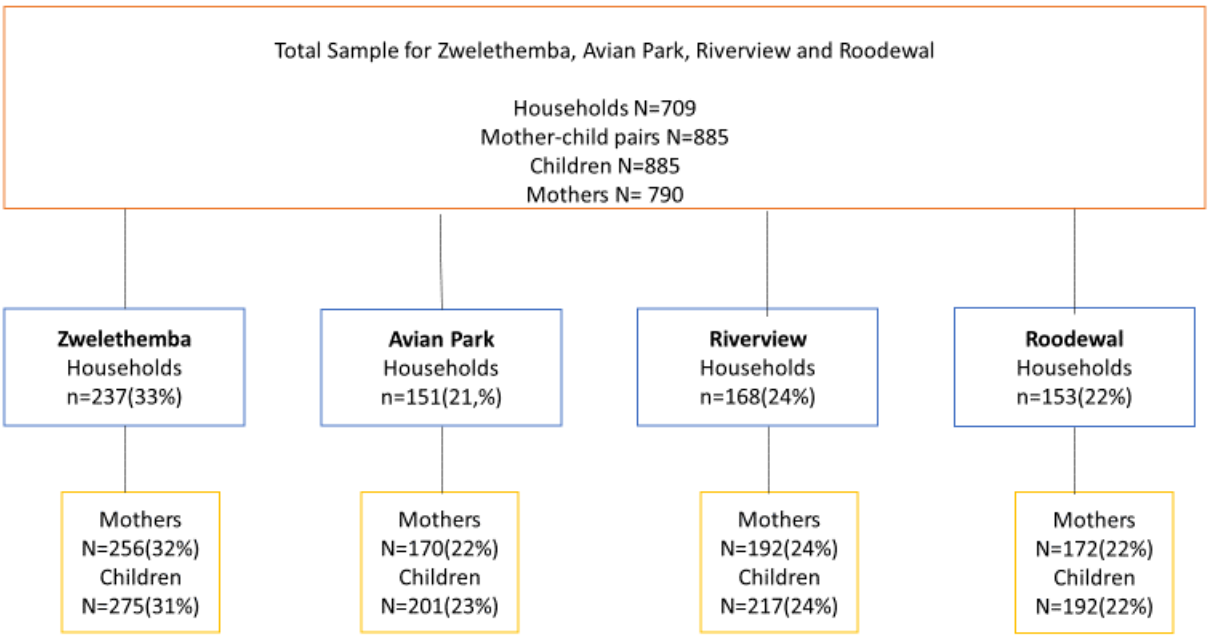


Figure 4.2 Diagrammatical representation of study population included in the research for Avian Park, Riverview, Roodewal and Zwelethemba, Worcester, Breede Valley

Figure 4.3 depicts the contribution percentage of mother-child pairs in each area, to the study population included in the research study. Zwelethemba made up the biggest proportion of the study population, as there were more CHWs available to work within the specified area.

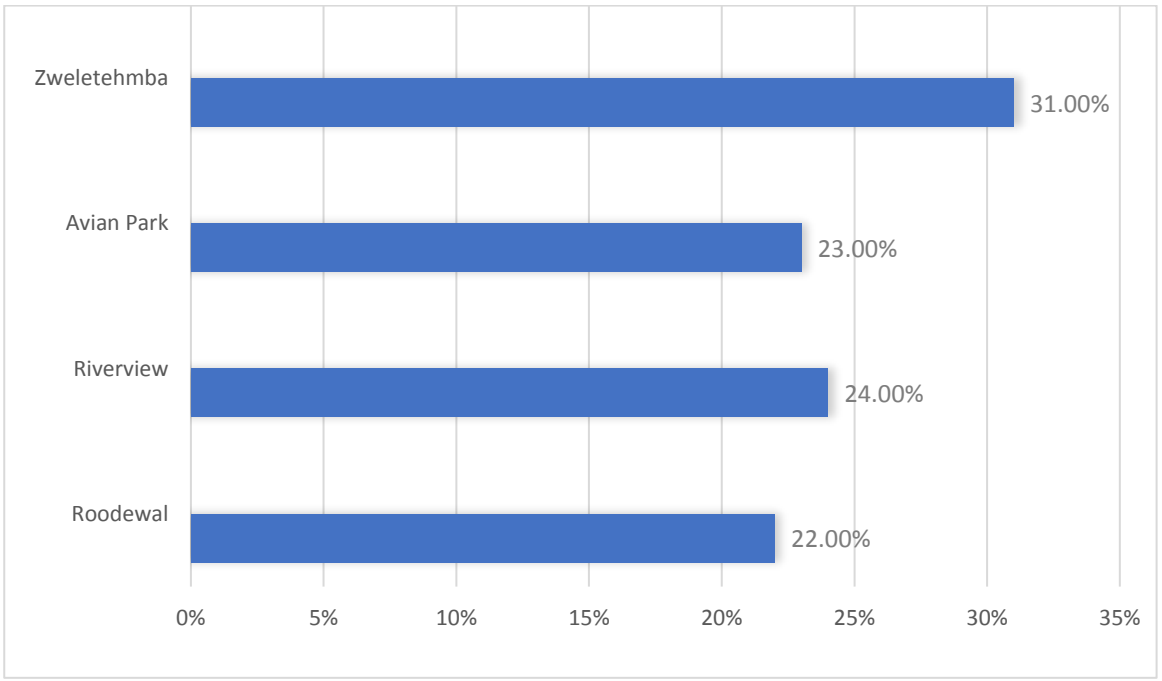


Figure 4.3 Percentage contribution of mother-child pairs to the study population per area in Worcester, Breede Valley

4.2 SOCIO-DEMOGRAPHICS CHARACTERISTICS OF MOTHER-CHILD PAIRS IN WORCESTER, BREEDE VALLEY

4.2.1 MATERNAL AND HOUSEHOLD CHARACTERSTICS

The socio-demographic information for mother-child pairs are presented in Table 4.1 and 4.2. The mean age of mothers was 28.35 years (±7.05), with the youngest aged 16 and oldest 49 years. Of the total number of children, 3.64% (n=32/879) of their mothers were below the age of 19 years, the majority of which unmarried (n=660/885; 74.58) while 34.01% (n=301/885) had completed grade 12. Further results showed that 3.16% (n=28/885) of mothers continued their education after school. It was also found that 73.67% (n=652/885) of participants were unemployed with 28.68% (n=180/652; 27.60%) of these mothers being unemployed by choice (not shown in table). Furthermore, 80.54% (712/884) of mothers received a child support grant for the child included in the study. The majority of participants' main source of income was derived from child support grants and contributions from other family members, and only 18.76% (n=166/885) of mothers' main source of income was their own salaries.

Most mother-child pairs had access to piped water and flush toilets in Worcester, Breede Valley; approximately 8% had inadequate access to water (n=70/885; 7.91%) and sanitation facilities (n=66/885; 7.46%).

The selected areas showed significant differences for the following socio-demographic characteristics: main source of income (own salary) and, care of infant and young children (Pearson's Chi square test: p=0.038 and p=0.021). Zwelethemba had the most mothers who earned their own salary (n=67/275; 24.67%), followed by Roodewal (n=33/192; 17.19%), Riverview (n=35/217; 16.13%) and lastly Avian Park (n=31/201; 15.42%) which showed the least number of employed mothers.

The majority of mothers personally took care of the participating child. The children who were not looked after by the mothers, consisted of 20.68% (n=183/885) of the sample and generally the grandmothers or siblings took the responsibility of caring for the included child participants.

Most mothers who did not personally take care of their included child participants were residing in Zwelethemba (n=71/275; 25.82%), and the most children who attend a crèche during the day (n=29/275; 10.55%) was also found in this area. Avian Park, on the other hand showed the least number of mothers (n=29/201; 14.43%), who did not personally take care of their included child participants. In Riverview and Roodewal, 21.66% (n=47/217) and 18.75% (n=36/92) of mothers did not personally take care of their included child participants, respectively.

Table 4.1 Socio-demographic information of mother-child pairs in Worcester, Breede Valley

	n (%)
Maternal age (years) (n,%)	n=879(99.32)
Mean (SD)	28.66 (7.75)
Range	16.12-49.97
<19	32 (3.64)
19-34	689(78.39)
≥35	158 (17.97)
Marital status (n,%)	N=885(100)
Married	225(25.42)
Single	660 (74.58)
Educational Achievement (n,%)	N=885(100)
Mean (SD)	Grade 10(1.81)
Range	Grade 0-12
≤ Primary school	69(7.80)
Grade 8-11	515 (58.19)
Grade 12	301(34.01)
Employment (n,%)	N=885(100)
Employed	233(26.30)
Unemployed	652(73.70)
Tertiary education (n,%)	N=885(100)
Yes	28(3.16)
No	857(96.84)
Main source of income (n,%)	N=885(100)
Own salary	166(18.76)
Other	719(81.24)
Child support grant (n,%)	n=884(99.88)
Receive	712(80.54)
Don't receive	172(19.46)
Main source of water (n,%)	N=885(100)
No facilities	29(3.28)
Communal tap	41(4.63)
Piped water	815(92.09)
Main form sanitation (n,%)	N=885(100)
No facilities	30(3.39)
Portable/pit latrine	36(4.07)
Flush toilets	819(92.54)

Married=traditional/legal/living together

Single=unmarried/separated/divorces/widowed

4.2.2 CHILDREN BETWEEN THE AGES 0-60 MONTHS CHARACTERISTICS

The mean age of the infants and young children included in the study was 26 months (±16.85). The children's ages were similar between the four included areas, as confirmed by the Pearson Chi square test (p=0.076). From the total sample, 51.75% (n=458/885) were male and 48.25% (n=727/885) were female thus, there was no significant difference between the four areas with regards to gender distribution. The larger proportion of children fell in the age group 36 - 60 months. Table 4.2 presents the socio-demographic information of child participants included in the study.

The study showed 37.09% (n=335/884) of the children included, was the first or only child. For those who were not the first or only child, the number of siblings ranged from 1-7 children, however, the majority of children had one (n=238/549; 43.33%) or two (n=173/549; 31.511%) older siblings (not indicated in table). Almost all the included children had a birth certificate (n=845/884; 95.59%).

Birthweights were available for 91.41% (n=809) child participants, showing 18.92% (n=153/809) of the children were born with birthweight below 2500g (ELBW + VLBW + LBW). A thorough breakdown of birthweight classifications is presented in Table 4.2. Furthermore, most children were born in a hospital or clinic setting.

Out of the mothers who could remember if their children were treated for recent illnesses more than three times in the past 12 months, 99.20%(n=878/885) recalled this information. During the period the data collection took place, it was recorded that 21.87% (n=192/878) of children were treated more than three times in the past year, for the following illnesses: diarrhea, colds and flu, painful swollen stomach, vomiting or any other specified illnesses.

Significant differences across the four study areas were observed for the following child characteristics: birth order of child and children experiencing illnesses more than three times in the last year. (Pearson's chi square test p=0.033 and p<0.001)

Child participants who were the first or only child was respectively 43.43% (n=119/274) in Zwelethemba, 36.46% (n=70/192) in Roodewal, 39.17% (n=85/217) in Riverview and 30.35%(n=61/201) in Avian Park. Likewise, Avian Park also had the highest number of child participants recorded with illnesses (n=72/201; 35.82%), followed by Riverview (n=55/215; 25.58%), Zwelethemba (n=53/270; 19.63%) and lastly Roodewal. (n=12/192; 6.25%).

Table 4.2 Sociodemographic information of children between the ages 0 - 60 months in Worcester, Breede Valley

	n (%)
Child age (months) (n,%)	N=885(100)
Mean (SD)	26.43(16.85)
Range (months)	0.09-59.82
0-5 months	97(10.96)
6-11 months	111(12.54)
12-23 months	216(24.41)
24-35 months	177(20.00)
36-60 months	284(32.09)
Gender (n,%)	N=885(100)
Female	427(48.25)
Male	458(51.75)
Birth certificate (n,%)	n=884(99.88)
Yes	39(4.41)
No	845(95.59)
Birth order (n,%)	n=884(99.88)
First child	335(37.90)
Not first child	549(62.10)
Born at health care facility (n,%)	N=885(100)
Hospital	448(50.62)
Clinic	420(47.4)
No healthcare facility	17(1.92)
Birthweight categories (kg) (n,%)	n=809(91.41)
Mean (SD)	2.9 (0.65)
Range (g)	0.60-7.3
ELBW	2(0.25)
VLBW	13(1.61)
LBW	138(17.06)
≥2.500g	656(81.08)

ELBW-Extremely Low birthweight (<1000g); VLBW-very low birthweight (<1500g); LBW-Low birthweight (<2500g)

4.3 NUTRITIONAL PROFILE OF MOTHER-CHILD-PAIRS IN WORCESTER, BREEDE VALLEY

4.3.1 NUTRITION PROFILE OF CHILDREN BETWEEN THE AGES 0-60 MONTHS

Table 4.3 provides characteristics of the anthropometric data for the child study participants. In addition, Table 4.4 and Figure 4.4 describe the current nutritional situation in Worcester, per area, for children between 0 - 60 months.

Table 4.3 Anthropometric information of children between the ages 0-60 months in Worcester, Breede Valley

Child anthropometry:	(n)	Mean (SD)	Range
Weight (kg)	885	11.68(4.74)	1.66 - 28.00
0-5 months	97	6.10(1.98)	
6-11 months	111	8.02(2.39)	
12-23 months	216	10.46(1.81)	
24-35 months	177	10.01(2.97)	
36-60 months	284	15.00(2.62)	
Length/Height (cm)	885	82.10(14.57)	42.00-117.3
0-5 months	97	59.00(7.69)	
6-11 months	111	66.72(7.67)	
12-23 months	216	76.93(5.49)	
24-35 months	177	75.23(11.25)	
36-60 months	284	97.05(6.65)	
Head circumference (cm)	885	46.80(4.55)	32.00-47.00
0-5 months	97	40.00(3.51)	
6-11 months	111	43.25(3.68)	
12-23 months	216	46.68(2.23)	
24-35 months	177	45.62(3.95)	
36-60 months	284	49.53(2.28)	
MUAC (cm)	788	15.46(1.91)	9.50-26.00
0-5 months	0	0	
6-11 months	111	14.27(2.03)	
12-23 months	216	15.38(1.55)	
24-35 months	177	15.03(1.91)	
36-60 months	284	16.31(1.60)	
HAZ	883	-1.15(1.49)	-5.74 - 4.49
WAZ	884	-0.29(1.32)	-5.55 - 4.10
WHZ	876	0.52(1.46)	-4.36-4.93
HCZ	885	0.00(1.57)	-6.61-7.86

MUAC-Mid-upper-arm circumference; HAZ-Height-for-age z-score; WHZ-weight-for-height z-score; WAZ-weight-for-age z-score; HCZ- Head circumference z-score

Table 4.4 provides details of the anthropometric classifications for all the areas included. There were significant differences between the four areas with regards to HAZ (Pearson chi square test < 0.001) and WAZ (Pearson chi square test = 0.001). Zwelethemba showed a high prevalence of overweight and obesity while the remaining areas showed a higher prevalence of stunting and underweight in children between 0 - 60 months.

Table 4.4 Prevalence of nutritional disorders for children between the ages 0 - 60 months in Worcester, Breede Valley

	n (%)	Avian Park n (%)	Riverview n (%)	Roodewal n (%)	Zwelethemba n (%)
Severely stunted HAZ <-3 z score	85 (9.62)	27(13.43)	23(10.59)	16(8.38)	19(6.93)
Stunted HAZ <-2 z score	147(16.65)	44(21.89)	34(15.67)	39(20.42)	30(10.95)
Total	**232(26.27%)**	**71(35.32)**	**57(26.27)**	**55(28.80)**	**49(17.88)**
Severely underweight WAZ < -3 z score	19(2.15)	5(2.49)	6(2.76)	5(2.62)	3(1.10)
Underweight WAZ <-2 z-score	71(8.03)	20(9.95)	22(10.14)	21(10.99)	8(2.90)
Total	**90(10.18)**	**25(12.44)**	**28(12.90)**	**26(13.61)**	**11(4.00)**
Severely wasted WHZ <-3 z-score	5(0.57)	1(0.50)	2(0.92)	1(0.52)	1(0.37)
Wasted WHZ < -2 z-score	31(3.54)	7(3.54)	8(3.69)	9(4.74)	7(2.58)
Total	**36(4.11)**	**8(4.04)**	**10(4.61)**	**10(5.26)**	**8(2.95)**
Obese WHZ > 3 z-score	38(4.34)	8(4.04)	7(3.22)	4(2.10)	19(7.01)
Overweight WHZ > 2 z-score	100(11.41)	18(9.09)	21(9.68)	12(6.32)	49(18.08)
Total	**138(15.75)**	**26(13.13)**	**28(12.90)**	**16(8.42)**	**68(25.09)**
MAM	8(1.02)	4(2.29)	1(0.53)	1(0.55)	2(0.83)
SAM	4(0.51)	2(1.13)	2(1.06)	0(0)	0(0)

HAZ-Height-for-age z-score; WAZ- Weight-for age z-score; WHZ- weight-for-height z-score; MAM- Moderate Acute Malnutrition (mid-upper arm circumference < 12.5 cm); SAM- Severe Acute Malnutrition (mid-upper arm circumference <11.5 cm)

The overall prevalence of underweight was 10.18% (n=90/885), wasting was 4.11%(n=36/876) and overweight and obesity was 11.41% (n=100/876) and 4.34% (n=38/876) respectively. Head circumference z-scores were derived; 9.26% (n=82/885) of children HCZ fell below the -2 z-score and 9.85% (n=88/885) of children had a head circumference above the 2 z-score line, indicating small and large head size respectively. (Table 4.4)

For ease of reference, a visual representation per area of Table 4.4 can be seen in Figure 4 4.

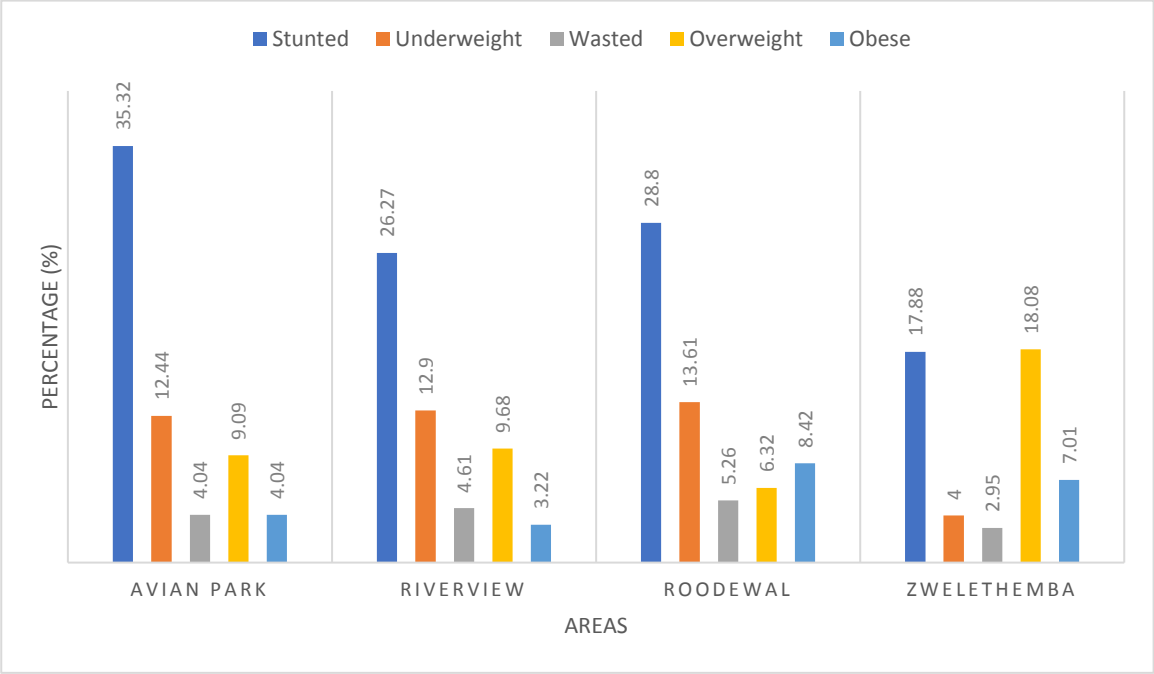


Figure 4.4 The prevalence of nutritional disorders for children between the ages 0-60 months per area in Worcester, Breede Valley.

The overall prevalence of stunting was 26.27% (n=232/883) with 9.62% (n=85/883) of the children identified to be severely stunted, however, stunting prevalence was higher in Avian Park compared to the other included areas.

Stunting was higher among males (n=131/232; 28.73%) than females (n=101/232; 23.65%) in this study. Pearson chi square test indicated that there was no association between stunting and gender as a whole (p=0.087).

Infants between 0 to 5 months had the highest prevalence of stunting overall. The age distribution was similar between the four areas (Pearson's chi square=0.076) and, there was no significant association between the various age categories and HAZ below the -2 z-score (Pearson chi square=0.406). Figure 4.5 and Figure 4.6 present the prevalence of stunting for each age category and per gender in the four areas respectively.

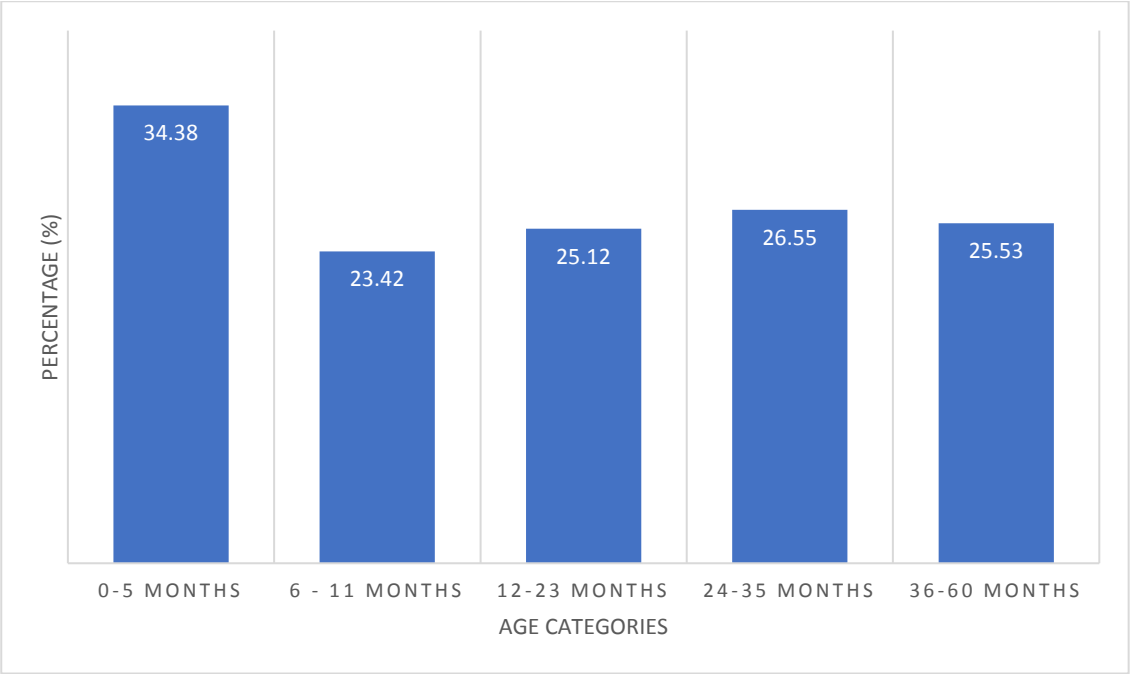


Figure 4.5 Percentage of stunted children between the ages 0 - 60 months per age category in Worcester, Breede Valley

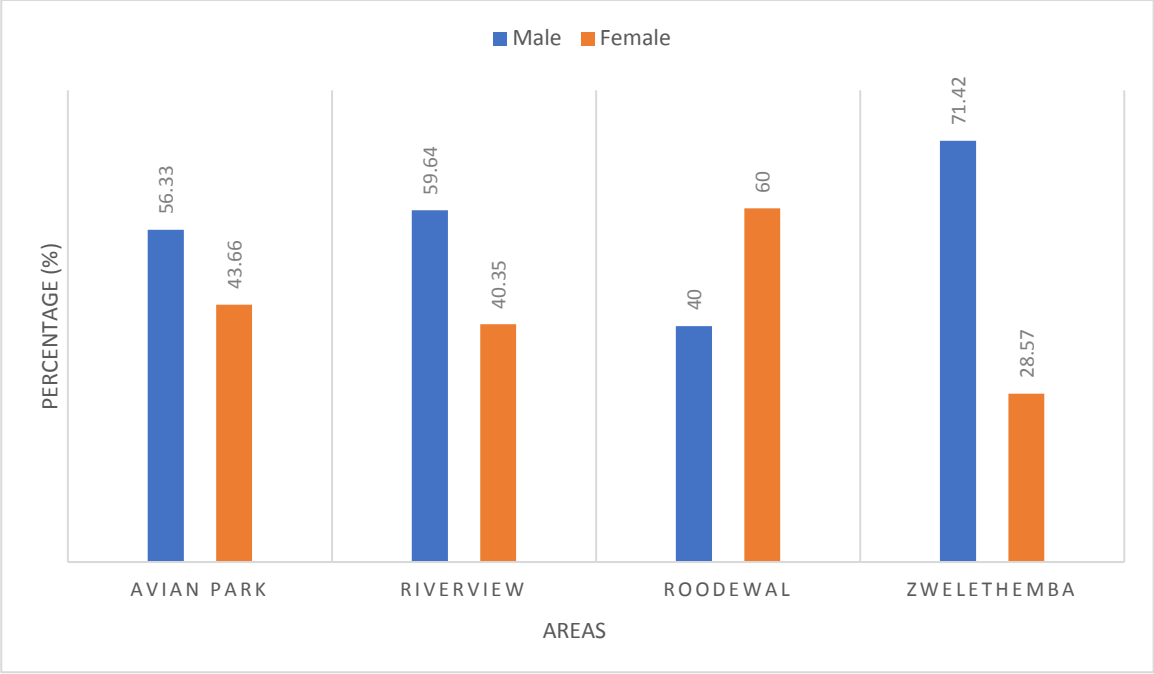


Figure 4.6 Percentage of male and female stunted children between the ages 0 - 60 months per area in Worcester, Breede Valley

Pearson chi square tests showed a significant association between WAZ and HAZ ($p < 0.001$) but not WHZ and HAZ. Figure 4.7 demonstrates the co-occurrence of stunting with other anthropometric classifications such as wasting, overweight and obesity. WAZ is used as an overall indicator for population health and WHZ reflects the current nutritional status of the child participants. More stunted children were found to be overweight and obese than those who were a normal weight for their height or wasted.

The mid-upper-arm circumference measurements of children between the ages 6 - 60 months (n=788) was done. Eight children (n=8/788; 1.01%) had an arm circumference less than 12.5cm and four children (n=4/788; 0.50%) below 11.5cm, which is a measurement used to classify moderate and severe acute malnutrition (MAM and SAM).

