GROW GREAT

May 2021

NUTRITIONAL STATUS OF CHILDREN UNDER FIVE

IN WORCESTER, BREEDE VALLEY, WESTERN CAPE, SOUTH AFRICA

in collaboration with Stellenbosch University, Faculty of Medicine and Health Sciences, Department of Global Health, Division of Human Nutrition

UNIVERSITEIT iYUNIVESITHI STELLENBOSCH UNIVERSITY

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ABBREVIATIONS

CHW	Community Health Worker
CI	Confidence Interval
CSG	Child Support Grant
DDS	Dietary Diversity Score
DHIS	District Health Information System
GHS	General Household Survey
HAZ	Height/Length-for-Age
IQR	Interquartile Range
MAM	Moderate Acute Malnutrition
MUAC	Mid Upper Arm Circumference
NIDS	National Income Dynamics Study
OR	Odds Ratio
SA	South Africa
SADHS	South African Demographic Health Survey
SAM	Severe Acute Malnutrition
SANHANES	South African National Health and Nutrition Examination Survey
SASSA	South African Social Security Agency
SOCPEN	Social Pensions
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WAZ	Weight-for-Age
WHO	World Health Organisation
WHZ	Weight-for-Height/Length

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EXECUTIVE SUMMARY

Grow Great is a campaign that seeks to mobilise South Africa towards a national commitment to zero stunting by 2030. Stunting is a result of prolonged undernutrition and exposure to repeated infections at the beginning of a child's life, perpetuated by factors at the household, community and societal levels.

Our view is that through investing in nutrition and reducing stunting, South Africa will be able to optimise what we can achieve from our other development work in education, health and youth unemployment. Ignoring the burden of stunting undermines the development interventions we already have in place, as well as efforts to reduce inequality.

In settings with high rates of stunting, interventions that target women of reproductive age and young children, have made significant reductions in stunting. In one such setting – the Indian state of Maharashtra – evidence suggests that through collecting and disseminating high-quality data on the prevalence of child malnutrition, communities were mobilised to hold their government accountable to bring change. This led to multi-sectoral responses and actions that ultimately contributed to meaningfully addressing malnutrition.

In the absence of good quality data, in part due to small sample sizes and infrequent national surveys, South Africans are not able to mimic their Indian counterparts and yield similar results in local communities. To remedy this, Grow Great's strategy includes data-driven advocacy through surveying a selection of high burden communities across the country.

This report presents and describes findings from a study in one such setting, Worcester in the Western Cape. The study set out to respond to two objectives: firstly, to describe the prevalence of stunting in children under five years of age in four communities in Worcester by means of a cross-sectional survey. Secondly, to collect data on evidence-based drivers of stunting to inform locally relevant intervention design. The results section (from page 14) includes descriptive statistics of key indicators and predictor variables of stunting, namely socio-economic markers and health factors, followed by the estimates of association between child stunting and a set of predictor variables from using logistic regression analyses.

Among the 854 children surveyed, stunting was identified in 216 children (of whom 81 were severely stunted). The prevalence of stunting was 26% (95% CI [23,29]). This is similar to the national estimate of 27%, and higher than the Western Cape provincial

estimate of 23%. Assessing one risk factor at a time, we found that poor maternal education, not having an up-to-date deworming record, obesity, inadequate dietary diversity, being underweight and a low birth weight were significantly associated with stunting. However, when all the factors were considered in a multivariate logistic model, only male gender (Adjusted OR=1.68; 95% CI [1.04,2.71]), an inadequate dietary diversity score (Adjusted OR=3.83; 95% CI [1.64,8.92]), underweight (Adjusted OR=77.70, 95% CI [22.28,270.99]) and obesity (Adjusted OR=3.90, 95% CI [1.38,11.00]) remained predictive of stunting.

We conclude that children in this setting are not sufficiently benefitting from free basic preventative primary healthcare services, such as deworming. This finding is particularly concerning in light of the low levels of dietary diversity in this population of children – with only 68% (95% CI [63,73]) of children aged 6-23 months found to have an adequate dietary diversity. Furthermore, underweight was found to be a significant predictor of stunting in this setting. This condition can be diagnosed and treated at the community level; community health worker programmes should therefore be strengthened to ensure that children in this community, and similarly vulnerable communities in the Western Cape, are routinely growth monitored and benefit from basic preventative primary healthcare services. Due to evidence of the double burden of under- and overnutrition among children in this setting, we recommend that double-duty interventions are scaled up.

In terms of the high levels of unemployment and food insecurity brought on by the Covid-19 pandemic, we expect that the nutrition profile of children under five in Worcester will have further deteriorated. Given the lifelong impact of poor nutrition and stunting, this community should call for interventions that speak to both the direct and indirect causes of malnutrition.

1. INTRODUCTION

Stunting, defined as height-for-age below two standard deviations of the World Health Organisation's (WHO) child growth standards median,[1] is a condition where young children do not reach their full growth potential.

Stunting, defined as a height-for-age z-score below minus two standard deviations of the World Health Organisation's (WHO) child growth standards median,[1] is a condition where young children do not reach their full growth potential. This nutritional disorder is directly caused by chronic nutritional deprivation, repeated infections or disease, and lack of psychosocial stimulation. Indirectly, it is caused by structural barriers to good nutrition, such as food insecurity, poor access to water and sanitation, inadequate healthcare, poverty and inequality.[1,2]

Stunting is associated with lifelong cognitive defects, educational and employment challenges, increased risk of chronic diseases in adulthood and cycles of intergenerational poverty.[3] The importance of addressing stunting is increasingly on the global development agenda: for example, Sustainable Development Goal 2.2 calls on all countries to meet the internationally agreed targets on stunting and wasting for all children under five by 2025. The World Health Assembly global targets for 2025 include reducing stunting by 40% in children under age five and increasing to at least 50% the rate of exclusive breastfeeding in the first six months.[4]

The prevalence of stunting among South Africa's children is worryingly high, with prevalence rates estimated at 27% for children under five[5] – far higher than would be expected for an upper middle-income country, and far higher than many of South Africa's developing country counterparts.[6] In fact, according to the United Nations Children's Fund (UNICEF), South Africa is one of the 10 countries that accounts for 80% of the stunting burden in the region.[7]

An up-to-date comprehensive profile of the nutritional status of South Africa's children remains elusive.[8] When detailed data are collected through national surveys like the South African National Health and Nutrition Examination Survey (SANHANES), the South African Demographic and Health Survey (SADHS) and the National Income Dynamics Study (NIDS), data collected on dietary intake and food security are limited, not representative of the population, or they are collected at too irregular intervals.[8] Data on childhood nutrition indicators, such as stunting, remain hampered by unreliable provincial estimates emanating from employing small samples in national surveys, making it difficult to determine the extent of stunting at provincial and district levels, as well as inequalities that may exist across geographies.[5] In addition, height-for-age data

collected from primary healthcare clinics are not reported in the District Health Information System (DHIS), making sophisticated assessments of the prevalence of stunting in South Africa – and how it is evolving over time across districts and provinces – challenging.

The availability of quality nutritional data has significant benefits, including informing early identification and treatment for poor physical growth; driving informed, responsive and timely government decisions on nutrition service delivery; and improving the ability of communities to hold government accountable for the quality and effectiveness of its investments in nutrition. In the Indian state of Maharashtra, stunting decreased from 39% in 2006 to 22.8% in 2012.[9] It has been argued that it was through the collection and dissemination of high-quality data on the prevalence of malnutrition in children under six in Maharashtra – and the public outcry that followed – that resulted in state-level action and multi-sectoral responses that addressed the problem of malnutrition.[9] This research aims to create a similar profile of the nutritional status of children under five in vulnerable communities in Worcester in the Western Cape, South Africa.

2. METHODOLOGY

2.1. AIM

The aim of this study was to profile the nutritional status of children under five years old in four neighbourhoods in Worcester in the Western Cape, namely Zwelethemba, Riverview, Roodewal and Avian Park.

2.2. OBJECTIVES

The objectives of this study were to:

a. *Determine the prevalence of stunting in children under five in the above-mentioned areas*
b. *Determine the drivers of stunting in children under five in the above-mentioned areas.*

2.3. STUDY DESIGN

2.3.1. METHODS AND SETTING

A descriptive cross-sectional study design was employed in Zwelethemba, Riverview, Roodewal and Avian Park in Worcester.

2.3.2. POPULATION

The study population of interest included children under five living in the above-mentioned areas, as well as their biological mother, where present.

