FINAL REPORT

NUTRITION CAUSAL ANALYSIS

REVIEW OF AVAILABLE EVIDENCE ON RISK FACTORS OF UNDERNUTRITION BASED ON THE LINK NCA METHODOLOGY

Chin State, Myanmar
November 2021

ACTION AGAINST HUNGER

CRS CATHOLIC RELIEF SERVICES

Save the Children

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ABBREVIATIONS

ANC	Antenatal Care
ARI	Acute Respiratory Infections
cGAM	Combined Global Acute Malnutrition
CI	Confidence Interval
CMAM	Community Management of Acute Malnutrition
DHS	Demographic and Health Survey
EBF	Exclusive Breastfeeding
ENA	Emergency Nutrition Assessment
FSL	Food Security and Livelihoods
GAM	Global Acute Malnutrition
GBV	Gender-Based Violence
HAZ	Height for Age Z-Score
HH	Household
HHS	Household Hunger Scale
HDDS	Household Dietary Diversity Score
IDDS	Individual Dietary Diversity Score
IPC	Integrated Phase Classification
IYCF	Infant and Young Child Feeding
IYCN	Infant and Young Child Nutrition
LIFT	Livelihoods and Food Security Trust Fund
LZ	Livelihood Zone
MAHFP	Months of Adequate Household Food Provisioning
MAM	Moderate Acute Malnutrition
MCH	Maternal and Child Health
MCCT	Maternal and Child Cash Transfer Programme in Chin State
MDD-W	Minimal Dietary Diversity for Women
MSWRR	Ministry of Social Welfare, Relief and Resettlement
MUAC	Mid-Upper Arm Circumference
NCA	Nutrition Causal Analysis
NGO	Non-Governmental Organization
PLW	Pregnant and Lactating Women
PNC	Postnatal Care
PPS	Probability Proportionate to Size
rCSI	Reduced Coping Strategy Index
RFS	Risk Factor Survey
SAM	Severe Acute Malnutrition
SFP	Supplementary Feeding Programme
SMART	Standardized Monitoring for Assessment in Relief & Transitions
TBA	Traditional Birth Attendant
TSFP	Targeted Supplementary Feeding Programme
UNICEF	United Nations' Children's Fund
UNOPS	United Nations Office for Project Services
USD	United States Dollar
WASH	Water, Sanitation and Hygiene
WAST	Concurrent Wasting and Stunting
WAZ	Weight for Age Z-Score
WHO	World Health Organization
WHZ	Weight for Height Z-Score
WRA	Women of Reproductive Age

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EXECUTIVE SUMMARY

Located in northwest Myanmar, Chin remains one of the least developed areas in Myanmar and is home to some of the most isolated communities in the country. Chin performs poorly in social development indicators and faces serious challenges in access to water and sanitation facilities, adequate nutrition or child protection.[15]

With one of the highest rates of stunting in the South East Asian region, malnutrition is highly prevalent in Myanmar. According to the Myanmar Demographic and Health Survey 2015-2016, 19 % of children under 5 years of age were underweight, 29 % of children were stunted, and 7 % were wasted.[15] The prevalence of stunting peaking at 40% is particularly concerning in Chin State,[1] in remote upland households of Falam, Thatlang and Matupi townships.

While a patchwork of research initiatives examined various socio-cultural aspects in Chin State, none of these have been used to thoroughly understand how these aspects impact the nutritional status of children under five years of age. Therefore, the purpose of this review was to pool existing data sources to build a strong evidence base for the development of future interventions to address child stunting in a holistic, integrated, sustainable way.

This review consisted of review of available secondary data sources relevant for the study zone as well as secondary quantitative data analyses using datasets provided by Department of Social Welfare (DSW) under the Ministry of Social Welfare, Relief and Resettlement (MSWRR) from Maternal and Child Cash Transfer Programme in Chin State (MCCT) baseline survey conducted in 2017. *It is possible that the identified risk factors might have changed or their effect increased due to the Covid-19 pandemic and the political crisis in country. The findings presented in this report should therefore be studies with caution.*

Key findings

The analyses undertaken during this review allowed to identify 20 risk factors, believed to have an impact on the incidence of undernutrition in the study zone. Following a triangulation of data from diverse sources, 5 risk factors were identified as having a major impact, 10 risk factors were classified as having an important impact and 5 risk factors were judged to have a minor impact on the incidence of undernutrition in the zone of study. Among the major risk factors, three were identified in the sector of food security and livelihoods, namely low access to a quality diet, low access to income sources and low coping capacities, while two factors were identified in the health sector, namely low birth-spacing/early, repetitive or unwanted pregnancies and low nutritional status of women.

Based on available data provided by MSWRR, the calculation of statistical associations between individual risk factors and nutritional status of children in surveyed households allowed to differentiate between risk factors of wasting, stunting, underweight and concurrent wasting and stunting (WaSt).

Common risk factors for *wasting* on the basis of at least one index (WHZ or MUAC or WHZ and/or MUAC), *stunting* and *underweight* include mother's MUAC <21 cm or low BMI[3], farming or animal husbandry as household's primary occupation, household taking a loan or inadequate food provisioning due to inadequate income.

Common protective factors for the three nutrition outcomes include year-round adequate food provisioning[2], exclusive breastfeeding and ownership of at least one wooden or steel bed, a mattress or table. The increasing number of months of adequate food provisioning, or asset categories owned by the household as well as the increasing HDDS or MDD-W scores decreased child's chances of being wasted, stunted or underweight. Most of these factors align with identified risk and protective factors for concurrent wasting and stunting with the

[1] *MMFCS 2017-2018.*
[2] *MAHFP twelve months.*

exception of dietary diversity scores, which did not demonstrate statistical associations with *WaSt*. In addition, children less than 24 months are more likely to be wasted and concurrently wasted and stunted while it is rather children more than 24 months which are more likely to be stunted or underweight.

The key differences between risk factors for *wasting* on the basis of at least one index (WHZ or MUAC or WHZ and/or MUAC) and *stunting* include reverse observations for male child, which appears to be less likely to be wasted but more likely to be stunted. The same pattern was observed for children in households with more than one child under 59 months and low income households[52]. Additionally, indicators related to sudden shocks, such as illness or violence, appeared to be relevant for *wasting* but not *stunting* while hygiene indicators appeared to be more relevant for *stunting* but not *wasting*. Children from households residing in rural areas were more likely to be *stunted* and *underweight* while the association with *wasting* was not observed. Mother's socio-economic status, including age, education, income and education, seemed to play a particular role in relation to *stunting* while the evidence was scarcer in relation to *wasting* and *underweight*. With the exception of few factors, risk and protective factors for *stunting* and *underweight* greatly overlap.

Wasting (WHZ, MUAC or MUAC and/or WHZ)

Risk factors: Children younger than 36 months were more likely to be wasted by MUAC and MUAC and/or WHZ. Children of mothers with MUAC <21 cm or low BMI[3] were more likely to be wasted on the basis of WHZ, MUAC and MUAC and/or WHZ. Mother's increasing age increased child's chances to be wasted by WHZ[4].

Children living in households with regular income from NGOs[53] were more likely to be wasted on the basis of WHZ while children living in households which reported farming or animal husbandry as their primary occupation were more likely to be wasted on the basis of MUAC and MUAC and/or WHZ.

Children living in households experiencing inadequate household provisioning due to a loss of regular job were more likely to be wasted on the basis of MUAC; children living in households experiencing inadequate food provisioning due to inadequate income were more likely to be wasted on the basis of WHZ and MUAC and/or WHZ and children living in households experiencing inadequate food provisioning due to illness or being victim of violence/crime were more likely to be wasted on the basis of MUAC and MUAC and/or WHZ. Children living in households which experienced an earthquake were more likely to be wasted on the basis of WHZ.

Children living in households which took a loan in the 12 months prior the data collection were more likely to be wasted on the basis of MUAC and/or WHZ. Children living in households which owned at least one boat without a motor[54] or radio/cassette player were more likely to be wasted on the basis of WHZ.

Children living in households which experienced water scarcity were more likely to be wasted on the basis of MUAC. Children living in households which were straining water through a cloth as means to treat water were more likely to be wasted on the basis of WHZ while children living in households which were letting the water to stand and settle were more likely to be wasted on the basis of WHZ, MUAC and/or WHZ. The increasing distance to latrines increased child's chances of being wasted on the basis of WHZ and MUAC.

Protective factors: Male children were less likely to be wasted on the basis of MUAC and MUAC and/or WHZ. Children living in households with more than one child under 59 months

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[3] *Pregnant women excluded.*
[4] *It is hypothesised that this trend is linked with an increasing number of children in the household and therefore less time for optimal care practices.*

or households with year-round adequate food provisioning[2] were less likely to be wasted on the basis of MUAC and/or WHZ. The increasing number of months of adequate food provisioning decreased child's chances of being wasted on the basis of WHZ and MUAC. The increasing HDDS or MDD-W scores decreased child's chances of being wasted by WHZ and MUAC while the increasing IDDS score decreased child's chances of being wasted by MUAC.

Mother's increasing BMI[3] decreased child's chances of being wasted on the basis of WHZ and MUAC while her increasing age decreased child's chances of being wasted by MUAC. Children who were exclusively breastfed were less likely to be wasted by MUAC and/or WHZ. Children of mothers who were taking contraceptives or other means to delay pregnancy or mothers who were involved in decisions about major household decisions were less likely to be wasted on the basis of MUAC. Children who underwent a health check within two weeks of delivery were less likely to be wasted on the basis of WHZ and MUAC.

Children living in households which owned at least one wooden or steel bed, mattress or table were less likely to be wasted on the basis of MUAC and/or WHZ. Children living in households which owned at least one fuel efficient wood stove were less likely to be wasted on the basis of MUAC while children living in households which owned at least one fish net were less likely to be wasted on the basis of WHZ. The increasing number of asset categories owned by the household decreased child's chances of being wasted on the basis of WHZ and MUAC.

Children living in households which used an improved water source[5] in summer were less likely to be wasted on the basis of MUAC.

Stunting (HAZ)

Risk factors: Male children, children from rural households and children from above average sized households (> =7 members[6]) were more likely to be stunted. The increasing age of a child or the increasing number of members within a household increased child's chances of being stunted. Children living in households with more than one child under 59 months or children who were less than 24 months apart from their sibling were more likely to be stunted. The same trend was observed for children who had experienced illness before or children from households with more than one child under 59 months who had fever as their most recent illness. Children of mothers who were pregnant at the time of the data collection or mothers who did not desire future pregnancy and were not taking contraceptives were also more likely to be stunted.

Children of mothers with MUAC <21 cm, low BMI[3] or short stature (<151.7 cm)[7] were more likely to be stunted. Children of mothers who only complemented their elementary education or children of widowed mothers were also more likely to be stunted while mother's increasing age increased child's chances to be stunted.

Children living in low income households[52], households which demonstrated below average asset ownership[8], or households which reported farming or animal husbandry or casual labor as their primary occupation were more likely to be stunted. Children were also more likely to be stunted if they lived in households experiencing inadequate food provisioning due to poor harvest or inadequate income, or households which took a loan, particularly for food purchases.

Children living in households in which a water container was observed unclean or uncovered or households which received sanitation sensitisation in the six months prior the data collection[59] were more likely to be stunted. Children were also more likely to be stunted if they

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[5] *Variable generated by MMR analyses. This includes piped water into dwelling or to yard/plot, public tap/standpipe, tube well/borehole, protected dug well, protected spring or bottled purified water.*
[6] *Average household size= 6.5.*
[7] *Population mean.*
[8] *Mean: 5.5; Minimum: 0, Maximum: 17.*

lived in houses with palm leaves or tarpaulin as the main roof material. The likelihood of children being stunted increased if children were living in houses which only used palm leaves as the main roof material.

Protective factors: Children younger than 36 months were less likely to be stunted. Children living in households of government employees or households which owned at least one car or a piece of gold were less likely to be stunted. Children were also less likely to be stunted if they lived in households which owned at least one wooden or steel bed, mattress, table, gas/electric stove, generator, fridge, sewing machine, video player/recorder, TV or satellite dish. Children living in households with electricity or electricity at night had lower chances of being stunted. The increasing number of asset categories owned by the household decreased child's chances of being stunted.

Children living in households with year-round adequate food provisioning[2] or households with HDDS higher than mean score[9] were less likely to be stunted. The increasing number of months of adequate food provisioning or increasing HDDS score decreased child's chances of being stunted. Children were also less likely to be stunted if they lived in households which migrated before and/or after the childbirth or if they were exclusively breastfed.

Children of overweight mothers[3] were less likely to be stunted as mother's increasing BMI[3] or MDD-W score decreased child's chances of being stunted. The increasing number of months of iron folic acid supplementation during pregnancy also decreased child's odds of being stunted.

Children living in households in which woman's income surpassed that of her husband, children of mothers who made decisions about major household decisions or mothers who completed at least four ANC visits during last pregnancy were also less likely to be stunted. Children who underwent a health check within two weeks of delivery or children of mothers 18 years old or younger were less likely to be stunted.

Children living in households which used a filter to treat water or households in which a water container was observed clean were less likely to be stunted. Children were also less likely to be stunted if they lived in households where soap could be observed at the place of handwashing or mothers reported using soap to wash hands.

Underweight (WAZ)

Risk factors: Children from rural households, households with more than one child under 59 months, children of mothers who were pregnant at the time of the data collection or children of mothers who did not desire future pregnancy and were not taking contraceptives were more likely to be underweight. The increasing age of a child or increasing number of members within a household increased child's chances of being underweight.

Children of mothers with MUAC <21 cm, low BMI[3] or short stature (<151.7 cm)[7] were more likely to be underweight. Children of mothers who only complemented their elementary education or children of widowed mothers were also more likely to be underweight while mother's increasing age increased child's chances of being underweight. Children who had experienced illness before were more likely to be underweight.

Children living in low income households[52], households which demonstrated below average asset ownership[8] or households which reported farming or animal husbandry as their primary occupation were more likely to be underweight. Children were also more likely to be underweight if they lived in households experiencing inadequate food provisioning due to inadequate income or households which took a loan, particularly for food purchases.

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[9] *Min: 1, Max: 12. Mean: 6.6. [6.4-6.7].*

Children living in houses with palm leaves or tarpaulin as the main roof material were more likely to be underweight. The likelihood of children being underweight increased if children were living in houses which only used palm leaves as the main roof material. The increasing distance to water facilities or latrines also increased child's chances of being underweight. Children living in households in which a water container was observed unclean or uncovered were also more likely to be underweight.

Protective factors: Children younger than 24 months or children younger than less than 36 months were less likely to be underweight. Children living in households of government employees or households which owned at least one car or a piece of gold were less likely to be underweight. Children were also less likely to be underweight if they lived in households which owned at least one wooden or steel bed, mattress, table, gas/electric stove, generator, sewing machine, fish net, video player/recorder, TV or satellite dish. Children living in households with electricity or electricity at night had lower chances of being underweight. The increasing number of asset categories owned by the household decreased child's chances of being underweight.