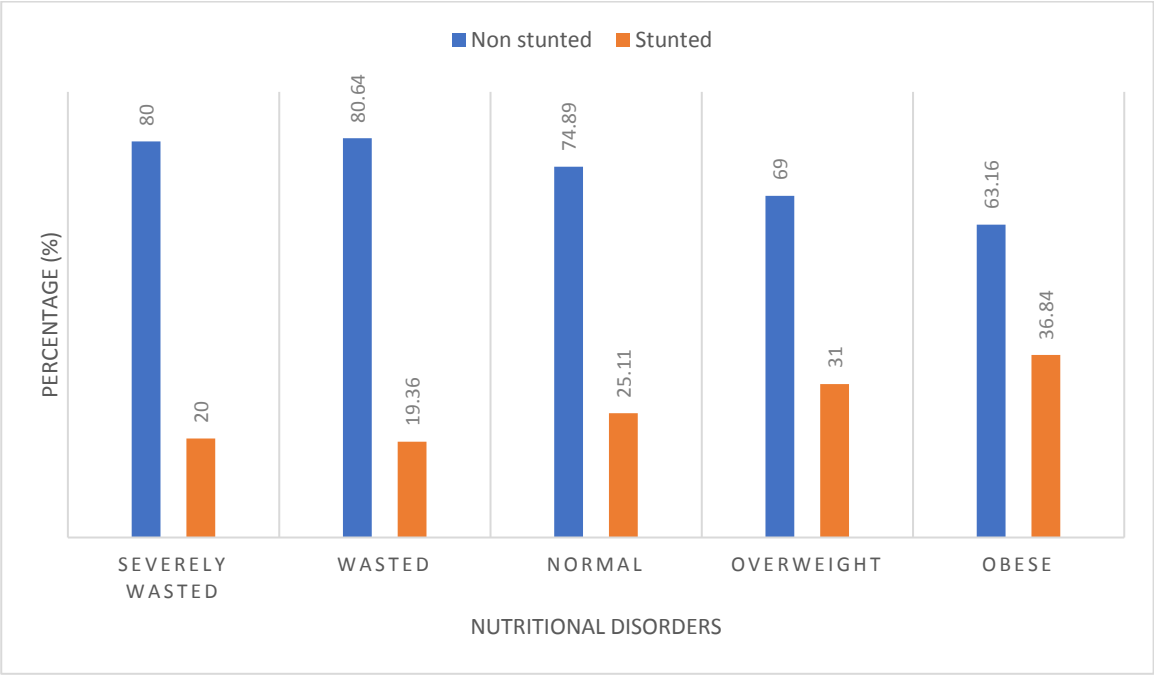


Figure 4.7 Co-existence of nutritional disorders and stunting for children between the ages 0 - 60 months in Worcester, Breede Valley

4.3.2 NUTRITIONAL PROFILE OF MOTHERS

Maternal anthropometric results are presented in Table 4.5. The number of mothers for whom anthropometric data was reported differs from the total included, as anthropometric measurements could not be done for all mothers. The following results are presented as mother-child pairs.

Table 4.5 Maternal anthropometrical information in Worcester, Breede Valley

	n(%)
Weight (n,%)	n=863(97.51)
Mean (SD)	68.41(21.47)
Range	29.20-176.00
BMI (n,%)	n=851(96.15)
Mean (SD)	27.42(8.37)
Range (kg/m^2)	12.08-73.11
Underweight	99(11.63)
Normal	282(33.14)
Overweight	206(24.21)
Obese	264(31.02)
Height (n,%)	n=868(98.07)
Mean (SD)	1.57(0.079)
Range (m)	1.06-2.09
≥1.45 m Normal stature	842(97.00)
<1.45 m Maternal short stature	26(3.00)
Waist Circumference (n,%)	n=869(98.19)
Mean (SD)	87.97(16.67)
Range (cm)	36.00-143.00
<88 cm	445(51.21)
≥88 cm	424(48.79)
MUAC: (n,%)	n=884(99.88)
Mean (SD)	30.16(5.85)
Range (cm)	17.00-64.84
≤23 cm	791(89.48)
>23 cm	93(10.52)

BMI-Body Mass Index; MUAC- Mid- upper arm circumference

The vast majority of mothers were overweight and obese (n=470/851; 55.23%) and 11.63% (n=99/851) was identified to be underweight. Figure 4.8 shows the BMI profile of mothers in the four areas. A Pearson chi-square analysis proved that the BMI profile of mothers included in the study was significantly different between the four areas ($p<0.001$). When the mothers' BMI were compared, it was found that Zwelethemba had a high prevalence of obesity (n=126/268; 47.19%) and Riverview had a high prevalence of underweight (n=47/216; 21.75%). Just under 3% (n=30/880; 3.00%) of mothers were identified with maternal short stature. No significant difference was observed between maternal height across the selected areas.

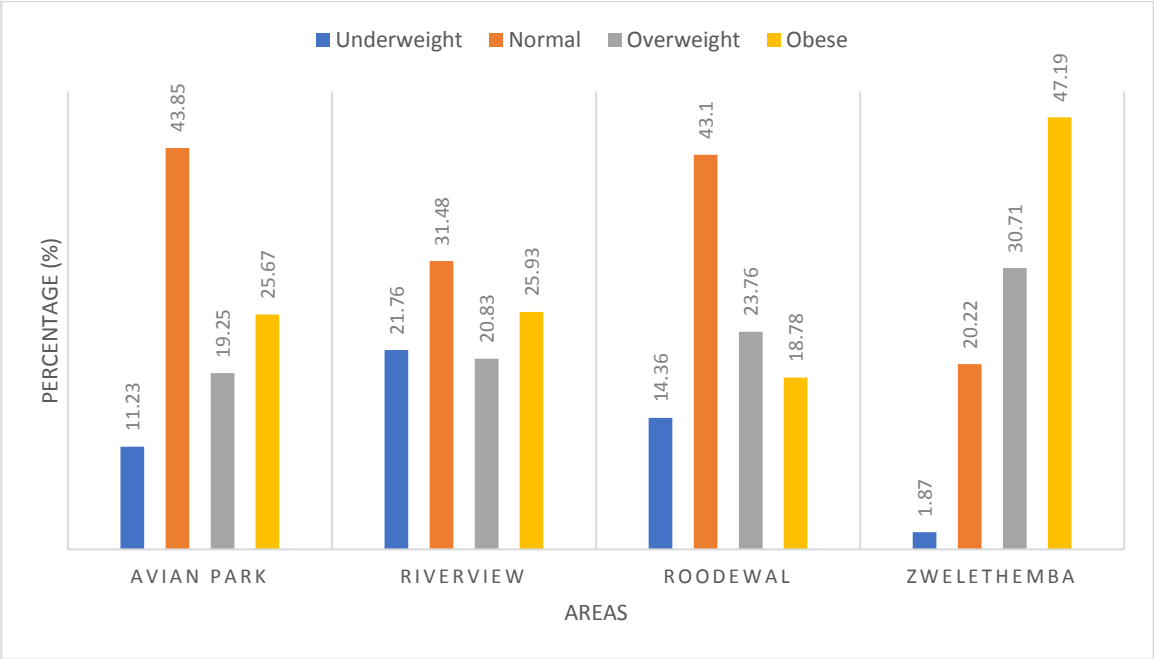


Figure 4.8 Body Mass Index (BMI) profile of mothers per area in Worcester, Breede Valley

The mean waist circumference was 88cm (±16.67cm) which indicates an increased risk for non-communicable diseases. The high mean maternal waist circumference and the percentage of mothers at risk for metabolic diseases of lifestyle in Zwelethemba, was consistent with the high prevalence of overweight and obesity. Figure 4.9 present the waist circumference for the four study areas. Furthermore, the mean maternal MUAC was 30.16cm.

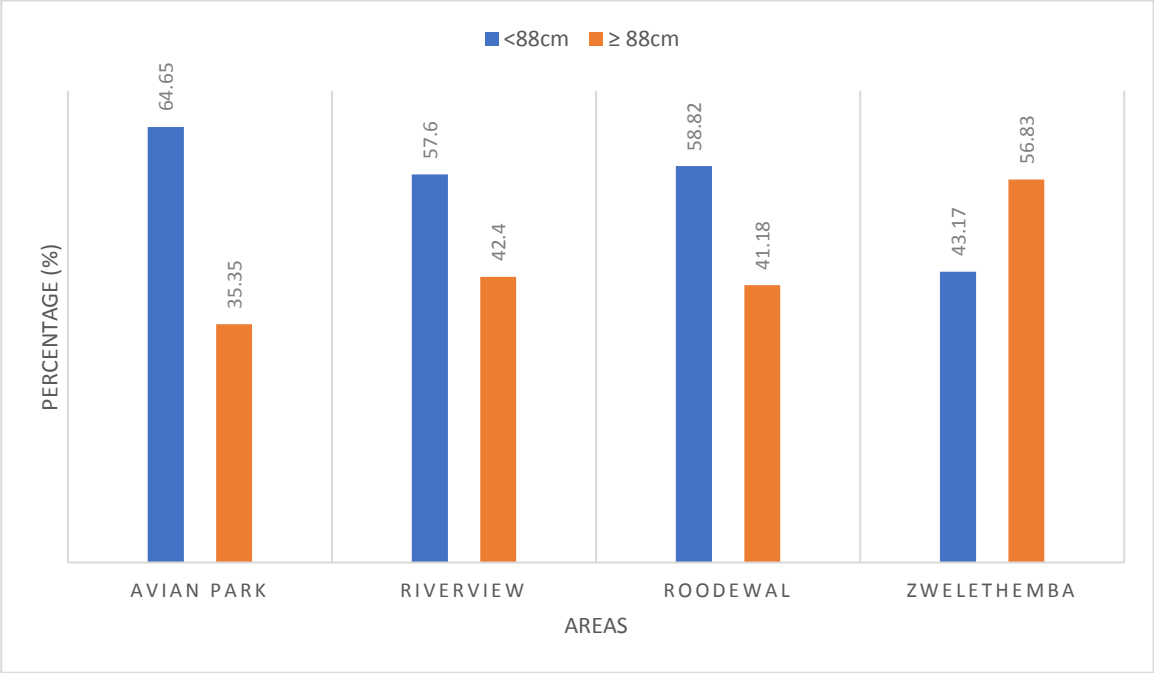


Figure 4.9 Maternal waist circumference profile per area in Worcester, Breede Valley

Figure 4.10 demonstrates that as maternal BMI increases, childhood stunting prevalence increases in their offspring. In total 11.18% (n=95/849) of stunted children had overweight or obese mothers, whereas 4.30% (n=37/849) had underweight mothers. Maternal BMI was found to be significantly associated with childhood stunting (Pearson chi square test; p<0.001).

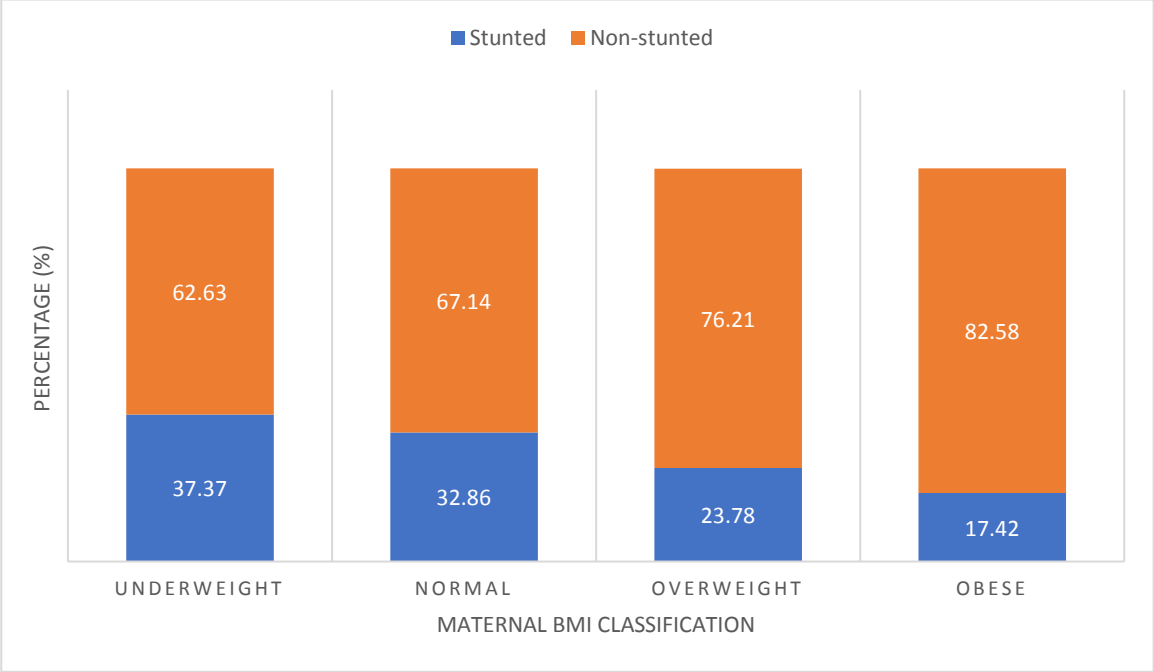


Figure 4.10 Relationship between maternal body mass index (BMI) profile and stunting for children between the ages 0-60 months in Worcester, Breede Valley

Maternal waist circumference showed a significant association (Pearson chi square; p<0.001) with childhood stunting. Results show that children have increased odds of being stunted if their mothers' waist circumference was below 88cm. Maternal MUAC categorised below 23cm and 23cm and more was found to be significantly associated with childhood stunting, by means of a Pearson chi square test. (p=0.002.)

4.4 INFANT AND YOUNG CHILD FEEDING PRACTICES IN WORCESTER, BREEDE VALLEY

Table 4.6 provides an overview of antenatal care and infant feeding practices, and Table 4.7 presents the DDS of children between the ages 6 - 60 months. The totals differ for each category as certain questions were left unanswered.

4.4.1 ANTENATAL CARE ATTENDANCE AND BREASTFEEDING HISTORY

The majority of mothers (n=867/885; 97.97%) attended ANC and indicated that breastfeeding was discussed during these sessions. Avian Park had the least number of mothers who attended ANC whereas all mothers indicated attendance in Zwelethemba. Individual counselling sessions was the most dominant form of breastfeeding education (n=653/848; 76.82%) and 20.94% (n=178/848) of mothers had group education sessions. In addition, 2.24% (n=17/848) received both forms of educational sessions and only 4.06% (n=36/855) of babies did not receive breastmilk as their first feed post-birth. Of those who did not receive

breastmilk 3.84% (n=34/885) received formula milk. Two mothers were unsure of the first feed that was provided. Mothers initiated breastfeeding early, within one hour after birth, in 88.55% (n=750/847) of the cases. Significant differences were observed across the four areas for ANC attendance, first feed post birth and breastfeeding initiation time (Pearson chi square: p=0.007; p=0.036; p<0.001).

All (n=275/275; 100%) mothers in Zwelethemba attended ANC for their included child participants. Five (n=5/192; 2.60%) mothers in Roodewal did not attend ANC and four (n=4/217; 1.84%) in Riverview. Avian Park had the highest number of mothers who did not attend ANC (n=9/201; 4.48%).

With regards to the first feed post birth, the following was noted: the majority of child participants (n=849/885; 95.93%) received breastmilk as their first feed post birth. Zwelethemba had the most children (n=18/275; 6.55%) that did not receive breastmilk as the first feed post birth, followed by Roodewal (n=8/192; 4.17%), Avian Park (n=7/201; 3.48%) and Riverview (n=3/217; 1.38%). The child participants who did not receive breastmilk, received formula milk feeds instead.

The highest percentage (n=175/183; 95.63%) of mothers who initiated breastfeeding within the first hour was in Roodewal. Zwelethemba initiated breastfeeding within an hour post birth in 89.15% (n=230/258) of cases, followed by Riverview with 88.79% (n=190/214). Avian Park was last in line with 80.73% (n=155/192).

Table 4.6 Antenatal care and infant and young child feeding practices per area in Worcester, Breede Valley

		AP	RV	RW	ZW
	n (%)	n (%)	n (%)	n (%)	n (%)
ANC (N)	885(100)	201(100)	217(100)	192(100)	275(100)
Attended	867(97.97)	192(95.52)	213(98.16)	187(97.40)	275(100)
Not attended	18(2.03)	9(4.48)	4(1.84)	5(2.60)	0(0)
Discussed BF at ANC clinic (n)	882 (99.66)	200(100)	216(100)	191(100)	275(100)
Yes	853(96.71)	190(95.00)	203(93.98)	187(97.91)	273(99.27)
No	29(3.29)	10(5.00)	13(6.02)	4(2.09)	2(0.73)
Session type at ANC clinic (n)	848(95.81)	191(100)	201(100)	185(100)	271(100)
Individual	653(76.82)	136(71.20)	142(70.65)	141(76.22)	234(85.71)
Group	178(20.94)	48(25.13)	56(27.86)	38(20.54)	36(13.19)
Both	17(2.24)	7(3.66)	3(1.49)	6(3.24)	1(0.37)
First feed BM (N)	885(100)	201(100)	217(100)	192(100)	273(100)
Breastmilk	849(95.93)	194(96.52)	214(98.62)	184(95.83)	257(93.45)
Not BM	36(4.07)	7(3.48)	3(1.38)	8(4.17)	18(6.55)
Initiation time (n)	847(95.70)	192(100)	214(100)	183(100)	258(100)
≤ 1hour	750(88.55)	155(80.73)	190(88.79)	175(95.63)	230(89.15)
> 1 hour	77(9.09)	24(12.50)	24(11.21)	7(3.83)	22(8.53)
Don't know	20(2.36)	13(6.77)	0(0.00)	1(0.55)	6(2.32)
EBF 0-5 months (n)	97(10.96)	25(100)	27(100)	10(100)	35(100)
Yes*	65(67.01)*	18(72.00)	18(66.66)	6(60.00)	23(65.71)
No	32(32.99)	7(28.00)	9(33.33)	4(40.00)	12(34.28)
Continued BF at 12-15 months (n)	73(8.24)	18(100)	12(100)	16(100)	27(100)
Yes	45(61.64)	14(77.77)	10(83.33)	9(56.25)	12(44.44)
No	28(38.36)	4(22.22)	2(16.66)	7(43.75)	15(55.55)

Table 4.6 continues on p68

Table 4.6 Antenatal care and infant and young child feeding practices per area in Worcester, Breede Valley

		AP	RV	RW	ZW
	n (%)	n (%)	n (%)	n (%)	n (%)
Introduction to complementary foods at 6-8 months (n)	52(5.87)	9(100)	10(100)	10(100)	23(100)
Yes	37(71.15)	6(66.66)	5(50.00)	10(100.00)	16(69.56)
No	15(28.85)	3(33.33)	5(50.00)	0	7(30.43)
Min DDS 6-23 months (n)	327(36.94)	65(100)	92(100)	71(100)	99(100)
≥ 4 food groups	191(58.58)	34(52.30)	57(61.95)	37(52.11)	63(63.63)
< 4 food groups	135(41.41)	31(47.69)	35(38.04)	34(47.88)	36(36.36)
Continued BF at 24 months (n)	59(6.66)	11(100)	20(100)	15(100)	13(100)
Yes	32(54.24)	7(63.63)	14(70.00)	8(53.33)	3(23.07)
No	27(45.76)	4(36.36)	6(30.00)	7(46.66)	10(76.92)

ANC-antenatal care Min DDS-Minimum Dietary Diversity score. AP- Avian park RV-Riverview; RW- Roodewal; ZW-Zwelethemba; BF-breastfeeding; BM-Breastmilk; EBF-Exclusive breastfeeding

* Contradicting responses, were picked up from the data. As the mean for the question relating to the first introduction to anything other than breastmilk (Question D.3.1.1 in addendum C) in the 0 - 5 months age category was 1.22 months (±0.86) and the range was 1 week to 2 months. Therefore, the data reflects predominant breastfeeding rather than exclusive breastfeeding.

Exclusive breastfeeding was calculated for all babies between the age of 0 to 5 months, defined as those who only received breastmilk up to the day of the survey. EBF was reported in 67.01% (n=65/97) of cases. Continued breastfeeding was calculated for children between 12 -15 months, as well as continued breastfeeding at two years for children between 20-23 months. The proportion of children who had breast milk between 12-15 months was 61.64% (n=45/73). Furthermore, the proportion of children who continued breastfeeding at the age of two years was 54.24% (n=32/59).

While the study took place 41.02% (n=363/885) of the total child participants reportedly still received breastmilk and 22.37% (n=198/885) were on formula milk. Of these children 5.08% (n=45/885) were mixed fed thus, receiving both breastmilk and formula milk. Out of the mothers providing formula feeds to their children, 11.11% (n=22/198) did not always have access to formula at all times. All were reported to have access to clean water and all but one had access to electricity or some other form of fuel. Of the children still receiving breastmilk, 97.52% (n=354/363) was suckling on the breast.

The average time period wherein mothers introduced anything other than breastmilk was 4 months (±3.07) and mean age for breastfeeding cessation was 10 months (±10.03). Reasons for breastfeeding cessation are

shown in Figure 4.11 and included mostly the perception of “not enough milk,” the baby “not wanting breastmilk” and work-related issues.

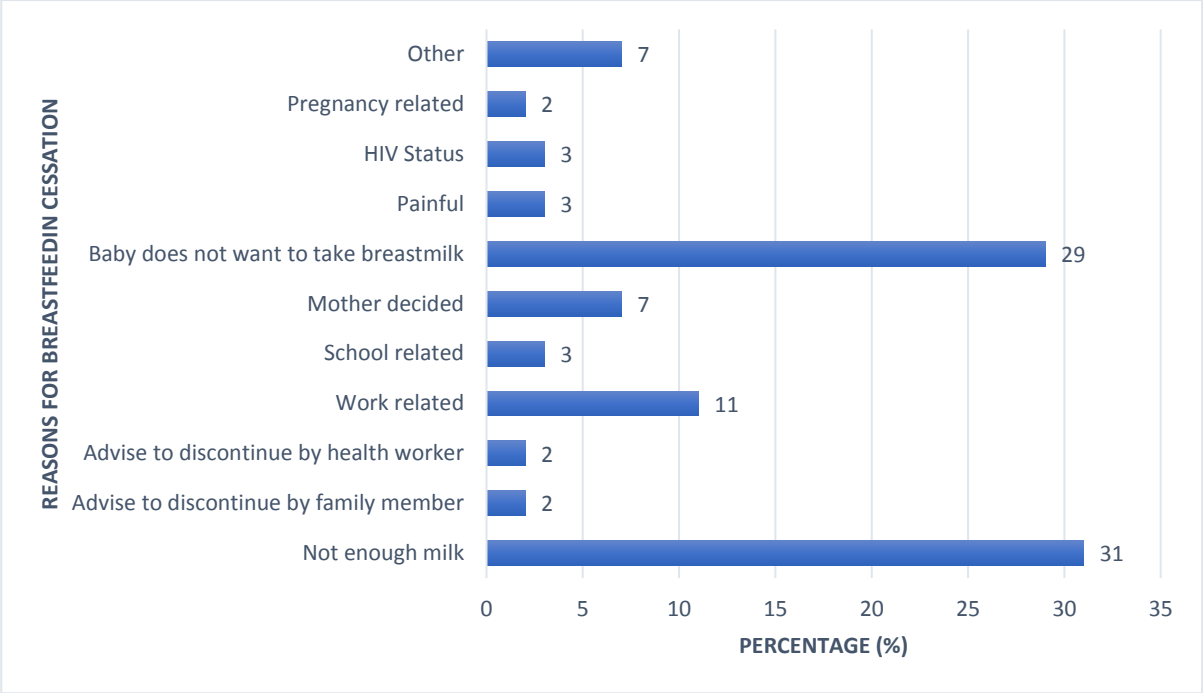


Figure 4.11 Reasons for breastfeeding cessation of mothers in Worcester, Breede Valley

Complementary foods were calculated for children between 6-8 months and 71.15% (n=37/52) received complementary foods in the form of solid, semi-solid, or soft foods this age group.

4.4.2 DIETARY DIVERSITY SCORE

The mean DDS for children between 6 - 60 months included in the study was 4 (±1.91), indicating an adequately diverse diet. By means of using a Pearson chi-square analysis on the DDS of the four areas, it was shown to be significantly different ($p<0.001$). As such, significantly more children had a high DDS (above score 4) in Zwelethemba when compared to the other areas. DDS per area are presented in Table 4.7.

Table 4.7 DDS for children between ages of 6 - 60 months per area in Worcester, Breede Valley

Area Mean (SD)	Avian Park 4(1.66)	Riverview 4(1.74)	Roodewal 4(2)	Zwelethemba 4(1.92)	Total 4 (1.19)
DDS 6-60 months (n;%)	176	190	182	240	788
Low	79(44.89)	72(37.89)	65(35.72)	68(28.33)	284(36.04)
Medium	76(43.18)	102(53.68)	103(56.59)	91(37.92)	372(47.21)
High	21(11.93)	16(8.43)	14(7.69)	81(33.75)	132(16.75)
Eggs: (n;%)	173	186	182	218	759
Yes	36(20.81)	42(22.58)	34(18.68)	135(61.92)	247(32.54)
No	137(79.19)	144(77.42)	148(81.32)	83(38.07)	512(67.45)

DDS-Dietary diversity score; Low- ≤ 3 food groups; Medium- 3-5 food groups; High-≥ 6 food groups

Figure 4.12 shows the various food groups tested in the DDS and the percentage of children between the ages 0 - 60 months who ingested these foods the previous day. Lentils and beans were the food group avoided most the previous day of the study.

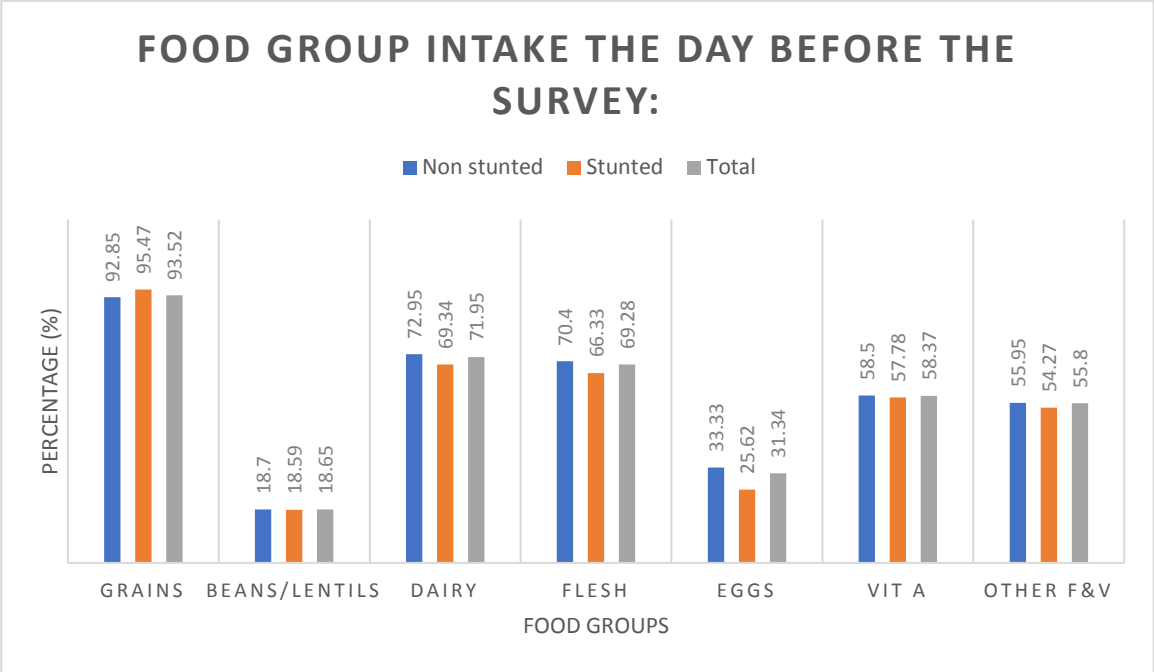


Figure 4.12 Food group intake the day preceding the survey, for children between the ages 0-60 months in Worcester, Breede Valley

4.4.3 INFANT FEEDING DECISIONS AND INFLUENCES

The key influencing factors, regarding the infant feeding practices and choices, were based on mothers' decisions concerning what they believe is best, followed by information from their close relatives and lastly health care workers. However, when the mothers require additional information, the majority (n=662/885; 74.80%) reported to enquire at the primary health care facilities close to their homes, during clinic visits.