2.3.3. SAMPLING STRATEGY

Maps of the four areas were used to conduct random sampling of streets and starting points within those streets. Once a starting point was randomly selected, subsequent households along each street that met the inclusion criteria were included consecutively. To minimise sampling bias, the direction of approach between randomly-selected streets was alternated between ascending and descending.

2.3.4. INCLUSION AND EXCLUSION CRITERIA

The following inclusion and exclusion criteria were applied:

Inclusion criteria

- *Households with children between the ages of 0-60 months*
- *Mothers of children between the ages of 0-60 months.*

Exclusion criteria

- *Households with no children between the ages of 0-60 months*
- *Households where the mother did not provide consent*
- *Households where the mother was below the age of 18 years.*

2.3.5. DATA COLLECTION

Data were collected by pairs of contracted Community Health Workers (CHWs) in service of the Western Cape Department of Health. CHWs were trained on the questionnaire and anthropometric measurement by the Grow Great team's professional nurse and a registered dietitian (a Masters of Nutrition student at Stellenbosch University). In-field supervision and quality assurance were provided by Philani Maternal, Child Health and Nutrition Trust's Mentor Mothers*, who rotated between pairs of CHWs, ensuring that anthropometric measurements were correctly obtained and that CHWs were following standard operating procedures. A pilot study was conducted in July 2018 to test the data collection tools. Data collection took place between July and October 2018.

2.3.6. DATA ANALYSIS

Data were captured in Microsoft Excel and analysed using STATA version 16.0. The WHO definitions for child growth standards and cut-offs, *as defined in Table 1*, were used to calculate standard child growth measures and indicators on binary scales. For example, height-for-age was calculated by comparing a child's height/length at a given age to a median of a reference population. Then a child height-for-age z-score was taken as the difference between the height and the median, divided by the standard deviation of the reference at that age. A child whose score is below -2 z-score was considered stunted.

Preliminary statistical analyses for continuous data involved obtaining means (SD) or as median and interquartile ranges (IQR) for skewed distributions. Discrete or categorical data were summarised using frequencies and

** Philani's flagship Mentor Mother Programme provides community-based services to mothers and children in South Africa, an approach underpinned by the peer positive deviant model.*

percentages. Continuous data were expressed as means (SD) or as median and interquartile ranges for skewed distributions. Discrete or categorical data were summarised using frequencies and percentages. Associations between various stunting and potential predictors were quantified by odds ratios (ORs) with 95% confidence intervals (CI) and p values. Predictor variables were selected based on other studies and research experience. All predictors with a Wald score greater than 15 or significance level (p-value) < 0.25 were included in the initial multivariate logistic regression analyses to model stunting. Factors from the multivariate logistic regression that had odds ratios that were exceedingly large or demonstrated the possibility of collinearity were eliminated.

2.3.7. ETHICS CONSIDERATIONS

Ethics approval was obtained from the Health Research Ethics Committee of Stellenbosch University (Reference number: S18/05/100). Voluntary, written informed consent was obtained from all study participants. CHWs were trained to refer any children who were acutely unwell or requiring medical support or social support. Questionnaires were stored securely by study leaders and personal identifiers were anonymised in the database used for analysis. All participating households received age-appropriate reading material for the child as a token of appreciation for their participation.

TABLE 1
WHO CHILD GROWTH STANDARDS AND CUT OFFS

Z-SCORE	CLASSIFICATION
LENGTH/HEIGHT-FOR-AGE (LAZ/HAZ)	
<-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 (WLZ/WHZ)	
>3 z-score	Obese
>2 z-score	Overweight
<-2 z-score	Wasted
<-3 z-score	Severely wasted

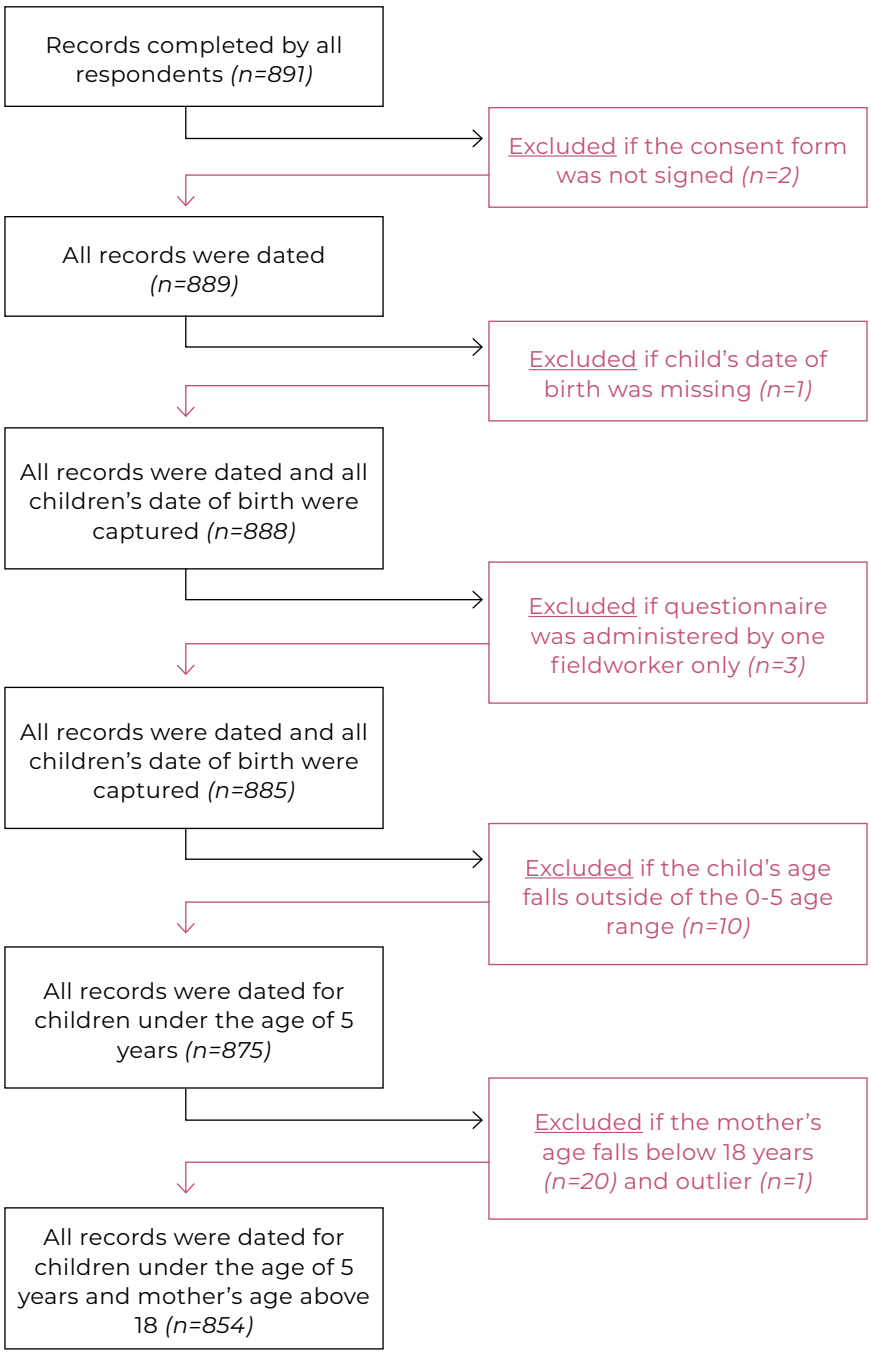
3. RESULTS

A total of 891 questionnaires were completed by CHWs. Questionnaires that were found to have consent forms not signed by the study participant; a child's date of birth missing; anthropometry only conducted by a single CHW instead of the required two; children older than five years of age; or mothers who were younger than 18 at the time of data collection, were excluded from the analysis.

As a result, of the 891 completed questionnaires, only 854 fully and correctly completed questionnaires were included in the final analysis. Those excluded comprised: two caregiver consent forms that were not signed; one with a child's missing date of birth; three questionnaires administrated by one fieldworker only; ten children outside the age range; and twenty mothers under the age of 18 years. See Figure 1 for more detail.

Figure 1

RECORDS INCLUDED FOR ANALYSIS



3.1. SOCIO-DEMOGRAPHIC INFORMATION

3.1.1. NEIGHBOURHOOD

Of the 854 study participants, the majority (31%) resided in Zwelethemba, followed by Riverview (25%), Avian Park (23%) and Roodewal (21%).