Children living in households with year-round adequate food provisioning[2] or households with HDDS higher than mean score[9] were less likely to be underweight. The increasing number of months of adequate food provisioning or increasing HDDS score decreased child's chances of being underweight. Children were also less likely to be underweight if they lived in households which migrated before and/or after the childbirth or if they were exclusively breastfed.

Children of overweight mothers[3] were less likely to be underweight as mother's increasing BMI[3] or MDD-W score decreased child's chances of being underweight. Children of mothers who completed at least four ANC visits during last pregnancy or children who underwent a health check within two weeks of delivery were also less likely to be underweight. The increasing number of months of iron folic acid supplementation during pregnancy decreased child's odds of being underweight.

Children living in households which used composite filters to treat water or households in which owned a water container for storage were less likely to be underweight. Children were also less likely to be underweight if they lived in households where soap could be observed at the place of handwashing.

Concurrent wasting and stunting (WaSt)

Risk factors: Children were more likely to be concurrently wasted and stunted if they were younger than 24 months old[10] or if they lived in households with more than one child under 59 months and had fever as their most recent illness. They were also more likely to be concurrently wasted and stunted if their mothers were of short stature (<151.7 cm)[7], if their mothers' MUAC were lower than 21 cm or their mothers completed only their elementary education.

Children living in households which demonstrated below average asset ownership[8], households which took a loan in the 12 months prior the data collection or households which were letting the water to stand and settle as means to treat water were more likely to be concurrently wasted and stunted.

Protective factors: Children were less likely to be concurrently wasted and stunted if they were exclusively breastfed, if they lived in households with year-round adequate food provisioning[2] or households which owned at least one wooden or steel bed or mattress.

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[10] *The overall household sample is skewed towards households with young children, since per definition, households without young children or a pregnant household member are excluded. This has an impact on the found household age distribution. More specifically, it leads to an overrepresentation of the age group of children below five years of age, which is twenty-seven percent (26.7%) compared to nine percent (9%) nationally.*

Summary of ongoing interventions

The national strategy to eradicate hunger and reduce malnutrition, MS-NPAN, targeted Chin state as one of its top priority states and regions to launch nutrition-specific and nutrition sensitive interventions led by the government, non-governmental actors and private sector providers. These include long-term development interventions in agriculture, food security and livelihoods, social protection, health and nutrition, and gender sectors, led by national and international organisations. In Southern Chin, humanitarian assistance is also provided to internally displaced populations.

The Ministry of Social Welfare, Relief and Resettlement (MSWRR), through the Department of Social Welfare (DSW) started Chin State's Maternal and Child Cash Transfer (MCCT) programme in June 2017. This program aimed to improve the nutritional outcomes for all mothers and children during the first 1000-day period. A 15,000 MMK monthly payment was given to pregnant women or mothers with children up to 2 years to increase their purchasing power and to invest in health, hygiene and nutrition.[11]

Karuna Mission Social Solidarity (KMSS) Hakha has been conducting nutrition-sensitive activities in Chin State since 2016 in partnership with Catholic Relief Services (CRS) and nutrition-specific activities with Save the Children since 2017, both with funding support from UNOPS-Livelihood and Security Fund (LIFT).

Due to the ongoing political crisis in country at the time of writing this report, the above-described formal government interventions have been halted. Non-governmental organizations continue to provide support. CRS and KMSS have introduced new interventions to stave off potential nutritional decline, including short-term cash and food distributions for targeted households in project villages with children under 5-years old. These distributions are accompanied with nutrition and hygiene informational materials in five local languages, with illustrations that are contextually appropriate for Chin State. KMSS and Save the Children are running a mobile clinic and providing cash with messages to encourage families to use them for medical referrals or to eat protein-rich foods.

Recommendations

Based on these findings, the following key activities are thus recommended to be considered for an incorporation into current/future interventions:

- Considering a potential effect of Covid-19 pandemic coupled with a political crisis in country, it is recommended to collect new household data, potentially via MCCT endline survey, to assess to which extent risk factors detailed in this report are still relevant. If child, caregiver and household identifiers exist, it is recommended to conduct the endline survey in the same households as MCCT baseline survey in order to evaluate an evolution of personal and household indicators and their potential effect on child's nutritional status;
- Considering missing qualitative data about community perceptions of undernutrition and its causal mechanisms in Chin State, it is recommended to conduct primary qualitative data collection on this topic and to triangulate it with the evidence detailed in this review and any new evidence produced by MCCT endline survey or other studies and assessments;
- Considering a concurrence of multiple forms of undernutrition among malnourished children (wasted, stunted or underweight), it is recommended to consider programmatic adaptations which would address common risk factors of wasting, stunting and underweight, instead of focusing on stunting only;
- Considering that a child's nutritional status is strongly linked with that of their mother, it is recommended to promote the importance of health among women of reproductive age, to systematically assess their nutritional status, especially during pregnancy and

[11] *Country-led Formative Evaluation of the Maternal and Child Cash Transfer Programme in Chin and Rakhine States in Myanmar, DSW, MSWRR, Myanmar, 2020.*

breastfeeding, while advocating for optimal birth-spacing to ensure child's proper development *in/ex utero*;

- Considering that children from above average-sized households or households with more than one child under 59 months or children less than 24 months apart from their sibling are at greater risk of undernutrition, it is recommended that caregivers receive adequate sensitisation and support if caring for more than one child under 59 months. This could include one-on-one mentoring by community health workers or advocacy for greater engagement in child care by other family members;
- Considering that at least one third of recipients considers the current amount of provided cash transfer inadequate[11], it is recommended to consider its increase to reflect dietary diversity needs of a child as well as their mother. In addition, it is recommended to extend the support to all children under 59 months living in the most vulnerable households;
- Considering that children from low income households, households which demonstrated below average asset ownership or households which took a loan are at greater risk of undernutrition, it is recommended that such households receive adequate support, per their main income source, to ensure the continuity of household food provisioning over the course of twelve months, while strengthening their capacity to optimally manage income, expenses and loans. In case of a shock, these households should have an access to in-time support to deal with consequences of such event and its potential effect on nutritional status of household members;
- Considering that inadequate water management has effect on the occurrence of multiple forms of undernutrition, it is recommended that respective behaviour change strategies are strengthened, primarily promoting the use of household water filters and optimal water storage.

I. INTRODUCTION

Located in northwest Myanmar, Chin remains one of the least developed areas in Myanmar and is home to some of the most isolated communities in the country. Chin struggles with the highest poverty rate in Myanmar, where close to six out of ten persons are poor. Chin performs poorly in social development indicators and faces serious challenges in access to water and sanitation facilities, adequate nutrition or child protection.[15]

With one of the highest rates of stunting in the South East Asian region, malnutrition is highly prevalent in Myanmar. According to the Myanmar Demographic and Health Survey 2015-2016, 19 % of children under 5 years of age were underweight, 29 % of children were stunted, and 7 % were wasted.[15] The prevalence of stunting peaking at 40% is particularly concerning in Chin State,[1] in remote upland households of Falam, Thatlang and Matupi townships. Reported immediate causes of high stunting prevalence include inadequate dietary intake among pregnant/lactating women (PLW) and children under two years, and high disease burden among children under five years of age. According to the Lancet 2013 Maternal and Child Nutrition Series, suboptimal maternal, infant and young child nutrition practices contribute significantly to wasting and stunting.

While certain progress has been noted over the years, the Covid-19 pandemic and the political crisis developing concurrently in 2020-2021, there is a widespread concern that any of the nutritional gains made over the past decade will backslide as governmental nutritional commitments have been halted.

Justification of the review

While a patchwork of research initiatives examined various socio-cultural aspects in Chin State, none of these have been used to thoroughly understand how these aspects impact the nutritional status of children under five years of age. Therefore, the purpose of this review was to pool existing data sources to build a strong evidence base for the development of future interventions to address child stunting in a holistic, integrated, sustainable way.

II. STUDY OBJECTIVES

Global objective

The main objective of this review was to identify the major risk factors of undernutrition (stunting) in Norther Chin State, namely in Thantlang, Falam, Hakha and Tedim townships.

Specific objectives

- To identify and categorize risk factors responsible for stunting among the population in the study area;
- To understand how risk factors responsible for stunting among the population in the target area interact with each other in order to determine which causal pathways to undernutrition are likely to explain most cases of stunting in the target area;
- To understand how risk factors responsible for stunting among the population in the target area have evolved over time and/or evolve in different seasons;
- To identify vulnerable groups for each major risk factor of stunting among the population; and
- To use study results and develop actionable recommendations to address identified risk factors, targeting most vulnerable communities.

III. METHODOLOGY

Type of methodology

A Link NCA Nutrition Causal Analysis is a method for analysing the multi-causality of undernutrition, as a starting point for improving the relevance and effectiveness of multi-sectoral nutrition security programming in a given context. It is a structured, participatory and holistic study that builds on UNICEF's conceptual framework of child undernutrition with an objective to build an evidence-based consensus on plausible causes of undernutrition in a local context[12].

Originally, this review was meant to be conducted as a Link NCA study, following the precisely defined methodological guidelines. However, due to numerous constraints exacerbated by the COVID-19 global emergency, it was not possible to conduct the study as planned. The commissioning organisation therefore agreed to proceed with analyses based on available data sources and to reclassify the study as a review of available evidence on risk factors of undernutrition. In contrast to a standard Link NCA study, this review does not include a qualitative component, which is used extensively for the contextualisation of findings and more sensible adaptations of future programming based on community needs.

In consequence, this assessment was not able to answer a series of Link NCA study questions, namely:

- To understand how risk factors responsible for stunting among the population in the target area interact with each other in order to determine which causal pathways to undernutrition are likely to explain most cases of stunting in the target area;
- To understand how risk factors responsible for stunting among the population in the target area have evolved over time and/or evolve in different seasons;
- To identify vulnerable groups for each major risk factor of stunting among the population.

Key stages

A. Preparatory phase & Identification of hypothesised risk factors and causal pathways (January – February 2020)

The main objective of a preparatory phase was to define key parameters of the study, including its objectives, geographical coverage and feasibility. A preliminary secondary data and literature review was conducted in order to define the structure of the study. Safeguarding a mixed method approach of the Link NCA methodology, a preference was given to the qualitative data collection, complementing it with analyses of existing MCCT baseline survey datasets from 2017.

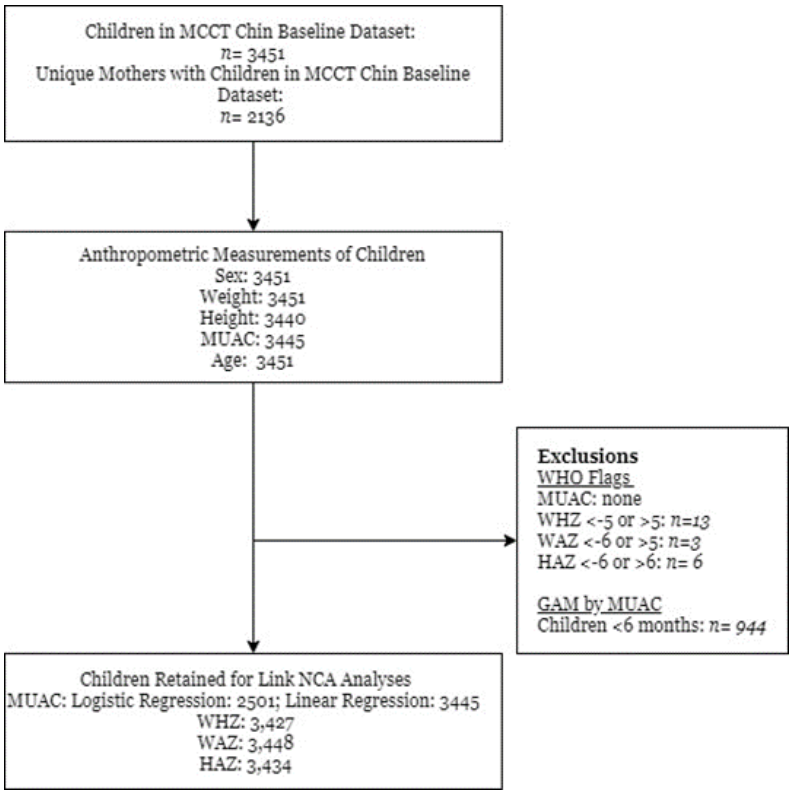
The literature review (using the *Link NCA Pathways to Undernutrition* module and all grey literature available locally) was conducted in February 2020. The aim of the exercise was to identify a set of risk factors and their interactions, which might trigger undernutrition among the target population.

A thorough study protocol was presented to the Myanmar Internal Review Board in February 2020, followed by an approval from MSWRR to use the MCCT baseline datasets on 17 March 2020. Due to a dual crisis caused by Covid-19 pandemic and a coup on 1 February 2021, the formal ethical approval for the study could not be granted and therefore the study was reconfigured, as it is noted above.

[12] For more information about the methodology, please refer to www.linknca.org.

B. Secondary quantitative data analysis (August 2020)

Secondary data analyses conducted for the purposes of this review focused on identifying statistical associations between the nutritional status of children under 5 years of age and their health and living conditions captured via indicators of MCCT baseline survey. These analyses, including both logistic and linear regression, made it possible to differentiate between the risk factors of wasting, stunting, underweight and concurrent wasting and stunting in order to help prioritize and adapt interventions of operational partners in Chin State aimed at reducing undernutrition in the study zone.



Received MCCT baseline survey datasets included a wide range of variables, including anthropometrics and health status for children under 59 months, household food security situation, household water and sanitation situation, dietary diversity as well as mother's nutritional status and decision-making powers.

Upon reception of datasets, the data were reviewed and standardised. WHO 2006 flags were applied to find outlier data. *It is important to note that MCCT baseline survey report did not drop any "flagged" anthropometric measurements and therefore findings included in this report might vary.*

Figure1: Exclusion criteria applied on MCCT baseline survey datasets

The quantitative data analyses were conducted with STATA software. The anthropometric data was analysed using ENA for SMART software (2020 version).

Notes on data management and interpretation:

- Data representativeness: Households were selected to participate in the survey based on the presence of female respondents who were either currently pregnant or had recently given birth. Respondents were selected through a purposive sampling method. In rural enumeration areas, eligible respondents were identified with the support of local village authorities and leaders; based amongst others on village lists where available or local knowledge of the local population. In urban areas, households were screened for eligible respondents and once identified, further participants were found by applying a snowballing approach. Only respondents that were currently pregnant or who had recently given birth [child < 24 months} were selected. All children < 59 months old were measured; however, some questions were only posed for children 0-24 months. 13% of respondents were in their first pregnancy and thus dropped from analyses for the purposes of this review;
- Geographic representativeness: Considering practical limitations, the study decided to exclude villages from the sample that have a population of less than thirty households. Two implications need to be considered. Firstly, the sample of villages is skewed towards larger

villages. Secondly, an exclusion of villages under thirty households is most likely to exclude the most remote and difficult to access villages in Chin State.