4.5 FACTORS ASSOCIATED WITH STUNTING IN WORCESTER, BREEDE VALLEY

In the next section, factors associated with childhood stunting in Worcester, Breede Valley will be presented. The totals differ for each variable as certain questions were left unanswered or certain measurements could not be done.

4.5.1 CATEGORICAL VARIABLES ASSOCIATED WITH STUNTING

Pearson's chi square test of association was done for categorical variables. There were significant associations between maternal employment (p=0.014), main source of income (own salary) (p=0.003) and whether or not the mother herself took care of the child (p=0.008). Table 4.8 presents the socio-demographic data of mother-child pairs comparison to stunting prevalence in children and Table 4.9 presents the results for children between the ages 0 - 60 months demographics comparison to stunting prevalence. Birth order (p=0.043) and birthweight (p<0.001) was significantly associated with stunting.

Table 4.10 shows concurrent underweight, wasted, overweight and obesity with childhood stunting. WAZ (p<0.001) and MUAC for children between the ages 6 - 60 months (p=0.026) was identified to be significantly associated with childhood stunting.

Maternal anthropometric results comparison to childhood stunting is shown in Table 4.11. Maternal BMI, MUAC and waist circumference was significantly associated with childhood stunting (p<0.001; P=0.002; p<0.001).

Lastly, Table 4.12 shows the summary of ANC attendance and infant and child feeding practices comparisons to childhood stunting. The following was associated with stunting; maternal ANC attendance (p=0.021), continued breastfeeding practices at 12-15 months (p=0.019) and at two years (p=0.006). Min DDS (at least 4 food groups the previous day) for children age 6-23 months (p=0.020) as well as DDS for children between the ages 6-60 months DDS(p=0.029).

Table 4.8 Socio-demographic information of mother-child pairs comparison according to stunting prevalence in Worcester, Breede Valley

	Total n(%)	Non-stunted n(%)	Stunted n(%)	P†
Caregiver age (n,%)				0.447
<19	32(100)	21(65.63)	11(34.38)	
19-34	687(100)	511(74.38)	176(25.62)	
≥35	158(100)	113(71.52)	45(28.48)	
Marital status (n,%)				0.845
Married	225(100)	167(74.22)	58(25.78)	
Single	658(100)	484(73.56)	174(26.44)	
Level of education (n,%)				0.143
≤Primary school	69(100)	39(56.52)	30(43.48)	
Grade 8-11	514(100)	368(71.60)	146(28.40)	
Grade 12	300(100)	244(81.33)	56(18.67)	
Employment (n,%)				0.014*
Employed	233(100)	186(79.83)	47(20.17)	
Unemployed	650(100)	465(71.54)	185(28.46)	
Main source of income (n,%)				0.002*
Own salary	166(100)	138(83.13)	28(16.87)	
Other	717(100)	513(71.55)	204(28.45)	
Care of child (n,%)				0.008*
Not mother	183(20.72)	149(81.42)	34(18.58)	
Mother	700(100)	502(71.71)	198(28.29)	
Source of drinking water (n,%)				0.090
No facilities	29(100)	19(65.52)	10(34.48)	
Communal tap	41(100)	25(60.98)	16(39.02)	
Pipe water	813(100)	607(74.66)	206(25.34)	
Main source of sanitation (n,%)				0.407
No facilities	30(100)	19(63.33)	11(36.67)	
Pit latrine	36(100)	26(72.22)	10(27.78)	
Flush toilet	817(100)	606(74.17)	211(25.83)	
Child support grant (n,%)				0.434
Receive	710(100)	520(73.24)	190(26.76)	
Don't receive	172(100)	131(76.13)	41(23.86)	

P†-Pearson chi square p-value

*-significant p-value <0.05

Table 4.9 Socio-demographic information of infant and children and comparisons according to stunting prevalence in Worcester, Breede Valley

	Total n(%)	Non- stunted n(%)	Stunted n(%)	P†
Gender (n,%)				0.087
Female	427(100)	326(76.35)	101(23.65)	
Male	456(100)	325(71.27)	131(28.73)	
Birth certificate (n,%)				0.052
Yes	843(100)	617(73.19)	226(26.81)	
No	39(100)	34(87.18)	5(12.82)	
Birth order (n,%)				0.043*
First child	334(100)	259(77.54)	75(22.46)	
Not first child	548(100)	391(71.35)	157(28.65)	
Born at health care facility (n,%)				0.208
Hospital	447(100)	339(75.84)	108(24.16)	
Clinic	418(100)	301(72.01)	117(27.99)	
No healthcare facility	18(100)	11(61.11)	7(38.89)	
Birthweight (g) (n,%)				< 0.001*
<2500g	153(100)	86(56.21)	67(43.79)	
≥2.500g	655(100)	514(78.47)	141(21.53)	

LBW- Low birth weight

* significant P<0.05

P†-p-value Pearson chi square

Table 4.10 Child anthropometric indications (WAZ, WHZ and MUAC) comparison according to stunting prevalence in Worcester, Breede Valley

	Total n(%)	Non-Stunted n(%)	Stunted n(%)	P†
WAZ (n,%)				< 0.001*
Severely underweight	19(100)	1(5.30%)	18(94.70)	
Underweight	71(100)	16(22.50)	55(77.50)	
Normal	793(100)	634(79.90)	159(20.10)	
WHZ (n,%)				0.319
Severely wasted	5(100)	4(80.00)	1(20.10)	
Wasted	31(100)	25(80.64)	6(19.36)	
Normal	701(100)	525(74.89)	176(25.11)	
Overweight	100(100)	69(69.00)	31(31.00)	
Obese	38(100)	24(63.16)	14(36.84)	
MUAC 6-60 months (n,%)				0.026*
≥12.5 cm	775(100)	583(75.23)	192(24.77)	
<12.5 cm	8(100)	3(37.50)	5(62.50)	
<11.5 cm	4(100)	2(50.00)	2(50.00)	

WAZ- Weight-for-age; WHZ- Weight-for-height/length; MUAC- Mid-upper-arm-circumference

* significant P<0.05

P†-p-value Pearson chi square

Table 4.11 Maternal anthropometric profile comparison according to stunting prevalence in Worcester, Breede Valley

	Total n(%)	Non-Stunted n(%)	Stunted n(%)	P†
BMI (n,%)				< 0.001*
Underweight	99(100)	62(62.63)	37(37.37)	
Normal	280(100)	188(67.14)	92(32.86)	
Overweight	206(100)	157(76.21)	49(23.79)	
Obese	264(100)	218(82.58)	46(17.42)	
Maternal Height (n,%)				0.060
Maternal short stature	26(100)	15(57.69)	11(42.30)	
Normal stature	840(100)	623(74.16)	217(25.83)	
Maternal waist circumference (n,%)				<0.001*
< 88 cm	449(100)	300(66.82)	149(33.18)	
≥ 88cm	414(100)	337(81.40)	77(18.60)	
MUAC				0.002*
≤ 23 cm	93(100)	56(60.22)	37(39.78)	
> 23 cm	790(100)	595(75.32)	195(24.68)	

BMI- Body Mass Index; MUAC-Mid-Upper-Arm- Circumference

* significant P<0.05

P†-p-value Pearson chi square

Table 4.12 Antenatal Care and Infant feeding practices comparrison according to stunting prevalence in Worcester, Breede Vally

	Total n(%)	Non- stunted n(%)	Stunted n(%)	P†
Attended ANC (n,%)				0.021*
Yes	865(100)	642(74.22)	223(25.78)	
No	18(100)	9(50)	9(50)	
First feed BM (n,%)				0.181
Breastmilk	847(100)	621(73.32)	226(26.68)	
Not BM	36(100)	30(83.33)	6(16.67)	
Initiation time (n,%)				0.655
≤ 1hour	749(100)	554(73.97)	195(26.03)	
> 1 hour	76(100)	58(76.32)	18(23.68)	
EBF 0-5 months (n,%)				0.281
Yes*	65(100)	45(69.23)	20(30.77)	
No	31(100)	18(58.06)	13(41.94)	
Continued BF at 12-15 months (n,%)				0.019*
Yes	45(100)	31(6823)	14(31.11)	
No	27(100)	25(92.59)	13(41.94)	
Introduction to complementary foods at 6-8 months (n,%)				0.630
Yes	37(100)	30(81.08)	7(18.92)	
No	15(100)	13(86.67)	2(13.33)	
Min DDS 6-23 months (n,%)				0.020*
≥4 food groups	191(100)	153(80.10)	38(19.90)	
<4 food groups	135(100)	93(68.89)	42(31.11)	
Continued BF at 24 months(n,%)				0.006*
Yes	32(100)	15(46.88)	17(53.13)	
No	27(100)	22(81.48)	5(18.52)	
DDS 6-60 months (n,%)				0.029*
<4 food groups	283(100)	196(69.26)	87(30.74)	
4-5 food groups	372(100)	291(78.23)	81(21.77)	
≥ 6 food groups	132(100)	101(76.52)	31(23.48)	
Eggs 6-60 months: (n;%)				0.034*
Yes	247(100)	196(79.35)	51(20.65)	
No	511(100)	369(72.21)	142(27.79)	

ANC- Antenatal care; BM-Breastmilk; EBF-Exclusive breastfeeding; Min DDS- Minimum Dietary diversity score; DDS- dietary diversity; BF-breastfeeding

P†-p-value- Pearsons chi square

* significant p<0.05

Table 4.13 presents logistic regression analysis on factors associated with childhood stunting. There were significant associations (without adjusting for other co-variates) between stunting and maternal education (grade 8-11: p=0.011; grade 12; p<0.001), employment (p=0.014), main source of income (p=0.003) and whether or not the mother herself took care of the child (p=0.008).

Maternal anthropometric measurements that showed significant associations with stunting in the bivariate analysis was waist circumference (p<0.001) and maternal MUAC (p=0.002).

Child weight at birth (p<0.001), ANC attendance (p=0.027), continued breastfeeding practices at 12-15 months (p=0.031), as well as at 24 months (p=0.008), was also associated with childhood stunting in the bivariate analysis. Additionally, a minimum dietary diversity score for children between 6-23 months (p=0.021) and, a medium diverse diet in children from 6-60 months were significantly associated with childhood stunting (p=0.010).

Table 4.13 Univariate, bivariate and multivariate logistic regression analysis on stunting prevalence in Worcester, Breede Valley

Variable	Crude OR	Std Err	Z	P>|z|	95% CI
Caregiver age					
<19	1.52	0.58	1.10	0.273	0.71-3.21
19-34	1				
≥35	1.15	0.22	-12.20	0.461	0.78-1.70
Marital status:					
Married	1				
Single	1.03	0.18	0.20	0.845	0.73-1.46
Educational achievement					
≤Primary	1				
8-11	0.51	0.13	-2.53	0.011	0.30-0.86
12	0.29	0.08	-4.25	<0.001*	0.17-0.52
Tertiary education					
Yes	1				
No	2.18	1.19	1.43	0.153	0.74-6.35
Employment					
Employed	1				
Not employed	1.57	0.29	2.45	0.014*	1.09-2.26
Main source of income					
Own salary	0.51	0.11	-3.01	0.003*	0.32-0.79
Other	1				
Care of child					
Mother	1.72	0.35	2.63	0.008*	1.15-2.59
Not mother	1				
Child Social grant					
Receive	1				
Don't receive	0.85	0.16	-0.78	0.434	0.58-1.26
Main source water					
No facilities	1				
Communal tap	1.21	0.61	0.39	0.699	0.45-3.27
Pipe water	0.64	0.25	-1.10	0.271	0.29-1.40
Main source of sanitation					
No facilities	1.66	0.64	1.31	0.189	0.77-3.55
Pit latrine/portable toilets	1.10	0.42	0.26	0.794	0.52-2.32
Flush toilets	1				

Table 4.13 continue p79

Table 4.13 Univariate, bivariate and multivariate logistic regression analysis on stunting prevalence in Worcester, Breede Valley

Variable	Crude OR	Std Err	Z	P>|z|	95% CI
Child age:					
0-5 months	1				-
6-11 months	0.58	0.18	-1.73	0.083	0.31-1.07
12-23	0.64	0.17	-1.67	0.094	0.37-1.07
24-35	0.69	0.18	-1.35	0.176	0.4-1.18
36- 60 months	0.64	0.16	-1.70	0.089	0.39-1.06
Gender					
Female	1				
Male	1.30	0.20	1.71	0.087	0.96-1.75
Birth certificate					
Yes	1				
No	0.40	0.19	-1.88	0.060	0.15-1.03
Birth Order					
First child	1				
Not first child	1.38	0.22	2.02	0.043*	1.01-1.90
Born at Health care facility					
Hospital	1				
Clinic	1.22	0.18	1.28	0.200	0.90-1.65
No HC facility	1.99	0.99	1.40	0.163	0.75-5.28
Birthweight:					
< 2500g	2.84	0.53	5.53	<0.001*	1.96-4.11
≥ 2500g	1				
Diarrhea					
Yes	1.93	0.54	2.35	0.019*	1.11-3.34
No	1				
Maternal stature					
< 1.45 Short stature	2.10	0.85	1.84	0.066	0.95-4.65
≥ 1.45 Normal stature	1				
Waist circumference					
< 88 cm	1				
≥ 88cm	0.46	0.07	-4.82	<0.001*	0.33-0.63
MUAC					
≤ 23 cm	2.01	0.45	3.08	0.002*	1.29-3.14
> 23 cm	1				

Table 4.13 continue p80

Table 4.13 Univariate, bivariate and multivariate logistic regression analysis on stunting prevalence in Worcester, Breede Valley

Variable	Crude OR	Std Err	z	P>|z|	95% CI
ANC					
Attended	0.34	0.16	-2.21	0.027	0.13-0.88
Not attendant	1				
First feed					
Breastmilk	0.54	0.24	-1.32	0.187	0.22-1.33
Not breastmilk	1				
Breastfeeding initiation					
≤ 1hour	0.88	0.24	-0.45	0.656	0.50-1.53
> 1 hour	1				
EBF 0- 5 months					
Yes	1				
No	1.62	0.73	1.07	0.283	0.66-3.94
Continued BF at 12-15					
Yes	1				
No	0.17	0.14	-2.16	0.031*	0.03-0.85
Introduction to complementary foods at 6-8 months					
Yes	1				
No	0.65	0.57	-0.48	0.631	0.12-3.61
Min DDS 6-23 months					
≥ 4 food groups	1				
< 4 food groups	1.81	0.47	2.30	0.021*	1.09-3.02
Continued BF at 24 months					
Yes	1				
No	0.20	0.12	-2.64	0.008*	0.06-0.66
DDS 6- 60 months					
<4	1				
4-5	0.62	0.11	-2.59	0.010*	0.44-0.89
≥6	0.69	0.16	-1.52	0.128	0.42-1.11
Inclusion of eggs 6-60 months					
Yes	1				
No	1.47	0.27	2.11	0.035*	1.02-2.12

ANC-Antenatal Care; EBF-Exclusive breastfeeding; BF-breastfeeding; Min DDS-Minimum Dietary diversity score; DDS-Dietary diversity score

4.6 DRIVERS ASSOCIATED WITH STUNTING IN WORCESTER, BREEDE VALLEY

Table 4.14 presents data entered into the multiple regression model of stunting. Due to missing data across the covariates, the multiple regression model total included n=663 children compared to the n=883 children with stunting outcomes. This could lead to bias in estimation, based on the children with complete data, except if we assume data is missing at random.

A multivariate analysis was done for factors that was significantly associated with stunting, which included the selected areas. As certain variables were only applicable to a small subgroup of the sample, only 13 variables were entered into the multivariate analysis model. Table 4.8 presents the results of the bivariate and multivariate analysis for associations with childhood stunting.

After adjusting for 13 variables, the following was found to be significantly associated with childhood stunting in the study area: child gender (p=0.021), maternal waist circumference (p<0.001) and child weight at birth (p=0.001). The adjusted variables (OR with 95% CI) included: area, sex, maternal education, employment and main form of income, child care, birthweight, order of child, diarrhoea prevalence, maternal and child MUAC 6 - 60 months, egg intake 6 - 60 months and DDS 6 - 60 months.

In the present study, gender was significantly associated with stunting. Male babies and young children were 1.58 times (AOR=1.58, 95% CI: 1.07 to 2.35) more likely to be stunted compared to their female counterparts. The likelihood of stunting increased with a normal/lower maternal waist circumference (AOR=0.46 CI: 0.30 to 0.71). Thus, mothers with a waist circumference above the 88cm cut-off, was found to have a protective effect against stunting in children however, this should be interpreted with caution as the promotion of maternal overweight and obesity to reduce stunting is not ideal.

Similarly, child weight at birth was found to be significantly associated with the odds of becoming stunted. LBW babies were 2.21 (AOR=2.21, CI: 1.38 to 3.52) times more likely to be stunted compared to babies born at a normal weight at birth, i.e. ≥ 2500g. Overall, DDS for children 6 - 60 months was found to be significantly associated with stunting (p=0.016).

In summary the drivers of stunting in Worcester, Breede Valley identified from the multivariate regression model is being of male gender (AOR=1.58, 95% CI: 1.07 to 2.35), maternal waist circumference (AOR=0.46 CI: 0.30 to 0.71), LBW babies(AOR=2.21, CI: 1.38 to 3.52) and overall DDS for children between the ages 6-60 months. (p=0.016).

Table 4.14 Multivariate logistic regression model of stunting in children prevalence in Worcester, Breede Valley

Variable	Adjusted OR	Std. Err	Z	P>|z|	95% CI
Riverview	0.91	0.24	-0.34	0.737	0.53-1.54
Roodewal	1.11	0.30	0.38	0.703	0.64-1.90
Zwelethemba	0.55	0.17	-1.88	0.061	0.29-1.02
Gender; Male	1.58	0.31	2.31	0.021*	1.07-2.35
Education; Grade 8-11	0.69	0.23	-1.07	0.285	0.35-1.35
Grade 12	0.49	0.18	-1.90	0.057	0.23-1.02
Employment; unemployed	0.98	0.34	-0.05	0.959	0.49-1.93
Main source of income: own salary	0.56	0.25	-1.29	0.198	0.23-1.34
Care of child; Mother	1.14	0.40	0.38	0.704	0.57-2.28
Maternal waist circumference; ≥88cm	0.46	0.10	-3.56	0.000*	0.30-0.70
MUAC ≤ 23cm	1.12	0.34	0.38	0.702	0.62-2.03
Birthweight< 2500g	2.20	0.52	3.32	0.001*	1.38-3.52
Birth order; not first child	1.47	0.31	1.80	0.071	0.96-2.24
Diarrhea episodes	1.64	0.55	1.48	0139	0.85-3.18
MUAC 6-60 months <12.5cm	3.15	3.02	1.20	0.231	0.48-20.64
MUAC 6- 60 months <11.5 cm	2.19	2.55	0.68	0.499	0.22-21.52
Eggs inclusion 6- 60 months; No	1.20	0.34	0.66	0.509	0.68-2.11
DDS 6- 60 months 4-5 food groups	0.67	0.14	-1.84	0.066**	0.43-1.02
DDS 6- 60 months ≥ 6 food groups	1.60	0.58	1.29	0.197**	0.78-3.27

MUAC- Mid-upper arm circumference; DDS-Dietary diversity score

* significant p<0.05

** DDS 6-60 months significant overall p=0.161

4.7 DIFFERENTIAL EFFECTS OF FATORS ASSOCIATED WITH STUNTING PER AREA IN WORCESTER, BREEDE VALLEY

There was a significant difference between the four selected areas and the prevalence of stunting (Pearson chi square test: $p<0.001$). Stunting in Avian Park was the highest (n=71/201; 35.32%) compared to the three remaining areas. Stunting prevalence was the lowest in Zwelethemba (n=49/274; 17.88%), and as there were significant differences between the four included areas regarding stunting prevalence, a stunting risk factor analysis by area was conducted.

Maternal MUAC was the only risk factor that showed a differential effect on stunting across the four areas. Yet, this could only be assessed within three areas namely Avian Park, Riverview and Roodewal, as a limited number of mothers MUAC was below 23cm in Zwelethemba. The study was underpowered in testing the differential effects between the four selected areas in Worcester, Breede Valley.

CHAPTER 5: DISCUSSION

5.1 INTRODUCTION

This study described the prevalence of, and factors associated with stunting in four vulnerable communities of Worcester, Breede Valley, namely Avian Park, Riverview, Roodewal and Zwelethemba. CHWs served as fieldworkers of the study, administering questionnaires and conducting anthropometrical assessments on mothers and their children below the age of five. The purpose of this study was to create a stunting profile and an in-depth understanding regarding the factors that drive stunting rates within these specific areas. These vulnerable communities were purposively selected to assess factors of childhood stunting, as the majority of children in these areas live below the upper bound poverty line[113] and known factors of stunting are prevalent including LBW rates and poor access to water and sanitation.[112]

5.2 CHILD STUNTING PROFILE IN WORCESTER, BREEDE VALLEY

In these four vulnerable areas in Worcester, Breede Valley, the prevalence of stunting in young children is worryingly high with just 1% below the national average.[10] A Community Nutrition Security Project (CNSP) previously conducted in two of the areas included in the present study (Avian Park and Zwelethemba), reported various food and nutrition indicators in children below the age of three.[124] For children between 0-36 months, the prevalence of stunting was reported to be 31.2 %[124] while in the present study, 26.63% of children between the age of 0-36 months were identified as stunted. Another part of the CNSP project that paid more attention to infant feeding factors and practices, found the prevalence of stunting in Avian Park and Zwelethemba was 28.9% in children between the age of 0-23 months.[12] For this particular age category the stunting prevalence in the present study was 26.77% which projects a slight difference in stunting between 2011 - 2018.

Furthermore, the present study found poor anthropometric profiles of children below the age of five months and of their mothers, which corresponds with the previous studies conducted in the area[12,124]. Underweight, wasting, overweight and obesity prevalence in the present study was 10.18%, 4.11%, 11.41% and 4.34% respectively where the CNSP previously showed 5.6% was underweight, 0.7% was wasted and 20.7% was overweight and obese.[124] The CNSP infant feeding study found underweight, wasting and overweight prevalence for infants between 0-23 months to be 4.8%, 0.96% and 21.8% respectively.[12]

The present study could signal a slight decrease in the prevalence of stunting, underweight and wasting as well as an increased prevalence of obesity in these study areas, but since all the referenced studies conducted in Worcester were of cross-sectional nature, direct comparisons cannot be made. The differences in the present study could also be attributed to the larger sample size and the inclusion of two additional vulnerable areas. Therefore, trend or continuous data is needed to make the comparison between studies possible [8,125]. In additional, real-time data should also be gathered and effectively used for example, DOH should use the anthropometric data gathered at clinic level to inform the child anthropometric profiles from national surveys. Haddad made the case that more frequent data should be generated on malnutrition, which he

motivated in stating that the occasional surveys conducted every few years are helpful, but "*an economic policy would not be run on data that were 4 years out of date, why should a child growth policy do so*?"[126]

The prevalence of stunting in Avian Park was the highest of the four vulnerable areas in Worcester, Breede Valley and far exceeded the national average of 27%.[10] The stunting prevalence in Riverview and Roodewal was closer to the South African national prevalence. Zwelethemba, in contrast, had the lowest prevalence of stunting, and the highest manifestation of overweight and obesity in children below the age of five, far exceeding the national average of 13%.[10] All areas, with the exception of Roodewal, exceed the national child overweight and obesity statistics. Gathering disaggregated area or community specific data, and not only summarised sub-district level data, can help managers to focus their interventions and budgets on the most vulnerable areas.[127] A study in India emphasised the variability of stunting prevalence and determinants in specific areas, and shed light on the importance of addressing critical determinants district-by-district to reduce the prevalence of stunting.[127] In addition, a study in Kenya suggest that aggregated age data for children below the age of five does not provide an accurate picture of morbidity and mortality throughout the age ranges,[128] which suggests that measures against stunting should be adjusted to community specific evidence.[129] In Ethiopia, variations in stunting prevalence were attributed to individual and community-level differences.[130] Thus, identifying priority areas for stunting prevention within each vulnerable area in Worcester, Breede Valley sub-districts, may help prioritise future interventions within specific areas.

The age group with the highest prevalence of stunting were those between 0 – 5 months, however, age was not significantly associated with childhood stunting in Worcester, Breede Valley. Bommer et al.[75] focused on the stunting-age relationship between LMIC and found the prevalence of stunting for children below the age of 6 months to range from 16.1% to 17.8%, with no significant differences between wealth quartiles. Yet, the children in the older age categories were found to have higher levels of stunting.[75] Similarly studies also found, stunting prevalence tend to increase with age.[131,416] Bergard et al.[132] concluded that the main indicator for impaired linear growth was impaired foetal linear growth, placing emphasis on the importance of maternal nutrition interventions during pregnancy. A Guatemalan study associated found a high rate of moderate and severe stunting in six week old infants.[133] Data pertaining to the length at birth could not be obtained for the present study, but nevertheless remains an important measurement that should be recommended for future research.