3.1.2. AGE OF MOTHER

The mean age of mothers included in the study was 29 years (SD=7), with the youngest mother aged 18 and the eldest aged 50 years. The participants in this study included a higher proportion of women in the 25-34 age group *as illustrated in Figure 3.*

3.1.3. EMPLOYMENT STATUS OF MOTHER

The majority (73%) of mothers were unemployed, with only a quarter reporting being in employment. Of the 619 mothers who were unemployed, 71% reported that they were unable to find employment and 29% reported being unemployed by choice. Two did not respond to the question, and one mother offered multiple responses *(see Figure 5).*

3.1.4. EDUCATION STATUS OF MOTHER

Sixty-six percent of the mothers did not complete a grade 12 qualification *as shown in Figure 6.*

3.1.5. CHILD AGE

The mean age of the children under five included in the study was 26.7 months, with the youngest child aged 0 months (newborn) and the eldest aged 59.97 months. Forty-eight percent of the children included in this study were under the age of two years, *as illustrated in Figure 7.*

3.1.6. CHILD SEX

Fifty-two percent of children included in the study were boys, 48% were girls.

Figure 2

STUDY AREAS *(n=854)*

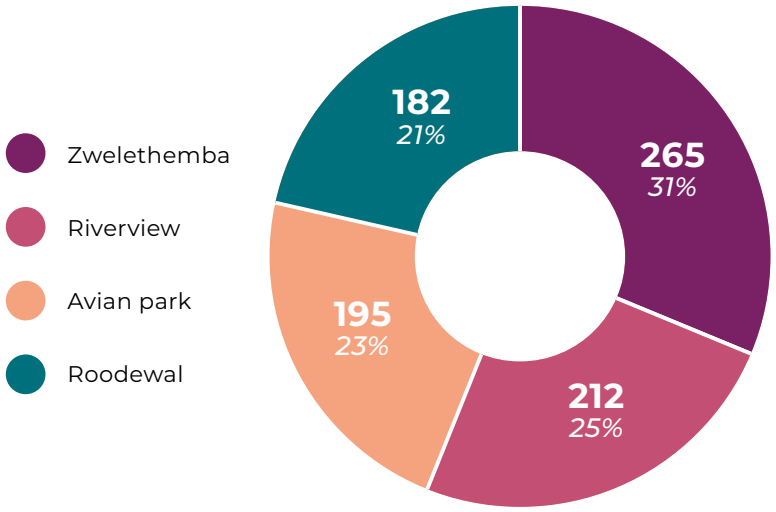


Figure 3

MOTHERS' AGE *(n=846)*

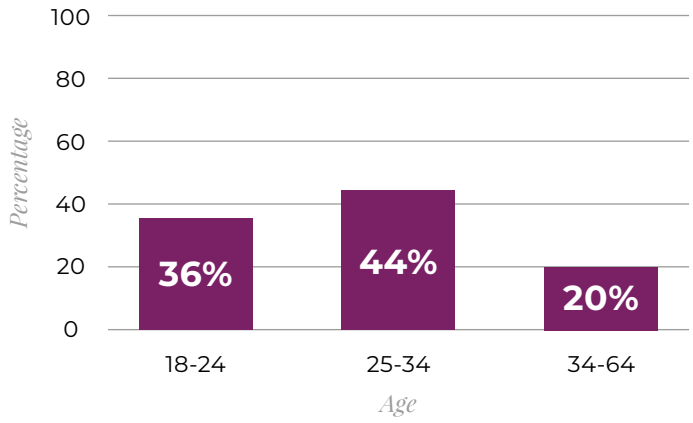


Figure 4

CURRENT EMPLOYMENT STATUS *(n=845)*

Are you currently employed?

- Yes
- No

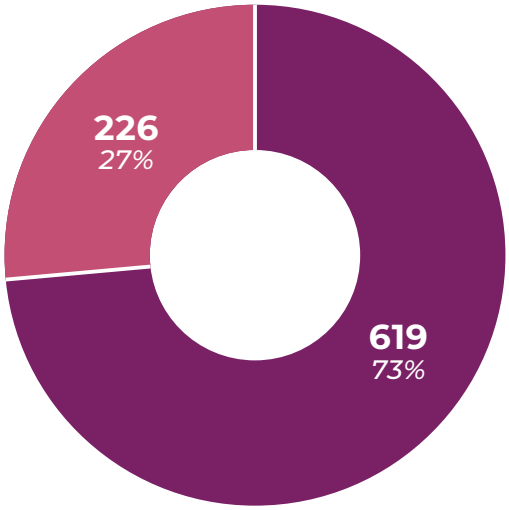


Figure 5

UNEMPLOYMENT *(n=624)*

If unemployed, are you looking for employment or are you unemployed by choice?

- Unemployed
- Unemployed by choice
- Multiple responses

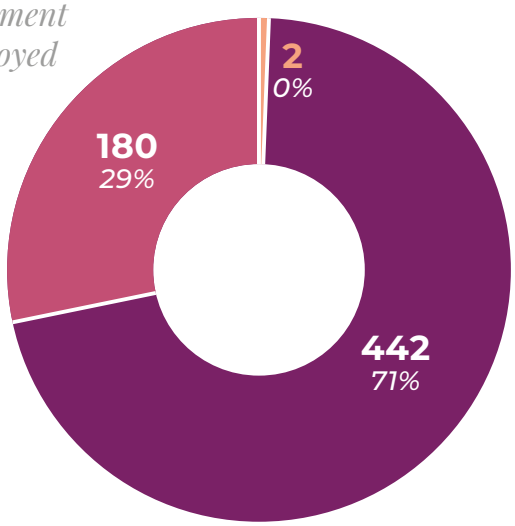


Figure 6

HIGHEST GRADE PASSED *(n=854)*

What is the highest grade that you have passed at school?

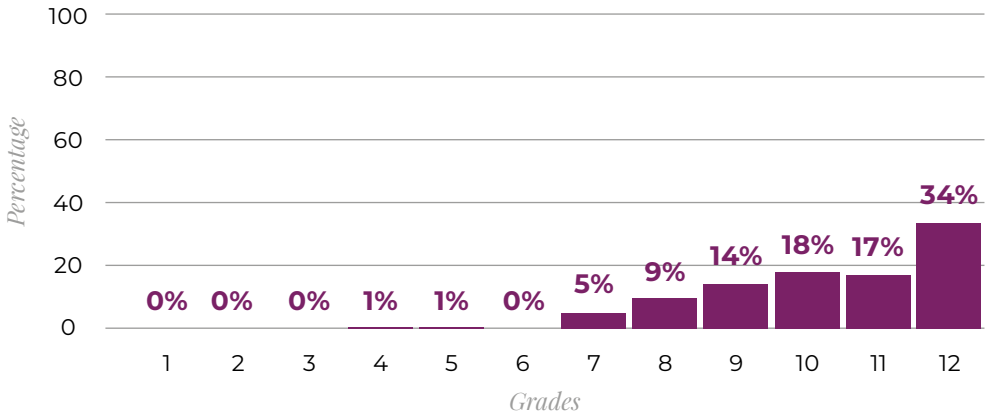


Figure 7

CHILDREN'S AGE CATEGORIES *(n=854)*

Children under the age of 5 years

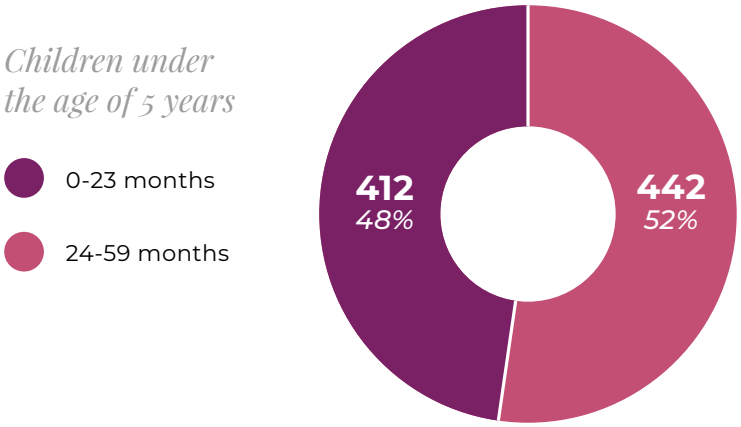
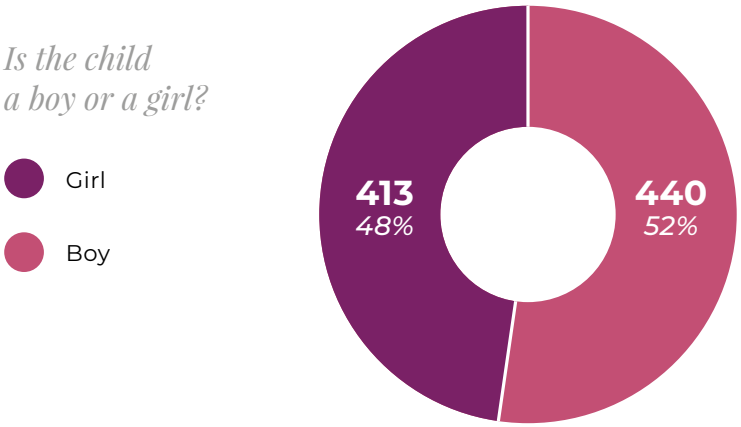


Figure 7

CHILD SEX *(n=853)*

Is the child a boy or a girl?