- Scoring of scale indicators: scale indicators, such as IDDS, HDDS, MDD-W or MAHFP were not scored if one item was missing. rCSI was asked over a non-standard recall period of twelve months and therefore not retained for analyses for the purposes of this review.
- Scoring of "Unknown/I don't know": "unknown" or "I don't know" was an option to answer most of the questions in the MCCT baseline survey. For the purposes of this review, all such responses were deleted in order to limit their influence on findings. In other words, responses as "unknown" were not grouped with the other categories answers to keep the quality of the analysis.

C. Synthesis of results (September-October 2021)

All available data were duly collated and triangulated in order to categorise risk factors according to their relative impact on undernutrition in the study zone. The categorisation of risk factors took into account the scientific literature available globally, secondary data sources available locally and secondary quantitative data analyses conducted for the purposes of this review.

Review limitations

- Unavailability of certain Link NCA standard indicators- While the use of MCCT baseline survey datasets represented a valuable insight into the living arrangements of surveyed households, the datasets did not include all indicators used during a Link NCA exercise involving a primary quantitative data collection[13]. For this reason, certain risk factors could not be sufficiently triangulated due to missing analyses. Consequently, the categorisation of these risk factors was impacted as they generally ranked lower than other risk factors, for which quantitative analyses could be conducted. Therefore, the interpretation of the categorisation of risk factors should be done with caution as the unavailability of data does not imply a lack of contribution of a respective risk factor to the undernutrition in the study zone.
- Statistical associations: It is advised to appraise statistical associations with caution as observed links do not necessarily prove the causality, while unobserved links do not mean that the causality does not exist. Correlations thus must be considered within a larger framework, triangulated with other sources of data, and as such can be used for a prioritization of current and future interventions. In the narrative of this report, all p-value associations of <0.05 are referred to as 'significant' associations with the outcome of interest, i.e. wasting, stunting or underweight with the intention of inspiring future research on the relationship between that risk factor and said nutrition outcome.

[13] *Missing indicators were particularly noticeable for Hypothesis F (caregiver's well-being), I (caregiver-child interactions), Q (food and environmental hygiene) and R (women's workload).*

IV. FINDINGS

UNDERNUTRITION

SECONDARY DATA REVIEW[14]

- Children in Chin State more likely to be malnourished than an average child in Myanmar[15]; townships of Mindat and Kanpetlet exhibited high levels of stunting[16];
- *Wasting*: Slight decline from 8.9% in 2009-2010[17] to 7.0% in 2015[18] and 3.3%[19] in 2016; 4.5% of wasted children on the basis of MUAC[20]; vulnerability: boys[21]
- *Stunting*: Gradual decline from 58% in 2009-2010 to 41% in 2015-2016[18] and 40.3% in 2017-2018[22]; stunting prevalence in Chin State highest in Myanmar; severe stunting at 13%[20]; stunting in children 6-11 months (17.8%), 12-23 months (33.2%), peaking at 24-35 months (43.7%)[17] (similar trend for underweight); vulnerability: boys[21], children from rural areas[23] and poor families[23], children with less than average perceived birth size[23], non-breastfed children[23], children of working mothers[23], children of mothers of short stature[23], children who received minimum meal frequency[23];
- *Underweight*: 19.0%[18] in 2015; considerable decline in Chin State from 30.7%[17] in 2009-2010 to 16.7% in 2016[19].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, male children were less likely to be wasted on the basis of MUAC (p=0.000) and MUAC and/or WHZ (p=0.001), however, they were more likely to be stunted (p=0.020) (Cf. *Annex A: Logistic Regression*).

Children younger than 24 months[10] were more likely to be wasted by MUAC (p=0.000) and MUAC and/or WHZ (p=0.000), however, they were less likely to be stunted (p=0.000), underweight (p=0.000) or concurrently wasted and stunted (0.004) (Cf. *Annex A: Logistic Regression*). Similar associations were observed for children under 36 months who were more likely to be wasted by MUAC (p=0.000) and MUAC and/or WHZ (p=0.003), however, they were less likely to be stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex A: Logistic Regression*). Analyses by linear regression support these observations as the increasing age of a child decreases his/her chances of being wasted on the basis of MUAC (p=0.000) but increases his/her chances of being wasted on the basis of WHZ (p=0.000), stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex B: Linear Regression*).

Among children younger than 59 months old included in the analysed sample, children from rural households were more likely to be stunted (p=0.000) and underweight (p=0.002) (Cf. *Annex A: Logistic Regression*).

Concurrence of undernutrition

Of all children with WHZ and/or MUAC, HAZ and WAZ measurements retained for analyses, 45.7% [43.0-48.4%, 95% CI] were malnourished by one or more metric. Only 2.0% [1.4-2.8%,

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[14] *The data included in this section is not exhaustive and represent only a summary of available data at the time of the preparatory phase of the study. It is possible that the new data sources have since been published. Moreover, it is important to note that the inclusion of this data in the Link NCA report does not imply endorsement or comparability as some data is not automatically comparable. It is therefore advisable to evaluate these data with caution and to refer to the cited sources for more information.*
[15] *MCCT Baseline Survey, 2018.*
[16] *Pritchard et al, 2018.*
[17] *MNPED & MOH, 2011, cited in Situational Analysis by Save the Children, 2017.*
[18] *MOHS, cited in Barrier Analysis by Catholic Relief Services, 2017.*
[19] *MOHS and ICF International, cited in Situational Analysis by Save the Children, 2017.*
[20] *Food Security Atlas, 2019.*
[21] *Prenkert, 2016.*
[22] *MMFCS, cited in Barrier Analysis by Catholic Relief Services, 2017.*
[23] *DHS, 2018.*

95% CI] of all children analyzed, and 4.3% [3.1-6.0%, 95% CI] of malnourished children, were malnourished by all three metrics. Only one child who was concurrently wasted and stunted was not also underweight [s/he was wasted by MUAC <12.5, not WHZ <-2). Only 11.1% [8.3-14.7%, 95% CI] of underweight children were not also stunted.

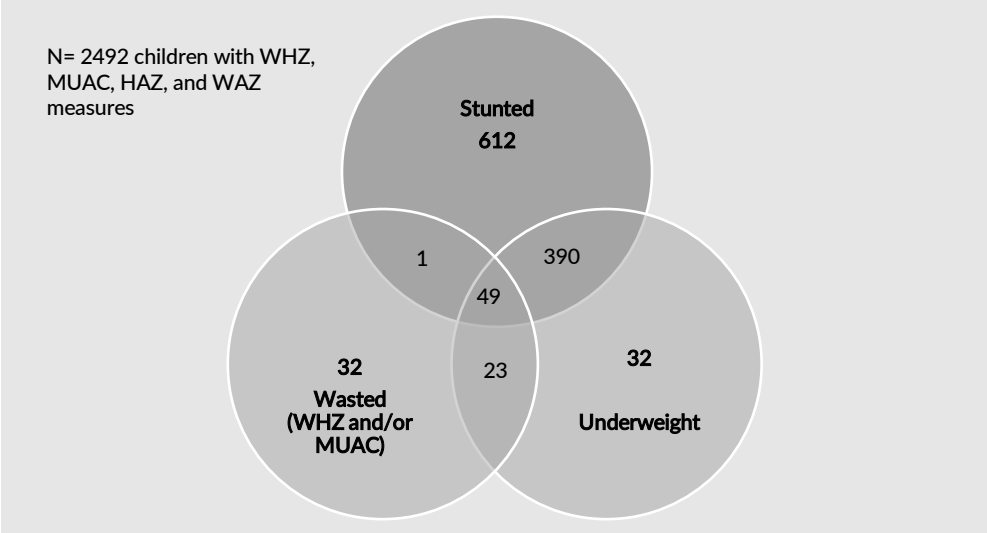
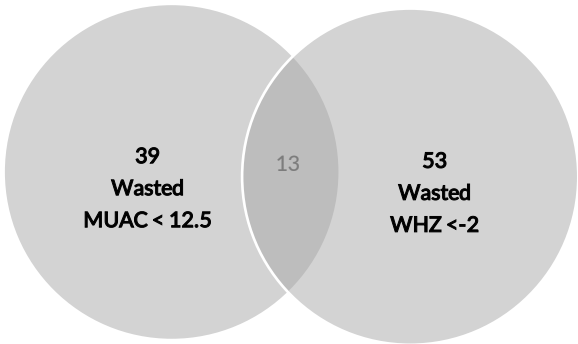


Figure2 & 3: Representation of concurrence of undernutrition based on MCCT baseline survey datasets

Of all children with WHZ and MUAC measurements retained for analyses, 4.2% [3.4-5.2%, 95% CI] were malnourished by one or both metrics. Of children malnourished by one or both metrics, 50.5% [40.7-60.2%, 95% CI] were wasted by WHZ only, while 37.1% [27.6-47.8%, 95% CI] were malnourished by MUAC. Only 12.4% [7.3-20.3%, 95% CI] of wasted children were identified by both metrics.



N= 2495 children with WHZ and MUAC measures

HEALTH AND NUTRITION

COMMON CHILD MORBIDITIES

SECONDARY DATA REVIEW[14]

- Main causes of death for children <59 months (excluding the neonatal period of 30 days): acute respiratory infections/pneumonia (28%), beriberi (17%) and diarrhoea (16%)[24];
- *Diarrhea*: 24.4% in Chin State, i.e. highest in the country, vs. 10.4% nationally[19]; prevalence nearly doubled since the MICS survey in 2010 MICS survey(13.1%)[17]; diarrhea with blood, which may be a sign of a more serious illness: 3.7% in Chin State vs. 0.5% nationally[19];
- *Anaemia*: 72.6%, severe anaemia 40.0%[25]; children age 6-23 months (76%[26] - 88%[27]); vulnerability: children who did not consume iron-rich foods[23]; boys[23], children of anaemic mothers[23] or mothers who attended ≥4 ANC visits[23].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children who had experienced illness before were more likely to be stunted (p=0.000) and underweight

[24] *MOH and UNICEF, 2014, cited in Situational Analysis, Save the Children, 2017.*
[25] *Zhao, et al, 2012, cited in Situational Analysis, Save the Children, 2017.*
[26] *WHO 2015a.*
[27] *Hlaing et al. 2015, cited in DHS Feeding Practices 2018.*

(p=0.032). Children from households with more than one child under 59 months who had fever as their most recent illness were more likely to be stunted (p=0.042) and concurrently wasted and stunted (0.038). No associations with nutrition outcomes were observed for diarrhoea (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS A: LIMITED ACCESS TO HEALTH SERVICES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- Healthcare is weak in remote rural areas; NGOs and private sector provide the majority of health care services[31]; Per 2018 MoHS Chin Health Report, health worker (doctor/nurse/midwife) – patient ratio is 0.99 per 1,000 people; out of 412 existing rural and sub-rural health centers, only 67 meet the MoHS standard design.[11]

Barriers of access to health care

- *Geographical barriers (distance, seasonal):* transport difficult and expensive in rural areas: lack of roads and infrastructure[32]; inaccessibility to adequate health facilities or services: major barrier to adequate health seeking behaviours in remote locations[15];
- *Financial barriers (fees for treatment/transport/consultation):* nearly half of women age 15-49 in Myanmar specified problems in accessing health care as: getting money for advice or treatment (34%), not wanting to go alone (31%), and distance to a health facility (23%)[33];
- *Temporal (workload, long waiting times):* linked w/ quality of care below;
- *Socio-cultural barriers (cultural beliefs and preferences):* health care workers are primarily Burmese speakers while patients speak one of a number of ethnic languages and therefore a translation is necessary during a consultation as well as health education[34]; family advice and social norms trump healthcare workers' recommendations[35]; reasons for not seeking medical treatment: treatment not necessary (30.2%), used alternative treatment (24.9%) or self-medicated (13.3%). Forty-five % (44.6%) of respondents in remote areas indicated either the absence or inaccessibility of a health facility;
- *Quality of care (untrained staff, absenteeism, stockouts, inappropriate approach, etc.):* Chin State: 45% of hospital positions vacant, 46% of rural health centre positions unfilled[36]; health facilities suffer from poor sanitation, lack of equipment and supplies[32]; many vitamin syrups are not registered with the Myanmar Food and Drug Administration, calling into question their quality and safety[32]; heavy marketing of vitamins and supplements for children in the country, including in Chin State[32]; service users expressed discriminatory treatment of low-income groups[31]; low quality has resulted in even poor citizens moving to the private sector (estimated 80% of patients nationally).

QUANTITATIVE ANALYSES FINDINGS

No data available.

[28] *Based on Link NCA "Pathways to Undernutrition" module.*
[29] *In case cross-sectional studies with statistical associations are available for the study zone. Otherwise, hypothesised strength of the association, if based on prevalence values.*
[30] *Statistical associations from eligible secondary datasets.*
[31] *UNDP,2014.*
[32] *Situational Analysis, Save the Children, 2017.*
[33] *DHS 2015-2016.*
[34] *Key informant interview, 2021.*
[35] *Kantar Public, 2018.*
[36] *MIID 2014a.*

HYPOTHESIS B: LIMITED UTILISATION OF HEALTH FACILITIES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	++
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- Regional gaps in utilisation of governmental services, such as antenatal care, institutional deliveries […] in regions such as Chin […] considerably lower than in other parts of the country[37] → certain indicators, specifically concerning antenatal care visits as well as immunization rates amongst children 12 and 23 months of age are the lowest in Myanmar[15];
- *Antenatal care*: number of ANC visits higher in Chin State (21.1%) than in rural settings (15.6%)[33] → 59% of women completed ≥4 ANC visits[33]; consultations include blood pressure measurement (91%), only about three in ten women had either a urine or blood sample taken during an ANC visit[33]; barriers of access: work, lack of transportation, shyness or forgetting[38];
- *Delivery*: institutional delivery 15% in Chin State vs. 37% nationally[33]; births at home 85.3%[33]; women with more than secondary education are three times more likely to receive skilled assistance at delivery than women with no education[33];
- *Postnatal care:* 71% of mothers and 36% of new-borns receive postnatal check-up within the first 2 days after birth[33];
- *Immunisation:* 31%[23], *Vitamin A supplementation:* 49%[23], *deworming*: 22%[23]

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children of mothers who completed at least four ANC visits during last pregnancy were less likely to be stunted (p=0.003) and underweight (p=0.002). No associations with nutrition outcomes were observed for children of mothers who did not complete any ANC visits during last pregnancy, travel time to ANC in dry and rainy season or necessity to borrow money to attend ANC (Cf. *Annex A: Logistic Regression*).

Among children younger than 24 months old included in the analysed sample, children who underwent a health check within days after the delivery were less likely to be wasted on the basis of MUAC (p=0.007); children who underwent a health check within two weeks of delivery were less likely to be wasted on the basis of WHZ (p=0.001) and MUAC (p=0.022) as well as less likely to be stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex B: Linear Regression*).