Gender was significantly associated with stunting, showing that male children were more likely to be stunted. Stunting has been identified to be higher among males than females both on a national scale [134]as well as in other studies.[1,41,131,135–137] Previous results from the CNSP found that males had a higher probability of being stunted in informal households[124] however, evidence suggest that gender and stunting differences are trivial when compared to other factors.[2] Behavioural patterns and cultural differences have been suggested as possible reasons for gender differences within communities, such as polygamy and the high value share of females in agricultural labour, leading to preferential treatment and favouritism.[138,139] An additional

explanation is the established sex differences in early foetal growth and development, leaving males more vulnerable and susceptible to illnesses, as females are reported to have advantages in utero associated with improved birth outcomes.[140–142]

The phenomenon of stunting's co-occurrence with undernutrition and overnutrition in individuals, especially within the same household, have previously been documented.[143,144] Vulnerable communities, such as the areas selected for this study, were identified as food insecure [124] and are able to access cheap, energy dense foods lacking in essential nutrients, which contributes to the growing epidemic of overweight and obesity. The nutritional transition is reinforced by poor maternal education and poor household circumstances with socio-economic disparities at the centre.[124] The co-existence of nutritional disorders has major implications for programmes and interventions aiming to ensure reduced stunting rates while simultaneously preventing concurrent and adulthood obesity. Interventions to reduce stunting may thus aid the reduction of overweight and obesity[16,143] as shared factors and determinants provide the potential to address both forms of malnutrition. Biological (in-utero nutrition/maternal nutritional status during pregnancy), environmental (access to nutritious food, healthcare and, water and sanitation) and socioeconomic factors (poverty, food insecurity) are all examples that play a role in the development of both under and overnutrition.[145] Double-duty actions by means of shared platforms can be utilised to address the dual burden. For example, interventions and initiatives to promote and protect breastfeeding for infants 6 months and above, have the potential to address both underweight and overweight simultaneously. Breastmilk is recognised for protection against childhood stunting and reducing the risk of becoming overweight and obese later in life. Breastfeeding additionally help mothers manage their weight and respectively lowers the risk of chronic diseases of lifestyle.[146]

In the present study there was no significant association between WHZ and stunting, however Symington et al.[102] recorded a significant negative association between BAZ and HAZ. In Worcester more stunted children were overweight (31%) and obese (36.84%) than wasted or with a normal weight for their height. Even though this was not significantly associated with stunting in the present analysis, the magnitude of the potential negative health effects should not be underestimated as literature indicates that stunted children have a higher risk of becoming overweight.[147]

The anthropometric results of mothers with children below the age of five, provide us with a picture of the nutritional situation currently in Worcester, Breede Valley. To this end, the WHO conceptual framework[3] identified key maternal factors that contribute to stunting which will be discussed in the section to follow.

5.3 MATERNAL ANTHROPOMETRIC PROFILE IN WORCESTER, BREEDE VALLEY

Multiple studies have connected maternal malnutrition to adverse health consequences in their children.[6,106] Maternal overnutrition is on the rise, specifically in low-income settings, including in South Africa, while child undernutrition persist.[148–151] In the present study, maternal overnutrition and childhood stunting and -overweight was found in Worcester, confirming previous results.[12]

The anthropometrical results confirm the co-existence or double burden of over- and undernutrition for mother-child pairs residing in the area. Froraita et al.[152] stated that maternal BMI is a partial reflection of the household economic status. The high rates of maternal obesity and increased waist circumferences in Worcester corresponds with previous studies and offers a picture of increased susceptibility to develop non-communicable diseases. No significant association was found between maternal BMI and childhood stunting, however, there was a significant association between maternal waist circumference and stunting. Mothers with a waist circumference above the 88cm cut-off for NCD was found to have a protective effect against stunting in children. This result should be interpreted with caution, as the promotion of maternal overweight and obesity in aid of reducing stunting, should be avoided. However, contradictory to Egal et al.[153] who proved the existence of a positive linear relationship between maternal waist circumference and childhood stunting, the current research indicated that higher waist circumference result in decreased odds of stunting. Yet, in keeping with the current study, Steyn et al. [154] concluded that children with overweight or obese mothers had a significantly decreased risk of being stunted, likewise children with underweight mothers had a significantly higher risk of stunting. No statistical significance was found between maternal short stature and childhood stunting in the present study which indicates that intergenerational stunting may not be a significant factor in the area.[107]

5.4 FACTORS OF STUNTING IN WORCESTER, BREEDE VALLEY:

5.4.1 HOUSEHOLD AND FAMILY FACTORS

In the unadjusted results, significant associations were found between maternal education, employment and income. Many studies have proven maternal education is a significant determinant of childhood stunting[131,138,155,156] and can considerably contribute to the reduction of stunting. However, Makoko et al.[157] concluded that this is only relevant if the level of education extends past primary school level. Research indicates that educated mothers make better feeding and healthcare choices that influence child growth and development[144] and thus a mother's educational attainment is considered as a robust predictor of child nutritional status in rural areas.[156] Considering the results of maternal education in the present study, the majority of mothers attended high school and more than a third completed grade 12.

In Worcester, maternal employment revealed a protective effect against stunting. The present study results corresponds with previous studies where maternal employment was not found to contribute to childhood stunting.[158–161] However, the association between stunting and maternal employment has proven to be

controversial as other studies reported stunting prevalence is higher when the mothers are employed.[162] Further reports indicate an intricate relationship exists between employment and childhood stunting[163] as evidence suggests maternal employment negatively affects infant feeding practices and decisions, such as the early initiation of complementary feeding or breastfeeding cessation. The potential lack of time to continue breastfeeding and potentially to provide adequate care and stimulation, were suggested as possible reasons.[164] On the other hand, maternal employment has been associated with increased maternal autonomy and income, leading to improved diets, since they now have access to improved food security as well as the ability to acquire products from better food sources.[160,165] In Breede Valley, the vast majority of mothers were unemployed and did not generate an income. However, for employed mothers, the children were found to be less stunted which supports one notion with the view that maternal employment and income positively affects nutritional status in children.[160,165]

In 2011, the CNSP study found a third of households in Avian Park and Zwelethemba were food insecure, and that stunting was significantly higher in children who received a child support grant.[124] Food security was not evaluated in the present study but taking the results of DDS, employment and income into consideration, this study can relate to the CNSP results, seeing as employment and income showed positive effects against childhood stunting. However, receiving child support grants was not significantly associated with childhood stunting in the present study.

A Kenyan study suggested that interventions against stunting should be implemented according to different levels of food security in communities.[129] Furthermore, food security was found to be a predictor of the double burden of malnutrition, [166] which was also prevalent in the communities of the present study. Further research on factors relating to the growing burden of under- and overnutrition needs to be evaluated in the Breede Valley community, as well as the security of food and nutrition, and the role child support grants play. Bhutta et al.[57] noted that without achieving nutrition security, the brutal cycle of poverty and poor development will continue. Since food and nutrition security was not evaluated in the present study it cannot be commented on however, it remains an important factor of childhood malnutrition.

Infant birthweight is a well-established driver of childhood stunting[1,2,56,61,94,167,168] and was also found to be significantly associated with stunting in Worcester. Consistent with other studies, a birthweight of more than 2500g was found to have protective effects against stunting in children.[1] Low birthweight is influenced by many factors, specifically maternal health and nutrition,[2,107] and is largely a reflection of intrauterine growth restriction or preterm birth.[169] Sub-optimal maternal nutritional status, such as deficits in essential nutrients, underweight, overweight and obesity, have health implications for pregnancy and infant birth outcomes. There are several other contributing causes resulting in LBW, including adolescent pregnancies, multiple pregnancies, infectious diseases, maternal smoking and other chronic health conditions. Gestational DM and hypertensive disorders during pregnancy are often a result of maternal overnutrition.[170] Intergenerational

influences of maternal anthropometry, such as maternal short stature are connected to birthweight as well. In addition there is an association between IUGR and LBW and child mortality.[107]

Alcohol consumption is significantly associated with preterm birth[171] and a meta-analysis done in 2011 found that heavy alcohol consumption during pregnancy increases the risk of SGA, LBW and prematurity.[172] A study conducted in a rural community in Western Cape found high rates of stunting prevalence, underweight and microcephaly, in particular for those with FAS and partial FAS.[173] Nel et al.[174] concluded that birthweight was significantly correlated with HAZ in the Northern Cape. Furthermore, babies whose mothers smoked and drank alcohol during pregnancy had significantly lower birthweights. Although not tested in the current research, alcohol and drug abuse have been reported for the present study areas.[175] The high prevalence of LBW babies in this area signals the need for multi-faceted interventions in women of child-bearing age in the study areas.

Without intervention, poor foetal growth and stunting in the first 1,000 days of life negatively affects adult height attainment, school and work performance, income generation, and health in later life. It also contributes to low birthweight and/or stunting in the next generation.[16] It is important to consider the contextual factors underlying all the determinants of malnutrition and their contribution to IUGR, preterm delivery and evidently LBW.[176] Furthermore, chronic diseases proven to be associated with LBW includes cardiovascular diseases, DM, osteoporosis and hypertension.[177] According to the Breede Valley statistics these conditions are prevalent.[175]

Maternal care of own child was significantly associated with stunting in the bivariate analysis. Child care and stimulation have an effect on children's nutrient intake and therefore, on their risk for stunting. [17,178] Children who continuously receive adequate care and stimulation tend to develop better than those lacking consistent and adequate care.[179,180] Caregivers' capacity to satisfy their children's growth and development needs are affected by poverty, suboptimal nutrition and infectious diseases.[181] Engle et al.[178] reported the effect caregiver-child interactions have on nutrient intake. Maternal education and health and wellness play a vital role in their ability to provide adequate and appropriate care to their children. Well-educated caregivers show greater commitments and are more likely to request help in situations where the child is sickly and/or not eating well. However, Armar-Klemesu et al.[144] noted that the positive effects of maternal education was due to improved care practices. Breede Valley results indicate maternal health is in a compromising position as evidence points to poor anthropometric profiles in the present and previous studies, as well as a high burden of NCD and infectious diseases such as HIV and TB stats reported. This may potentially influence their capacity to adequately care for their children, seeing as children who were not taken care of by their mothers, proved to be less stunted in the present study. Compromising maternal health and high alcohol and drug abuse in the area could potentially explain the findings. Food shortages, caregiver workload, autonomy and mental wellness were additionally suggested to negatively influence caring practices.[178] The UNICEF conceptual framework[182] acknowledge that caregiver behaviour influence child developmental outcomes,

but also focus on the role of the environment. Furthermore, the WHO conceptual framework refers to the importance of care as well. Engle et al.[178] concluded that a positive relationship between caregivers and their children may lead to increased food intake, as IYCF practices are affected by maternal care. In the present study, care practices were not evaluated and therefore cannot be commented on.

The birth order of a child was significantly associated with stunting in Worcester. First born children were less likely to be stunted which corresponds with the findings of another study [158] where younger siblings were found to be more nutritionally deficient. This could be due to contending for food within these households, since less food could be available, if it has to be divided between more siblings. Unequal Intra-household food distribution, depicted in the WHO framework of childhood stunting is supported by other studies from developing countries[183–185]

Although SES was not found to be a key contributing factor of stunting in the present study, more attention should be paid to the underlying effects of poor household and environmental living conditions, as multiple studies have proved the differences between wealth quartiles and stunting risk, including the CNSP study done in Avian Park and Zwelethemba.[2,75,124,158] Studies have repeatedly proven that mothers' socio-economic status have an impact on the growth and development of their children.[129,137,186] Poor social standing, inadequate water and sanitation facilities, food insecurity, violence and gangsterism, contribute to compromised community safety and especially child safety, which are all at play within the Breede Valley community. Safety issues were faced during this study, as the data collection procedures were interrupted on several occasions due to community shootings in Avian Park and Riverview. The lack of a secure and enabling environment is evident, as is the nutritional impact of safety issues, for example the lack of physical exercise. This is a result of mothers' reluctance to let their children play outside, due to the imminent dangers, and possibly a contributing aspect to the growing epidemic of overweight and obesity.

Breede Valley sub-district is still affected by the social injustice of the apartheid era and these effects are still playing out within the area.[187,188] This could fuel the intergenerational transmission of poverty[188] and contribute to the persistence of stunting.[189]

Furthermore, there is growing evidence that child growth and development are severely affected by poor WASH, due to continuous exposure to enteric pathogens.[70] Improved WASH can bring significant improvements in attempting to address childhood undernutrition, whether from an economical perspective or reduced exposure to pathogens. Evidence suggest that inadequate WASH is linked to a child's growth and development as unhygienic practices and poor sanitation correlates to child undernutrition. Cumming et al.[74] concluded that global efforts to reduce stunting requires WASH programmes and interventions, even though WASH alone will not eliminate stunting it still remains a critical point to include in strategies. It was found that approximately 8% of households had inadequate water and sanitation facilities in the present study. The highest prevalence of stunting, sanitation facilities and use of communal taps was found in Avian Park.

Despite the fact that the differential effects between the four areas could not be calculated, it still should not be ignored. In the past, studies suggested that WASH practices have significant effects on stunting prevalence[190,191] and a large movement was established to combine WASH and nutritional interventions as an attempt to prevent childhood stunting.[192]

5.4.2 INFECTION

Diarrhea was significantly associated with childhood stunting prior to adjusting for socio-economic conditions and area. The children who experience diarrhea episodes three or more times in the past year prior to the study had 1.9 times increased odds of being stunted. Evidence from demographic and health surveys from 1986-2007 stated the effect lack of clean water and sanitation have on the health for children under five in developing countries. Hygiene and sanitation practices within households affect risks for diarrhea and other morbidities prying on children growth. Improved sanitation was associated with a lower risk of mild or severe stunting, diarrhea and mortality.[193] Diarrhea was significantly associated with childhood stunting prior to adjusting for socio-economic conditions in the current study. Dewey et al.[82] concluded that infection is a major contributing cause for children not achieving adequate growth. Diarrheal infection is a major risk factor for childhood stunting. The interaction between infection and nutrition also cannot be ignored. A higher cumulative episodes of diarrhoea was associated with an increased prevalence of stunting in children aged two.[78] Thus the prevention of early childhood diarrhoea can aid the reduction of stunting.

5.4.3 BREASTFEEDING AND INADEQUATE COMPLEMENTARY FEEDING PRACTICES IN WORCESTER:

The vast majority of mothers attended antenatal care (ANC) but unfortunately, the number of visits were not evaluated in the current study. ANC has the potential to improve dietary practices and weight gain and, present an opportunity for timely interventions aimed at preventing LBW. Mothers' mean age for introducing anything other than breastmilk and discontinuing breastfeeding happened at the respective ages of four months and ten months. This serves as an indication that the Worcester communities do not follow the WHO recommendation of exclusive breastfeeding until 6 months, with adequate and timely introduction of complementary foods, whilst continuing breastfeeding till two years and beyond.[194] These poor feeding decisions correspond with previous focus groups results of the area.[195] Du Plessis et al.[93] review paper concluded that the high levels of stunting in South Africa, as well as rising levels of overweight and obesity, is a result of poor breastfeeding practices and, inadequate quality and quantity of complementary feeding during the critical time period from 6 months - 24 months of life.

A review of food security surveys done between 1999-2009 indicated the nutrient consumption of South African children were inadequate in meeting their growth and development needs. Children were found to have poor DDS and low food variety scores.[196] The DD questionnaire has been validated as a tool that indicates nutrient adequacy in developing countries, and has the potential to measure food security. Therefore, it is clear that a strong association between nutrient quality, dietary diversity and HAZ exist.[197–199] As such, DDS was found as a significant driver of stunting in Worcester, Breede Valley. The mean DDS was

approximately four for all the areas, which represents a medium diverse diet, including four or more food groups. The significance corresponds with other developing countries.[200–202] Likewise the National mean DDS reported by SANHANES-1 was 4.2, and provides an indication of decrease diversity in adults diet, relating to the struggle of food insecurity.[84]

In rural Bangladesh low DD was found to be a strong predictor of childhood stunting across all age groups, regardless of socioeconomic status, breastfeeding practices and other household characteristics.[203] Arimond et al.[204] proved that increasing diversity in children's diets was associated with higher HAZ scores for children in the complementary feeding period. Rah et al.[203] concluded that including different food groups during complementary feeding, has greater potential than prolonged breastfeeding to improve a child's nutritional status, especially from one year of age. Therefore, this study is in agreement with above mentioned studies and Ahmad et al., [205] concluding that the inclusion of a diverse diet may help alleviate the burden of stunting. Between the selected vulnerable areas in Worcester, Breede Valley, the children between the ages 6 -60 months DDS was found to be significantly different. Avian Park had the lowest DDS, which corresponds with the high prevalence of stunting; whereas Zwelethemba had the highest percentage of children with an adequately diverse diet and the least number of stunted children.

The dietary inclusion of eggs was significantly associated with lower childhood stunting, without adjusting for other factors.

This is though-provoking since a recent, randomised control trial concluded that the inclusion of eggs, which are generally accessible to the vulnerable communities, could possibly contribute to the global reduction of stunting.[32] Furthermore, the low consumption of eggs has been related to an increased probability of stunting in children residing in Maharashtra, India.[94] Educational interventions had positive impacts on length gain in China and Peru, where the key message included the regular intake of animal source food, including eggs.[206,207] While DDS only includes the food intake of the previous day, it provides us with an indication of average daily intake. When the seven food groups were compared, regarding the intake of all the children in the survey, the food group least included was beans/ legumes/nuts. Although nuts are expensive, legumes are economical, readily available at all nearby stores, and a good source of plant protein.[208] Both eggs and legumes form part of the recommended food in the draft Paediatric Food based dietary guidelines of South Africa.[209]

For the present study, the early initiation of breastfeeding was reported as 90,68% , which is higher than previously reported for the Breede Valley area.[12,210] EBF for children below six months was reported as 65%, however, it had previously been recorded as overreported[211], and when additional questions around infant feeding were asked, contradictory responses provided proof that EBF rates are more representative of predominant breastfeeding. The EBF indicator has been identified to regularly over classify exclusive breastfeeding, as children may have received other liquids or foods prior to the study.[212] Thus, these results

should be interpreted with caution. Furthermore, continuation of breastfeeding is not a rare practice for developing countries[213] and continued breastfeeding at 12- 15 months, as well as two years of age, was 45% and 32% respectively. The cost-effectiveness and immediate availability of breastmilk has been reported as a significant contributing factor to the continuation and predominant breastfeeding in the Breede Valley district[210] This could be a potential reason for the increased numbers seen for the current study.

Continued breastfeeding in the two categories showed protective effects however, these results are unadjusted for other variables, as the numbers were too small to continue with a multivariate regression analysis. Akombi et al.[136] and Tiwari et al.[214] found that prolonged breastfeeding significantly increases stunting prevalence in Nigeria and Nepal. Another study found prolonged breastfeeding potentiated stunting in poorer households,[168] whereas other studies found no significant effects with regards to prolonged breastfeeding and stunting.[215] Breastfeeding benefits have repeatedly been proven[216–218] and the present study supports the WHO recommendation of continuing breastfeeding for up to two years of age and beyond.[194]

The adequate timing of introduction to complementary foods was lower than previously reported.[12] About a third of children between 6-8 months did not receive any form of food up to the day of the survey. More than half the children aged 6-23 months received the minimum dietary diversity the day prior to the survey, almost 15% more than previously reported in the area. In present study, continued breastfeeding and minimum DDS indicated significant effects, prior to adjusting for other factors associated with stunting. However, we need to acknowledge the possibility of some mothers reporting what they thought the CHWs wanted to hear instead of actual practices.

Mathysen et al.[195], another sub-study part of the CNSP project, considered factors that influence the complementary feeding practices of 6-12 month old infants in Avian Park and Zwelethemba. The results indicated that there are no cultural differences between the areas that influence specific feeding practices and suggested a blanket intervention should be used in both communities. Comparing the four areas in this study showed no significant difference with regards to breastfeeding initiation, duration or cessation, which supports the recommendation of Mathysen et al.

Almost all mothers attended antenatal care sessions and out of those who attended, the majority received breastfeeding education at these visits. However, we did not assess what was discussed during these sessions. Goosen et al.[210] conducted focus group discussions in Worcester, which revealed limitations such as pamphlets that seemed to replace direct counselling and were misinterpreted, and the lack of explanations as to why certain feeding options are superior, affected mothers' comprehension and appliance. Out of the mothers who did receive breastfeeding education, the majority received individual counselling and this study showed that Avian Park had the highest number of mothers who attended group counselling while Zwelethemba had the lowest.

The majority of mothers initiated breastfeeding within one hour after birth - previously the early initiation was at 75% which was lower than the national figure at the time.[12] Similarly, Goosen et al.[210] found breastfeeding was accepted in the community and that the early initiation of breastfeeding was higher in 2014, at 95%, than the results of the present study. In 2016, national data indicated 84% of children were breastfed at some stage in their life and only 67% received breastmilk within the first hour after birth.[134]

Reasons for breastfeeding cessation mostly included the perception of "not enough milk" and "the baby not wanting breastmilk," as well as work-related issues. Goosen et al.[210] concluded that two of the main barriers of exclusive breastfeeding in Avian Park and Zwelethemba, was separation from their infants and the perception that their milk was not enough to satisfy their children's needs, which correlates with the results in the present study.

Poor feeding practices have detrimental impacts, and are the leading cause of malnutrition in developing countries for infants and young children.[219] The framework of childhood stunting specifically focused on the complementary feeding period,[3] as the complementary feeding practices directly influence the risk of becoming stunted.[57] Inadequate breastfeeding and complementary feeding practices form part of the most proximal factors related to stunting.[3] Therefore, policies, programmes and interventions have been implemented in order to support Infant and Young child feeding practices, worldwide, including in South-Africa.[220] These include strategies to promote, protect and support breastfeeding and improve complementary feeding by micronutrient supplementation (zinc, vitamin A, iodine), food supplementation in food insecure areas, food fortification and infant feeding education.[4] Interventions of the Integrated Nutrition programme (INP) currently implemented in primary health care facilities, include the Mother Baby-friendly hospital initiative and Road to health booklet. The INP[221] has achieved creditable success in South Africa, however, some nutritional disorders, such as stunting, persist.[222] Improved implementation of intervention programmes and policies, with adequate resources, as well as improving socioeconomic conditions for the vulnerable communities, such as the areas in the present study, are required to ensure continuous improvements in health and nutritional outcomes of infants and young children.[223]

5.5 RECOMMENDATIONS

The study results indicated poor nutritional profiles for both mothers and their children. The complex burden of stunting is a result of maternal under- and overnutrition. Seeing as there were high rates of both of these conditions, there is a need for interventions focused on improving maternal nutritional status. For the present study high rates of stunting, overweight and obesity as well as LBW in babies were highlighted as significant findings and these concurrent problems of childhood stunting increase the risk for adverse health outcomes later in life. The high rates of LBW babies provide an indication of maternal nutritional status during pregnancy. These factors all relate to the global targets set at the World Health Assembly in 2012.[224] i.e., stunting reduction by 40%, LBW reduction by 30% and to decrease prevalence of overweight and obese individuals. All these factors are interlinked and progress towards stunting requires evidence-based interventions. There is thus a call for double-duty actions to address malnutrition in Worcester, Breede Valley.

5.5.1 MATERNAL AND CHILD OVERNUTRITION

The results of the present study show the need for interventions focused not only on child health but also maternal health and well-being. Anthropometric results indicate rising levels of overweight and obesity in both mothers and children. Community projects and support groups that focus on healthy lifestyle behavioural changes and economic ways to implement such choices, as the majority of mothers are unemployed and live on social grants and contributions by family members, should be readily available to all mothers as well as their family members. De Onis et al.[225] and Victora et al.[16] noted the dramatic rise in childhood overweight and obesity since 1990 and established the importance of early recognition and effective interventions, regarding excessive weight gain relative to linear growth. Thus, interventions focused on the dual burden of malnutrition[226,227] needs to be implemented in Worcester, Breede Valley.

Creating health promoting living environments are essential to target and prevent continued rising burden of NCD and overweight and obesity levels. The National Health Review noted that by supporting a healthy food environment a reduction in obesity and improved nutrition can be achieved.[228] Aggregated local data on obesogenic environments structural drivers need to be collected for communities in Worcester, Breede Valley district as well as other communities, in order to implement policies and interventions addressing unhealthy living environments. Health in all policies are required. This requires a collaboration of stakeholders, with an in-depth understanding of environmental factors influencing health in the Worcester, Breede Valley communities. Ndlovui et al.[228] suggested municipalities restrict the number of fast food restaurants in communities by creating certain by-laws. As fast food is suspected to be one of the main drivers of obesity due to cheap price, wide-spread availability and easily accessibility.[228,229] A range of interventions have already been implemented to address the growing burden, such as sugar taxation, advertisement restrictions and the provision of healthy school meals, however insufficient progress has been made.[230,231]

Policies focussed on creating enabling food environments in vulnerable communities such as Worcester, Breede Valley are required to improve food preferences and behavioural changes, especially in children. The Lancet series paper on Obesity 2; identified a framework for the theory of change through which food policies could aid in obesity reduction.[231]

5.5.2 INFANT AND YOUNG CHILD NUTRITION

Poor complementary feeding practices were found in previous surveys conducted in Avian Park and Zwelethemba. The current results support the previous recommendation[195] to heighten food and nutrition security in these two areas as well as, the additional two areas included, to support and maintain adequate complementary feeding practices in the communities.

The unexpected high rates of stunting in children between the ages 0-5 months and high LBW rates, provide evidence that maternal nutrition during pregnancy is critical for infant birth outcomes, further supporting the importance of the first 1,000 days initiative,[232] as well as the Strategic Plan for Maternal, Newborn, Child and Women's Health (MNCWH) and nutrition in South Africa.[233] Long-term maternal care strategies, specifically focused on supporting foetal growth, are needed in Worcester, Breede Valley.

Furthermore, the result of the present study supports the IYCN advocacy strategy, suggested in CNSP, aimed at addressing the concerns of developmental and cognitive delays as a result of malnutrition.[234]

5.5.3 DDS

The importance of DD cannot be stressed enough. Mothers are under the impression that a diverse diet immediately means spending extra money, which they do not have. Although this could be true, highlighting the inclusion of economic diverse sources of food may help broaden their knowledge on what to look out for at supermarkets in future. Legumes was the food group least consumed in the study and thus, education of the benefits of eating these foods on a regular basis may help improve diet diversity. Child support grants have been proven to be insufficient to sustain the growing needs of children and therefore additional interventions are required to ensure optimal nutrition for all. Vegetable gardens can be found within Breede Valley but focus should be placed on capacity building and providing resources to maintain locally grown crops in the areas. Creating additional vegetable gardens holds potential to not only feed more people but also to create employment opportunities within each community. CHWs can be used as a line of communication to gain valuable insight on possible candidates to run these gardens as well as spread the word to those who will be able to purchase freshly grown food for next to nothing. Children should be involved from early stages in life, to set an example and create healthy behaviours to last them far beyond maturity. The results in the present study further emphasise the recommendation of planning and implementing community-based intervention programmes, enabling the members of the community to improve their nutrition security and, dietary diversity and intake.[124] This will require the involvement of government officials, civil society members, NGOs and community members.

5.5.4 LBW

Low and middle income countries, such as South Africa, are faced with high rates of low birth weight,[235] which was found to be the case for Worcester, Breede Valley as well. A 30% reduction of low birth weight was one of six specified global nutrition targets set for 2025, by the World Health Assembly Resolution in 2012.[236] LBW was proved to be significantly associated with stunting in not only the current study but also others. [2,61,94,167] Dean et al.[170] detailed the need for effective nutrition-specific interventions during preconception and, by integrating it with nutrition-sensitive programs, greater advances can be made. The development of community-based platforms to reach wider populations holds potential therefore, the inclusion of CHWs can be utilised here as well.