3.2. ACCESS TO BASIC SERVICES

3.2.1. SOURCE OF DRINKING WATER

The majority (92%) of children lived in homes that had piped water. Of the remainder, 5% accessed communal water and 3% collected water from a dam, river, or spring. *See Figure 9* for a graphic representation of the source of access to drinking water.

3.2.2. SOURCE OF SANITATION

Most (91%) children lived in households that had access to a source of sanitation i.e. a flush toilet; 4% used a pit latrine or long drop; and 3% had no facilities. *See Figure 10* for a breakdown of sanitation sources in the sample.

Figure 9

MAIN SOURCE OF DRINKING WATER *(n=854)*

What is the main source of drinking water for this household?

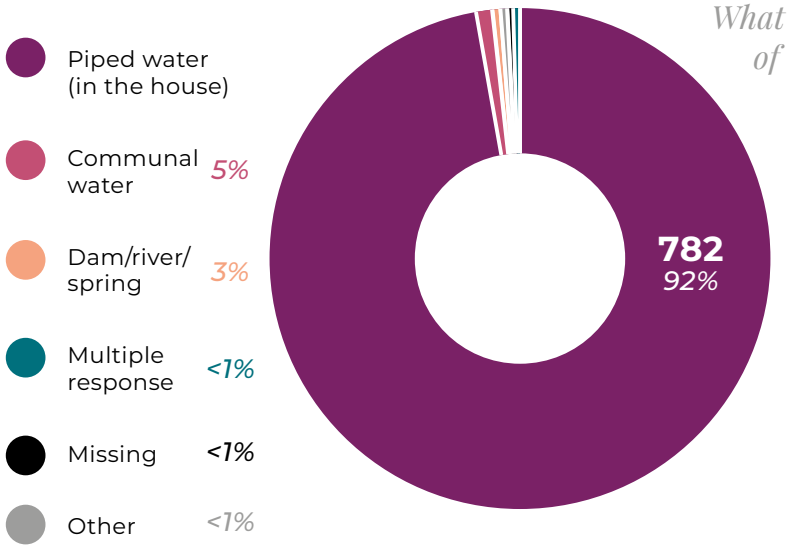
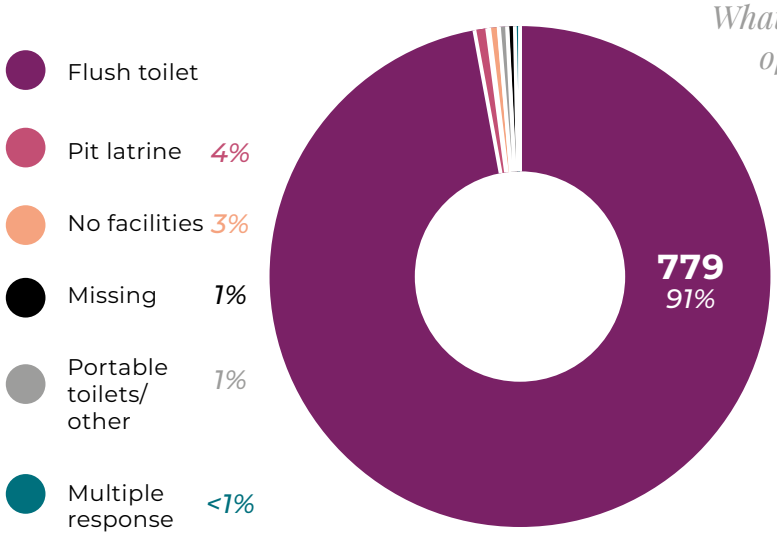


Figure 10

MAIN SOURCE OF SANITATION *(n=854)*

What is the main source of sanitation for this household?



3.3. CHILD HEALTH AND NUTRITION

3.3.1. VITAMIN A SUPPLEMENTATION

Of the 755 children older than six months in this study, 22% had no record of receiving their most recent Vitamin A dose.

3.3.2. DEWORMING

A third (32%) of the 644 children older than 12 months in this study did not have a record of receiving the most recent deworming medication.

3.3.3. EXCLUSIVE BREASTFEEDING

Fifty-nine percent of the children under six months included in the study were reportedly exclusively breastfed at the time of this research.

3.3.4. CHILD DIETARY DIVERSITY

The dietary diversity questionnaire is a validated tool to measure the nutrient adequacy of populations. We analysed the mean dietary diversity score (DDS) of children aged six months to 23 months, as this is the age of vulnerability to malnutrition when children transition from breastfeeding to the household diet.[10] The mean DDS for children aged 6-23 months in this study was found to be 4.2. Of the 306 children included in the study aged 6-23 months, 32% of them had an inadequate dietary diversity score (i.e. a score less than 4).