Children with a birth certificate were more likely to be stunted (p=0.001) (Cf. *Annex A: Logistic Regression*). The counter-intuitive nature of this finding warrants further research. No associations with nutrition outcomes were observed for vaccination, deworming, Vitamin A supplementation or use of government facilities or drug stores during last illness.

[37] *JICA, 2013.*
[38] *SBCC MCCT Save The Children, 2018.*

HYPOTHESIS C: SHORT BIRTH-SPACING / EARLY, REPETITIVE OR UNWANTED PREGNANCIES

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+
Strength of the association with undernutrition based on statistical analysis[30]	+++
Overall interpretation	+++

SECONDARY DATA REVIEW[14]

- *Ideal family size*: 2.5 children for women vs. 2.8 children for men[33] → women, rather than men, are more likely not to want more children, no matter how many children they already have[33]; married women aged 15-49 years want to have another child soon 13% vs. 18% want to wait at least 2 years vs. 61% want no more children or are sterilized[33]; *unwanted pregnancies*: 5%[33]; *fertility rate* 4.6 children in Chin State vs 2.3 nationally.[19]

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children from above average sized households (> =7 members[6]) were more likely to be stunted (p=0.023) (Cf. *Annex A: Logistic Regression*). Based on linear regression, the increasing number of members within a household increased child's chances of being stunted (p=0.003) and underweight (p=0.004) (Cf. *Annex B: Linear Regression*).

Children living in households with more than one child under 59 months were less likely to be wasted on the basis of MUAC and/or WHZ (p=0.041) but more likely to be stunted (p=0.000) and underweight (p=0.001). Children who were less than 24 months apart from their sibling were more likely to be stunted (p=0.007). Children of mothers who were pregnant at the time of the data collection were more likely to be stunted (p=0.000) and underweight (p=0.007) (Cf. *Annex A: Logistic Regression*).

Children of mothers who were taking contraceptives or other means to delay pregnancy were less likely to be wasted by MUAC (p=0.039). Children of mothers who did not desire future pregnancy and were not taking contraceptives were more likely to be stunted (p=0.007) and underweight (p=0.030) (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS D: LOW BIRTH WEIGHT

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- *Low birth weight*: Slight increase from 9.4%[19] in 2011 to 11.6% in 2016[19]; some reported preferring to give birth to small babies since access to skilled attendant at birth is poor and delivering a smaller baby is perceived to be easier[32];
- 28.9% of new-borns are weighed at birth.[19]

QUANTITATIVE ANALYSES FINDINGS

No associations with nutrition outcomes were observed (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS E: MOTHER'S NUTRITIONAL STATUS

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	+++
Overall interpretation	+++

SECONDARY DATA REVIEW[14]

- *BMI*: mean BMI in Chin among women of reproductive age (WRA) with height under 145 cm: 21.8[33]; 9.4%[33] WRA <18.5 (total thin); 2.4%[33] WRA <17.0 (moderately to severely thin); 12.9%[33] WRA 25.0-29.9 (overweight) and 1.2%[33] WRA ≥30 (obese);
- *Stature:* short stature (defined as height <145 cm) is a sign of a maternal malnutrition; 14% WRA in Chin State vs. 6.4% nationally are of short stature → strongest predictor of child stunting in Myanmar with children born to mothers of short stature 6 times more likely to be stunted[20];
- *Anaemia:* WRA 38.5% in Chin State vs. 46.5% nationally[19]; pregnant women in Chin State: 28.4%[1]; lactating women in Chin State: 23.2%; severe anaemia 4.6%[1]; 83% WRA took iron tablets during their last pregnancy[32];
- *Minimum dietary diversity*: poor dietary diversity for women[15] → common dietary restrictions compel them to limit consumption of micro-nutrient rich foods; rural areas report significantly lower dietary diversity scores 3.8 vs. 5.0 in urban areas[32]; 17 % WRA met minimum dietary diversity thresholds and consumed an average of 2.8 food groups in the last 24 hours[39]; MDD-W in Falam, Thantlang and Matupi townships: 14% of PLWs and mothers of children younger than 23 months consumed at least 5 out of 10 food groups the previous day[40]; 18% of female respondents reported decreasing food consumption during pregnancy[32], also because of traditional beliefs that some nutritious foods should be restricted during pregnancy[38]; breastfeeding women should not consume spicy food, corn soup with beans, sweet potato, taro and bitter food because it reduces the breast milk[32].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children of mothers with MUAC <21 cm were more likely to be wasted on the basis of WHZ (p=0.005), MUAC (p=0.004) and MUAC and/or WHZ (p=0.000) as well as stunted (p=0.000), underweight (p=0.000) and concurrently wasted and stunted (p=0.001) (Cf. *Annex A: Logistic Regression*).

Children of mothers with low BMI (pregnant women excluded) were more likely to be wasted on the basis of WHZ (p=0.019), MUAC (p=0.000) and MUAC and/or WHZ (p=0.000) as well as more likely to be stunted (p=0.042) and underweight (p=0.000). Children of mothers with low BMI (pregnant and lactating women excluded) were more likely to be wasted on the basis of MUAC and/or WHZ (p=0.042), stunted (p=0.014) and underweight (p=0.000). On the other side, children of overweight mothers (pregnant women excluded) were less likely to be stunted (p=0.000) or underweight (p=0.000). Children of overweight mothers (pregnant and lactating women excluded) were less likely to be underweight (p=0.040) (Cf. *Annex A: Logistic Regression*).

Analyses by linear regression support these observations as the increasing BMI (pregnant women excluded) decreases child's chances of being wasted on the basis of WHZ (p=0.000) and MUAC (p=0.000) as well as his/her chances of being stunted (p=0.000) and underweight (p=0.000). The increasing BMI (pregnant and lactating women excluded) decreased child's chances of being wasted on the basis of MUAC (p=0.004). The increasing MDD-W score decreased child's chances of being wasted by WHZ (p=0.001) and MUAC (p=0.000) as well as

[39] *FSIN, 2017.*
[40] *CRS and KMSS, 2016.*

his/her chances of being stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex B: Linear Regression*).

Children of mothers of short stature (<151.7 cm)[7] were more likely to be stunted (p=0.000), underweight (p=0.000) and concurrently wasted and stunted (p=0.027) (Cf. *Annex A: Logistic Regression*). The increasing number of months of iron folic acid supplementation during pregnancy decreased child's odds of being stunted or underweight.

MENTAL HEALTH & CARE PRACTICES

HYPOTHESIS F: CAREGIVER WELL-BEING

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	N/A
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	+

SECONDARY DATA REVIEW[14]

No available data.

QUANTITATIVE ANALYSES FINDINGS

No available data.

HYPOTHESIS G: NON-OPTIMAL BREASTFEEDING PRACTICES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	++
Overall interpretation	++

SECONDARY DATA REVIEW

- *Early initiation of breastfeeding*: 88.2% of deliveries in Chin State vs. 75.8% nationally[17]; 66.8% of women reported initiating breastfeeding within 1 hour of birth[33];
- Exclusive breastfeeding: 70.7% of infants exclusively breastfed in the first two months of life vs. 52.7% for infants 2-3 months of age, vs. 38.2% for infants of six months of age[61]; in Chin State 25.4% of children under 6 months of age are exclusively breastfed[32]; mothers supplement breast milk with non-milk liquids for children aged 3-4 months exposing them to pathogens in unsafe water and food[46]; mean duration of exclusive breastfeeding is 3.5 months[35]; having only one child under 5 years of age appears to be a protective factor for EBF: 73% of only children are exclusively breastfed while this number drops to 57% for children with another sibling under 5 years of age[41]:
- *Breastfeeding frequency*: Among those children who have been breastfed, almost half (44,6%) were breastfed 4 to 6 times a day, 35.4% received on demand and 20% of them received breast milk less than 3 times a day[47].
- *Duration of breastfeeding*: continued breastfeeding: at one year: 94.2% in Chin vs. 91% nationally; children aged 20–23 months breastfed: 83.9% in Chin vs. national rate of 65.4%[17]; children are weaned as soon as the mother becomes pregnant again[35]; early cessation of breastfeeding because of lack of time/mother needed to work in the fields, insufficient production of breastmilk to avoid the infant being hungry[47]; lack of continued support, mother's low nutritional diversity and fluid intake[35] or illness[42];

[41] *CHANGE Baseline Report, Catholic Relief Services, April 2021.*
[42] *Pistor 2017.*

- Mothers do not express breastmilk, majority never heard of it. Few who had expressed milk, rarely had intention to feed it to the infant[35]; evidence of extensive/illegal marketing of breastmilk substitutes and other processed foods (milk powder, snacks)[35].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 24 months old included in the analysed sample, children whose mothers initiated breastfeeding early were more likely to be wasted by MUAC (p=0.040). The counter-intuitive nature of this finding warrants further research. Children who were exclusively breastfed were less likely to be wasted by MUAC and/or WHZ (p=0.014), stunted (p=0.000), underweight (p=0.036) and concurrently wasted and stunted (p=0.045). No associations with nutrition outcomes were observed for other indicators, including introduction of colostrum or weaning age (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS H: NON-OPTIMAL COMPLEMENTARY FEEDING PRACTICES FOR CHILDREN 6-23 MONTHS

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	+
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- *Introduction to solid and semi-solid food:* solid food is given as early as possible[32]; 54.3% of caregivers reported initiating complementary feeding between 6.0 and 8.9 months old with solid, semi-solid or soft food[47];
- *Minimum Acceptable Diet:* 25% of children 6-23 months consuming a diet considered to be diverse enough to provide all needed vitamins and minerals, 16% achieve a "minimum acceptable diet"[61]; In Chin, children 6-23 months are five times less likely to meet the threshold for minimum dietary diversity than children in Shan or Kachin States[35];
- *Dietary diversity:* inadequate for children across ages[15]; 25% children achieved minimum dietary diversity (≥4 food groups)[23]; on average, children age 6-23 months consumed only 2.3 of the 7 dietary diversity food groups[40]; number of food groups consumed by children increases as they become older - children aged 6-11 months consume significantly fewer food groups (2.0 food groups) than children aged 18-23 months (2.6 food groups)[32]; children with "higher monthly income" (>75,000 kyat) had 602% higher odds of achieving minimum acceptable dietary diversity relative to children from households with lower income[48]; infants in near villages (those closer than 72.5 minutes from a market) consumed an average of 0.6 more food groups[43]; 59% of children were fed iron-rich foods[23];
- *Meal frequency*: mothers rely on children to demand foods[35]; 58% of children achieved minimum required meal frequency[23];
- Better IYCF practices if mother's education of higher level and if she attended ≥4 ANC visits.[23]

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 24 months old included in the analysed sample, children with acceptable IDDS[44] were more likely to be stunted (p=0.012) (Cf. *Annex A: Logistic Regression*). Based on linear regression, the increasing IDDS score decreased child's chances of being wasted by MUAC (p=0.000) but increased his/her chances of being stunted (p=0.000) (Cf. *Annex B: Linear Regression*). The counter-intuitive nature of this finding warrants further research. No associations with nutrition outcomes were observed for other IYCF indicators, including introduction to complementary foods or minimum meal frequency.

[43] *Croft, Production diversity, market access, and nutrition outcomes: Evidence from Chin State, 2019.*
[44] *Defined as four or more of the seven food groups. Children 6-<24 months.*

HYPOTHESIS I: LOW QUALITY OF INTERACTIONS BETWEEN A CHILD AND A CAREGIVER

Strength of the association with undernutrition in the *scientific literature*[28]	+
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	+

SECONDARY DATA REVIEW[14]

- Adolescent mothers are at higher risk of having fewer resources and demonstrating poor care practices[35].

QUANTITATIVE ANALYSES FINDINGS

No available data.

FOOD SECURITY AND LIVELIHOODS

- Chin is highly vulnerable to natural disasters (heavy rains and subsequent landslides)[20];
- 18% HHs did not own any land southern part of the state vs. 6% in the northern part of the state[20]; average plot size was the smallest in the country[20];
- Food insecurity caused by seasonality[20]; poor soil fertility (soil impoverished due to shorter fallow periods)[45], lack of irrigation and reliance on rain-fed fields[45], poor seed quality, and limited use of new practices & inputs leads to low crop yields[46] [32]; crop damage due to pest infestation and uncontrolled animal rearing[32] (high rates of livestock ownership in Chin[20]).

HYPOTHESIS J: LOW ACCESS TO A QUALITY DIET

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	+++
Overall interpretation	+++

SECONDARY DATA REVIEW

- Adequate household food provisioning in Chin lower than the national average[15]; HH food production does not cover the entire annual needs: 93% of households face problems during lean season[20]; third of the food consumed from own production vs. 42% is purchased using cash vs. 12.8% through credit, gifts or gathering wild foods (16%)[20];
- Home gardens more prevalent in southern Chin than in other states but diversity of plants very low[32]; home gardening limited also due to the lack of irrigation[32]; production diversity was 1.4 crops higher in far villages where markets were on average 2.5 hours away[43];
- 68% HHs worried about having enough food sometimes or often, two thirds fear going to bed hungry, high level of anxiety due to collective memory of famine across Chin ('rat famine' every half-century)[16]
- Financial constraints to afford purchasing meat, eggs, rice and oil in the long term. Even if income is available (from the MCCT, for example) to purchase nutrient-rich foods, next challenge is safe and durable storage of perishable foods[35];
- *Food diversity*: dietary diversity of both women and children is low[15]; HDDS<6 (82.3%)[1]; regular consumption of cereals, meat-based protein consumption very low (one third of HHs consumed meat, fish and eggs less than two days per week in Southern Chin; in the North, consumption of these food groups occurred less than once a week), consumption of pulse-based proteins and fruits also very low (half a day per week in each group)[20]; lack

[45] *GRET, 2019.*
[46] *Barrier Analysis, Catholic Relief Services, 2017.*

of time for cooking, access to diverse foods, lack of money and large families were identified as obstacles for protein food intake[47]; fruits, vegetables or honey from forest sources had been eaten by more than 60% of Chin HHs, while animals caught or hunted had been eaten by 20.1% of HHs in Mindat and 27.7% in Kanpetlet[32]; 'other' foods (e.g. sweets, seasonings, betel leaf, and alcoholic beverages) comprise 9% and 12% of food expenditure in 2010 and 2015[48]; production diversity has a significant impact on the dietary diversity of mothers and children in more distant villages - in villages closer than 72.5 minutes, there is no relationship between animal source food (ASF) consumption and production diversity for women or children[43] [49];

- Diets of poorer households were less diverse than those of wealthier ones[48]; poorer households tend to consume cheaper, more calorie-dense diets[48], highest rates of household dietary inadequacy in the hilly and mountainous states (40% in Shan, 52% in north Kachin, 85% in Chin) [48];
- *Food preparation:* 'traditional Chin ways' means that foods are mostly boiled (cooked for long time) or fried[32];
- Men in general ate more than women as they had to accomplish "hard work"[32].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in households with year-round adequate food provisioning[50] were less likely to be wasted on the basis of MUAC and/or WHZ (p=0.028), stunted (p=0.006), underweight (p=0.010) and concurrently wasted and stunted (p=0.025) (Cf. *Annex A: Logistic Regression*). The increasing number of months of adequate food provisioning decreased child's chances of being wasted on the basis of WHZ (p=0.014) and MUAC (p=0.008) as well as being stunted (p=0.005) and underweight (0.001) (Cf. *Annex B: Linear Regression*).