5.5.5 CONTEXTUAL FACTORS

By addressing the underlying determinants of stunting, significant improvements have been announced in countries such as Brazil[237] . Improvements were a result of improved maternal schooling, increased abilities to acquire food, upgraded health care facilities and better sanitation. Granted, these underlying factors was not associated with stunting in Worcester, strategies aimed at addressing these factors can however help address the high prevalence of stunting. Even though no differential effect could be determined for these areas, it's worth highlighting that, between the selected areas, Avian Park had the highest prevalence of stunting and, the lowest percentage of mothers to complete school, attend ANC and give birth at a health care facility. Additionally, this area had the highest percentage of children with a DDS less than 4.

A systematic review noted that education provided through training of health care providers, had positive impacts, as well as when mothers or caregivers were educated directly. Educational interventions are most effective when messages are cautiously selected with specified focused key messages relating to infant feeding. These messages should ideally be based on a needs evaluation and formative research with a specific population group. With this approach, areas most in need of change can be identified and interventions can be developed based on that.[51] More experience with linear growth assessments and interpretation are urgent for health care workers as this is an indispensable element to detect and address stunting.[2] Messages aimed at improved DD, breastfeeding practices and complementary feeding practices, found e.g. in the RtHB, should be communicated in clinics, home visits and public community events.

However, for interventions to be effective in the reduction of childhood stunting in Worcester, Breede Valley, it needs to be accompanied by changes targeting underlying factors of stunting as well. The influence of contextual factors depicted in the WHO Framework can't be ignored.[3,13] Bhutta et al.[4] concluded that, in order to eliminate stunting, the improvement and strengthening of the underlying determinants of undernutrition, which includes poverty and education, should be done.

5.5.6 STRENGTHENING CAPACITY OF CHW'S

Worcester requires programmes focused on the motivation and continuous training of CHWs within the four areas and possibly extend to the wider area of Breede Valley. The CHWs received in-depth training on growth monitoring prior to the survey, but it was clear from daily attitudes they had no intention of continuing the process after the research study was completed. By providing continuous support and motivation, as well as creating a sense accountability for the results and onwards referral systems, children at risk of growth faltering can be identified and referred to intervention programs available within the four communities, such as Nutrition therapeutic programme (NTP). Nisbet et al.[110] found the reduction of stunting in Maharashtra was a result of synergistic relationships and collaboration between various sectors including government, civil society and media with the specific focus on capacity building on ground level, i.e. CHWs. Mathysen et al.[195] identified health care workers as one of the fundamental information sources in Avian Park and Zwelethemba, with regards to IYCF. Throughout the data collection process, certain members of the community thoroughly welcomed community health workers within their homes. By strengthening the education, support and monitoring of these CHWs, more members of the community can be reached. Not only mothers and sickly patients attending clinics for medical reasons, but also grandmothers, fathers and other family members who have also been identified as key information sources in previous studies, as well as this one. The majority of mothers said they have the main authority on feeding decisions, but when in doubt, their mothers are second in line. Through this, elder members of the community's knowledge is broadened from the comfort of their homes and could potentially provide adequate, nutrition advice to their children. In this researcher experience, gained during data collection, CHWs in the four included areas form a link to the community and in many ways have the power to reach vulnerable individuals. Coming from similar backgrounds and sharing similar circumstances may have a greater impact on the acceptance of new information rather than information coming from policy makers and stakeholders invested in the reduction of stunting. The capacity of Boland Hospice to achieve improved CHWs programmes, require strengthening their capacity as an NGO by the sub-district government departments.

All health workers including, CHWs, need more experience in linear growth assessments and the interpretation thereof, as they play an essential role within communities to identify and address the prevalence of stunting.[2] Worldwide, growth monitoring along with health promotion is recognized as a key part of the prevention and management of childhood malnutrition.[238] Barriers of effective growth monitoring, including staff, equipment and time have been identified in the Western Cape and the need to improve health worker ,including CHWs, knowledge and skills have been stressed.[239]

5.5.7 ALCOHOL AND DRUG ABUSE

In the 2000s, an anonymous area in the Western Cape was found to have the highest prevalence of FAS children in an overall community population study.[240] Furthermore, in 2016, Olivier et al.[241] concluded that Foetal Alcohol Spectrum Disorder(FASD) rates in South Africa were amongst the highest worldwide, and is

an acknowledged public health concern for the country. Increased awareness and emphasis on the dangers of alcohol and drug abuse should be raised, as well as integrated into ANC and preconception period interventions.[172] The Boland area is estimated to have FAS prevalence of 10.3% and as an[242] NGO, FASFacts are currently working in the rural areas of Worcester to raise awareness of FAS. Du Plessis et al. [234] suggested the FASFacts model as one of the suggested models to include in advocacy of IYCN as part of a multisectoral approach. This holds potential to aid stunting reduction in the areas as well, seeing as maternal health and behavioural patterns during the preconception period and IYCN is one of the major contributing factors of childhood stunting in the WHO conceptual framework of stunting.

Du Plessis et al.[234] further highlighted the need for a people-centred approach, to ensure an enabling environment for the implementation of IYCN interventions. By means of multi-stakeholder engagements, the need for a deliberate community and advocacy strategy was highlighted for Worcester, Breede Valley, a recommendation that should again be strengthened. Local knowledge and evidence, aimed at creating an enabling environment, are crucial to implement interventions effectively. This study further contributes to the local knowledge and evidence-base.

5.6 STRENGTHS AND LIMITATIONS OF THE STUDY

5.6.1 STRENGTHS

The results will provide a profile specific to stunting in the four included areas namely Zwelethemba, Roodewal, Riverview and Avian Park. The findings help broaden the knowledge of the specific areas and create opportunities to design and implement specific strategies.

The CHWs has sufficiently learned how to plot the weight and height of a child and how to interpret their z-scores based on the WHO growth standards. They were trained on how to praise mothers for a healthy baby and how to effectively, refer a baby if required, without shaming the mother. Including the CHWs, who are familiar with the people and the area, can have beneficial effects for the implementation of interventions in the near future.

Necessary referrals were made, with specified clinic times, for individuals identified as malnourished and incomplete immunisations, vitamin A and deworming.

5.6.2 LIMITATIONS

5.6.2.1 SAMPLE SIZE

Due to unavoidable circumstances and logistical issues, the sample size was not reached.

- Difficulty obtaining mother-child pairs: The mothers were either at work or the children at crèche.
- CHWs had to walk far distances to get to their designated sampled household: This was time consuming and allowed for no more than two households to be assessed per day.
- The study took place in the heart of winter: Community members were reluctant to undress their babies for anthropometric measurements and often refused to take part. Others often said to come back in the afternoons when the temperatures are higher but unfortunately only the set times were available to collect data and afternoons were not a viable option.
- CHWs had various responsibilities and projects due: During the course of the study there were continuous changing schedules, and as a result, on most days, we did not have the full team of CHWs collecting data.
- The survey was halted on several occasions: Due to gang violence and shooting incidences.
- The CHWs expressed grievances: Objections regards to payment, work circumstances and other challenges relating to the survey caused them to strike on several occasions.

5.6.2.2 RELEVANCE

- The study findings are specific to the area and cannot be generalised to other areas.
- The growth pattern of a child cannot be determined with a once off measurement
- The gestational age of babies born with low birth weights were not evaluated.

5.6.2.3 FIELD WORKERS

The questionnaire and measurements took a substantial amount of time and was tiresome for certain participants as well as data collectors.

5.6.2.4 ANTHROPOMETRIC MEASUREMENTS

- Anthropometric measurements require adherence to strict guidelines thus, the accuracy and reliability depends on precision. Even though SOPs were developed and CHWs were adequately trained, continuous retraining was required where the equipment and techniques for these measurements were concerned.
- The environment affected the variability of length and height measurements. The housing was often not level, affecting the equipment accuracy.
- The children temperament, cooperation and behaviour could have potentially affected the way in which CHWs measured the infant and young child participants.
- Equipment was difficult to manage for the CHWs and mistakes were often noted and measurements had to be redone.

5.6.2.5 SAMPLING

- CHWs, having no research background, had great difficulties following the sampling procedure. They could not understand why they had to visit a street if they knew there were no children at home during the data collection day. The principle investigator had to explain the importance of following procedures repeatedly.
- The maps obtained of the four areas were relatively up to date. However, a certain number of streets were not reflected on the maps and for the more informal areas, the addresses did not correspond with the map numbers. The principle investigator received many complaints about house numbers and street names that were sampled which could not be found or did not exist. Sampling had to be redone multiple times, causing lost time and frustrated community health workers and supervisors.

5.2.6.6 PARTICIPANTS

- Mothers often had to recall information for certain questions, opening the possibility of recall bias.
- Maternal age was not specified in the inclusion and exclusion criteria.

5.7 CONCLUSION

High stunting levels prevail in Worcester, Breede Valley sub-district. The barriers to optimal feeding practices, is in essence a result of poverty and inequalities. The analysis indicated that in Worcester, Breede Valley the key drivers of stunting in children under the age of five was birthweight, male gender, DDS and maternal waist circumference. The small differences within the four vulnerable communities made it difficult to draw comparisons between the areas, therefore, no differential effects could be observed, even though stunting prevalence was significantly different between the four selected communities in Worcester, Breede Valley. Stunting is a multifaceted complex public health issue[57], which requires joint solutions from all stakeholders. Du Plessis et al.[188] noted the importance of taking deliberate steps to include all levels and sections in Worcester, Breede Valley in order to effectively address poor infant and young child feeding practices in the area. Thus, in effect, addressing contextual and immediate causes of childhood stunting highlighted in the WHO framework on childhood stunting.[3] The need for an enabling environment is undeniable as behaviours within the community, including alcohol and drug abuse as well as extreme violence and gangsterism, affect the health and well-being of the children, and needs to be assessed.

By collecting area specific and community level data, appropriate interventions can be implemented which could enable these vulnerable communities to improve or overcome the drivers that affect childhood stunting. The results will be used as an advocacy tool to build commitment from community members and stakeholders within the community that will aid the reduction of childhood stunting. In order to increase public awareness, the stunting profile will be presented back to the participating communities and increase their knowledge of ways to prevent childhood malnutrition.

CHAPTER 6: GENERAL CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter provides a brief summary of the results, including the current nutritional situation in Worcester, Breede Valley and key factors of stunting that were explored in the vulnerable communities in the district against the WHO conceptual framework on childhood stunting.[3] The study aimed to define the prevalence of stunting and identify the key drivers in the following four areas: Avian Park, Riverview, Roodewal and Zwelethemba. Additionally, a maternal nutritional profile was described for the areas.

6.2 SUMMARY OF MAIN FINDINGS

The results indicate suboptimal mother and child nutritional profiles. Anthropometric results confirmed a high prevalence of stunting in children, as well as overweight and obesity, including the co-existence within individuals. Mothers profiles indicated a high prevalence of overweight and obesity in certain areas and a moderate prevalence of undernutrition in others, indicating the presence of the double burden of disease within households and individuals.[124] Our results support and further highlights the identified need to improve maternal diets based on energy intake, as the prevalence of overweight and obesity was found to be 55.23% for all four communities combined.

Key drivers of stunting for the four areas included male infants and children, poor DDS, low weight at birth and maternal nutritional status.

These results correspond with previous studies conducted in Worcester.[12,195,210] The combination of poor nutritional profiles of mothers and their children, sub-optimal infant feeding practices and poor social determinants of health, requires a collaboration of stakeholders to be involved to establish an enabling environment, as previously confirmed by the CNSP research conducted in the area.[234]

6.3 CONCLUSION

Stunting has been identified as one of the key preventable risk factors for loss of development potential.[17] Reducing stunting in Worcester is a multifaceted challenge, and a focus on addressing maternal and child nutrition emerged as a key priority. The local data can be used to implement people-centered and area specific interventions to improve feeding practices and create healthy behavioural changes, that reduce stunting within the four communities. The key drivers presented in this study should form the basis of these interventions mentioned above. Double and triple-duty actions should be explored to address both under- and overnutrition in mothers and children below the age of five in Worcester, Breede Valley sub-district, Western Cape.

6.4 RECOMMENDATIONS FOR FUTURE RESEARCH IN BREEDE VALLEY

- Further investigations with regards to the challenges to the inclusion of a diverse diet in the four communities, as previous research also indicated poor DDS for mothers in the area. Maternal knowledge around beans and legumes needs to be investigated, as well as the inclusion of eggs as part of a daily diet.
- The role of maternal caregiving on stunting needs to be assessed for these communities, as well as the effect the environment has on caregiving behaviours and habits.
- Knowledge, attitudes and beliefs with regards to the roles CHWs play in the various areas needs to be assessed, as well as ways to create a supportive and safe environment for these community-based health workers.
- Further studies are necessary to develop a better understanding of the local environment in order to tailor interventions to each community's specific needs and implement the right targeted nutrition-sensitive and specific interventions to combat stunting in these vulnerable communities.
- Factors contributing to LBW in Worcester, Breede valley, needs to be evaluated, as high rates of early onset stunting, for children between the ages 0-5 months were found.
- Determine the effects interventions, already implemented, in Breede Valley, have on outcomes associated with under and overnutrition in order to identify potential platforms to include in double-duty actions addressing both under and overnutrition in children below the age of five.
- Secondary analysis on the present study data focussed on determining the key drivers of overweight and obesity within the four vulnerable areas.

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APPENDICES

Addendum A Protocol logistics

PROTOCOL LOGISTICAL INFORMATION

DATE	RESEARCH STEPS	CONTRIBUTORS
2017-2018	Drafted and finalised protocol	Ms. A. Lenhoff Dr. E. Van Niekerk Prof. L. Du Plessis Grow Great campaign: Ms. M. Konjore, Dr. K. M. Mabaso, Ms. B. Robertson Ms. N. Eley
29/06/2018	Apply to Health Research Ethics Committee (HREC)	Ms. A. Lenhoff
26/06/2018 - 28/06/2018 02/07/2018 - 04/07/2018	Training of CHWs	Ms B. Robertson Philani- mentor- mothers Ms A. Lenhoff Ms M. Konjore
05/07/2018	Acceptance from Health Research Ethics Committee (HREC)	
18/07/2018 & 23/07/2018	Pilot study	Ms A. Lenhoff Ms M. Konjore Philani-mentor-mothers
26/07/2018	Data collection commence	Ms. A. Lenhoff Ms. M. Konjore Philani-mentor-mothers
30/10/2018	Data collection ends	Ms. A. Lenhoff Ms. M. Konjore Philani-mentor-mothers

ROLES AND RESPONSIBILITIES OF RESEARCH TEAM

	ROLES AND RESPONSIBILITIES
Principle Investigator (PI)	• Assisted training of CHWs. • Trained Philani- mentor-mothers. • Supervised all steps of data collection. • Sampled starting households. • Lead debriefings sessions, informal discussions and WhatsApp group chats. • Visited at least one area per day. • Retraining of CHWs at monthly meetings and during data collection, if there was queries or anthropometric measurements were not done correctly. • Conducted spot checks during data collection. • Captured questioners on Excel spreadsheet and entered measurements in WHO Anthro (version 3.2.2) software (StatSoft, 2013, USA). • Asked the CHWs to return to households in case of missing information.
Grow Great investigators	• Funded the research study. • Made arrangements and conducted negotiations with Boland Hospice and Department of Health, Worcester, Breede Valley. • Responsible for training the CHWs. • Assisted supervision during data collection. • Assisted during debriefings sessions, informal discussions and WhatsApp group chats. • Provided continuous feedback to Boland Hospice and the Department of Health, Worcester, Breede Valley.
Philani-mentor-mothers	• Philani-mentor-mothers assisted training of CHWs. • Assisted supervision during data collection in the four selected areas. • Conducted spot checks during data collection. • Retrained CHWs during data collection in their selected areas. • Held daily informal discussions with the CHWs. • Assisted to check questionnaires during data collection. • Reported back to the PI after each data collection day. • Assisted CHWs to return to households with missing information.
Community Health Workers (CHWs)	• Attended training. • Worked in pairs of two during data collection. • CHW teams ensured that the instruments, forms, materials and equipment were ready to start the data collection process. • Walked to sampled households, obtained informed consent, completed questionnaires and the anthropometrical assessments on mothers and their children that fit the inclusion criteria. • It was their responsibility to plot the child participants on the growth charts and explain the growth of the child to the mother. • Necessary referrals to the clinic with specified times were made if growth was below the -2 z-score the weight-for-age and height/length-for-age growth chart. • CHWs were required to check for any danger signs and refer if necessary. • CHWs were required to check if the included child participants vitamin A, deworming and immunizations were up to date. If vitamin A and deworming were not up to date, they were required to supplement on site. • Necessary referrals were made (see addendum D).

Grow Great

Refresher Training

Exercise Book

Contents

1. Acronyms

CHW	Community Health Worker
Cm	Centimeters
COH	Circumference of Head
Kg	Kilograms
MUAC	Mid Upper Arm Circumference
RTHB	Road to Health Book
SOP	Standard Operating Procedure
WHO	World Health Organisation

2. Introduction to the Community Stunting Survey

Stunting arises from prolonged under-nutrition that affects physical and brain development. Its defined as shortness in height for a child's age and it can only be diagnosed by comparing the child's measurements to standardized growth charts.

The known drivers of stunting e.g. low birth weight, poor access to water and sanitation, high levels of poverty, high levels of maternal alcohol and drug abuse are believed to be high in communities in Worcester.

This survey aims to collect information about the growth of children in 4 communities in Worcester as well as information on factors that may cause poor growth. Households with children below the age of five in Zwelethemba, River View, Roodewal and Avian Park will be included in the survey.

The reason for the study is due to childhood undernutrition - particularly in the critical window of the first thousand days.

Measurements included for the mother is weight, height and waist circumference. For all children below the age of five weight, height/length, mid upper arm circumference and head circumference will be done. All measurements will be measured accurately according to standard operating procedures (SOP).

3. Work Flow - how we work in the field

During the period of data collection, you, the Community Health Worker (CHW) will work in pairs of two in the allocated areas and collect the necessary data.

Step by Step guide:

1. Introduce yourself and explain the reason for your visit.
2. Request informed consent from the mother or caregiver.
3. Each team will complete a questionnaire and measurements for the mother and qualifying child in the household.
4. The mother/legal guardian of the eligible child will be interviewed. Information will be gathered regarding the key drivers of stunting.

While the team is completing the questionnaire and assessments, they will be required to assess children for potential danger signs and make the necessary referrals simultaneously ensuring that children's' vitamin A supplementation and deworming is up to date. Weekly discussions will be conducted with the CHWs by the team for quality control purposes.

a. Consent forms – getting permission

The consent forms will be discussed in the training.

Addendum D Informed Consent form

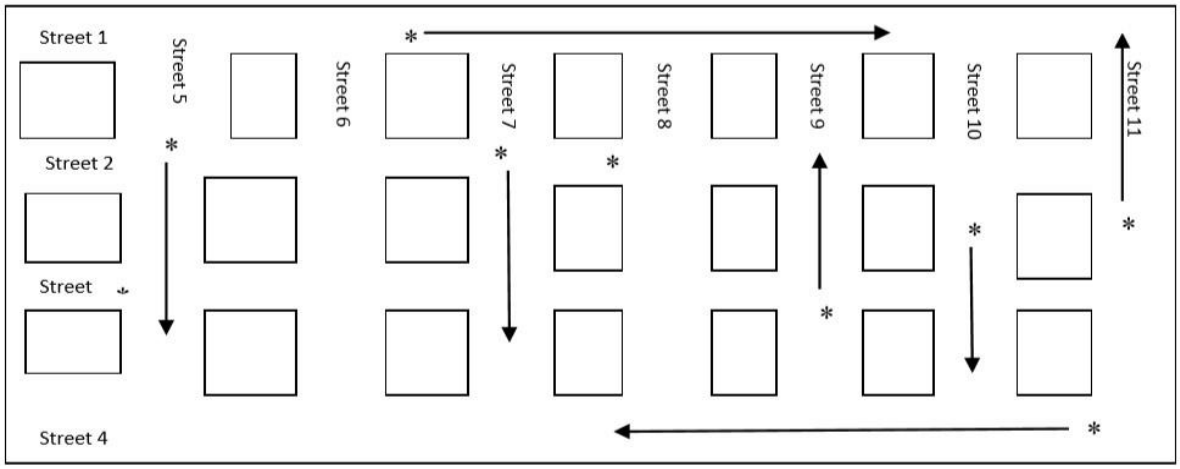
b. Questionnaire

Addendum A Questionnaire.pdf

The questionnaire will be discussed in the training.

c. Selection of homes

Data collection will commence at a random starting point in each area, thereafter consecutive households will be included to ensure an adequate sample size.



4. Growth monitoring

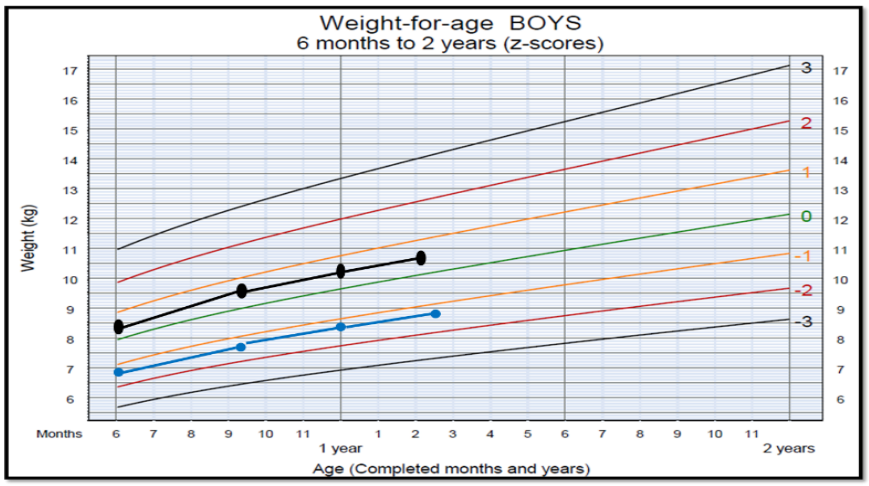
Tracking how children grow can tell us many things about their health. Normal growth in children is a sign of good health.

When you visit a home with a child under the age of 5 years, here are 4 things that you can do to make sure children in your community are growing.

1. Growth monitor all children:
   - Weigh all children and plot their weight on the growth chart
   - Measure the height/length of all children and plot it on the growth chart • Measure all children's Mid Upper Arm Circumference (MUAC)

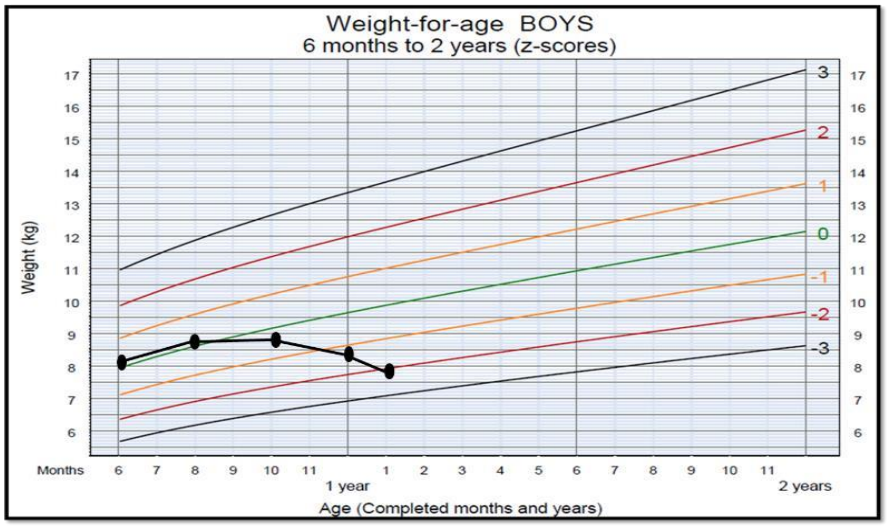
MUAC TAPE

2. Decide what the graph says:



Adequate growth: good enough, or

Stagnating growth: standing still, or



Growth faltering: Failing to grow

3. As a CHW, based on your measurements decide on the intervention. Here is a guide:

What to measure?	How often?	**What does it mean?**	**What you can do?**
MUAC (***Malnutrition***)	6 monthly	**Green**	Education, support & practical advice on child nutrition*
		Yellow	Refer to a health care facility/PHC
		Red	Refer immediatley to a health care facility/PHC
Height (***Stunting***)	6 monthly	**-1 to +1 Z Score** Normal height for age	Education, support & practical advice on child nutrition*
		-2 to -3 Z Score Stunted	Refer to a health care facility/PHC
		< -3 Z Score Severely stunted	Refer immediatley to a health care facility/PHC
Weight (***Underweight***)	At every visit	**-1 to +1** Normal	Education, support & practical advice on child nutrition*
		-2 to -3 Wasted	Refer to a health care facility/PHC
		< -3 Severely wasted	Refer to a health care facility/PHC

*Exclusive breastfeeding for 6 months and continued breastfeeding while introducing the right kind of complimentary foods. Improvement of complimentary feeding from 6 – 24 months of age. Think about energy giving foods (carbohydrates), protecting foods (vegetables and fruit) and building foods (meat, chicken, fish, eggs)

4. Support the growth of children by:

- Discussing healthy foods and encourage mothers and caregivers to give children small meals often.
- Use the Road to Health Booklet as a guide.
- Encouraging parents and caregivers to give children foods that are high in protein and energy like eggs.
- Check the Road to Health Booklet (RtHB) to make sure Vitamin A, deworming and immunizations are up to date. If they are not and if you are trained, give Vitamin A and deworming tablets. Refer to the clinic if you are not trained or if immunizations are not up to date.
- Babies need love, care, support and a healthy environment to thrive.

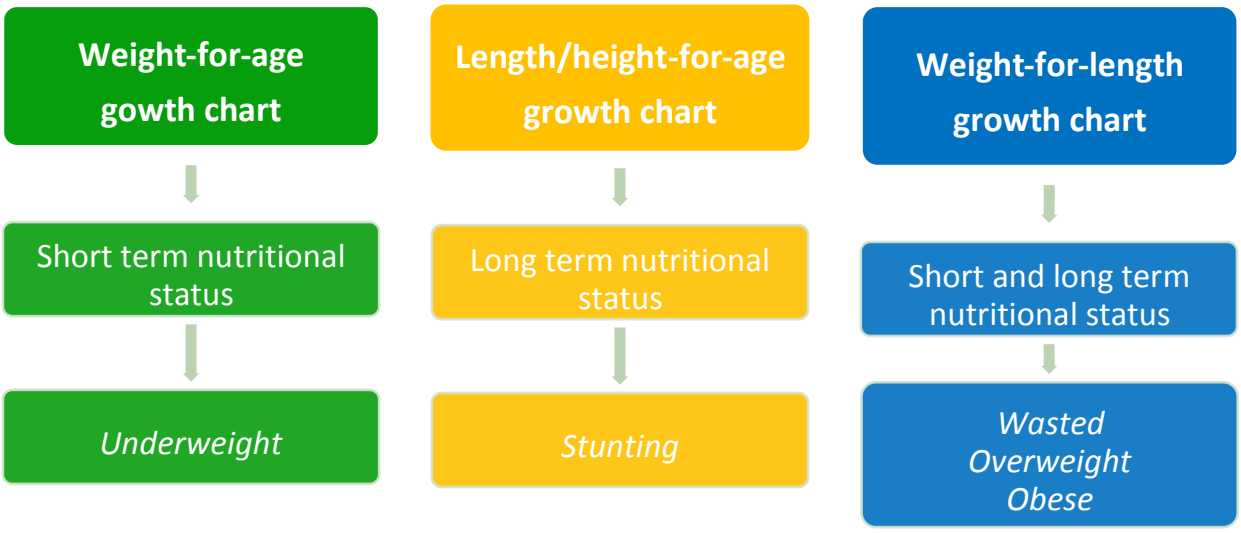
Tools needed to monitor growth

One does not need a lot of fancy equipment to monitor growth properly.