Figure 11

RECORD OF MOST RECENT VITAMIN A DOSE AMONG CHILDREN 6-59 MONTHS *(n=755)*

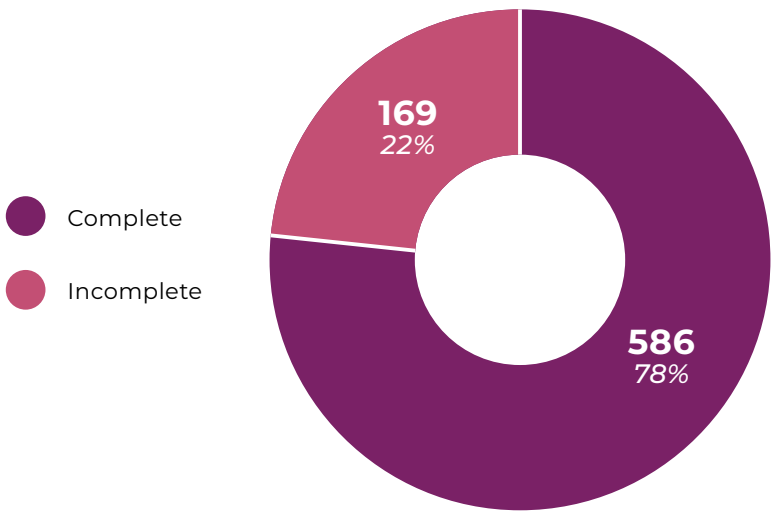


Figure 12

RECORD OF MOST RECENT DEWORMING MEDICATION OF CHILDREN AGED 12-59 MONTHS *(n=644)*

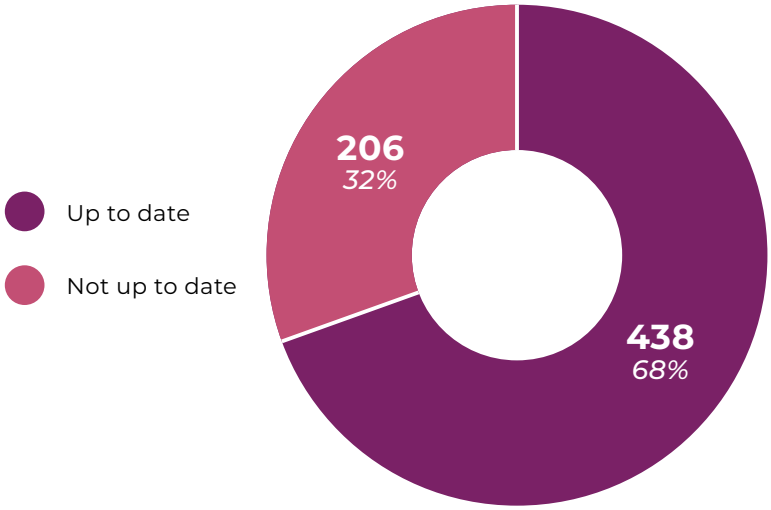


Figure 13

EXCLUSIVE BREASTFEEDING FOR CHILDREN UNDER 6 MONTHS *(n=99)*

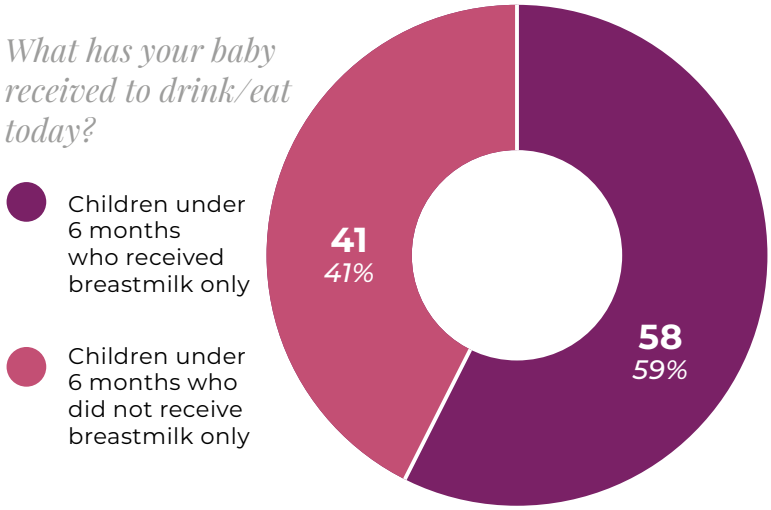
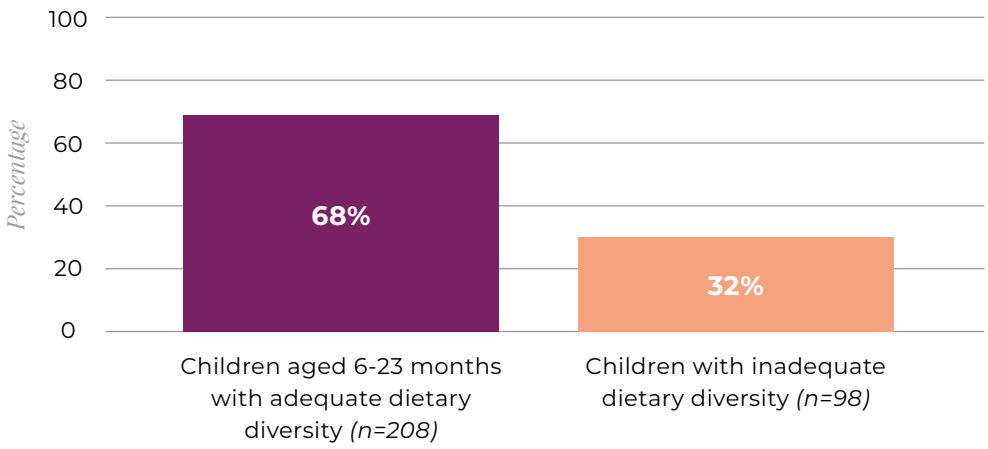


Figure 14

CHILD DIETARY DIVERSITY FOR CHILDREN UNDER 23 MONTHS *(n=306)*



3.4. SOCIAL PROTECTION

3.4.1. BIRTH CERTIFICATES

Only 4% of the children included in this study did not have birth certificates.

3.4.2. REGISTRATION OF CHILD SUPPORT GRANT

Eighty percent of children under the age of five who participated in this study received a child support grant.

Figure 15

CHILDREN WITH BIRTH CERTIFICATES *(n=849)*

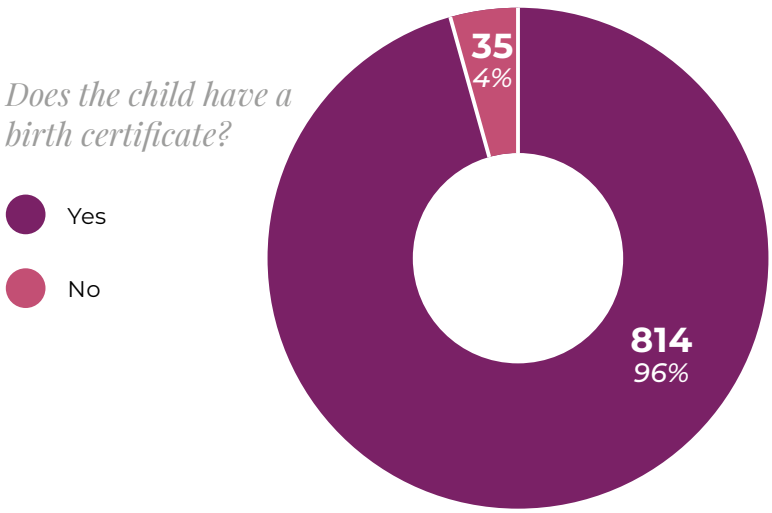
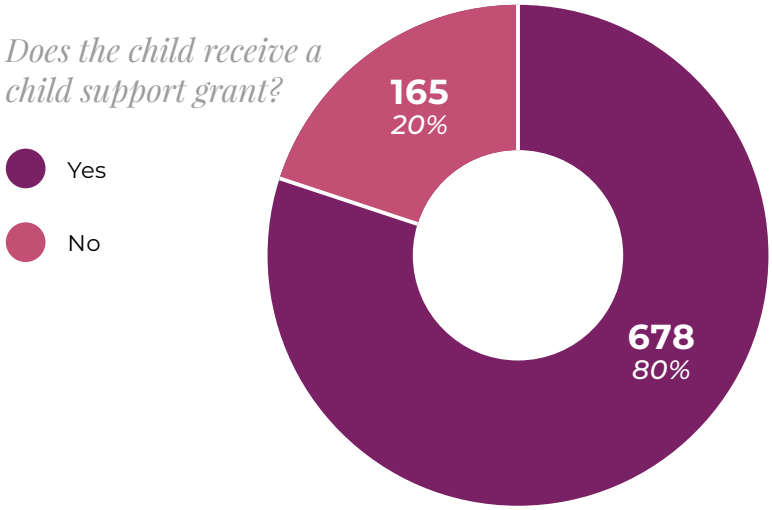


Figure 16

CHILDREN UNDER FIVE YEARS WHO RECEIVED A CHILD SUPPORT GRANT *(n=843)*



3.5. ANTHROPOMETRY

3.5.1. LOW BIRTH WEIGHT

Nineteen percent of children weighed less than 2.5 kg at birth, and thus would be classified as having had a low birth weight, *as illustrated in Figure 17.*

3.5.2. ACUTE MALNUTRITION

Mid upper arm circumference (MUAC) is often used as a community screening tool to identify children at risk of malnutrition. Moderate acute malnutrition (MAM) is defined as having a MUAC between 11.5cm and 12.5cm, and severe acute malnutrition (SAM) as a MUAC below 11.5cm. In the neighbourhoods where this study was conducted, 2.5% of children were classified as MAM and 2.5% as SAM cases, *as illustrated in Figure 18.*

3.5.3. WEIGHT-FOR-AGE – UNDERWEIGHT AND SEVERELY UNDERWEIGHT

According to the WHO Growth Standards, underweight is defined as a weight-for-age z-score that is more than 2 standard deviations below the median. Severely underweight is defined as a weight-for-age that is more than 3 standard deviations below the median. In this study, 10% of children under five were underweight, and 2% severely underweight.

3.5.4. WEIGHT-FOR-LENGTH/HEIGHT – WASTING, OVERWEIGHT AND OBESITY

3.5.4.1. Wasting and severe wasting

According to the WHO Growth Standards, wasting is defined as a weight-for-length/height that is more than 2 standard deviations below the median. Severe wasting is defined as a weight-for-length/height that is more than 3 standard deviations below the median. In our study, 5% of children under five were found to be wasted, and 1% severely wasted.

3.5.4.2. Overweight and obesity

A weight-for-height that is more than 2 standard deviations and more than 3 standard deviations above the median are both signs of overnutrition and are respectively classified as overweight and obesity. Eleven percent of the children included in this study were found to be overweight and 5% obese.