Children living in households experiencing inadequate food provisioning due to poor harvest were more likely to be stunted (p=0.029). However, no associations with nutrition outcomes were observed for inadequate food provisioning due to drought, floods, cyclone or landslides (Cf. *Annex A: Logistic Regression*).

Children living in households experiencing inadequate food provisioning due to illness or being victim of violence/crime were more likely to be wasted on the basis of MUAC (p=0.006 and 0.009, respectively) and MUAC and/or WHZ (p=0.042 and 0.004, respectively) (Cf. *Annex A: Logistic Regression*).

Children living in households experiencing inadequate food provisioning due to inadequate income were more likely to be wasted on the basis of WHZ (p=0.037) and MUAC and/or WHZ (p=0.015) as well as being stunted (p=0.021) and underweight (p=0.023). Children living in households experiencing inadequate household provisioning due to a loss of regular job were more likely to be wasted on the basis of MUAC (p=0.062). However, no associations with nutrition outcomes were observed for inadequate food provisioning due to being unemployed (Cf. *Annex A: Logistic Regression*).

Analyses by linear regression demonstrate that the increasing HDDS score decreases child's chances of being wasted on the basis of WHZ (p=0.005) and MUAC (p=0.000) as well as being stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex B: Linear Regression*). Children living

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[47] *PACE MCJ, 2018.*
[48] *IFPRI, 2019.*
[49] *In these villages with strong market access, production diversity had no significant impact on dietary diversity, suggesting that interventions designed to increase crop diversity would not contribute to positive nutrition outcomes. These villages may rely more on purchasing the foods they need and/or specializing in cash crops which may lead to lower production diversity.*
[50] *MAHFP twelve months*

in households with HDDS higher than mean score[51] were less likely to be stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS K: LOW ACCESS TO INCOME SOURCES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	+++
Overall interpretation	+++

SECONDARY DATA REVIEW[14]

- Chin - poorest region of the country, 73 % living below the poverty line, and 25% living in extreme poverty[20]; poverty higher among female headed households[37];
- Agrarian society with small-scale farming: 58% HHs in Northern Chin vs. 48% in Southern Chin, commercial activities below 10%[20], very few farmers are engaged exclusively in cash crops even in villages closest to Hakha Town[45]; cultivating mainly for their own needs[32]; direct link between the distance of the village from the town (e.g. Hakha or Falam) and the percentage of HHs engaged in shifting cultivation[45];
- HH income highly diversified: on average, HHs rely on 3 incomes over a period of 12 months[20]; farm and off farm occasional work sole source for cash flows[20]; however in most households, having a temporary labour does not even cover the daily cost of a minimum food basket[20];
- Only one third of HHs had women earners[20] ; disparities in wages between men and women[37];
- Low amount of productive assets[16].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in low income households[52] were less likely to be wasted on the basis of WHZ (p=0.039) but more likely to be stunted (p=0.000) and underweight (p=0.001). The partially counter-intuitive nature of this finding warrants further research. Children living in households with regular income from NGOs were more likely to be wasted on the basis of WHZ (p=0.044) [53]. Children living in households which reported farming or animal husbandry as their primary occupation were more likely to be wasted on the basis of MUAC (p=0.009) and MUAC and/or WHZ (p=0.024) as well as stunted (p=0.000) and underweight (p=0.015). Children living in households which reported casual labor as their primary occupation were more likely to be stunted (p=0.044). On the other hand, children living in households of government employees were less likely to be stunted (p=0.000) and underweight (p=0.004) (Cf. *Annex A: Logistic Regression*).

In terms of asset ownership, no associations with nutrition outcomes were observed for land ownership – either for dwelling and/or agriculture. Children living in households which owned at least one car or a piece of gold were less likely to be stunted (p=0.022 and 0.000, respectively) and underweight (p=0.010 and 0.000, respectively) (Cf. *Annex A: Logistic Regression*).

Children living in households which owned at least one wooden or steel bed or they owned at least one mattress were less likely to be wasted on the basis of MUAC and/or WHZ (p=0.012 and 0.021, respectively), stunted (p=0.000 and 0.001, respectively), underweight (both p=0.000) and concurrently wasted and stunted (p=0.012 and 0.041, respectively). Children living in households which owned at least one table were less likely to be wasted on the basis

[51] *Min: 1, Max: 12. Mean: 6.6. [6.4-6.7].*
[52] *Lower than 1,000,000 MMK per annum*
[53] *MCCT baseline report does not specify the type or frequency of NGO support. It is therefore difficult for the review team to explain the counter-intuitive nature of this finding and/or provide more details.*

of MUAC and/or WHZ (p=0.045), stunted (p=0.000) and underweight (p=0.000). Children living in household which owned at least one gas/electric stove or generator were less likely to be stunted (both p=0.000) and underweight (p=0.000 and 0.001, respectively). Children living in households which owned at least one fuel efficient wood stove were less likely to be wasted on the basis of MUAC (p=0.008). Children living in households which owned at least one fridge were less likely to be stunted (p=0.001) (Cf. *Annex A: Logistic Regression*).

Children living in households with electricity or electricity at night were less likely to be stunted (both p=0.000) and underweight (p=0.008 and 0.003, respectively). Children living in households which owned at least one video player/recorder, TV or satellite dish were less likely to be stunted (all p=0.000) and underweight (p=0.003, 0.000 and 0.000, respectively). Children living in households which owned at least one radio/cassette player were more likely to be wasted on the basis of WHZ (p=0.-15) (Cf. *Annex A: Logistic Regression*).

Children living in households which owned at least one sewing machine were less likely to be stunted (p=0.000) and underweight (p=0.001). Children living in households which owned at least one fish net were less likely to be wasted on the basis of WHZ (p=0.048) and underweight (p=0.004) while children living in households which owned at least one boat without a motor were more likely to be wasted on the basis of WHZ (p=0.045) (Cf. *Annex A: Logistic Regression*).[54]

Children living in households which demonstrated below average asset ownership[8] were more likely to be stunted (p=0.000), underweight (p=0.000) and concurrently wasted and stunted (p=0.005) (Cf. *Annex A: Logistic Regression*). The increasing number of asset categories owned by the household decreased child's chances of being wasted on the basis of WHZ (p=0.000) and MUAC (p=0.000) as well as being stunted (p=0.000) and underweight (p=0.000) (Cf. *Annex B: Linear Regression*).

Children living in households in which woman's income surpassed that of her husband were less likely to be stunted (p=0.043) (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS L: LIMITED ACCESS TO MARKETS

Strength of the association with undernutrition in the *scientific literature*[28]	+
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	+

SECONDARY DATA REVIEW[14]

- Lack of infrastructure and high transportation costs pose significant challenges for farmers to reach markets[32] → round trip to the market taking on average 33 hours in the north and 27 hours in the south[20]; market access in southern Chin State is primarily towards Rakhine State or the dry zone, while only two roads connect the capital Hakha in the north to the rest of the country - to Kalay in Sagaing Region and Gangaw in Magway Region[32].

QUANTITATIVE ANALYSES FINDINGS

No available data.

[54] *It is hypothesised that this risk factor is context-specific as boats are primarily used in the south of Chin State where waterways are the main form of transport. This area of Southern Chin is poor. Per MCCT baseline data, out of a total of 3451 children, 33 children were reported living in a household with a boat without a motor and 86 children in a household with a motor.*

HYPOTHESIS M: LOW COPING STRATEGIES / RESILIENCE

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	++
Overall interpretation	+++

SECONDARY DATA REVIEW

- *Coping strategies*: HHs adopted a variety of strategies such as borrowing food from family or neighbors, taking out loans or credit at shops, searching for daily labor (both men and women), selling foraged traditional herbs in the market or weaving textiles to generate income[16]; due to lack of a cash economy in the state, borrowing food is the most common means of surviving the periods of shortage[32]; 73% HHs consumed less preferable quality of food, 52% purchased food on credit, 46% reduced the number of daily meals, 50% limited portion sizes of meals, and 7% skipped meals[56];
- *Debts*: HHs in Chin State generally indebted, 70% having contracted debt or credit at the time of the assessment[55]; the governmental bank that provides rural credits to farmers (MADB) barely operates in Chin, and other formal sources of private credit are completely absent[20]; main reasons for indebtedness: to cover basic needs, such as purchasing food or expenditures on health; education expenditures are usually secondary to food and health expenditures[20];
- *Migration*: high prevalence of HHs with a migrated member in Chin[16]: 24% HHs have at least one economic migrant, 72% of migrants are male and 28% female[56] ; prominence of international migration (Malaysia, USA) compared to other states, where domestic migration is more common[57]; many female-headed households may be the result of economic migration[32].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in households which migrated before and/or after the childbirth were less likely to be stunted (p=0.000) and underweight (p=0.004). (Cf. *Annex A: Logistic Regression*).

Children living in households which took a loan in the 12 months prior the data collection were more likely to be wasted on the basis of MUAC and/or WHZ (p=0.032), stunted (p=0.001), underweight (p=0.009) and concurrently wasted and stunted (p=0.003). Out of these, children living in households which used the loan for food purchases were more likely to be stunted (p=0.016) and underweight (p=0.008). No associations with nutrition outcomes were observed for savings (Cf. *Annex A: Logistic Regression*).

WATER, SANITATION AND HYGIENE

HYPOTHESIS N: INADEQUATE ACCESSIBILITY, AVAILABILITY AND QUALITY OF WATER AT HOUSEHOLD LEVEL

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	+++
Overall interpretation	+++

[55] *MNPED-UNDP-UNICEF, 2011.*
[56] *WFP, 2010.*
[57] *LIFT, 2016 and Pritchard, 2017.*

SECONDARY DATA REVIEW[14]

- *Water source*: 80% HHs nationally have access to an improved water source, urban HHs (89%) vs. rural HHs (77%)[61]; rain and surface collections are main source of water in coastal/delta regions; springs in hilly regions, and wells are most common in the dry zone[16], predominant water source in Chin is from natural springs, using bamboo pipes[16] → Chin has the highest rate of piped water at 31.3% compared to 4.1% nationally[58]; despite the relatively high rates of piped water, a survey by CAD (2012) found that water is available year-round for only 75.7% of households, availability in Hakha lowest at 47.7%[32]; 30 (out of 36) HHs had good access to water during rainy season but this number decreased to 23 during hot/dry season[35];
- *Water treatment*: 85% HHs in Chin treat water before use, treatment methods vary[16]; drinking water treatment and storage practices are acceptable[35] but urban areas have better storage standards in comparison to rural areas[35];
- Perceived link between water quality and diarrhoea: smaller water sources perceived as of better quality, bigger sources, such as rivers perceived as worse quality, leading to diarrhea[32].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in households which used an improved water source[5] in summer were less likely to be wasted on the basis of MUAC (p=0.017). No associations with nutrition outcomes were observed for the use of improved water source in other seasons. Children living in households which experienced water scarcity were more likely to be wasted on the basis of MUAC (p=0.032) (Cf. *Annex A: Logistic Regression*). The increasing distance to water facilities increased child's chances of being underweight (p=0.034) (Cf. *Annex B: Linear Regression*).

With regards to water treatment methods, children living in households which were straining water through a cloth were more likely to be wasted on the basis of WHZ (p=0.037) while children living in households which were letting the water to stand and settle were more likely to be wasted on the basis of WHZ (p=0.001) and MUAC and/or WHZ (p=0.013) as well as concurrently wasted and stunted (p=0.002). Children living in households which used a filter to treat water were less likely to be stunted (p=0.043) while children living in households which used composite filters were less likely to be underweight (p=0.023). No associations with nutrition outcomes were detected for boiling water as means to treat water (Cf. *Annex A: Logistic Regression*).

Children living in households which owned water container for storage were less likely to be underweight (p=0.030). Out of these, children living in households in which a water container was observed clean were less likely to be stunted (p=0.001) while children living in households in which a water contained was observed unclean or uncovered were more likely to be stunted (p=0.000) and underweight (p=0.036) (Cf. *Annex A: Logistic Regression*).

HYPOTHESIS O: INADEQUATE HOUSEHOLD SANITATION PRACTICES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	+
Overall interpretation	++

[58] *UN Water, 2014, cited in Pritchard, 2017.*

SECONDARY DATA REVIEW[14]

- *Open defecation:* 6.4% of households across all rural Myanmar, further 5.7% other forms of unimproved sanitation facilities[16]; 68.8% of survey respondents practice open defecation when at work in the field[32];
- *Improved sanitation facilities*: 48% of households have improved toilet facilities, including 65% (urban) vs. 42% (rural), 11% of households have no toilet facility[61]; in southern Chin only 30% of households in Kanpetlet and Mindat had a flush toilet[16], pit latrines were more commonly the norm[16];
- Children's excreta in Chin State disposed safely (50.7%) vs. being left in the open (17.7%)[19];
- Strong evidence of fecal contamination in the household environment[35].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in households which received sanitation sensitisation in the six months prior the data collection were more likely to be stunted (p=0.018) (Cf. *Annex A: Logistic Regression*)[59]. The increasing distance to latrines increased child's chances of being wasted on the basis of WHZ (p=0.018) and MUAC (p=0.002) as well as being underweight (p=0.004) (Cf. *Annex B: Linear Regression*). However, no associations with nutrition outcomes were observed for ownership of basic sanitation facilities[60].

HYPOTHESIS P: INADEQUATE PERSONAL HYGIENE PRACTICES

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	+
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- Soap and water available in 95% urban vs. 80% of rural HHs[61]; the most common places for handwashing facilities are in the dwelling (38%) and in the yard (16%)[41]
- 90% of respondents ate their meals with their fingers but only 40.1% used soap for washing their hands before meals; 89.1% adults reported washing their hands after defecating but 70% did not use soap[32]; direct observation of mothers in Falam, Mindat, Tedim and Paletwa not washing hands before food preparation[35].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in households where soap could be observed at the place of handwashing were less likely to be stunted (p=0.000) and underweight (p=0.005). Children of mothers who reported using soap to wash hands were less likely to be stunted (0.019). No associations with nutrition outcomes were observed for fixed handwashing facility in dwelling or in yard (Cf. *Annex A: Logistic Regression*).