Basically you will need a reliable scale, a tape measure and the correct growth charts. If you have access to digital baby and grown up scales, length mats, stadiometers (height measuring tool) and MUAC tapes it is a bonus.

What each growth chart is measuring:

Each growth chart measures something else. Look at the table below:



4.1 Practical topics: Calculating age

In growth monitoring everything starts with working out the correct age for a baby or child because the growth charts found in the Road to Health Booklet compare weight and length/ height for certain ages.

Here is how you can calculate age:

Step 1: Write down the child's date of birth

Step 2: Count from today's date

Step 3: Start by counting the completed years up to today's date

Step 4: Then count the completed months from the previous year until today's date

Step 5: Then count the completed weeks from the last completed month until today's date Step 6: Then count the completed days until today's date

Please Note:

- When 'finding' the years, months, weeks and days use your fingers to count
- One month = 4 completed weeks
- One week = 7 completed days
- Rounding up for plotting on the growth charts:
  - If you get 5 or 6 days, round these up to complete the week and add this to the other weeks you have counted. For example:
    - ✦ If you counted one week, it now becomes 2 weeks. If you counted 2 weeks, it now becomes 3 weeks.
    - ✦ If you counted 3 weeks and now becomes 4 weeks, which equals one month, so you add one month to your total.
    - ✦ If you counted 11 months and now add a month it becomes 12 months, which is the same as one year. You then need to add that 1 year to your total.
- It is easier if you draw columns for counting.

Let's work on some

Date of birth	Number of completed years counted	Number of months counted	Number of weeks counted	Number of days counted
Vicky was born on the 8th February 2015. Today is the 19th June 2018	2016, 2017, 2018 = **3 years**	From 8th February 2018 up to 8th June 2018 is a month **= 4 months**	From 8th June to 15th June = **1 weeks**	From 16 June to 19th June is **= 4 days**
Today, on the 19th June 2018, Vicky is 3 years, 4 months, 1 week and 4 days old.				
Patrick was born on 16 August 2016. How old is he today? Today's date is the 19th June 2018.	2016 to 2017 = **1 year**	From 16th August 2017 to 16th June 2018 is = **10 months**	From 16th June 2018 to 19th June 2018 is less than 7 days **= 0 weeks**	From 16th June 2018 to the 19th June = **3 days**
Today, on the 19th June 2018, Patrick is 1 year, 10 months, 0 weeks and 3 days old.				
Bongi was born on the 31st January 2014. Today's date is the 19th June 2018.	2015, 2016, 2017, 2018 **= 4 years**	From 1st Feb 2018 to 30 May 2018 is **= 4 months**	From 1 June 2018 to 7th June 2018=1 week 8th June 2018 to 14th June 2018 = +1 week	15th June 2018 to 19th June 2018= **5 days** For plotting you round the 5 days up to 7 days = 1 week *Add the week to the other week you have counted*
	4 years	**4 months**	**= 2 weeks + 1 week = 3 weeks**	**0 days**
Bongi is 4 years, 4 months and 3 weeks old today				

Exercise 1: Calculating age

Calculate the age of the following children correctly.

Today's date is ……

Name of baby or child	Date of birth	Number of completed years counted	Number of months counted	Number of weeks counted	Number of days counted
Siviwe	08/02/2015				
Kholeka	15/02/2018				
Shannon	08/04/2017				
Natasha	30/01/2017				
Aubrey	13/07/2016				
Israel	31/05/2015				
Mpho	28/09/2014				

Exercise 2: The growth charts

Have a look at the RTHB and find the three growth charts as well as the place where COH and MUAC are recorded. Write down the page numbers for all.

1. Weight-for-age growth chart is on page……
2. Length/ height for age growth chart is on page…….
3. Weight-for-length growth chart is on page…….
4. COH is recorded on page…….
5. MUAC is recorded on page…….

Please note: There will be new editions of the RTHB soon. When these are given out, please check on which pages you can find the information. Also, make sure you get familiar with the new edition and what has changed in the book.

Exercise 3: Plotting on the growth chart

Below are some examples to help you practice plotting on the three different growth charts..

Use the boy's and girl's **weight for age growth charts** and plot the following children's findings in pencil. Interpret each growth curve.

1. Thandi is 4 years and 4 months old. She weighs 14kg.
2. Bongani has turned 2 years old. He weighs 12kg.
3. Nosipho is 8 months old. She weighs 7.5kg.
4. Nandipha is 16 months old. She weighs 9kg.
5. Bulelwa is 5 months old. She weighs 4.5kg.
6. Thebo is 1 week old. He weighs 2.2kg.
7. Sandile is 10 months old. He weighs 8.5kg.

8. Yanga is 12 months old. He weighs 6.5kg.

9. Zukiswa is 12 months old. She weighs 10kg.

10. Nokwanda is 3 months old. She weighs 4 kg. Her birthweight was 2,5kg.

The weight for age is ……

11. Peter is 6 months old. He weighs 8 kg. His birthweight was 2,3 kg. At 2 months he weighed 4 kg. At 3 months he weighed 5 kg, at 4 months he weighed 5,9 kg, at 5 months he weighed 7 kg.

The weight for age ……..

12. David has turned 2 years old. He weighs 12kg. His birthweight was 3,5 kg. At 1 year he weighed 9 kg. At 18 months he weighed 11 kg.

The weight for age is ……

13. John is 4 years and 4 months old. He weighs 14kg. His birthweight was 3,3 kg.

The weight for age is ……

Use the boy's and girl's **length/ height** for age growth charts and plot the following children's findings in pencil. Interpret each growth curve.

1. Marlene is 10 months old. Her length is 75cm. At birth her length was 55 cm.

She is ……..

2. Shane is 16 months old. His length is 83cm. At birth his length was 55 cm. At 1 year his length was 78 cm.

He is ……

3. Florence is 3 years and 5 months old. Her height is 87cm. At birth her length was 45 cm.

She is ……..

4. Mbali is 2 years and 8 months old. Her height is 85 cm. At birth her length was 48cm.

She is ……..

5. Nkosinathi has just turned 4 years old. His height is 89cm. At birth his length was 50 cm.

He is ……..

6. Audrey is 3 years and 1 month old. Her height is 104cm. At birth her length was 55cm.

She is ……..

7. Amos is 20 months old. His length is 82cm. At birth his length was 44 cm.

He is …….

8. Sipho is 2 years and 3 months old. His height is 78cm. at birth his length was 49cm.

He is …….

9. Mancane is 4 years and 7 months old. His height is 98cm. At birth his length was 42cm.

He is …….

10. Cindy is 1 month old. Her length is 45 cm. At birth her length was 45cm.

She is …….

Use the boy's and girl's **weight for length/ height** growth charts and plot the following children's findings in pencil. Interpret each growth curve.

1. Susan was 47 cm tall at birth and weighed 3.5 kg. When you saw her again she was 60 cm tall and weighed 7 kg.
2. At the first visit Mbongiseni was 50 cm long and weighed 3 kg, at the second visit he was 55 cm long and weighed 4 kg. at the third visit he was 60 cm long and weighed 5 kg, at the fourth visit he was 62 cm long and weighed 5.2 kg, at the fifth visit he was 62 cm long and weighed 5.3 kg, at the sixth visit he was 62 cm long and weighed 5.4 kg.
3. Thabiso weighed 10 kg and was 65 cm long the first time she was measured. At the next visit she weighed 11 kg and was 70 cm long. At her last visit she weighed 12 kg and was 72 cm long.
4. Thembeka weighed 4 kg and was 50cm long at his first visit. At the second visit he weighed7 kg and was 60 cm long. At the third visit he weighed 15 kg and was 95 cm long.
5. Linah weighed 4 kg and was 50 cm long at birth. At her next visit she weighed 8 kg and was 60 cm long. The visit after that she weighed 18 kg and was 95 cm tall.

6. Referral Notes:

It is important that after you have taken the measurements, you as a CHW need to decide if mom and/or baby needs to be referred. Referral notes will be given to you. Each referral booklet contains triplicates of each page in the same way as an invoice book. If a danger sign is found, fill in the name of the person being referred and describes the problem. Tear off one and give it to the family to present at the health facility. The second copy is kept in the folder and the third remains in the referral book.

Addendum C Drivers of stunting questionnaire (ENG)

QUESTIONNAIRE

PARTICIPANT NO:

House no:

Street:

Area:

Completed by – Fieldworkers' names:

Title of research project: A stunting profile of children younger than five years in selected vulnerable communities in Worcester, Breede Valley, Western Cape

Date

d	d	m	m	y	y	y	y

Section 1: Household Socio-Demographic Information

INSTRUCTIONS:

This questionnaire needs to be completed by a trained field worker, after obtaining written consent from the mother of an infant/child eligible for inclusion in the study. All answers must be filled in.

Obtain this information from the mother.

A. MOTHER'S INFORMATION						RESPONSE	
A1. What is your birth date? (this information can be verified from records in the child's Road-to-Health booklet or the mother's identify document)						__ / __ / ____ dd/mm/yyyy	
A2. What is your marital status?							
Unmarried	Married: legal	Married: traditional	Separated	Widowed	Living together	Divorced	Other: Specify

A3.1 What is the highest grade that you have passed at school? A3.2 What is your highest qualification obtained?	Grade _____ _____ Certificate _____ Diploma _____ Degree _____ Postgraduate _____TVET college (technical and vocational education and training)
A4.1 Are you currently employed? A4.2 If "no" – are you looking for employment or are you unemployed by choice (e.g. home maker)? A4.3 If yes, please indicate the nature of employment with regards to the term of employment.	_____ Yes _____ No _____ Unemployed _____ Unemployed by choice _____ Casual /seasonal _____ Contract _____ Permanent _____ Self employed
A5. What is the main source of income for your household? If other, please provide further details	_____ Own salary _____ Child grant _____ Contribution by family members _____Other

A6. Who do you stay with? Tick all the appropriate responses. If other, please provide further details	_____ Husband _____ Boyfriend _____ Mother _____ Siblings _____ Other family members _____ Friend _____ Other
A7. Who looks after your youngest child during the day? If other, please provide further details	_____ Self _____ My mother _____ My grandmother _____ Mother-in-law _____ My sister _____ Baby's sibling _____ Baby's father _____ Crèche _____ Other

Section 2: Water and Sanitation

A8.1 What is the <u>main</u> source of drinking water for this household?	____Piped water (in the house) ____Communal water ____Dam/River/Spring ____Rain water ____Other ____Don't know

A8.2 What is the <u>main</u> form of sanitation for this household?	____Flush toilet ____Pit latrine (long drop) ____Ventilated pit latrine ____Portable toilets ____No facilities ____Other ____Don't know

Section 3: Measurements of the Mother

Do the following measurements directly:

MEASUREMENT TYPE	**MEASUREMENT 1**	**MEASUREMENT 2**
Weight in KG	A9.1	A9.2
Height/ length in CM	A9.3	A9.4
Waist circumference in CM	A9.5	A9.6
Mid -upper arm circumference in CM	A9.7	A9.8

A10 Are you on Family planning? A10.1 If yes, what family planning are you currently on?	_____Yes _____No _____Oral contraceptives _____Condoms _____Implant _____IUCD _____Sterilisation _____Injection

Section 4: Information on the child

B 1. **Do you have the RtHB for your baby?** If NO: *Refer to the Police station to get an affidavit to take to the clinic in order to get a new book*	**____Yes** **____No**

INFANT / CHILD's INFORMATION	RESPONSE
B2. What is your baby's birth date? (this information can be verified from the child's Road-to-Health booklet)	__ / __ / ____ dd/mm/yyyy
B3. What was your baby's birth weight? (this information can be checked in the child's Road-to-Health booklet)	_____ Kg _____Don't know
B4.1 Where was the baby born? B4.2 If the baby was born at a health facility (hospital or clinic) – indicate the facility name: If the baby was born elsewhere, provide further details:	_____ Hospital _____ CHC _____ Clinic _____ At home _____ Other _____Don't know
B5. Is the baby a boy or a girl?	_____ Boy _____ Girl
B6.1 Is this the mothers first baby?	_____ Yes _____ No _____ Don't know

B6.2 If no, how many babies did you have before this one? B6.3 How many of these other babies/children are still alive?	_____ _____
B 7 Was your child treated for any of the following illnesses <u>three times</u> or more in the past 12 months?	____Diarrhoea ____Colds and Flu ____Painful swollen stomach ____Vomiting ____Other Specify: ____None
B8 Does the child have a birth certificate? *-Refer to the Department of Home Affairs if No*	____Yes ____No ____Don't know ____Not applicable
B9 Does the child receive a Child Support Grant? *-Refer to the Department of Social Development if No*	____Yes ____No ____Don't know ____ Not applicable

Do the following measurements for the child:

MEASUREMENT TYPE	MEASUREMENT1	MEASUREMENT 2
Weight in KG	B10.1	B10.2
Height/ length in CM	B10.3	B10.4
Mid upper arm circumference in CM	B10.5	B10.6
Head circumference in CM	B10.7	B10.8

Section 5: Infant and Young Child Health and Nutrition

C. HEALTH CARE and FIRST FEEDING INFORMATION	RESPONSE
C.1. Did you attend a health facility for antenatal care during your pregnancy? Specify facility's name:	_____ Yes _____ No
C.2.1 During antenatal care, has a health worker talked to you about breastfeeding? C.2.2 If "yes", was it individually or in a group session?	_____ Yes _____ No _____ Individually _____ Group session _____ Both _____ Other
C.3.1 What did the baby receive as the **first** feed after birth?	_____ Breastmilk _____ Formula _____ Fresh milk _____ Plain water _____ Sweetened water _____ Other

C.3.2 If the baby was put to the breast: How soon after birth was the baby put to the breast?	_____ Within an hour _____ More than an hour _____ Don't know
C.3.3 If you ticked other in C.3.1, provide further detail on what the baby was given to drink immediately after birth.	_____ Infant formula _____ Medication _____ Don't know
C.3.4 If the baby was fed anything other than breastmilk for the **first feed**, please put in plain words why?	_____ Infant's medical condition _____ Mother didn't have enough milk _____ Standard practice in the facility _____ Don't know

D. INFANT FEEDING	**RESPONSE**
D.1.1 What is your baby receiving to drink / eat today? Tick all the applicable answers. D.1.2 If other, please indicate full details below.	_____ Breastmilk _____ Formula _____ Water _____ Juice _____ Yoghurt _____ Soft porridge _____ Other (please give details)

D.2.1 If receiving breastmilk:	
D.2.1.1 How is this feed given to the baby?	_____ Suckling on the breast _____ Expressed milk in a cup _____ In a bottle _____ With a spoon _____ With a dropper _____ Other (please specify)
D.2.1.2 How often do you feed the baby breastmilk?	_____ Times during the day _____ Times during the night
D.3.1 If receiving formula or any drinks/food other than breastmilk:	
D.3.1.1 How old was the baby when this food/drink was first given to the baby?	_____ Weeks _____ Months _____ Don't know
D.3.1.2 How is this feed given to the baby?	_____ Bottle feeding _____ Cup feeding _____ With a spoon _____ With a dropper _____ Other (please specify)
.3 Do you always have the following when you prepare your baby's milk feed?	_____ Formula powder _____ Clean water _____ Fuel Specify fuel source:

	_____ Gas _____ Fire, wood, _____ Paraffin _____ Electricity _____ Other (please specify)
D.4.1 If you have breastfed the baby at any time and are no longer giving him/her breastmilk, give reason/s for this decision? D.4.2. If you no longer breast feed your baby, at what age did you stop giving your baby any breastmilk?	_____ Not enough milk _____ Advised to discontinue by family member _____ Advised to discontinue by a health worker _____ Baby doesn't want to take breastmilk _____ Painful _____ HIV status _____ Other (please specify) _____ Weeks _____ Months
D.5. Who played the major role in influencing your infant feeding choices and practices:	_____ Health workers _____ Self _____ Relative Specify: _____Grandmother _____Sister _____Aunt _____Mother-in-law _____Sister-in-law _____Other (please specify) _____ Friend

	_____ Media (tv/radio) _____ Other (please specify)
D6. Where do you go if you want to know more about feeding your infant? If other, please give further details.	_____ CHC / clinic _____ Hospital _____ Relative _____ Friends _____ Traditional Health Practitioner (sangoma) _____ Other (please specify)

CHECK ROAD TO HEALTH BOOKLET

D7. When was the last immunisation given? *If immunisations are not up to date -refer to the Primary Health Care Facility.*	_____Months _____Date given ____No Road to Health Booklet ____Not completed
D8. When was the Vitamin A schedule last updated? *If the Vitamin A supplementation is not up to date-Supplement Vit A and document in the RtHB.*	_____Months _____Date given ____No Road to Health Booklet ____Not completed
D9. If the child is older than 2 years: When was deworming last updated? *If deworming is not up to date -Give deworming tablet.*	_____months _____Date given ____No Road to Health Booklet ____Not completed

Section 6: Infant and Young Child Minimum Dietary Diversity

Mark with an √ if the child did receive the food types yesterday.

Mark with an X if the child did not receive foods types yesterday.

D10 Which of the following types of food did your baby receive yesterday?	**TICK**
Food groups:	
i) grains (maize, pap, cereal, bread, rice, samp)	
ii) beans, lentils or nuts	
iii) dairy products (milk, yogurt, cheese, amasi), excluding breastmilk	
iv) flesh foods (meat, fish, poultry and liver/organ meats)	
v) eggs	
vi) vitamin-A rich fruits and vegetables (e.g. sweet potato, carrots, pumpkin, spinach, broccoli, apricot, peach, mango)	
vii) other fruits and vegetables (list)	

REMEMBER REFERRALS FOR CHILD HEALTH!

AREA:	WHERE:	WHEN:	WHO:
Zwelethemba	Empilisweni Clinic	Fridays: 08H00-09H00	SR R Lourens
Roodewal Avian Park River View	Worcester CDC	Tuesday 08H00 – 16H00 Wednesdays 08H00 – 16H00	Sr Caesar

Addendum A: Drivers of stunting questionnaire (AFR)

VRAELYS

DEELNEMERNOMMER:

Huisnr.:

Straat:

Buurt:

Ingevul deur – veldwerkers se name:

Titel van navorsingsprojek: 'n Ingekortelengte-profiel van kinders onder die ouderdom van vyf jaar in geselekteerde kwesbare gemeenskappe in Worcester, Breedevallei, in die Wes-Kaap

Datum

d	d	m	m	j	j	j	j

Afdeling 1: Sosiodemografiese Inligting van die Huishouding

INSTRUKSIES:

'n Opgeleide veldwerker moet hierdie vraelys invul nadat die skriftelike toestemming eers verkry is van die ma van 'n baba of kind wat voldoen aan die vereistes om aan die projek deel te neem. Alle antwoorde moet ingevul word.

Jy moet die volgende inligting by die ma bekom.

A. INLIGTING OOR DIE MA						**ANTWOORD**	
A1. Wat is u geboortedatum? (Gaan hierdie inligting na in die aantekeninge op die kind se *Road to Health*-boekie – *RtHB* – of in die ma se identiteitsdokument.)						__ / __ / ____ dd/mm/jjjj	
A2. Wat is u huwelikstatus?							
Ongetroud	Getroud: wetlik	Getroud: tradisio-nele sere-monie	Uitmekaar	Eggenoot oorlede	Woon saam	Geskei	Ander (beskryf)

A3.1 Wat is die hoogste graad wat u op skool geslaag het?	Graad _____
A3.2 Wat is die hoogste kwalifikasie wat u behaal het?	Sertifikaat Diploma Graad Nagraads TVET-kollege (tegniese en beroepsonderrig en -opleiding)
A4.1 Het u tans ’n werk?	_____ Ja _____ Nee
A4.2 Indien “nee”: Soek u werk of is u uit eie keuse werkloos (bv. om die huishouding te versorg)?	Kry nie werk nie Werkloos uit eie keuse
A4.3 Indien “ja”: Watter soort werk doen u, volgens u diensvoorwaardes?	Los werk, seisoenswerk Kontrakwerk Permanente pos In eie diens
A5. Wat is u huishouding se hoofbron van inkomste? Indien “ander”, beskryf dit asseblief.	Eie salaris Onderhoudstoelaag vir kind Bydraes deur familielede Ander
A6. By wie woon u? Merk alle opsies wat van toepassing is. Indien “ander”, beskryf asseblief die omstandighede.	Man Vaste ou Ma Broers en susters Ander familielede Vriend Ander

A7. Wie kyk bedags na u jongste kind? Indien “ander”, beskryf asseblief die omstandighede.	Self My ma My ouma My skoonma My suster Die baba se broer of suster Die baba se pa Dagsorg-sentrum Ander

Afdeling 2: Water en Sanitasiedienste

A8.1 Wat is u huishouding se **hoofbron** van drinkwater?	Waterpypleiding (in die huis) Gemeenskaplike waterbron Dam/rivier/fontein Reënwater Ander Weet nie
A8.2 Wat is die huishouding se **hoofvorm** van sanitasiedienste?	____ Spoeltoilet ____ Puttoilet (“*long drop*”) ____ Geventileerde puttoilet ____ Draagbare toilette ____ Geen fasiliteite nie ____ Ander ____ Weet nie

Afdeling 3: Ma se Liggaamsmate

Neem die volgende mate tydens die onderhoud:

LIGGAAMSDEEL	METING 1	METING 2
Gewig in KG	A9.1	A9.2
Lengte in CM	A9.3	A9.4
Omtrek van middellyf in CM	A9.5	A9.6
Omtrek van die middelste deel van die boarm in CM	A9.7	A9.8

A10. Gebruik u voorbehoedmiddels?	_____ Ja _____ Nee
A10.1 Indien “ja”: Watter soort voorbehoeding?	_____ Pille _____ Kondome _____ Inplanting _____ IUA/IUD (intra-uteriene apparaat) _____ Sterilisasie _____ Inspuiting

Afdeling 4: Inligting Oor die Kind

B1. Het u u baba se *RtHB*? Indien "nee": *Verwys die ma na die polisiestasie om 'n beëdigde verklaring te kry, wat sy vir die kliniek moet neem om 'n nuwe boekie te kry.*	_____ **Ja** _____ **Nee**

INLIGTING OOR DIE BABA/KIND	**ANTWOORD**
B2. Wat is die baba se geboortedatum? (Gaan hierdie inligting in die kind se *RtHB* na.)	__ / __ / ____ dd/mm/jjjj
B3. Wat het u kind by geboorte geweeg? (Gaan hierdie inligting in die kind se *RtHB* na.)	_____ kg _____ Weet nie
B4.1 Waar is die baba gebore? B4.2 As die baba by 'n gesondheidsorgfasiliteit (hospitaal of kliniek) gebore is, wat was die fasiliteit se naam? As die baba op 'n ander plek gebore is, beskryf asseblief die omstandighede:	_ Hospitaal _ GGS (gemeenskap-gesondheidsentrum) _ Kliniek _ By die huis _____ Ander _____ Weet nie
B5. Is die baba 'n seun of 'n dogter?	_____ Seun _____ Dogter
B6.1 Is dit die ma se eerste baba?	_____ Ja _____ Nee _____ Weet nie

B6.2 Indien “nee”: Hoeveel babas het u voor hierdie een gehad? B6.3 Hoeveel van daardie ander babas/kinders leef steeds?	_____ _____
B7. Is u kind in die afgelope 12 maande <u>drie keer</u> of meer vir enige van die volgende siektes behandel?	Diarree Verkoue of griep Pynlike, opgeswelde maag Braking Ander (beskryf): ____ Geen

B8. Het die kind ’n geboortesertifikaat? *Indien “nee”, verwys die ma na die Departement Binnelandse Sake.*	____ Ja ____ Nee ____ Weet nie ____ Nie van toepassing
B9. Kry die kind ’n onderhoudstoelaag? *Indien “nee”, verwys die ma na die Departement Sosiale Ontwikkeling.*	____ Ja ____ Nee ____ Weet nie ____ Nie van toepassing

Neem die volgende liggaamsmate van die kind:

LIGGAAMSDEEL	METING 1	METING 2
Gewig in KG	B10.1	B10.2
Lengte in CM	B10.3	B10.4
Omtrek van die middelboarm in CM	B10.5	B10.6
Kop-omtrek in CM	B10.7	B10.8

Afdeling 5: Gesondheid en Voeding van die Baba/Jong Kind

C. GESONDHEIDSORG en INLIGTING OOR EERSTE VOEDING	ANTWOORD
C1. Het u terwyl u swanger was ’n gesondheidsorgfasiliteit besoek om voorgeboortesorg te kry? Indien “ja”: Wat is die fasiliteit se naam?	____ Ja ____ Nee

C2.1 Toe u voorgeboortesorg gekry het, het die gesondheidsorgwerker met u oor borsvoeding gepraat?	____ Ja ____ Nee
C2.2 Indien “ja”: Was u alleen of was dit ’n groepspraatjie?	____ Alleen ____ Groepspraatjie ____ Alleen én groep ____ Ander

C3.1 Wat was die **heel eerste** voeding wat u baba na geboorte gekry het?	____ Borsmelk ____ Formulemelk ____ Vars melk ____ Gewone water ____ Versoete water ____ Ander
C3.2 As u die baba geborsvoed het: Hoe lank nadat die baba gebore is, het u hom/haar begin borsvoed?	____ Binne ’n uur Meer as ’n uur later Weet nie
C3.3 As u by C3.1 “ander” gekies het, verskaf meer inligting oor wat die baba onmiddellik na geboorte gekry het om te drink.	____ Formulemelk ____ Medisyne ____ Weet nie
C.3.4 Indien die baba vir die **eerste voeding** iets anders as borsmelk gegee is, gee asseblief die redes kortweg.	Baba se mediese toestand Ma het te min melk gehad Dis wat die fasiliteit altyd doen Weet nie

D. BABA SE VOEDING	**ANTWOORD**
D1.1 Wat kry u baba vandag om te drink/eet? Merk al die antwoorde wat van toepassing is. D1.2 Indien “ander”: Beskryf dit asseblief in volle besonderhede hier onder.	_____ Borsmelk _____ Formulemelk _____ Water _____ Sap _____ Jogurt _____ Sagte pap _____ Ander (beskryf)

D2.1 As u die baba borsvoed:	
D.2.1.1 Hoe kry die baba die voeding in?	_____ Drink aan die bors _ Melk uitgedruk in ’n koppie _____ Met ’n bottel _____ Met ’n lepel _____ Met ’n drupper _____ Ander (beskryf asseblief)
D.2.1.2 Hoe dikwels gee u vir die baba borsmelk?	_____ keer gedurende die dag _____ keer gedurende die nag
D3.1 Indien die baba formulemelk of enige ander vloeistof/kos buiten borsmelk kry:	
D3.1.1 Op watter ouderdom het die baba hierdie kos/vloeistof die eerste keer gekry?	_____ weke _____ maande _____ Weet nie
D.3.1.2 Hoe word hierdie voeding vir die baba gegee?	_____ Met ‘n bottel _____ Met ’n koppie _____ Met ’n lepel _____ Met ’n drupper _____ Ander (beskryf asseblief)
.3 Het u altyd die volgende byderhand wanneer u u baba se melk voorberei?	_____ Formulemelkpoeier _____ Skoon water _____ Brandstof

	Watter soort brandstof gebruik u? ___ Gas ___ Vuur, hout ___ Paraffien ___ Elektrisiteit ___ Ander (beskryf asseblief)
D4.1 As u die baba vantevore geborsvoed het, maar dit nie meer doen nie, hoekom het u so besluit? D4.2. As u nie meer u baba borsvoed nie, hoe oud was die baba toe u daarmee opgehou het?	_ Te min melk _ 'n Familielid het my aangeraai om op te hou _ 'n Gesondheidsorgwerker het gedink ek moet ophou _ Die baba wil nie borsmelk drink nie _ Dis seer _ MIV-status _ Ander (beskryf asseblief) _____ weke _____ maande
D5. Wie het die grootste invloed gehad in u besluite oor wat u die baba gaan voer en hoe u dit gaan doen?	_____ Gesondheidsorgwerkers _____ Ek self _____ 'n Familielid Watter soort familielid? ____ Ouma ____ Suster ____ Tante ____ Skoonma ____ Skoonsuster Ander (beskryf asseblief)

	_ ‘n Vriend _ Openbare media (bv. TV en radio) _ Ander (beskryf asseblief)
D6. Waar gaan soek u inligting as u iets oor die voeding van u baba wil weet? Indien “ander”: Beskryf asseblief hier onder hoe u te werk gaan.	_____ GGS/kliniek _____ Hospitaal _____ ’n Familielid _____ Vriende _ Tradisionele gesondheidspraktisyn (sangoma) _____ Ander (beskryf asseblief)

GAAN DIE *ROAD TO HEALTH*-BOEKIE NA

D7. Wanneer is die laaste immunisering gedoen? *As alle immuniserings nie gedoen is nie, verwys die ma na die primêregesondheidsorg-fasiliteit.*	_____ maande _____ Datum gegee ____Geen *RtHB* nie ____ Nie ingevul nie

D8. Wanneer laas is die vitamien A aanvulling toegedien? *As al die vitamien A-aanvullings nie gedoen is nie, gee ’n VIT. A-aanvulling en teken in die* RtHB *aan.*	_____ maande _____ Datum toegedien ____ Geen *RtHB* nie ____ Nie ingevul nie
D9. As die kind ouer as 2 jaar is: Wanneer laas het die kind medikasie vir ontwurming gekry? *As ontwurming nie gereeld gedoen is nie, gee ’n ontwurmingstablet.*	_____ maande _____ Datum toegedien ____Geen *RtHB* nie ____ Nie ingevul nie

Afdeling 6: Minimum Dieetverskeidenheid vir Baba/Kind

As die kind die betrokke voedselgroep gister ingekry het, merk met 'n √.