Figure 17

LOW BIRTH WEIGHT *(n=781)*

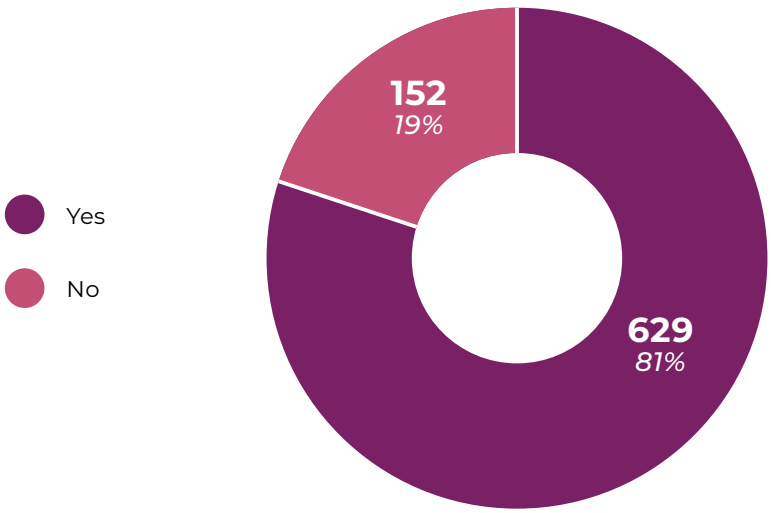
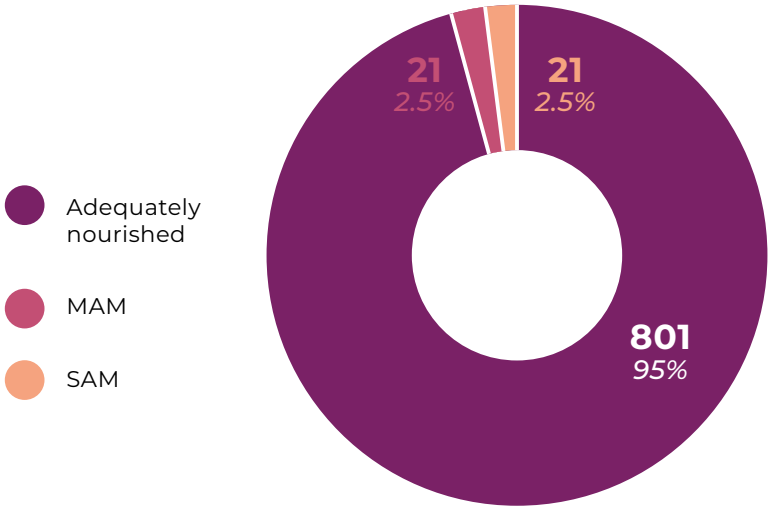


Figure 18

MAM AND SAM *(n=843)*



3.5.5. STUNTING (HEIGHT/LENGTH-FOR-AGE)

According to the WHO Growth Standards, children with a height/length-for-age that is more than 2 standard deviations below the median are considered to be stunted i.e. they have not reached their linear growth potential due to chronic malnutrition, among other reasons. Children whose height/length-for-age is more than 3 standard deviations below the median are considered to be severely stunted.

In the study population, 26% (95% CI [23,29]) of children under the age of five were stunted, while 10% (95% CI [8,12]) were severely stunted.

4.
RISK FACTORS FOR STUNTING AND HOW THEY RELATE TO THE STUNTING PREVALENCE IN THE WORCESTER COMMUNITY

4.1. SOCIO-DEMOGRAPHIC INFORMATION

4.1.1. MOTHER'S AGE

Mothers who were between 23-34 years were at 11% lower odds of having children who are stunted compared to mothers between 18-24 years. Mothers between 35-64 years had 20% higher risk of having children who are stunted compared to mothers between 18-24 years. This odds ratio was not statistically significant.

TABLE 2
MOTHER'S AGE

MOTHER'S AGE	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Mother's age (Ref: 18-24 years)	1.00		
23-34 years	0.89	>0.05	0.62-1.26
35-64 years	1.20		0.79-1.83

4.1.2. MOTHER'S EMPLOYMENT STATUS

The odds of mothers who were employed of having stunted child were found to be 22% less compared to unemployed mothers. This odds ratio, however, was not statistically significant.

TABLE 3
MOTHER'S EMPLOYMENT STATUS

MOTHER'S EMPLOYMENT STATUS	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Unemployed	1.00		
Employed	0.78	>0.05	0.55-1.13

4.1.3. MATERNAL EDUCATION

The odds of a mother who completed high school, ie obtained a Grade 12 qualification, having a stunted child was found to be 35% lower than mothers who did not complete high school. The odds ratio was statistically significant.

TABLE 4
MOTHER'S EDUCATION

MOTHER'S EDUCATION	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Did not complete high school	1.00		
Completed high school	0.65	<0.05	0.47-0.92

4.1.4. CHILD'S AGE

The odds of being stunted were 3% less for children older than two years compared to younger children. However, this odds ratio was not statistically significant.

TABLE 5
CHILD'S AGE

CHILD'S AGE	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
(Ref: Children aged < two years)	1.00		
Children aged > two years	0.97	>0.05	0.71-1.32

4.1.5. CHILD'S SEX

Boys were found to have an increased odds of 33% of being stunted compared to girls. However, this odds ratio was not statistically significant.

TABLE 6
CHILD'S SEX

CHILD'S SEX	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: girls	1.00		
Boys	1.33	>0.05	0.97-1.81

4.2. ACCESS TO BASIC SERVICES

4.2.1. SOURCE OF WATER

Children who lived in households without access to good quality water had an increased odds of 62% of being stunted compared to children who lived in households with access to good quality water. However, this odds ratio was not statistically significant.

TABLE 7
SOURCE OF WATER

SOURCE OF WATER	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Good water	1.00		
Poor water	1.62	>0.05	0.95-2.76

4.2.2. SOURCE OF SANITATION

Children who lived in households that did not have access to good quality sanitation had an increased odds of 29% for being stunted compared to children who lived in households with access to good quality sanitation. However, this odds ratio was not statistically significant.

TABLE 8
SOURCE OF SANITATION

SANITATION	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Good sanitation	1.00		
Poor sanitation	1.29	>0.05	0.72-2.30

4.3. CHILD HEALTH AND NUTRITION

4.3.1. VITAMIN A SUPPLEMENTATION

Children aged six months or older with an incomplete Vitamin A record, had a 16% increased odds of being stunted compared to children with records of receiving their most recent Vitamin A dose. However, this odds ratio was not statistically significant.

TABLE 9
VITAMIN A

VITAMIN A RECORD	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Record of receiving most recent Vitamin A dose	1.00		
Missing record of most recent Vitamin A dose	1.16	>0.05	0.79-1.71

4.3.2. DEWORMING

Children aged 12 months or older with an incomplete deworming record, had a 61% increased odds of being stunted compared to children with records of receiving their most recent deworming medication. This odds ratio was statistically significant.

TABLE 10
DEWORMING STATUS

DEWORMING	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Record of receiving most recent deworming medication	1.00		
Missing record of most recent deworming medication	1.16	<0.05	1.11-2.33

4.3.3. EXCLUSIVE BREASTFEEDING

Children below the age of 6 months who were not exclusively breastfed, had a 54% increased odds of being stunted compared to children who were reported to be exclusively breastfed. However, this odds ratio was not statistically significant.

TABLE 11
EXCLUSIVE BREASTFEEDING

BREASTFEEDING	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Exclusive breastfeeding	1.00		
Non-exclusive breastfeeding	1.54	>0.05	0.60-3.97

4.3.4. CHILD DIETARY DIVERSITY

Children aged 6-23 months who had an inadequate dietary diversity score were twice as likely to be stunted compared to same-aged children with an adequate dietary diversity. This odds ratio was found to be statistically significant.

TABLE 12
DIETARY DIVERSITY

DIETARY DIVERSITY SCORE	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Adequate dietary diversity score	1.00		
Inadequate dietary diversity score	2.00	<0.05	1.18-3.39

4.4. SOCIAL PROTECTION

4.4.1. BIRTH CERTIFICATES

Children under five years of age with no birth certificates were at marginally reduced odds (2%) of being stunted compared to children under five who did have birth certificates. This counterintuitive finding was found to be statistically significant. In children aged one year or younger, there was no association found between absence or presence of birth certificates and stunting.

TABLE 13
BIRTH CERTIFICATES

BIRTH CERTIFICATES	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Presence of birth certificate (children under 5)	1.00		
Absence of birth certificate (children under 5)	0.08	<0.05	0.01-0.61
Ref: Presence of birth certificate (children under 1)	1.00		
Absence of birth certificate (children under 1)	1.00		

4.4.2. CHILD SUPPORT GRANT

Children under five years of age who were not receiving a child support grant had a 36% reduced odds of being stunted compared to children under five who were receiving grants. This odds ratio was statistically significant. When the same analysis was done for child support grants in children under one years old, it was found that the absence of a child support grant in children younger than one year reduced the odds of stunting by 20% in comparison to children receiving the child support grant, but this finding was not statistically insignificant.