[59] *It is hypothesised that a geographical location may be a confounding factor in this case as better-off villages would be less likely to be targeted for sensitisation messages.*
[60] *Basic sanitation requirements refer to households that have an improved toilet or latrine for household members that is not shared with other households and that is functional at the time of visit.*
[61] *MS-NPAN, 2018.*

HYPOTHESIS Q: INADEQUATE ENVIRONMENTAL AND FOOD HYGIENE PRACTICES

Strength of the association with undernutrition in the *scientific literature*[28]	+++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	+
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- Increased risk of faecal oral contamination due to roaming animals, unsafe disposal of baby faeces and poor practices related to hand washing, food preparation and storage → understanding of the relationships between hygiene & health and/or and hygiene & growth is very low[35].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children living in houses with palm leaves or tarpaulin as the main roof material were more likely to be stunted (p=0.026) and underweight (p=0.023). The likelihood of children being stunted (p=0.015) or underweight (p=0.006) increased if children were living in houses which only used palm leaves as the main roof material (Cf. *Annex A: Logistic Regression*).

GENDER

HYPOTHESIS R: CAREGIVER'S HEAVY WORKLOAD

Strength of the association with undernutrition in the *scientific literature*[28]	++
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+++
Strength of the association with undernutrition based on statistical analysis[30]	N/A
Overall interpretation	++

SECONDARY DATA REVIEW[14]

- Women are in charge of household food preparation and collection of firewood[32]; women retain unilateral control over chickens and ducks[62]; during harvesting periods, women work in the fields with their male partners in addition to carrying out a "second shift" at home[38] women take prime responsibility for childcare[38] → fathers are willing to share the responsibilities around child feeding, but don't know how to[35];
- Limited time and energy to prepare nutritious foods for young children, especially when working[38].

QUANTITATIVE ANALYSES FINDINGS

No available data.

HYPOTHESIS S: LOW FEMALE AUTONOMY/ LOW DECISION-MAKING POWER

Strength of the association with undernutrition in the *scientific literature*[28]	+
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	++
Strength of the association with undernutrition based on statistical analysis[30]	+
Overall interpretation	+

SECONDARY DATA REVIEW[14]

- Women are poorly represented in Chin State on at least two fronts: leadership within the township and in citizen participation[31]; women in Chin appear to have less exposure to

[62] *CRS Gender Value Chain, 2019.*

public information and government news[31]; 33% women vs. 70% men participated in village tract ward meetings[31];
- Women's participation in decision making is limited even in economic activities, women tend to have lower level posts[37];
- Women have limited access to control over: land, transportation, and large equipment: land ownership and ownership of large animals being male domains; women have access to seeds and home gardens, decisions on what to plant year to year are made jointly by women and men, but men final say[38]; in a family where a woman lives with her mother-in-law and husband, she does not have decisional power and she cannot spend money for either herself or the child;[11]
- Mothers make most of the decisions regarding children, followed by fathers and to a much lesser extent, grandparents, while mothers-in-law and uncles and aunts were cited by less than 1% of respondents[63].

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children of mothers who make decisions about major household decisions were less likely to be stunted (p=0.000) while children of mothers who are involved in decisions about major household decisions were less likely to be wasted on the basis of MUAC (p=0.028). No associations with nutrition outcomes were observed for other decision-making powers, including making decision for own earnings, husband's earnings, healthcare, visits to family or relatives or well-being of children (Cf. *Annex A: Logistic Regression*). Similarly, no association between nutrition outcomes and the amount of money the woman controls was detected (Cf. *Annex B: Linear Regression*).

HYPOTHESIS T: LOW SOCIAL SUPPORT FOR WOMEN

Strength of the association with undernutrition in the *scientific literature*[28]	+
Strength of the association with undernutrition based on *secondary data review* relevant for the study zone[29]	+
Strength of the association with undernutrition based on statistical analysis[30]	++
Overall interpretation	+

SECONDARY DATA REVIEW[14]

- Sons inherit land, houses and other important family property; daughters are considered as 'temporary' family members, or the 'others' → often followed by discrimination in education and inheritance practices. Many fathers consider investing in their daughter's education a waste because they will leave the family after marriage and belong to the husbands' families. Sons are given priority for higher education than daughters[64];
- 52% of women and 22% of men reported having received nutrition information at any time from government health workers (including midwives, auxiliary midwives and health assistants) but only 4% of women and 5% of men were able to recall at least 5 out of 7 key messages on MIYCF and nutrition sensitive practices.[41]

QUANTITATIVE ANALYSES FINDINGS

Among children younger than 59 months old included in the analysed sample, children of mothers 18 years old or younger were less likely to be stunted (p=0.003) (Cf. *Annex A: Logistic Regression*). Mother's increasing age increased child's chances to be wasted by WHZ (p=0.002), stunted (p=0.005) and underweight (p=0.000), although it decreased his/her chances of being wasted by MUAC (p=0.059) (Cf. *Annex B: Linear Regression*).

[63] *Nielsen and MMRD, 2015, data provided by UNICEF, cited in Situational Analysis, Save the Children, 2017.*
[64] *NINU, 2018.*

Children of mothers who only complemented their elementary education were more likely to be stunted (p=0.000), underweight (p=0.000) and concurrently wasted and stunted (p=0.032). No associations with nutrition outcomes were observed for children of mothers with no formal education (Cf. *Annex A: Logistic Regression*).

Children of mothers who were widowed were more likely to be stunted (p=0.038) (Cf. *Annex A: Logistic Regression*).

V. CONCLUSION AND RECOMMENDATIONS

Summary of risk and protective factors per nutrition outcome

The calculation of statistical associations between individual risk factors and nutritional status of children in households included in MCCT baseline survey allowed to differentiate between risk factors of wasting, stunting, underweight and concurrent wasting and stunting (WaSt). While some may overlap, differences in risk factors between each form of undernutrition exist and should be noted for programming purposes.

Wasting

Risk factors: Children younger than 36 months were more likely to be wasted by MUAC and MUAC and/or WHZ. Children of mothers with MUAC <21 cm or low BMI[3] were more likely to be wasted on the basis of WHZ, MUAC and MUAC and/or WHZ. Mother's increasing age increased child's chances to be wasted by WHZ.

Children living in households with regular income from NGOs[53] were more likely to be wasted on the basis of WHZ while children living in households which reported farming or animal husbandry as their primary occupation were more likely to be wasted on the basis of MUAC and MUAC and/or WHZ.

Children living in households experiencing inadequate household provisioning due to a *loss of regular job* were more likely to be wasted on the basis of MUAC; children living in households experiencing inadequate food provisioning due to *inadequate income* were more likely to be wasted on the basis of WHZ and MUAC and/or WHZ and children living in households experiencing inadequate food provisioning due to *illness or being victim of violence/crime* were more likely to be wasted on the basis of MUAC and MUAC and/or WHZ.

Child-level factors	
Age <24/36 months *MUAC / MUAC and/or WHZ*	**Sex** Male *MUAC / MUAC and/or WHZ*
Caregiver-level factors	
Mother's nutritional status MUAC <21cm *WHZ / MUAC / MUAC and/or WHZ* Low BMI *WHZ / MUAC / MUAC and/or WHZ* **Mother's age** ↑ Age *WHZ*	**Mother's nutritional status** ↑ Mother's BMI *WHZ / MUAC* **Mother's age** ↑ Age *MUAC* **Care practices** Exclusive breastfeeding *WHZ / MUAC* Health check-up w/in 2 wks of delivery *WHZ / MUAC* **Birth-spacing** Use of contraceptive means *MUAC* **Decision-making** Involved in decisions about major HH decisions *MUAC*
Household-level factors	
Inadequate access to food Inadequate HH food provisioning due to: Loss of regular job *MUAC* Inadequate income *WHZ / MUAC and/or WHZ* Illness / Victim of violence/crime *MUAC / MUAC and/or WHZ* **Inadequate access to income** Regular NGO assistance *WHZ* Farming or animal husbandry *MUAC / MUAC and/or WHZ* Asset ownership: Boat w/ a motor *WHZ* Radio/cassette player *WHZ* **Inadequate coping strategies** Taking a loan *MUAC and/or WHZ* **Inadequate access to water** Water scarcity *MUAC* Water treatment: straining through a cloth *WHZ* sand and settle *WHZ / MUAC and/or WHZ* **Inadequate access to sanitation** ↑ Distance to latrines *WHZ / MUAC*	**HH size** >1 child <59 months *MUAC and/or WHZ* **Adequate access to food** Year-round MAHFP *MUAC and/or WHZ* ↑ MAHFP *WHZ / MUAC* ↑ HDDS / MDD-W *WHZ / MUAC* ↑ IDDS *MUAC* **Adequate access to income** Asset ownership: Wooden or steel bed *MUAC and/or WHZ* Mattress *MUAC and/or WHZ* Table *MUAC and/or WHZ* Fuel efficient wood stove *MUAC* Fish net *WHZ* ↑ Assets *WHZ / MUAC* **Adequate access to water** Improved water source in summer *MUAC*

Children living in households which took a loan in the 12 months prior the data collection were more likely to be wasted on the basis of MUAC and/or WHZ. Children living in households which owned at least one boat without a motor or radio/cassette player were more likely to be wasted on the basis of WHZ.

Children living in households which experienced water scarcity were more likely to be wasted on the basis of MUAC. Children living in households which were straining water through a cloth as means to treat water were more likely to be wasted on the basis of WHZ while children living in households which were letting the water to stand and settle were more likely to be wasted on the basis of WHZ, MUAC and/or

WHZ. The increasing distance to latrines increased child's chances of being wasted on the basis of WHZ and MUAC.

Protective factors: Male children were less likely to be wasted on the basis of MUAC and MUAC and/or WHZ. Children living in households with more than one child under 59 months or households with year-round adequate food provisioning[2] were less likely to be wasted on the basis of MUAC and/or WHZ. The increasing number of months of adequate food provisioning decreased child's chances of being wasted on the basis of WHZ and MUAC. The increasing HDDS or MDD-W scores decreased child's chances of being wasted by WHZ and MUAC while the increasing IDDS score decreased child's chances of being wasted by MUAC.

Mother's increasing BMI[3] decreased child's chances of being wasted on the basis of WHZ and MUAC while her increasing age decreased child's chances of being wasted by MUAC. Children who were exclusively breastfed were less likely to be wasted by MUAC and/or WHZ. Children of mothers who were taking contraceptives or other means to delay pregnancy or mothers who were involved in decisions about major household decisions were less likely to be wasted on the basis of MUAC. Children who underwent a health check within two weeks of delivery were less likely to be wasted on the basis of WHZ and MUAC.

Children living in households which owned at least one wooden or steel bed, mattress or table were less likely to be wasted on the basis of MUAC and/or WHZ. Children living in households which owned at least one fuel efficient wood stove were less likely to be wasted on the basis of MUAC while children living in households which owned at least one fish net were less likely to be wasted on the basis of WHZ. The increasing number of asset categories owned by the household decreased child's chances of being wasted on the basis of WHZ and MUAC.

Children living in households which used an improved water source[5] in summer were less likely to be wasted on the basis of MUAC.

Stunting

Risk factors: Male children, children from rural households and children from above average sized households (> =7 members[6]) were more likely to be stunted. The increasing age of a child or the increasing number of members within a household increased child's chances of being stunted. Children living in households with more than one child under 59 months or children who were less than 24 months apart from their sibling were more likely to be stunted. The same trend was observed for children who had experienced illness before or children from households with more than one child under 59 months who had fever as their most recent illness. Children of mothers who were pregnant at the time of the data collection or mothers who did not desire future pregnancy and were not taking contraceptives were also more likely to be stunted.

Children of mothers with MUAC <21 cm, low BMI[3] or short stature (<151.7 cm)[7] were more likely to be stunted. Children of mothers who only complemented their elementary education or children of widowed mothers were also more likely to be stunted while mother's increasing age increased child's chances to be stunted.

Children living in low income households[52], households which demonstrated below average asset ownership[8], or households which reported farming or animal husbandry or casual labor as their primary occupation were more likely to be stunted. Children were also more likely to be stunted if they lived in households experiencing inadequate food provisioning due to poor harvest or inadequate income, or households which took a loan, particularly for food purchases.

Children living in households in which a water container was observed unclean or uncovered or households which received sanitation sensitisation in the six months prior the data collection[59] were more likely to be stunted. Children were also more likely to be stunted if they lived in houses with palm leaves or tarpaulin as the main roof material. The likelihood of children

being stunted increased if children were living in houses which only used palm leaves as the main roof material.

Protective factors: Children younger than 36 months were less likely to be stunted. Children living in households of government employees or households which owned at least one car or a piece of gold were less likely to be stunted. Children were also less likely to be stunted if they lived in households which owned at least one wooden or steel bed, mattress, table, gas/electric stove, generator, fridge, sewing machine, video player/recorder, TV or satellite dish. Children living in households with electricity or electricity at night had lower chances of being stunted. The increasing number of asset categories owned by the household decreased child's chances of being stunted.

Children living in households with year-round adequate food provisioning[2] or households with HDDS higher than mean score[9] were less likely to be stunted. The increasing number of months of adequate food provisioning or increasing HDDS score decreased child's chances of being stunted. Children were also less likely to be stunted if they lived in households which migrated before and/or after the childbirth or if they were exclusively breastfed.

Children of overweight mothers[3] were less likely to be stunted as mother's increasing BMI[3] or MDD-W score decreased child's chances of being stunted. The increasing number of months of iron folic acid supplementation during pregnancy also decreased child's odds of being stunted.

Children living in households in which woman's income surpassed that of her husband, children of mothers who made decisions about major household decisions or mothers who completed at least four ANC visits during last pregnancy were less likely to be stunted. Children who underwent a health check within two weeks of delivery or children of mothers 18 years old or younger were less likely to be stunted.

Children living in households which used a filter to treat water or households in which a water container was observed clean were less likely to be stunted. Children were also less likely to be stunted if they lived in households where soap could be observed at the place of handwashing or mothers reported using soap to wash hands.

Child-level factors	
Sex Male **Age** ↑ age **Health** Prior illness Fever, if HH >1 child <59 months	**Age** <24/36 months
Caregiver-level factors	
Mother's nutritional status MUAC <21cm Low BMI Short stature <151.7 cm **Mother's socio-economic status** ↑ Age Widow Elementary education only **Birth-spacing** Birth-spacing <24 months Mother currently pregnant Mother not desiring future pregnancy & not taking contraceptives	**Health** ≥4 ANC visits **Mother's nutritional status** Overweight ↑ Mother's BMI **Mother's socio-economic status** Income higher than husband's **Care practices** Exclusive breastfeeding Health check-up w/in 2 wks of delivery **Decision-making** Made decisions about major HH decisions **Adequate hygiene practices** Washing hands w/ soap
Household-level factors	
HH characteristics Rural Above average-sized HH (≥ 7 members) ↑ no. HH members >1 child <59 months House roof made of palm leaves or tarpaulin **Inadequate access to income** Low income HH Below-average asset ownership Farming or animal husbandry Casual labour **Inadequate coping strategies** Taking a loan, particularly for food purchases **Inadequate access to food** Inadequate HH food provisioning due to: Poor harvest Inadequate income **Inadequate access to water** Unclean or uncovered water container	**Adequate access to income** Government employee Asset ownership: Car / Piece of gold Wooden or steel bed / Mattress /Table Gas/electric stove Generator / Fridge Sewing machine Video player/recorder TV or satellite dish Electricity or electricity at night ↑ Assets **Adequate access to food** Year-round MAHFP ↑ MAHFP Higher than mean HDDS ↑ HDDS / MDD-W HH migrated before/after childbirth **Adequate access to water** Clean water container Water treatment: filter **Adequate hygiene practices** Soap at hand-washing place

Underweight

Risk factors: Children from rural households, households with more than one child under 59 months, children of mothers who were pregnant at the time of the data collection or children of mothers who did not desire future pregnancy and were not taking contraceptives were more likely to be underweight. The increasing age of a child or increasing number of members within a household increased child's chances of being underweight.