As die kind die betrokke voedselgroep nié gister ingekry het nie, merk met 'n X.

D10. Watter van die volgende kossoorte het jou baba gister gekry?	MERK AF
Voedselgroepe:	
i) graan (mieliemeel, pap, ontbytgraankos, brood, rys, stampmielies)	
ii) boontjies, lensies of neute	
Iii) suiwelprodukte (melk, jogurt, kaas, amasi); moenie borsmelk byreken nie	
Iv) vleiskos (vleis, vis, pluimvee en lewer/orgaanvleis)	
v) eiers	
vi) vrugte en groente wat ryk aan vitamien A is (bv. soetpatat, wortels, pampoen, spinasie, broccoli, appelkose, perskes, veselperskes)	
vii) ander vrugte en groente (noem op)	

ONTHOU OM DIE MA TE VERWYS VIR HULP MET DIE KIND SE GESONDHEID!

BUURT:	WAAR:	WANNEER:	WIE:
Zwelethemba	Empilisweni-kliniek	Vrydae 08:00 – 09:00	Sr R Lourens
Roodewal Avian Park River View	Worcester-gemeenskapsdagkliniek	Dinsdae 08:00 – 16:00 Woensdae 08:00 – 16:00	Sr Caesar

FORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT:
A stunting profile of children under the age of five in selected vulnerable communities in Worcester, Western Cape.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: Miss A Lenhoff

PHYSICAL ADDRESS:
Francie van Zijl Drive
Parow, Tygerberg
Cape Town
Western Cape

CONTACT NUMBER: +27 21 938 9259

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

This project wants to collect information in Worcester communities about the growth of the children and the reasons that may cause poor growth, so that we can inform mothers and caregivers on ways to ensure better growth for their children. Households with children below the age of five in Zwelethemba, River View, Roodewal and Avian Park will be included in the research. We aim to get 1320 households to take part in our study.

If you agree to take part, we will ask you some questions about your family and we will also take measurements of you (the mother) and your children under five in the household.

Why have you been invited to participate?

Your household is invited to take part in the study because you have children below the age of five living in your home.

What will your responsibilities be?

You will be asked to answer a questionnaire regarding all children under the age of five living in the household. The questions will be about general information about your household, what foods you eat, your health and other information.

Will you benefit from taking part in this research?

You and your child/children may benefit from the research if the reasons for poor growth is found in the research and the ways to improve it, apply to you. Referrals will be made to the government departments, when:

- *Your child does not have a birth certificate.*
- *Your child does not receive a social grant.*
- *If your child show danger signs of illness during the visit.*
- *If your child has a disability detected by the community health workers. If you do not benefit from the research directly, the answers you give may help the researchers to help other households with children under five to grow better.*

Are there in risks involved in your taking part in this research?

There are no risks for you to take part in the research. However, you may find some of the questions sensitive and personal. If you feel uncomfortable, you don't have to answer. You do not have to answer any question you do not want to.

Who will have access to your records?

All the answers and measurements will be kept private and no one else will know it was your household that took part in the study. The identity of your household and your child will remain anonymous (unnamed and unidentified) throughout the research as well as when the results are available. Only the study investigators will see your information.

Will you be paid to take part in this study and are there any costs involved? *No, you will not be paid to take part in the study but there will be no costs involved for you, if you do take part. All households that take part will receive a reading booklet for the children to thank you for your time.*

What will happen with after the research is done?

This research is very important good research on nutritionalinformation because have benefits for theto spot malnutrition earlier andbetter the community by helping growth of the to children.

The results will be reported back to the communities during a "community imbizo". It will also be discussed on the local radio station so that households will be informed about the ways to improve the growth of their children.

Is there anything else that you should know or do?

➢ You can contact the Health Research Ethics Committee at 021-938 9207 or the primary investigator at 083 291 4905 if you have any concerns or complaints that have not been answered or talked through by the Community Health Workers.

➢ You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I ……..……. agree to take part in a research study entitled:
A stunting profile of children under the age of five in selected vulnerable communities in Worcester, Western Cape.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....…..…….. on (*date*) ……...…….. 2018.

Signature of participant **Signature of witness**

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....…….. on (*date*) ……...…….. 2018.

Signature of investigator **Signature of witness**

Declaration by interpreter

I *(name)* ……..…… declare that:

- I assisted the investigator (*name*) …… to

explain the information in this document to (*name of participant*)

……..…….. using the language medium of

Afrikaans/Xhosa.

- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) .....…….. on (*date*) ……...…….2018.

Signature of interpreter **Signature of witness**

INLIGTINGSBLAD EN TOESTEMMINGSVORM VIR DEELNEMERS

TITEL VAN DIE NAVORSINGSPROJEK:
'n Ingekortelengtegroei-profiel van kinders onder die ouderdom van vyf jaar in geselekteerde kwesbare gemeenskappe in Worcester in die Wes-Kaap.

VERWYSINGSNOMMER: #S18/05/100

HOOFNAVORSER: Mej A Lenhoff

STRAATADRES:
Francie van Zyl-rylaan
Parow, Tygerberg
Kaapstad
Wes-Kaap

KONTAKNOMMER: 083 291 4905

Ons wil u uitnooi om aan 'n navorsingsprojek deel te neem. Lees asseblief rustig deur die inligting op hierdie bladjie, want dit verduidelik mooi hoe die projek werk. Vra asseblief die navorsingspersoneel as daar enigiets oor die projek is wat u nie heeltemal verstaan nie. Dit is baie belangrik dat u geheel en al tevrede voel dat u presies weet waaroor hierdie navorsing gaan en wat dit beteken om daaraan deel te neem. Onthou ook, u deelname is **heeltemal vrywillig**. U mag dus weier om deel te neem. As u besluit om nié deel te neem nie, sal dit hoegenaamd geen slegte gevolge vir u inhou nie. U kan ook op enige tydstip aan die projek onttrek, selfs al het u aan die begin ingestem om deel te neem.

Die **Gesondheidsnavorsingsetiekkomitee van die Universiteit Stellenbosch (GNEK)** het hierdie projek goedgekeur, en die navorsers sal hulle werk doen volgens die etiese riglyne en beginsels van die internasionale Helsinki-verklaring, die Suid-Afrikaanse riglyne vir goeie kliniese praktyk, en die Mediese Navorsingsraad (MNR) se etiese riglyne vir navorsing.

Waaroor gaan hierdie navorsingsprojek?

Die doel met hierdie navorsingsprojek is om inligting onder gemeenskappe in die Worcester-omgewing in te samel oor kinders se groei, en wat die redes vir swak groei kan wees. Dit sal ons help om ma's en versorgers in te lig oor maniere om te verseker dat hulle kinders gesonder groei. Die navorsing gaan gedoen word by huishoudings met kinders onder vyf jaar in Zwelethemba, River View, Roodewal en Avian Park. Ons mikpunt is om 1 320 huishoudings te kry wat aan die projek sal deelneem.

As u instem om deel te neem, gaan ons u 'n paar vrae oor u gesin vra. Ons moet ook die liggaamsmate neem van u, wat die ma is, en van die kinders in die huis wat jonger as vyf jaar is.

Hoekom nooi ons juis vir u om deel te neem?

U huishouding word uitgenooi om aan hierdie navorsingsprojek deel te neem omdat daar kinders wat jonger as vyf jaar is, hier woon.

Wat gaan ons van u verwag?

Ons gaan u vra om 'n lys vrae te beantwoord oor alle kinders onder vyf jaar wat by u woon. Die vrae sal handel oor algemene inligting oor u huishouding, watter soort kos u eet, u gesondheid, en sulke soort inligting.

Watter voordeel is daar vir u as u aan hierdie projek deelneem?

As die navorsingsprojek uitvind wat swak groei veroorsaak en hoe dit verbeter kan word, kan u en u kind(ers) daaruit voordeel trek as dit op u van toepassing is.

In geval van die volgende sal ons u verwys na die regeringsdepartement wat u kan help:

- U kind het nie 'n geboortesertifikaat nie.
- U kind ontvang nie 'n maatskaplike toelaag nie.
- U kind toon gevaartekens van 'n siekte wanneer ons u kom besoek.
- 'n Gemeenskapsgesondheidswerker kom agter dat u kind 'n gestremdheid het.

Selfs al trek u nie regstreeks voordeel daaruit as u aan die projek deelneem nie, kan u antwoorde ons wys hoe ons ander huishoudings met kinders jonger as vyf jaar kan help om gesonder te groei.

Watter risiko's is daar vir u as u aan hierdie projek deelneem?

Dit hou geen risiko's vir u in as u aan die projek deelneem nie. U mag dalk voel dat party van die vrae sensitief en persoonlik is. As u ongemaklik voel, hoef u nie te antwoord nie. U is nie verplig om enige vraag te beantwoord wat u nie wil nie.

Wie sal kan sien watter inligting ons oor u het?

Alle antwoorde en mates wat aangeteken word, sal vertroulik hanteer word, en niemand anders sal weet dis u huishouding wat aan die navorsingsprojek deelgeneem het nie. Niemand sal u huishouding of u kind kan uitken terwyl die projek aan die gang is nie (ons noem nie name nie en verklap niks waaraan u uitgeken kan word nie), en ook nie wanneer ons die uitslae bekendmaak nie. Slegs die projeknavorsers sal toegang hê tot u inligting.

Sal u betaal word om aan hierdie studie deel te neem, of sal dit u enigiets kos?

Ons betaal u niks om aan hierdie projek deel te neem nie, en dit sal u ook niks kos om deel te neem nie. Ons gee 'n leesboekie vir die kinders van alle huishoudings wat deelneem, net om dankie te sê vir u tyd.

Wat gebeur nadat die projek afgehandel is?

Hierdie navorsingsprojek is baie belangrik, want goeie navorsing oor voedingsinligting bevoordeel die hele gemeenskap. Dit help ons om wanvoeding vroeër raak te sien en kinders te help om gesonder te groei.
Ons sal 'n "gemeenskap-imbizo" hou om die gemeenskappe oor die uitslae in te lig. Dit sal ook op die plaaslike radiostasies bespreek word, sodat huishoudings ingelig kan wees oor die maniere waarop hulle hulle kinders gesonder kan laat groei.

Is daar enigiets anders wat u moet weet of doen?

- As u ontevrede voel oor die manier waarop 'n gemeenskapsgesondheidswerker u probleme of klagtes hanteer het, kan u die Gesondheidsnavorsingsetiekkomitee by 021 938 9207 bel of die hoofnavorser by 083 291 4905.
- Ons sal u 'n afskrif van hierdie inligtingsblad en toestemmingsvorm gee wat u by u kan hou.

Verklaring deur deelnemer

Deur hier onder te teken, stem ek, (*naam*) ..……..……., in

om deel te neem aan 'n navorsingsprojek met die titel:

'n Ingekortelengtegroei-profiel van kinders onder die ouderdom van vyf jaar in geselekteerde kwesbare gemeenskappe in Worcester in die Wes-Kaap.

Ek verklaar soos volg:

- Ek het hierdie inligtingsblad en toestemmingsvorm gelees, of dit is aan my voorgelees, en dit is geskryf in 'n taal waarmee ek gemaklik is en wat ek goed praat.
- Ek het geleentheid gehad om vrae te stel, en al my vrae is goed genoeg beantwoord.
- Ek verstaan dat ek vrywillig aan hierdie studie deelneem, en niemand het my gedwing om deel te neem nie.
- Ek besef ek kan op enige tydstip besluit om nie verder deel te neem nie, sonder dat ek enigsins gestraf of benadeel sal word.
- Die navorsingspan kan my vra om my aan die projek te onttrek voordat dit afgehandel is as die projeknavorser dink dit is in my beste belang, of as ek nie hou by die projekreëls waarop ons ooreengekom het nie.

Geteken te (*plek*) .....…..……..….. op (*datum*) ……...…….. 2018.

_____ _____

Deelnemer se handtekening **Getuie se handtekening**

Verklaring deur navorser

Ek, (*naam*) ……..……, verklaar soos volg:

- Ek het die inligting in hierdie dokument aan (*deelnemer*)

.....……..... verduidelik.

- Ek het die deelnemer aangemoedig om vrae te stel en het genoeg tyd daaraan afgestaan om dit te beantwoord.
- Ek is tevrede dat die deelnemer alle aspekte van hierdie evaluering, soos dit hier bo uiteengesit is, ten volle begryp.
- Ek het (nie) 'n tolk gebruik (nie). *(Indien 'n tolk gebruik is, moet die tolk die verklaring hier onder teken.)*

Geteken te (*plek*) .....…….....…….. op (*datum*) ……...…….. 2018.

_____ _____

Navorser se handtekening **Getuie se handtekening**

Verklaring deur tolk

Ek, (*naam*) ……..……, verklaar soos volg:

- Ek het die navorser, (naam) ...……., bygestaan om die inligting in hierdie dokument in Engels of Xhosa aan (deelnemer)

……..…….. te verduidelik.

- Ons het die deelnemer aangemoedig om vrae te stel en het genoeg tyd daaraan afgestaan om al die vrae te beantwoord.
- Ek het 'n feitelik korrekte weergawe oorgedra van wat aan my vertel is.
- Ek is tevrede dat die deelnemer die inhoud van hierdie ingeligtetoestemmingsvorm ten volle begryp, en dat al sy of haar vrae bevredigend beantwoord is.

Geteken te (*plek*) .....…….....…….. op (*datum*) ……...…….. 2018.

_____ _____

Tolk se handtekening **Getuie se handtekening**

IPHETSHNCWADANA ENENKCAZELO YOMTHATHINXAXHEBA NEFOMU YEMVUME

ISIHLOKO SEPROJEKTI YOPHANDO:
Imbali yobomi bokunzatha kwabantwana abangaphantsi kweminyaka emihlanu ubudala kwiindawo ezikhethiweyo ezingakhuselekanga eVostile, eNtshona Kapa.

INOMBOLO YESALATHISI: #S18/05/100

UMPHANDI OYINTLOKO: Nkszn A Lenhoff

IDILESI YENDAWO YOKUHLALA:
Francie van Zijl Drive
Parow, Tygerberg
Cape Town
Western Cape

IINOMBOLO ZOQHAGAMSHELWANO: 083 291 4905

Uyamenywa ukuba uthathe inxaxheba kwiprojekti yophando. Nceda uthathe ixesha ukuze ufunde ulwazi olulapha, oluya kucacisa iinkcukacha zale projekthi. Nceda ubuze abasebenzi bophononongo nayiphi na imibuzo nangayiphi na inxalenye yale projekthi ongayiqondi kakuhle. Kubaluleke kakhulu ukwaneliseka ngokupheleleyo ukuqonda ngokucacileyo oko kuqukwa lolu phando nendlela onokubandakanyeka ngayo. Kwakhona, ukuthatha kwakho inxaxheba kolu phando **kokokuzithandela ngokupheleleyo** yaye ukhululekile ukuba wale ukuthatha inxaxheba. Ukuba uyala oku akusayi kukuchaphazela ngendlela embi nangayiphi na indlela. Kanti ukhululekile ukurhoxa kuphononongo nanini na, kwanokuba ubuvumile ukuthatha inxaxheba.

Olu phononongo lugunyaziswe yiKomiti engokuziPhatha kuPhando lwezeMpilo ye**Yunivesithi yaseStellenbosch** yaye luza kwenziwa ngokuvumelana nemiqathango engqongqo nemigaqo yesiBhengezo seHlabathi saseHelsinki, iziKhokelo zokuQhuba uNyango ngokuFanelekileyo zaseMzantsi Afrika neziKhokelo ezingokuziPhatha kuPhando zeBhunga loPhando kuNyango (MRC). .

Luphathelele ntoni olu phononongo lophando?

Le projekthi yophando yenzelwe ukuqokelela ulwazi kubahlali baseVostile ngokukhula kwabantwana nezizathu ezinokubangela ukungakhuli kakuhle, ukuze sichazele oomama nabanyamekeli ngeendlela abanokuqinisekisa ngazo ukuba bakhula kakuhle abantwana babo. Amakhaya anabantwana abangaphantsi kweminyaka emihlanu eZwelethemba, eRiver View, eRoodewal nase-Avian Park baya kuqukwa kolu phando. Sizimisele ukufumana amakhaya ali-1320 aza kuthatha inxaxheba kuphononongo lwethu.

Ukuba uyavuma ukuthatha inxaxheba, siya kukubuza imibuzo ethile ngentsapho yakho kanti siya kuthatha nemilinganiselo yakho (umama) nomntwana ongaphantsi kweminyaka emihlanu ekhayeni.

Kutheni umenyiwe ukuba uthathe inxaxheba?

Ikhaya lakho liceliwe ukuba lithathe inxaxheba kuphononongo lophando ngenxa yokuba unabantwana abangaphantsi kweminyaka emihlanu abahlala ekhayeni lakho.

Ziya kuba yintoni iimbopheleleko zakho?

Uya kucelwa ukuba uphendule uxwebhu lwemibuzo ngokuphathelele kubo bonke abantwana abangaphantsi kweminyaka emihlanu ubudala abahlala ekhayeni lakho. Imibuzo iya kuba malunga nenkcazelo eqhelekileyo ngekhaya lakho, ukutya okutyayo, impilo yakho nenye inkcazelo.

Ngaba uya kuzuza ngokuthatha inxaxheba kolu phando?

Wena nomntwana/abantwana bakho ninokuzuza kuphononongo lophando ukuba izizathu zokungakhuli kakuhle ziye zafunyaniswa kuphononongo lophando yaye neendlela zokukuphucula ziyasebenza kuni.
Niya kuthunyelwa kumasebe karhulumente, xa:
•Umntwana wakho engenaso isatifikethi sokuzalwa.
•Umntwana wakho engasifumani isibonelelo sikarhulumente.
•Ukuba umntwana wakho ubonakalisa iimpawu ezoyikisayo zokugula ebudeni botyelelo.
•Ukuba umntwana wakho unokukhubazeka okufunyaniswe ngoonompilo basekuhlaleni.
Ukuba akuzuzi ngokuthe ngqo kuphononongo lophando, iimpendulo ozinikelayo zinokunceda abaphandi ukuba bancede amanye amakhaya anabantwana abangaphantsi kweminyaka emihlanu ukuba bakhule bhetele.

Ngaba kukho nayiphi na imingcipheko ebandakanyekayo kolu phando?

Ayikho imingcipheko kuwe yokuthatha inxaxheba kuphononongo lophando. Noko ke, unokufumanisa ukuba eminye imibuzo ibuthathaka yaye ibuza ngawe buqu. Ukuba uziva ungakhululekanga, akuyomfuneko ukuba uyiphendule. Ungangawuphenduli nawuphi na umbuzo ongafuni kuwuphendula.

Ngubani oya kufikelela iingxelo zakho?

Zonke iimpendulo nemilinganiselo iya kugcinwa iyimfihlo yaye akakho omnye umntu oya kwazi ukuba likhaya lakho ebelithatha inxaxheba kuphononongo lophando. Ikhaya lakho nabantwana bakho baya kuhlala bengaziwa (anizi kubizwa ngagama okanye nichazwe) kulo lonke uphononongo lophando kwanaxa iziphumo sele zikho. Ngabaphandi bophononongo kuphela abaya kubona inkcazelo yakho.

Ngaba uza kuhlawulwa ngokuthatha inxaxheba kolu phononongo yaye ngaba zikho iindleko ezibandakanyekayo?
Hayi, akusayi kuhlawulwa ngokuthatha inxaxheba kuphononongo kodwa akusayi kubakho ziindleko kuwe, ukuba uye wathatha inxaxheba. Onke amakhaya athatha inxaxheba aya kufumana incwadana yokufunda yabantwana ngelokukubulela ngexesha lakho.

Kuya kwenzeka ntoni kwinkcazelo emva kokuphela kophando?
Olu phononongo lophando lubaluleke kakhulu ngenxa yokuba uphando olululo ngenkcazelo yezondlo inceda abahlali ngokuthi kufunyaniswe ukungondleki kuselithuba kuze kuphuculwe ukukhula kwabantwana.
Iziphumo ziya kuchazelwa abahlali ebudeni 'bembizo yabahlali'. Kanti ziya kushukuxwa kwisitishi sikanomathotholo sasekuhlaleni ukuze kwaziswe amakhaya ngeendlela zokuphucula ukukhula kwabantwana bawo.

Ngaba ikho enye into ofanele uyazi okanye uyenze?

➢ Ungaqhagamshelana ne yiKomiti engokuziPhatha kuPhando lwezeMpilo ye**Yunivesithi yaseStellenbosch** kule nombolo 021-938 9207 okanye umphandi oyintloko kule nombolo 083 291 4905 ukuba unazo naziphi na izinto ezikuxhalabisayo okanye izikhalazo ezingakhange ziphendulwe okanye kuthethwe ngazo ngoonoMpilo basekuHlaleni.

➢ Uya kufumana ikopi yale nkcazelo nefomu yemvume ukuze uzigcinele.

Isibhengezo somthathi-nxaxheba

Ngokusayina ngezantsi, mna ……..……. ndiyavuma ukuthatha inxaxheba kolu phononongo lophando lunalo mxholo:
I mbali yobomiyokunzatha kwabantwana abangaphantsi kweminyaka emihlanu ubudala kwiindawo ezikhethiweyo ezingakhuselekanga eVostile, eNtshona Kapa.

Ndivakalisa ukuba:

- Ndiye ndayifunda okanye ndayifundelwa le nkcazelo nefomu yemvume yaye ibhalwe ngolwimi endiluthetha kakuhle nendiluva kakuhle.
- Ndiye ndaba nethuba lokubuza imibuzo yaye yonke imibuzo yam iphendulwe kakuhle.
- Ndiyaqonda ukuba ukuthatha inxaxheba kolu phononongo **kokokuzithandela** yaye andikhange ndinyanzelwe ukuba ndithathe inxaxheba.
- Ndingakhetha ukulushiya uphononongo nanini na yaye andisayi kudliwa mali okanye ndicalulwe nangayiphi na indlela.
- Ndisenokucelwa ukuba ndilushiye uphononongo ngaphambi kokuba luphele, ukuba ugqirha wophononongo okanye umphandi uvakalelwa kukuba kokona kuya kuba kuhle kum okanye ukuba andisilandeli isicwangciso sophononongo, njengoko bekuvunyelwene.

Isayinwe e (*indawo*) .....……..…….. ngo (*umhla*) ……..…….. 2018.

.....…….....…..... .....

Usayino lomthathi-nxaxheba **Usayino lwengqina**

Isibhengezo somphandi

Mna *(igama)* ……..…… ndivakalisa ukuba:

- Ndiye ndayicacisa le nkcazelo ikolu xwebhu ku ……..
- Ndiye ndamkhuthaza ukuba abuze imibuzo, ndaza ndathatha ixesha elaneleyo ukuyiphendula.
- Ndanelisekile ukuba uziqonda kakuhle zonke iinkalo zolu phando, njengoko kuchazwe ngasentla
- Bendinetoliki/bendingenatoliki. (*Ukuba kusetyenziswe itoliki, loo toliki imele isayine isindululo esingezantsi.)*

Isayinwe e (*indawo*) .....…….. ngo (*umhla*) ……...…….. 2018.

....

Usayino lomphandi **Usayino lwengqina**

Isibhengezo esenziwa yitoliki

Mna *(igama)* ……..…… ndivakalisa ukuba:

- *Ndiye ndancedisa umphandi (*igama) …….

  ukucacisa inkcazelo ekolu xwebhu ku (*igama lomthathi-nxaxheba*)

  ……..…….. Ndisebenzisa ulwimi lwesi-

Afrikaans/Xhosa.