TABLE 14
CHILD SUPPORT GRANT

CHILD SUPPORT GRANT	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Presence of child support grant (children under 5)	1.00		
Absence of child support grant (children under 5)	0.64	<0.05	0.42-0.98
Ref: Presence of child support grant (children under 1)	1.00		
Absence of child support grant (children under 1)	0.80	>0.05	0.40-1.63

4.5. ANTHROPOMETRY

4.5.1. BIRTH WEIGHT

Children with low birth weight were twice as likely (OR=2.42) to be stunted compared to those with normal weight at birth. This odds ratio was statistically significant.

TABLE 15
LOW BIRTH WEIGHT

BIRTH WEIGHT	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Normal birth weight	1.00		
Low birth weight	2.42	<0.05	1.65-3.56

4.5.2. ACUTE MALNUTRITION

Children with diagnosed moderate or severe acute malnutrition had higher odds of being stunted than children with an adequate nutritional status (as identified by MUAC). The odds ratios were statistically insignificant.

TABLE 16
ACUTE MALNUTRITION

ACUTE MALNUTRITION	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Normal MUAC measurement	1.00		
MAM	1.10	>0.05	0.39-3.14
SAM	1.33		0.50-3.53

4.5.3. WEIGHT-FOR-AGE (UNDERWEIGHT)

Children who were found to be underweight were 17 times more likely (OR=17.39) to be stunted compared to those with normal weight. This odds ratio was statistically significant. Children who were severely underweight were 45 times (OR=45.6) more likely to be stunted compared to those with normal weight. This odds ratio was statistically significant.

TABLE 17
UNDERWEIGHT

WEIGHT-FOR-AGE	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Normal weight	1.00		
Underweight	17.39	<0.05	9.66-31.33
Severely underweight	45.6		5.99-347.39

4.5.4. WEIGHT-FOR-HEIGHT (WASTING, OVERWEIGHT AND OBESITY)

Children under five years of age who were wasted had a 40% reduced odds of being stunted compared to children who were not wasted. However, this seemingly protective effect was not found to be statistically significant. Children who were overweight had a 32% increased odds of being stunted compared to children with normal weight for height. However, this odds ratio was also not statistically significant. Children who were obese, however, were found to be nearly three times as likely (OR=2.77) to be stunted compared to those with normal weight. This odds ratio was statistically significant.

TABLE 18
WASTING, OVERWEIGHT AND OBESITY

WEIGHT-FOR-HEIGHT	ODDS RATIO	P VALUE	CONFIDENCE INTERVAL
Ref: Normal weight for height	1.00		
Wasting	0.60	>0.05	0.24-1.45
Overweight	1.32	>0.05	0.82-2.14
Obesity	2.77	<0.05	1.43-5.36

4.6. SUMMARY

The risk factors for stunting that were found to be statistically significant *are indicated in Table 19.*

TABLE 19
STATISTICALLY SIGNIFICANT RISK FACTORS FOR STUNTING
IN THE SELECTED WORCESTER COMMUNITY

RISK FACTORS	ODDS RATIO	CONFIDENCE INTERVAL
Missing most recent record of deworming medication	1.61	1.11-2.33
Obesity	2.77	1.43-5.36
Inadequate dietary diversity	2.00	1.18-3.39
Underweight	17.39	9.66-31.33
Severely underweight	45.6	5.99-347.39
Low birth weight	2.42	1.65-3.56

The factors that were found to have a protective effect against stunting *are indicated in Table 20.*

TABLE 20
STATISTICALLY SIGNIFICANT PROTECTIVE FACTORS AGAINST STUNTING IN THE SELECTED WORCESTER COMMUNITY

RISK FACTORS	ODDS RATIO	CONFIDENCE INTERVAL
Mother obtained Grade 12	0.65	0.47-0.92
Absent birth certificates in under 5s	0.08	0.01-0.61
Absent child support grants in under 5s	0.64	0.42-0.98

After controlling for all confounding variables, an inadequate dietary diversity score (Adjusted OR=3.83; 95% CI [1.64,8.92]), underweight (Adjusted OR=77.70; 95% CI [22.28,270.99]) and obesity (Adjusted OR=3.90; 95% CI [1.38,11.00]) remained predictive of stunting. Male gender emerged as predictive of stunting (Adjusted OR=1,68; 95% CI [1.04,2.71] after controlling for confounding variables.

5. DISCUSSION

5.1. SOCIO-DEMOGRAPHICS

5.1.1. MATERNAL EDUCATIONAL ATTAINMENT

Completing high school (Grade 12 qualification) was found to be protective against stunting in this study. This was a statistically significant finding. Children whose mothers had completed high school were found to have lower odds of being stunted than children whose mothers did not complete high school. This finding is consistent with literature from other African countries and global settings[11-15] that maternal education attainment is protective against stunting. Sadly, most mothers (66%) included in the study, did not attain a high school level education. This is not unique to Worcester but is typical of the South African experience i.e. that women living in disadvantaged communities such as those included in this study are likely to have poorer education outcomes than their counterparts living in privileged communities.[16] This is a grave injustice, not only for the woman who herself is denied the opportunity to participate in the South African formal economy (the absence of Grade 12 or tertiary education is associated with higher unemployment)[17], but also for the child who is at a greater risk of stunting and its long-term consequences, in part as a result of his/her mother being structurally unsupported to achieve a high school level education. As stunting itself has long-term consequences on the educational attainment of the child, this serves to trap families in intergenerational cycles of poverty.[3]

5.1.2. CHILD SEX

Boy children were found to have increased odds of being stunted compared to girl children. This finding remained statistically significant even after controlling for confounding factors such as maternal education, maternal employment, access to basic services and nutritional status of the child. This is consistent with the local and international literature.[5,18,19] Boy children typically fare worse than girl children across a range of childhood illnesses.[20] Female children seem to have stronger immune response to infection, which may account for why boy children are sicklier.[21]

5.2. ACCESS TO BASIC SERVICES

5.2.1. WATER AND SANITATION

No statistically significant relationship was found in the selected Worcester community between stunting and access to basic services, which is to be expected as the majority of children included in this study lived in households with access to adequate water and good sanitation. These statistics are akin to provincial statistics for access to adequate water and good sanitation, which are estimated at 99% and 94%[22] respectively.

5.3. CHILD HEALTH AND NUTRITION

5.3.1. DEWORMING

Thirty percent (30%) of children over one years old included in this study, did not have a record of having received their most recent deworming medication. Helminth or worm infestations deprive young children of the nutrients their bodies require to grow.[23] It was thus not surprising to find that children who did not have an up-to-date deworming record had increased odds of being stunted when compared to children whose deworming records were up to date. This was a statistically significant finding.

5.3.2. DIETARY DIVERSITY SCORE

High dietary diversity scores have been found to be positively associated with the nutritional status of children, particularly higher height for age scores.[10] Thirty-two percent of children between 6-23 months participating in this study were found to have an inadequate dietary diversity score, suggesting that they were not receiving an adequately varied diet at the time of the research.

In our study population, children aged 6-23 months with an inadequate dietary diversity score were almost four times as likely to be stunted compared to children with an adequate dietary diversity score, after adjusting for confounding variables such as maternal education, male gender, maternal employment and access to basic services. Considering that South Africa is a food secure country, more needs to be done to improve the accessibility of nutritious foods to children living in vulnerable households as well as nutrition education in communities.

5.3.3. VITAMIN A COVERAGE

Although Vitamin A coverage were suboptimal in our study population, it was not found to be statistically significantly associated with higher odds of being stunted.

5.3.4. EXCLUSIVE BREASTFEEDING RATES

Exclusive breastfeeding rates for children under six months at 59% were found to be higher than national rates of 32%[5] and higher than what has been reported in a 2016 study[24] conducted in Worcester, which estimated a 38% exclusive breastfeeding rate. Although this marked improvement in exclusive breastfeeding rates in the Worcester community is encouraging, it should be read with caution as there may have been a desirability bias at play, where caregivers reported to CHWs what they thought they might want to hear. In addition, research suggests that the concept of exclusive breastfeeding is not always well understood by communities.[25] Exclusive breastfeeding in this study population was, however, not found to have a statistically significant protective effect against stunting. This counterintuitive finding may be due to the small sample size of children under six months of age (n=99) included in the study.

5.4. SOCIAL PROTECTION

5.4.1. BIRTH REGISTRATION

Most children (96%) included in the study had birth certificates. Only 5% of the under one-year-olds did not have birth certificates, which is an improvement on provincial statistics of 11%.[26] Interestingly, in the under-five age category, not having a birth certificate had a marginal protective effect on stunting with reduced odds of 2%.