Children of mothers with MUAC <21 cm, low BMI[3] or short stature (<151.7 cm)[7] were more likely to be underweight. Children of mothers who only complemented their elementary education or children of widowed mothers were also more likely to be underweight while mother's increasing age increased child's chances of being underweight. Children who had experienced illness before were more likely to be underweight.

Child-level factors	
Age ↑ age **Health** Prior illness	**Age** <24/36 months
Caregiver-level factors	
Mother's nutritional status MUAC <21cm Low BMI Short stature <151.7 cm **Mother's socio-economic status** ↑ Age Widow Elementary education only **Birth-spacing** Mother currently pregnant Mother not desiring future pregnancy & not taking contraceptives	**Health** ≥4 ANC visits **Mother's nutritional status** Overweight ↑ Mother's BMI **Care practices** Exclusive breastfeeding Health check-up w/in 2 wks of delivery
Household-level factors	
HH characteristics Rural Above average-sized HH (≥ 7 members) ↑ no. HH members >1 child <59 months House roof made of palm leaves or tarpaulin **Inadequate access to income** Low income HH Below-average asset ownership Farming or animal husbandry **Inadequate coping strategies** Taking a loan, particularly for food purchases **Inadequate access to food** Inadequate HH food provisioning due to: Inadequate income **Inadequate access to water** ↑ distance to water facilities Unclean or uncovered water container **Inadequate sanitation practices** ↑ distance to latrines	**Adequate access to food** Year-round MAHFP ↑ MAHFP Higher than mean HDDS ↑ HDDS / MDD-W HH migrated before/after childbirth **Adequate access to income** Government employee Asset ownership: Car / Piece of gold Wooden or steel bed / Mattress /Table Gas/electric stove Generator / Fish net Sewing machine Video player/recorder TV or satellite dish Electricity or electricity at night ↑ Assets **Adequate access to water** Own water container for storage Water treatment: composite filters **Adequate hygiene practices** Soap at hand-washing place

Children living in low income households[52], households which demonstrated below average asset ownership[8] or households which reported farming or animal husbandry as their primary occupation were more likely to be underweight. Children were also more likely to be underweight if they lived in households experiencing inadequate food provisioning due to inadequate income or households which took a loan, particularly for food purchases.

Children living in houses with palm leaves or tarpaulin as the main roof material were more likely to be underweight. The likelihood of children being underweight increased if children were living in houses which only used palm leaves as the main roof material. The increasing distance to water facilities or latrines also increased child's chances of being underweight. Children living in households in which a water container was observed unclean or uncovered were also more likely to be underweight.

Protective factors: Children younger than 36 months were less likely to be underweight. Children living in households of government employees or households which owned at least one car or a piece of gold were less likely to be underweight. Children were also less likely to be underweight if they lived in households which owned at least one wooden or steel bed, mattress, table, gas/electric stove, generator, sewing machine, fish net, video player/recorder, TV or satellite dish. Children living in households with electricity or electricity at night had lower chances of being underweight. The increasing number of asset categories owned by the household decreased child's chances of being underweight.

Children living in households with year-round adequate food provisioning[2] or households with HDDS higher than mean score[9] were less likely to be underweight. The increasing number of months of adequate food provisioning or increasing HDDS score decreased child's chances of being underweight. Children were also less likely to be underweight if they lived in households which migrated before and/or after the childbirth or if they were exclusively breastfed.

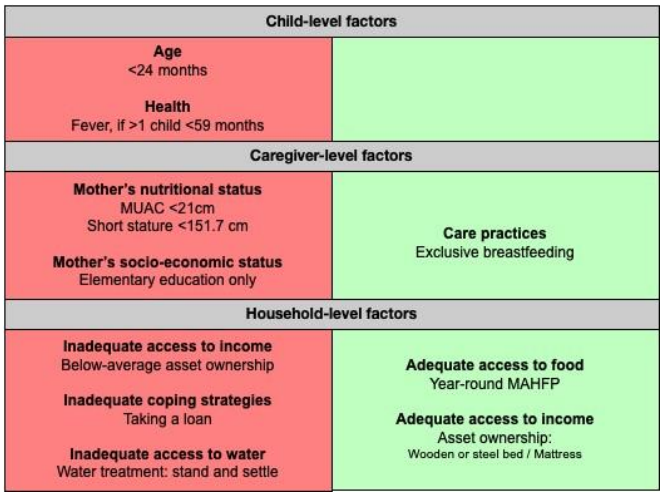
Children of overweight mothers[3] were less likely to be underweight as mother's increasing BMI[3] or MDD-W score decreased child's chances of being underweight. Children of mothers who completed at least four ANC visits during last pregnancy or children who underwent a health check within two weeks of delivery were also less likely to be underweight. The increasing number of months of iron folic acid supplementation during pregnancy decreased child's odds of being underweight.

Children living in households which used composite filters to treat water or households in which owned a water container for storage were less likely to be underweight. Children were also less likely to be underweight if they lived in households where soap could be observed at the place of handwashing.

Concurrent wasting and stunting

Risk factors: Children were more likely to be concurrently wasted and stunted if they were younger than 24 months old[10] or if they lived in households with more than one child under 59 months and had fever as their most recent illness. They were also more likely to be concurrently wasted and stunted if their mothers were of short stature (<151.7 cm)[7], if their mothers' MUAC were lower than 21 cm or their mothers completed only their elementary education.

Children living in households which demonstrated below average asset ownership[8], households which took a loan in the 12 months prior the data collection or households which were letting the water to stand and settle as means to treat water were more likely to be concurrently wasted and stunted.



Protective factors: Children were less likely to be concurrently wasted and stunted if they were exclusively breastfed, if they lived in households with year-round adequate food provisioning[2] or households which owned at least one wooden or steel bed or mattress.

Undernutrition

Common risk factors for *wasting* on the basis of at least one index (WHZ or MUAC or WHZ and/or MUAC), *stunting* and *underweight* include mother's MUAC <21 cm or low BMI[3], farming or animal husbandry as household's primary occupation, household taking a loan or inadequate food provisioning due to inadequate income. Common protective factors for the three nutrition outcomes include year-round adequate food provisioning[2], exclusive breastfeeding and ownership of at least one wooden or steel bed, a mattress or table. The increasing number of months of adequate food provisioning, or asset categories owned by the household as well as the increasing HDDS or MDD-W scores decreased child's chances of being wasted, stunted or underweight. Most of these factors align with identified risk and protective factors for concurrent wasting and stunting with the exception of dietary diversity scores, which did not demonstrate statistical associations with *WaSt*. In addition, children younger than 24 months

are more likely to be wasted and concurrently wasted and stunted while it is rather children more than 24 months which are more likely to be stunted or underweight.

The key differences between risk factors for *wasting* on the basis of at least one index (WHZ or MUAC or WHZ and/or MUAC) and *stunting* include reverse observations for male child, which appears to be less likely to be wasted but more likely to be stunted. The same pattern was observed for children in households with more than one child under 59 months and low income households[52]. Additionally, indicators related to sudden shocks, such as illness or violence, appeared to be relevant for *wasting* but not *stunting* while hygiene indicators appeared to be more relevant for *stunting* but not *wasting*. Children from households residing in rural areas were more likely to be *stunted* and *underweight* while the association with *wasting* was not observed. Mother's socio-economic status, including age, education, income and education, seemed to play a particular role in relation to *stunting* while the evidence was scarcer in relation to *wasting* and *underweight*. With the exception of few factors, risk and protective factors for *stunting* and *underweight* greatly overlap.

Summary of categorisation of risk factors

The analyses undertaken during this review allowed to identify 20 risk factors, believed to have an impact on the incidence of undernutrition in the study zone. Following a triangulation of data from diverse sources, 5 risk factors were identified as having a major impact[65], 10 risk factors were classified as having an important impact and 5 risk factors were judged to have a minor impact on the incidence of undernutrition in the zone of study. Among the major risk factors, three were identified in the sector of food security and livelihoods, namely low access to a quality diet, low access to income sources and low coping capacities, while two factors were identified in the health sector, namely low birth-spacing/early, repetitive or unwanted pregnancies and low nutritional status of women.

Risk factor		Overall interpretation/ Impact of risk factor
A	Limited access to health services	++
B	Limited utilisation of health services	++
C	Low birth spacing/ early, repetitive or unwanted pregnancies	+++
D	Low birth weight	++
E	Low nutritional status of women	+++
F	Parental stress	+
G	Non-optimal breastfeeding practices	++
H	Non-optimal complementary feeding practices	++
I	Low quality of interactions between a child and a caregiver	+
J	Low access to a quality diet	+++
K	Low access to income sources	+++
L	Limited access to markets	+
M	Low coping capacities	+++
N	Inadequate accessibility, availability and quality of water at household level	++
O	Poor sanitation practices	++
P	Poor hygiene practices	++
Q	Poor food and environmental hygiene	++
R	Heavy workload of women	++
S	Low female autonomy/ decision-making	+
T	Low social support for women	+

Table 1: Summary of categorisation of risk factors, Chin State

Summary of ongoing interventions

As a part of national unified response to the UN Secretary General's Zero Hunger Challenge, the national strategy to eradicate hunger and reduce malnutrition, Multisector National Plan of Action for Food and Nutrition (MS-NPAN) 2018/19 – 2022/23, identified Chin State as one

[65] *In the table below, major risk factors are highlighted in red with +++, important risk factors are highlighted in orange with ++ and minor risk factors are highlighted in green with +.*

of its top priority areas for a launch of a proposed package of nutrition-specific and nutrition sensitive interventions led by the government, non-governmental actors and private sector providers. These include long-term development interventions in agriculture, food security and livelihoods, social protection, health and nutrition, and gender sectors, led by national and international organisations. In Southern Chin, humanitarian assistance is also provided to internally displaced populations.

The Ministry of Social Welfare, Relief and Resettlement (MSWRR), through the Department of Social Welfare (DSW) started Chin State's Maternal and Child Cash Transfer (MCCT) programme in June 2017. This program aimed to improve the nutritional outcomes for all mothers and children during the first 1000-day period. A 15,000 MMK monthly payment was given to pregnant women or mothers with children up to 2 years to increase their purchasing power and to invest in health, hygiene and nutrition.[11]

Due to the ongoing crisis in country at the time of writing this report, the above-described formal government interventions have been halted. Non-governmental organizations continue to provide support.

Karuna Mission Social Solidarity (KMSS) Hakha has been conducting nutrition-sensitive activities in Chin State in partnership with Catholic Relief Services (CRS) since 2016 and nutrition-specific activities with Save the Children since 2017, both with funding support from UNOPS Livelihood and Security Fund (LIFT). CRS/KMSS current nutrition-sensitive activities aim to improve nutrition outcomes of children under two years in targeted areas. Project activities include: 1) increasing household income through improved small-animal husbandry practices; 2) budgeting household income to prioritize the purchase of diverse foods including increased protein consumption of both animal and plant foods; and 3) providing targeted maternal, infant and young child feeding (MIYCF) messages through the Care Group approach. Gender-awareness is cross-cutting in each component and specific messages are tailored to encourage male involvement and equitable participation in household decision-making.

Due to the sustained political crisis together with the effects of Covid-19, there is widespread concern that nutritional gains made during the past decade, will be lost due to the dual crisis. CRS and KMSS have introduced new interventions to stave off nutritional decline. Short-term cash and food distributions have been provided to targeted households in project villages with children under 5-years old. These distributions are accompanied with nutrition and hygiene informational materials in five local languages, with illustrations that are contextually appropriate for Chin State. In addition, KMSS and Save the Children are running a mobile clinic and providing cash with messages to encourage families to use them for medical referrals or to eat protein-rich foods.

Recommendations

Based on these findings, the following key activities are recommended to be considered for an incorporation into current/future interventions:

- Considering a potential effect of Covid-19 pandemic coupled with a political crisis in country, it is recommended to collect new household data, potentially via MCCT endline survey, to assess to which extent risk factors detailed in this report are still relevant. If child, caregiver and household identifiers exist, it is recommended to conduct the endline survey in the same households as MCCT baseline survey in order to evaluate an evolution of personal and household indicators and their potential effect on child's nutritional status;
- Considering missing qualitative data about community perceptions of undernutrition and its causal mechanisms in Chin State, it is recommended to conduct primary qualitative data collection on this topic and to triangulate it with the evidence detailed in this review and any new evidence produced by MCCT endline survey or other studies and assessments;

- Considering a concurrence of multiple forms of undernutrition among malnourished children (wasted, stunted or underweight), it is recommended to consider programmatic adaptations which would address common risk factors of wasting, stunting and underweight, instead of focusing on stunting only;
- Considering that a child's nutritional status is strongly linked with that of their mother, it is recommended to promote the importance of health among women of reproductive age, to systematically assess their nutritional status, especially during pregnancy and breastfeeding, while advocating for optimal birth-spacing to ensure child's proper development *in/ex utero*;
- Considering that children from above average-sized households or households with more than one child under 59 months or children less than 24 months apart from their sibling are at greater risk of undernutrition, it is recommended that caregivers receive adequate sensitisation and support if caring for more than one child under 59 months. This could include one-on-one mentoring by community health workers or advocacy for greater engagement in child care by other family members;
- Considering that at least one third of recipients considers the current amount of provided cash transfer inadequate[11], it is recommended to consider its increase to reflect dietary diversity needs of a child as well as their mother. In addition, it is recommended to extend the support to all children under 59 months living in the most vulnerable households;
- Considering that children from low income households, households which demonstrated below average asset ownership or households which took a loan are at greater risk of undernutrition, it is recommended that such households receive adequate support, per their main income source, to ensure the continuity of household food provisioning over the course of twelve months, while strengthening their capacity to optimally manage income, expenses and loans. In case of a shock, the households should have an access to in-time support to deal with consequences of such event and its potential effect on nutritional status of household members;
- Considering that inadequate water management has effect on the occurrence of multiple forms of undernutrition, it is recommended that respective behaviour change strategies are strengthened, primarily promoting the use of household water filters and optimal water storage.