- Siye samkhuthaza ukuba abuze imibuzo, ndaza ndathatha ixesha elaneleyo ukuyiphendula.
- Ndiye ndadlulisela izibakala ezichanileyo zoko bendikuxelelwe.
- Ndanelisekile ukuba umthathi-nxaxheba ukuqonda ngokupheleleyo, okuqulethwe lolu xwebhu lwemvume esekelwe kulwazi yaye yonke imibuzo yakhe iye yaphendulwa ngendlela eyanelisayo.

Isayinwe e (*indawo*).....…….. ngo (*umhla*) ……...……2018.

....

Usayino lwetoliki **Usayino lwengqina**

Standard Operating Procedures SOP:

Anthropometric Measurements

1. Abbreviations

SOP: Standard Operating Procedures

MUAC: Mid-Upper Arm Circumference

CHW: Community Health Worker

2. Introduction

Scope: This document describes the exact procedures that are to be followed during the taking of anthropometric measurements namely weight, height, length and mid upper arm circumference (MUAC).

Background: The aim of this SOP document is to standardize the manner in which CHWs execute the specific anthropometric measurements previously named. Standardization is essential to ensure the reliability and validity of the data collected.

Applicability: All CHWs involved should follow all processes described in this document, in the execution of all anthropometric measurements. The measurements will be used to determine the prevalence of stunting and to describe the anthropometric profile of children below the age of five.

Responsibility: Tasks will be delegated to trained Community Health Workers, as it is not possible for the principle investigators to execute all measurements. It is the responsibility of the principle investigators to ensure that the SOP's are followed exactly. It is, however, the responsibility of all CHWs involved in the study to report any deviations from the SOP to the principle investigators. Any deviation from the SOP must be documented correctly, as it is a violation of the protocol.

3. Delegation of tasks

The CHWs that the tasks are delegated to should be adequately trained and qualified to take the needed anthropometric measurements. The qualifications (and training) of the specific CHWs should be included in the study file.

4. General guidelines:

Documentation: All anthropometric measurements should be documented on the appropriate case report forms. It would be the responsibility of the principle investigators to ensure that all the data collected is documented. An appropriate unit of measure should accompany all measured values.

Initial Steps: The following initial steps need to be performed prior to the execution of any measurements.

1. The principal researchers must ensure that all equipment required to perform the measurements are available and accessible.
2. All scales must be properly calibrated and fully functioning.
3. CHWs must introduce themselves to the participants and state the measurements they want to take.
4. Parents or caregivers must then be asked for consent before any assessments are done on the child.
5. CHWs must respect the mother/caregiver and child privacy. Measurements should be completed in a private room, if possible.
6. CHWs must ensure their hands are clean before taking the measurements.
7. Equipment must be wiped clean after every measurement has been done.
8. The equipment must also be handled with care and returned after use in the same condition.
9. All CHWs must follow the SOP and repeat measurements three times.

5. Measurements for the child

Weight: Children younger than 2 years of age (Omitted light clothing)

1. Ensure the scale is positioned on a flat, hard surface and turn on the scale.
2. Weigh the mother: Please ask mother to step onto the scale, stand up straight and not move.
3. When the scale stabilises, record the measurement to the nearest 0.1kg
4. Document the mother's weight measurement on the appropriate form.
5. Remove the baby shoes and clothes. Ensure baby has a dry nappy.
6. Weigh the mother again while holding her baby.
7. Document the mother and baby combined weight on the appropriate form.
8. Ask the mother to step off the scale and put clothing back on.

Weight: Children older than 2 years of age (Omitted light clothing)

1. Ensure the scale is positioned on a flat, hard surface and turn on the scale.
2. When the scale stabilises (0.0 appears), the scale is ready to be used.
3. Ask the child to step onto the middle of the scale, feet slightly apart, stand up straight and as still as possible.
4. When the scale stabilises, record the measurement to the nearest 0.1kg.
5. Document the measurement on the appropriate form.
6. Ask the child to step of the scale and put shoes and clothing back on.
7. If the child is restless or unable to stand, ask the mother to assist and weigh the mother and child as for children below the age of two. (method in previous section)

Length: Children younger than 2 years of age

1. Cover the length board with a thin cloth or soft paper for hygiene and for the baby's comfort.
2. Ensure the child is not wearing any shoes/socks or head ornaments.
3. With the help of your partner, place the baby on the length board.
4. One CHW help to hold the baby's head in place while the other take the measurement.
5. The CHW holding the baby head in place should stand on the opposite side of the tape measure.
6. Place baby head against the fixed headboard.
7. Move quickly and surely without distressing the baby.
8. Compress the baby hair.
9. Position the head so that an imaginary vertical line from the ear canal to the eye socket is perpendicular to the board.
10. Child's eyes should be looking straight up.
11. Move behind the headboard and hold the head in this position.
12. The second CHW should stand on the measuring tape side and move the footboard.
13. Check that the child lies straight along the board and does not change position.
14. Shoulders should touch the board.
15. Ensure the spine do not arch.
16. Apply gentle pressure to the knees to straighten the legs as far as they can go without causing injury.

(Note: it is not possible to straighten the knees of a new born to the same degree as older children. Their knees are fragile and could be injured easily, so apply minimum pressure.)

17. If a child is extremely agitated and both legs cannot be held in position, measure with one leg in position.
18. While holding the knees, pull the footboard against the child's feet.
19. The soles of the feet should be flat against the footboard and toes pointing upwards.
20. Read the measurement and record to the nearest 0.1 cm on the appropriate form.

Height: Children older than 2 years of age

1. Ensure the stadiometer is on level ground.
2. Ensure the child's shoes, hats and hair ornaments are removed.
3. Kneel down and show the child to stand with their feet slightly apart.
4. Ensure the back of the heels, calves, buttocks, shoulder blades and back of the head are touching the stadiometer.
5. Ask the mother to hold the child's knees and ankles to help keep the legs straight and feet together, with heels and calves touching the vertical board.
6. Ask her to focus the child's attention, soothe the child as needed, and inform you if the child moves out of position.
7. Position the child's head so that a horizontal line from the ear canal to the lower border of the eye socket runs parallel to the baseboard.
8. To keep the head in this position, hold the bridge between your thumb and forefinger over the child's chin.
9. Push gently on the child's stomach to help the child stand to full height.
10. Still keeping the head in position, use your other hand to pull down the headboard to rest firmly on top of the head and compress the hair.
11. Read the measurement and record the child's height in centimetres to the last completed 0.1 cm.

Mid-upper Arm Circumference (MUAC)

MUAC measurements can be done on children from the age of 6 months.

Use a three coloured, flexible, non-stretchable measuring tape.

1. Measurement should be done on the left arm.
2. Determine the midpoint between the elbow and the shoulder (acromion and olecranon).
3. Place the tape measure around the left arm.
4. The arm should be relaxed and hanging down the side of the body.
5. Measure the MUAC while ensuring that the tape neither pinches the arm nor is left loose.
6. Read the measurement from the window of the tape or from the tape.
7. Record the MUAC to the nearest 0.1 cm or 1mm on the appropriate form.

See next page for interpretation.

Interpret the colour on the WHO measuring tape:

A measurement in the green zone means the child is properly nourished; A measurement in the yellow zone means that the child is at risk of malnutrition; A measurement in the red zone means that the child is acutely malnourished. - *Immediately refer to the nearest clinic.*

MUAC less than 11.5 cm indicates SEVERE ACUTE MALNUTRITION **(REFER URGENTLY)**

MUAC between 11.5 cm and 12.5 cm indicates MODERATE ACUTE MALNUTRITION (Manage as in **IMCI guidelines**)

MUAC 12.5 cm or more indicates NAM (NO ACUTE MALNUTRITION)

Head Circumference:

Measure the head circumference

Use a flexible and non-stretchable measuring tape.

1. Position the child standing or sitting on the mothers/ CHW partner lap.
2. Take off all hair ornaments.
3. Stand on the right side of the child.
4. Place lower edge of measuring tape just above the child eyebrows, above the ears, around the occipital prominence at the back of the
5. Pull the tape to compress the hair
6. Measure to the nearest 0.1 cm and record the measurement on the appropriate form.

Measurements for the mother

Weight:

Take the measurement with an electronic scale.

1. Ensure the scale is positioned on a flat, hard surface and turn on the scale.
2. Ask the mother to take of her shoes and clothes.
3. When the scale stabilises (0.0 appears), the scale is ready to be used.
4. Ask the mother to step onto the middle of the scale, feet slightly apart, stand up straight and as still as possible.
5. When the scale stabilises, record the measurement to the nearest 0.1kg.
6. Document the measurement on the appropriate form.
7. Ask the mother that she can step of the scale and put shoes and clothing back on.

Height:

Take the measurement with a stadiometer.

1. Ensure the stadiometer is on level ground.
2. Ask the mother to take of her shoes, hats and hair ornaments.
3. Ensure the back of her heels, calves, buttocks, shoulder blades and back of her head is touching the stadiometer.
4. Ensure her feet are together, flat on the floor and her legs are straight.
5. Position the mother's head so that a horizontal line from the ear canal to the lower border of the eye socket runs parallel to the baseboard. (Frankfurt plane)
6. Her arms must be relaxed at the side.
7. Ask the mother to breath. Take the measurement when she inhales.
8. Bring down the stadiometer and read the measurement off.
9. Take the measurement to the nearest 0.1 cm and document on the appropriate form.

How to put the stadiometer together?

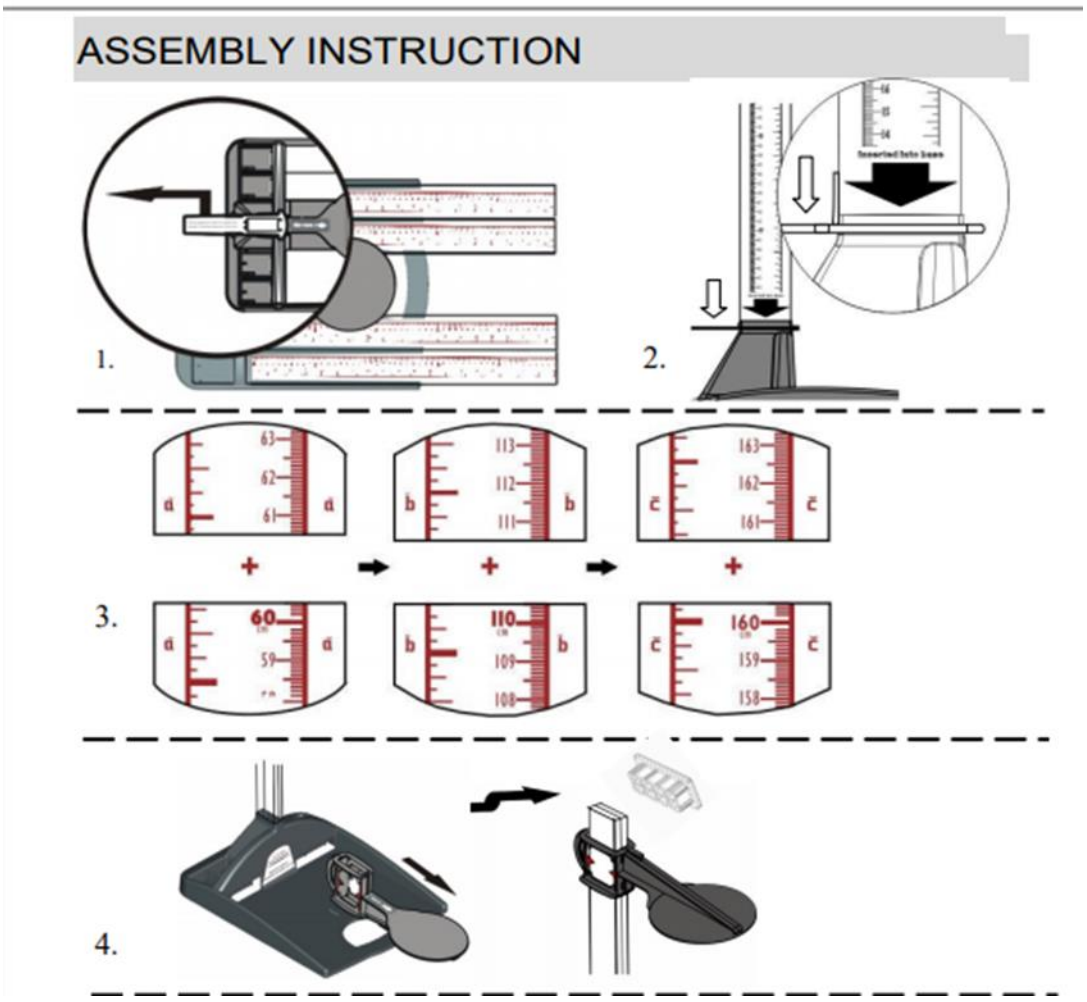
Step1 Put the foot piece on the floor.

Step 2 Pace the small white support plate on top of the food piece. The long end must face the back of the stadiometer.

Step 3 Place the measuring rods on top of the foot piece on by one. Make sure the numbers are in order.

Step 4 Put the head stopper on the top of the measuring rod.

Step 5 Place the second white support plate on top of the head piece. Make sure the long end is pointing to the back of the stadiometer.



Waist circumference:

Measure with a flexible and non-stretchable measuring tape.

1. Take the measurement on the right side of the mother.
2. Do not take the measurement over clothes.
3. Ask the mother to stand up straight.
4. Take the measurement in the middle between the last rib and the tip of the hip bone (Cresta ileaca)
5. Position the measuring tape around the mother's waist in a horizontal manner.
6. Ensure the measuring tape does not cut into her skin.
7. Ask the mother to breath in and out. Take the measurement when she exhales.
8. Measure to the nearest 0.1 cm and record on the appropriate form.

Mid-upper Arm Circumference:

Take the measurement with a flexible and non-stretchable measuring tape.

1. Start by measuring the midpoint of the right arm:

   Instruct the mother to stand up straight with her feet together.

   The arm must be bent at a 90-degree angle.

   Her palm should be facing upwards.

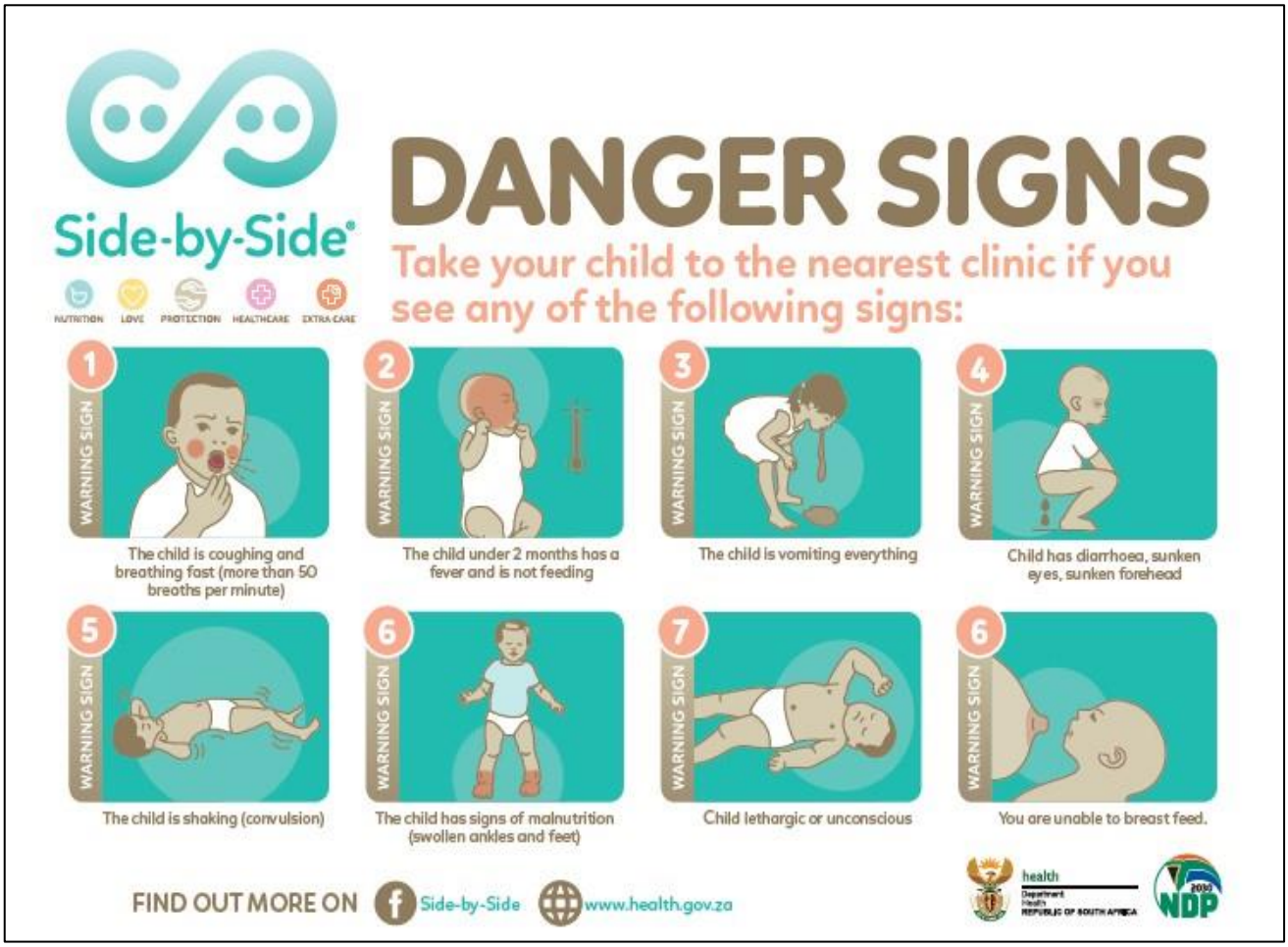
   Measure the midpoint of the arm, between the acromion and the olecranon from the mothers back side.
2. Wrap the measuring tape around the arm at the level of the midpoint.
3. Instruct the mother to relax and stand with her arms hanging along her sides.
4. Make sure the tape does not cut into her skin.
5. Take the measurement to the nearest 0.1 cm and record on the appropriate form.

REMEMBER REFERRALS!

AREA:	WHERE:	WHEN:	WHO:
Zwelethemba	Empilisweni Clinic	Fridays: 08H00-09H00	SR R Lourens
Roodewal Avian Park River View	Worcester CDC	Tuesday 08H00 – 16H00 Wednesdays 08H00 – 16H00	Sr Caesar

Addendum F Danger signs and referral pathways

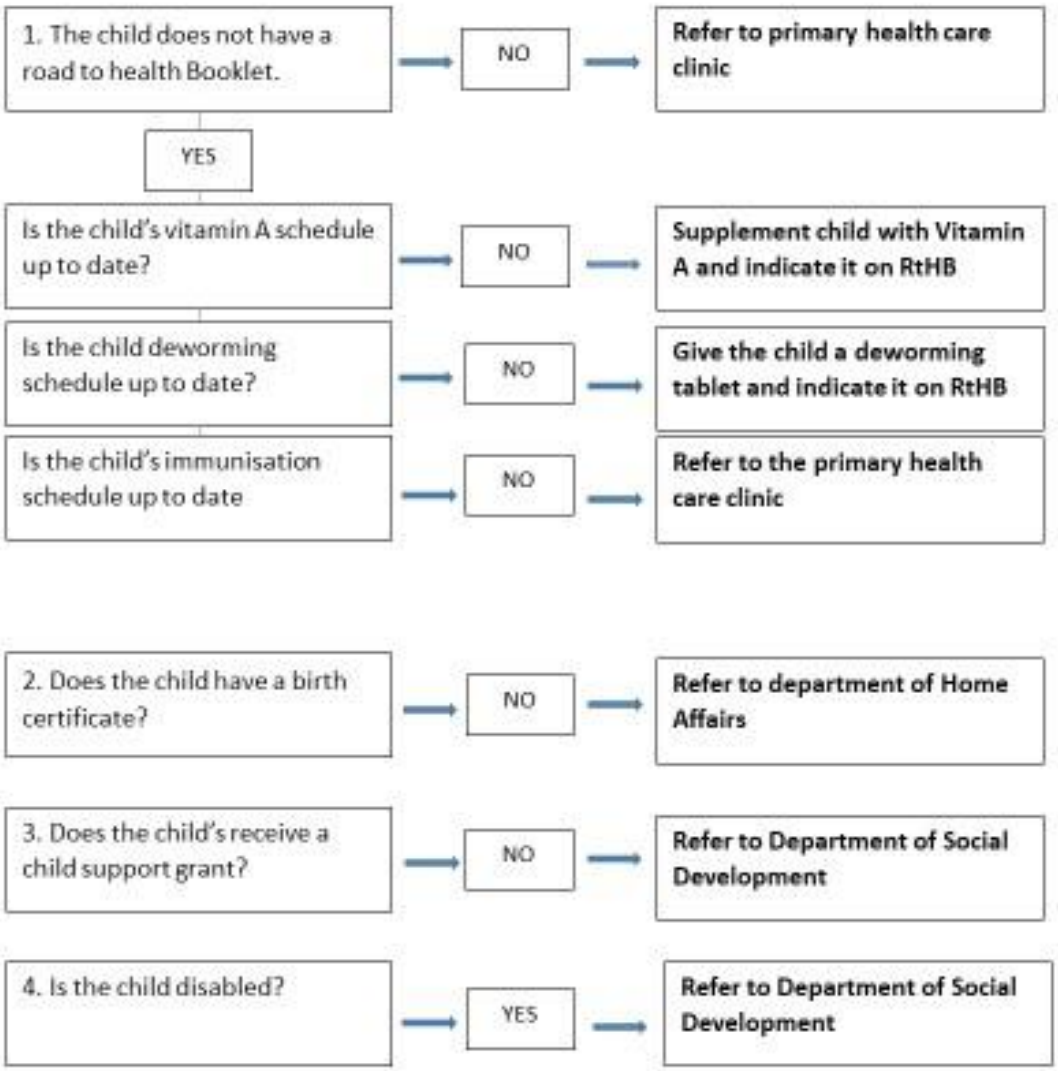
INSTRUCTIONS: WHEN VISITING HOUSEHOLDS, COMMUNITY HEALTH CARE WORKERS SHOULD BE ON THE LOOK OUT FOR THE DANGER SIGNS LISTED BELOW AND REFER TO THE NEAREST HEALTH CARE FACILITY



LIST OF 8 DANGER SIGNS:

1. The child is coughing and breathing fast (more than 50 breaths per minute)
2. The child is under 2 months has a fever and is not feeding.
3. The child is vomiting everything.
4. The child has diarrhoea, sunken eyes and sunken forehead.
5. The child is shaking (convulsions)
6. The child has signs of malnutrition (swollen ankles and feet)
7. Child is lethargic and unconscious.
8. The mother is unable to breastfeed.

REFERRAL PATHWAYS – COMMUNITY HEALTH WORKERS SHOULD REFER TO CARE WHEN:



CHWs Checklist for Research Protocol:

1. Remember the inclusion criteria: child below **the age of five and staying there for 27 weeks**.
2. **Introduce** yourself, be friendly and respect the mothers.
3. **Explain** the **consent form.**
4. There is **two consent** forms: – One for <u>the mother</u>
   – One <u>for you</u>

   Remember **mom, you & witness** to sign both forms
5. **One CHW** start with the **measurements.**
6. The other CHW start by **filling in the questionnaire** by using the **RtHB.**

If **<u>No RtHB</u>** →complete questionnaire by asking the questions.

You still have to **plot the measurements** on the growth chart.

Refer to the police station to get an affidavit

7. Then the CHW **who did the measurements** should **calculate the age** and **plot** the children on the **growth charts.**
8. While the other CHW completes the **questionnaire. Remember not to leave blank spaces.**
9. Remember to give each mother or caregiver ONE NaliBali reading booklet before you leave.
10. **Make sure you wrote down the household number and street name on the consent form and the questionnaire.**
11. Make sure you put the completed questionnaire, consent form and growth charts in the blue folder.
12. Make sure you leave the **mother/caregiver's consent form with her.**
13. Remember to mark off the household on your map with a tick √ if they are included in the study.
14. Mark of with an **X** if the household did not want to participate.
15. If no one was home when you approached the house mark off with an **<u>?</u>**
16. Remember the referrals.

REMEMBER REFERRALS FOR CHILD HEALTH!

AREA:	WHERE:	WHEN:	WHO:
Zwelethemba	Empilisweni Clinic	Fridays: 08H00-09H00	SR R Lourens
Roodewal Avian Park River View	Worcester CDC	Tuesday 08H00 – 16H00 Wednesdays 08H00 – 16H00	Sr Caesar

What if the mother has more than one child below the age of 5? Fill in a form for both children. (There will be extra forms available.)

FOR EXAMPLE, CLEARLY WRITE: The house number, street name as normal, and write down Child 1 or Child 2

If a mother has more than one child under 5 years, number each child. For example, Child 1, Child 2, Child 3

on the consent forms, questionnaires and growth charts. **SO YOU NEED TO FILL IN THE FORMS FOR EACH CHILD**.

If a household has more than one mother, and each mother has children below the age of 5, then number each mother as Mother 1, Mother 2 and so forth. Fill in the consent form, questionnaire and growth charts for both mothers and their children. For each mother, number their children as **Mother 1, Child 1, Mother 2, Child 1**.

If you have any questions, please ask the Philani mentor mothers, Boland Hospice supervisors or phone us by:

Annemie Lenhoff: 083 291 4905

Merve Konjore: 072 907 4428

Addendum H Ethics approval letter

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Health Research Ethics Committee (HREC)

Approval Notice

New Application

05/07/2018

Project ID :7287

HREC Reference # S18/05/100

Title: A stunting profile of children under the age of five in selected vulnerable communities in Worcester

Dear Miss Annemie Lenhoff

The **New Application** received on 29/06/2018 08:10 was reviewed by members of **Health Research Ethics Committee** via **expedited** review procedures on 05/07/2018 and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **This project has approval for 12 months from the date of this letter.**

Please remember to use your project ID (7287) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Translation of the informed consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Please note you can submit your progress report through the online ethics application process, available at: Links Application Form Direct Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/healthresearchethics) for guidance on how to submit a progress report. The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Departement of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic

institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website https://applyethics.sun.ac.za/ProjectView/Index/7287

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Miss Elvira Rohland ,

National Health Research Ethics Council (NHREC) Registration Number:

REC-130408-012 (HREC1)·REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372
Office of Human Research Protections (OHRP) Institutional Review Board (IRB) Number: IRB0005240 (HREC1)·IRB0005239 (HREC2)

*The Health Research Ethics Committee (HREC) complies with the SA National Health Act No. 61 of 2003 as it pertains to health research. The HREC abides by the ethical norms and principles for research, established by the*World Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects;*the South African* Department of Health (2006). Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa (2nd edition); as well as the Department of Health (2015). Ethics in Health Research: Principles, Processes and Structures (2nd edition).

The Health Research Ethics Committee reviews research involving human subjects conducted or supported by the Department of Health and Human Services, or other federal departments or agencies that apply the Federal Policy for the Protection of Human Subjects to such research (United States Code of Federal Regulations Title 45 Part 46); and/or clinical investigations regulated by the Food and Drug Administration (FDA) of the Department of Health and Human Services.