5.4.2. ACCESS TO CHILD SUPPORT GRANT

Most children (80%) included in the study were receiving a child support grant. However, in the under one age category, only 67% of children were receiving the child support grant. As our study did not assess whether the children were eligible for grants, we are unable to comment on whether the 33% of under one-year-olds not receiving grants reflect late registration or ineligibility. Interestingly, however, not receiving a child support grant was found to reduce a child's odds of being stunted by 36%. This might be a confounding factor, pointing to the protective effect of living in a higher income household (and thus not being eligible for a grant) on a child's risk of stunting.

5.5. ANTHROPOMETRY

5.5.1. STUNTING

Twenty-six percent (26%) of children under five included in this study suffered from stunting. The prevalence of stunting found in this community was higher than provincial estimates of 23% and akin to national estimates of 27%.[5]

5.5.2. LOW BIRTH WEIGHT

Nineteen percent (19%) of children had a low birth weight, which exceeds provincial trends of 14.2%.[27] Having a low birth weight in this population was found to increase the odds of a child being stunted by a factor of 2.42. This highlights the importance of maternal nutrition interventions beginning in pregnancy. At present in South Africa, State social assistance for the purposes of nutrition support for vulnerable and poor children is only provided after the child is born in the form of the child support grant. South Africa does not provide this kind of support to vulnerable and poor pregnant women. This is a missed opportunity because, as has been demonstrated in this study, much of the vulnerability to stunting begins in pregnancy.

5.5.3. UNDERNUTRITION

The study population had low levels of both moderate and severe acute malnutrition (as screened for on MUAC measurement) at 2.5% for both. Being identified with a MUAC measurement suggestive of moderate or severe malnutrition was not found to be related to increased odds of being stunted in this study population. The prevalence of weight for age of more than 2 standard deviations below the median, however, was significantly higher, with underweight estimated at 10% for the study population. This is similar to what has been reported for the Western Cape more broadly (estimated 12%).[5] Underweight children were 78 times more likely to be stunted compared to children who had a normal weight for age, after adjusting for confounding factors. Although the proportion of children who were found to be severely underweight was only 2%, these children were 45 times more likely to be stunted compared to children with a normal weight-for-age.

Related to undernutrition, 5% of children were found to be wasted and 1% were found to be severely wasted.

5.5.4. OVERNUTRITION

Eleven percent (11%) of children included in this study were found to be overweight and 5% were found to be obese. Obese children in this study population were found to be almost 4 times more likely to be stunted than children who had a normal weight-for-height, even after controlling for confounding variables.

5.6. LIMITATIONS

Some questions relied on participants' memory of past events. Self-reported data can lead to recall and social desirability bias. Questions on immunisation schedules were imprecisely phrased, making it difficult for researchers to interpret this data and draw conclusions from it, thus resulting in these specific data being left out of the analysis. Future community-based surveys will improve upon these design elements. Nonetheless this study makes an important contribution to the limited empirical literature on the nutritional status of South Africa's children.

6. CONCLUSION AND RECOMMENDATIONS

Poor maternal education in this study population was found to increase the odds of a child being stunted. This is in line with research evidence.[11–15] Almost two-thirds of mothers participating in this research did not obtain a high school level education, which is higher than the national school dropout prevalence of 40%.[28]

Literature suggests that for girl children in particular, teenage pregnancy and child care for their own children is one of the primary reasons why high school girls drop out.[15] Thus, the Worcester community should invest in improving access to contraception for high school learners, as well as supporting learners with children to benefit from high-quality and affordable childcare that enables them to continue with their schooling career whilst having the peace of mind that their child is in a safe and stimulating environment.

We also found in this community, that a significant proportion of children were not benefiting from free basic preventative primary healthcare services, such as deworming and Vitamin A supplementation. This finding is particularly concerning in light of the low levels of dietary diversity in this population of children i.e. the limited amount of nutrients they receive is potentially further undermined by preventable helminth infestations. Furthermore, deworming medication is freely available for all children in South Africa. This finding, as well as the sub-optimal Vitamin A coverage found in this study population, speaks to the need to strengthen CHW-led home visiting programmes to ensure that children in this community, and similarly vulnerable communities in the Western Cape, are adequately cared for. CHWs should be trained and empowered to assess deworming and Vitamin A records in children's Road to Health booklets, and to administer the necessary medications and supplements as required, particularly in light of the high national stunting and Vitamin A deficiency prevalence amongst children under five in South Africa.[18] Local experience and experience from other developing country settings suggests that a trained and supported CHW workforce can play a critical role in helping to improve nutrition outcomes of children.[9, 29, 30]

A substantial number of children in the study population were not consuming a diet with the required diversity for healthy growth, even though

80% are beneficiaries of the CSG. This speaks to the concerns raised across South African civil society regarding the value of the grant i.e. it falls well below the food poverty line, and due to the abject poverty the majority of South Africans face (60% of children live in food poor households), the CSG is often used for purposes other than nutrition costs alone. With COVID-19 plunging families into even deeper poverty, and malnutrition rates estimated to have regressed to 2008 global recession levels,[31] it is likely that access to nutritionally diverse food in this community has deteriorated further since this study was conducted and so increasing the CSG to the food poverty level needs to be actioned as a matter of urgency.

At a community level, parents should be equipped with information and support to provide their children with nutritious food within household budgetary constraints. This kind of support could again be delivered through CHWs already visiting homes and/or through community-based parent support groups.

An encouraging finding stemming from this research, was that reported exclusive breastfeeding rates for children under six months (56%) were higher than national rates (32%). Breastfeeding is the critical first nutrient-rich food source that promotes healthy growth and development. Community and health system interventions that support exclusive breastfeeding should be sustained.

Likewise, most children in Worcester had birth certificates and were receiving the CSG. These social protection measures should be sustained, and CHWs should be supported to identify children who qualify for grants and connect them to the relevant government services.

Worcester had a high prevalence of stunting (26%) in children under five, similar to the high prevalence rates seen nationally (27%) and higher than the provincial prevalence of 23%. This high prevalence of stunting is coupled by high levels of low birth

weight. In this study low birthweight was found to increase the odds of a child being stunted by a factor of 2.42. This suggests that much of the disadvantage that puts children at risk of eventually becoming stunted, starts in pregnancy and thus pre-pregnancy and antenatal focused interventions that support women during this critical time need to be prioritised in the Worcester community. This further speaks to the need to extend state social protection programs, such as the child support grant, into pregnancy. In addition to the stunting problem, one in 10 children in the Worcester communities were found to be underweight. After adjusting for confounding variables, low weight-for-age was found to increase these children's risk of being stunted by a factor of 78. Addressing underweight in the Worcester community should be a matter of priority as this research suggests it independently increases the risk of stunting even after accounting for social circumstances and biological differences. CHWs should be equipped with scales and trained in the early identification of growth faltering in the home, so that children who are not growing well and who require additional support are referred timeously. At present, CHWs are typically only equipped with MUAC tapes. The findings of this study suggest that if children are only screened for mid upper arm circumference and not routinely weighed, many children vulnerable to becoming stunted will be missed, as a MUAC reading suggestive of moderate or severe acute malnutrition was in this study not found to increase the odds of a child being stunted. In addition, evidence from Cambodia suggests that solely relying on MUAC tapes as a screening tool for malnutrition misses as many as 90% of severely wasted children.[32]

The research also found that 11% of children under five in this study were overweight and 5% obese, suggesting a double burden of both under- and overnutrition in the Worcester community. After adjusting for confounding variables, those who were obese had 3.9 times increased odds of being stunted

than children who had a normal weight-for-height. Although the overweight rates in the Worcester community were lower than national and provincial estimates of 13% and 14% respectively,[5] parent support and nutrition education programmes need to be rolled out in the Worcester community to empower parents to provide healthy meals to their children. In addition, 'double duty' interventions such as supporting mothers to exclusively breastfeed for the first six months of their child's life – which is protective against both under- and overnutrition – should be sustained and scaled up.[33]

The Western Cape Government has identified the reduction of stunting as one of six measures of success in meeting its objectives of Empowering People (Vision-Inspired Priority 3). This study presents evidence for where programmes aimed at reducing stunting in Worcester specifically, but also in similar communities in the Western Cape, should be targeting their activities.[34] In light of the child nutrition-related setbacks that COVID-19 has placed on communities, it is critical that programmes and policies be informed by evidence and focused on cost-effective interventions that have been shown here, and in other studies, to significantly reduce stunting and bring us closer to a future where no child will be denied the opportunity to reach their full potential from a preventable condition.

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