ANNEX A: LOGISTIC REGRESSION

Statistical associations between risk factors and wasting, stunting, underweight and WaSt demonstrated by logistic regression

QUESTIONS POSED TO ALL CHILDREN <59 MONTHS																
Risk factor					Wasting (W/H) *Children 0-59 months*		Wasting (MUAC) *Children 6-59 months*[66]		Wasting by MUAC and/or W/H *Children 6-59 months*		Stunting *Children 0-59 months*		Underweight *Children 0-59 months*		WaST *Children 0-59 months*	
Indicator	N	n	Proportion in analyzed sample [95% CI]	Design effect	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]
DEMOGRAPHICS																
Male child	3451	1707	49.5 [47.8-51.1]	0.9	0.419	0.85 [0.57-1.27]	0.000	0.13 [0.05-0.30]	0.001	0.49 [0.32-0.74]	0.020	1.18 [1.03-1.37]	0.171	1.14 [0.95-1.36]	0.202	1.58 [0.78-3.18]
Age group -<24 months[67]	3451	1869	54.2 [52.6-55.7]	0.9	0.172	1.33 [0.88-2.00]	0.000	13.82 [5.88-32.48]	0.000	2.60 [1.75-3.87]	0.000	0.17 [0.16-0.20]	0.000	0.25 [0.20-0.31]	0.004	0.32 [0.15-0.69]
Age group <36 months	3451	2504	75.3 [71.1-73.9]	0.9	0.444	1.20 [0.75-1.91]	0.000	13.82 [5.88-32.48]	0.003	2.01 [1.27-3.17]	0.000	0.31 [0.27-0.36]	0.000	0.33 [0.27-0.40]	0.061	0.51 [0.26-1.03]
Rural	3451	2694	78.1 [71.3-83.6]	19.5	0.590	0.88 [0.55-1.40]	0.640	1.19 [0.58-2.46]	0.819	1.06 [0.64-1.74]	0.000	1.81 [1.50-2.18]	0.002	1.46 [1.15-1.85]	0.342	1.59 [0.61-4.13]
Above average household size (> =7 members[68])	3451	1545	44.8 [41.8-47.7]	3.1	0.930	0.98 [0.66-1.47]	0.613	1.15 [0.67-2.00]	0.700	0.93 [0.62-1.37]	0.023	1.18 [1.02-1.36]	0.392	1.08 [0.90-1.30]	0.525	0.80 [0.9-1.61]
Household has any electricity	3451	1198	35.6 [29.3-42.4]	16.3	0.975	1.00 [0.65-1.55]	0.622	1.16 [0.65-2.06]	0.611	1.12 [0.73-1.70]	0.000	0.67 [0.58-0.79]	0.008	0.76 [0.62-0.93]	0.889	0.95 [0.44-2.04]
House has electricity at night	3451	1077	31.2 [25.3-37.8]	16.0	0.270	0.77 [0.49-1.22]	0.916	1.03 [0.57-1.87]	0.571	0.88 [0.57-1.36]	0.000	0.64 [0.54-0.75]	0.003	0.73 [0.59-0.90]	0.213	0.59 [0.25-1.36]
HEALTH/ NUT																
Mother currently pregnant	3451	418	12.1 [10.4-14.1]	2.9	0.751	0.90 [0.48-1.70]	0.175	0.53 [0.21-1.33]	0.510	0.83 [0.48-1.45]	0.000	1.68 [1.36-2.07]	0.007	1.43 [1.10-1.85]	0.115	1.96 [0.85-4.56
Birth spacing <24 months	1968	572	29.1 [26.6-31.7]	1.6	0.156	0.64 [0.34-1.19]	0.131	1.72 [0.85-3.45]	0.810	1.07 [0.62-1.84]	0.007	1.32 [1.08-1.62]	0.691	1.06 [0.81-1.38]	0.682	0.81 [0.29-2.24]
More than 1 child under 59 months	3451	2416	70.0 [67.7-72.2]	2.2	0.447	0.85 [0.55-1.30]	0.188	0.68 [0.38-1.21]	0.041	0.65 [0.43-0.98]	0.000	1.85 [1.56-2.18]	0.001	1.46 [1.18-1.80]	0.664	0.85 [0.41-1.76]
Low BMI: Pregnant women dropped	3030	242	8.0 [6.7-9.5]	2.1	0.019	2.06 [1.12-3.76]	0.000	3.55 [1.78-7.12]	0.000	3.00 [1.74-5.15]	0.042	1.33 [1.01-1.75]	0.000	1.87 [1.37-2.56]	0.171	2.12 [0.72-6.19]
Low BMI: Pregnant and lactating women dropped	766	43	5.6 [3.9-8.1]	1.6	0.380	1.95 [0.44-8.71]	0.051	4.93 [0.99-24.47]	0.042	3.16 [1.04-9.59]	0.014	2.31 [1.18-4.52]	0.000	3.16 [1.69-5.90]	0.064	4.46 [0.92-21.68]

[66] *MUAC <125 mm*

[67] *The overall household sample is skewed towards households with young children, since per definition, households without young children or a pregnant household member are excluded. This has an impact on the found household age distribution. More specifically, it leads to an overrepresentation of the age group of children below five years of age, which is twenty-seven percent (26.7%) compared to nine percent (9%) nationally"*

[68] *Average household size= 6.5*

Overweight/ obese BMI: Pregnant women dropped	3030	378	12.5 [10.6-14.7]	3.03	0.333	0.70 [0.33-1.45]	*Perfect collinearity*		0.099	0.49 [0.21-1.14]	0.000	0.64 [0.49-0.82]	0.000	0.50 [0.34-0.72]	0.465	0.58 [0.14-2.48]
Overweight/ obese BMI: PLW's dropped	766	121	15.8 [12.8-19.4]	1.6	0.915	0.93 [0.27-3.24]	*Perfect collinearity*		0.492	0.65 [0.19-2.20]	0.054	0.68 [0.46-1.01]	0.040	0.58 [0.34-0.98]	0.614	0.59 [0.07-4.67]
Short stature (<151.7 cm)[69]	3451	1835	53.2 [50.2-56.1]	3.1	0.911	0.98 [0.65-1.46]	0.890	1.04 [0.60-1.80]	0.625	1.10 [0.74-1.63]	0.000	1.97 [1.70-2.28]	0.000	1.73 [1.43-2.10]	0.027	2.38 [1.10-5.13]
Maternal MUAC < 21 cm	3447	126	3.7 [2.8-4.8]	2.4	0.005	2.77 [1.36-5.62]	0.004	3.57 [1.49-8.60]	0.000	3.28 [1.69-6.37]	0.000	2.13 [1.49-3.05]	0.000	2.41 [1.63-3.56]	0.001	4.87 [1.85-12.82]
Child has a birth certificate	3451	1203	34.9 [31.2-38.7]	5.6	0.731	0.93 [0.61-1.42]	0.082	0.58 [0.31-1.07]	0.587	0.89 [0.60-1.34]	0.001	1.29 [1.11-1.50]	0.117	1.16 [0.96-1.41]	0.574	0.81 [0.38-1.70]
At least 4 ANC visits during last pregnancy	3180	2286	71.9 [68.5-75.1]	4.4	0.985	1.00 [0.63-1.59]	0.104	0.62 [0.35-1.10]	0.941	1.02 [0.65-1.59]	0.003	0.78 [0.67-0.92]	0.002	0.72 [0.59-0.89]	0.498	1.34 [0.58-3.12]
Zero ANC visits in last pregnancy	2764	252	9.1 [7.3-11.3]	3.4	0.343	0.64 [0.26-1.60]	0.854	0.91 [0.2-2.56]	0.294	0.61 [0.24-1.53]	0.126	1.25 [0.94-1.65]	0.584	0.90 [0.61-1.32]	0.948	0.95 [0.22-4.09]
HDDS: More than the mean score[70]	3451	1618	46.9 [43.4-50.4]	4.4	0.253	1.26 [0.85-1.88]	0.095	0.61 [0.34-1.09]	0.608	0.90 [0.61-1.34]	0.000	0.68 [0.59-0.79]	0.000	0.63 [0.52-0.76]	0.228	0.65 [0.32-1.32]
WDDS: More than or equal to five food groups	3451	1231	35.7 [32.5-39.0]	4.1	0.574	1.13 [0.75-1.70]	0.083	0.56 [0.29-1.08]	0.482	0.86 [0.56-1.31]	0.000	0.70 [0.60-0.81]	0.000	0.65 [0.53-0.79]	0.172	0.57 [0.26-1.27]
FSL																
Low Income Household[71]	3451	1716	49.7 [45.9-53.6]	5.3	0.039	0.65 [0.43-0.98]	0.750	1.09 [0.63-1.90]	0.528	0.88 [0.60-1.30]	0.000	1.43 [1.24-1.65]	0.001	1.37 [1.14-1.64]	0.892	0.95 [0.48-1.89]
Supporting biological children outside of the home	3451	246	7.1 [6.0-8.5]	2.1	0.670	0.83 [0.36-1.92]	0.742	0.82 [0.25-2.66]	0.206	0.52 [0.19-1.43]	0.782	1.04 [0.79-1.37]	0.840	1.04 [0.73-1.47]	0.808	0.84 [0.20-3.52]
Regular income from NGO's/ other	3451	265	7.7 [6.1-9.6]	3.9	0.044	1.85 [1.02-3.35]	0.995	1.00 [0.36-2.79]	0.151	1.57 [0.85-2.93]	0.567	0.92 [0.70-1.21]	0.613	0.91 [0.64-1.30]	0.118	2.15 [0.82-5.62]
Primary occupation: Farming/ animal husbandry	3451	1184	34.3 [30.5-38.4]	6.2	0.516	1.15 [0.76-1.73]	0.009	2.08 [1.20-3.60]	0.024	1.57 [1.06-2.33]	0.000	1.37 [1.18-1.59]	0.015	1.26 [1.05-1.53]	0.327	1.42 [0.71-2.83]
Primary occupation: Casual labor	3451	112	3.3 [2.4-4.4]	2.9	0.483	0.60 [0.15-2.48]	0.512	0.51 [0.07-3.76]	0.340	0.50 [0.12-2.07]	0.044	1.48 [1.01-2.18]	0.853	0.95 [0.56-1.61]	0.938	0.92 [0.13-6.82]
Primary occupation: Government job	3451	170	4.9 [3.8-6.4]	3.1	0.589	1.26 [0.54-2.92]	0.383	0.41 [0.06-3.02]	0.732	0.84 [0.30-2.32]	0.000	0.49 [0.33-0.72]	0.004	0.43 [0.24-0.76]	0.620	0.60 [0.08-4.45]
Primary occupation: Private salary/ job	3451	15	0.4 [0.0-0.8]	1.3	*Perfect collinearity*[72]						0.066	0.15 [0.02-1.14]	*Perfect collinearity*			
Primary occupation: Retail/ petty shop	3451	114	3.3 [2.6-4.2]	1.9	0.868	0.91 [0.28-2.90]	*Perfect collinearity*		0.491	0.61 [0.15-2.51]	0.331	0.81 [0.54-1.23]	0.296	0.74 [0.42-1.30]	0.924	0.91 [0.12-6.70]
Mother or household member took a loan in the last 12 months	3451	1869	54.2 [51.0-57.3]	3.5	0.271	1.26 [0.84-1.89]	0.148	1.53 [0.86-2.72]	0.032	1.57 [1.04-2.36]	0.001	1.29 [1.11-1.49]	0.009	1.28 [1.06-1.54]	0.003	3.85 [1.59-9.35]

[69] *Population mean.*
[70] *Min: 1, Max: 12. Mean: 6.6. [6.4-6.7].*
[71] *Lower than 1,000,000 MMK per annum*
[72] *Perfect collinearity is the condition whereby there is an exact linear relationship between two variables (i.e. all malnourished children were unvaccinated) and therefore a regression analysis outputs no meaningful results to interpret. This is more likely to happen with small sample sizes*

Loan from VSLA	1869	105	5.6 [4.2-7.5]	2.4	0.449	0.58 [0.14-2.40]	*Perfect collinearity*		0.263	0.44 [0.11-1.84]	0.171	0.74 [0.48-1.14]	0.567	0.85 [0.49-1.47]	0.693	1.34 [0.31-5.74]
Loan from family/ friend	1869	1203	64.4 [60.0-68.5]	3.8	0.555	1.18 [0.68-2.06]	0.926	1.03 [0.51-2.11]	0.620	1.14 [0.68-1.90]	0.776	0.97 [0.80-1.19]	0.317	0.88 [0.69-1.13]	0.895	0.95 [0.43-2.08]
Most important use of loan: Food purchases	1869	1037	55.5 [51.4-59.5]	3.2	0.548	1.18 [0.69-1.99]	0.506	1.27 [0.63-2.55]	0.574	1.15 [0.70-1.89]	0.016	1.27 [1.04-1.54]	0.008	1.40 [1.09-1.79]	0.244	1.61 [0.72-3.61]
Most important use of loan: School fees	1869	216	11.6 [9.7-13.7]	1.9	0.125	0.40 [0.12-1.29]	0.879	1.09 [0.38-3.12]	0.534	0.76 [0.32-1.79]	0.676	0.94 [0.69-1.27]	0.901	1.02 [0.71-1.49]	0.226	0.29 [0.04-2.15]
Most important use of loan: Health expenses	1869	812	43.5 [40.0-47.0]	2.4	0.671	0.89 [0.53-1.51]	0.285	1.45 [0.73-2.87]	0.504	1.18 [0.73-1.92]	0.851	0.98 [0.81-1.19]	0.733	1.04 [0.82-1.33]	0.373	1.41 [0.66-3.02]
Respondent or any household member saved any money in the last 12 months	3451	370	10.7 [8.8-13.0]	4.2	0.274	1.38 [0.78-2.45]	0.747	1.15 [0.49-2.73]	0.284	1.37 [0.77-2.45]	0.270	0.88 [0.69-1.11]	0.961	0.99 [0.74-1.34]	0.801	1.14 [0.40-3.27]
Year-round adequate home food provisioning[73]	3451	2827	81.9 [78.2-85.1]	7.2	0.174	0.72 [0.45-1.16]	0.116	0.61 [0.33-1.13]	0.028	0.61 [0.39-0.95]	0.006	0.77 [0.64-0.93]	0.010	0.74 [0.59-0.93]	0.025	0.44 [0.21-0.90]
Inadequate food due to poor harvest	3451	176	5.1 [3.7-7.1]	5.2	0.969	0.98 [0.39-2.45]	0.300	0.35 [0.05-2.55]	0.501	0.71 [0.26-1.95]	0.029	1.41 [1.04-1.93]	0.644	1.10 [0.73-1.65]	*Perfect collinearity*	
Inadequate food due to loss of livelihood	3451	14	0.0 [0.0-0.0]	4.5	*Perfect collinearity*						0.782	1.17 [0.39-3.49]	0.876	0.89 [0.20-3.98]		
Inadequate food due to loss of illness	3451	128	3.7 [2.7-5.2]	3.8	0.221	1.70 [0.73-3.95]	0.006	3.46 [1.44-8.31]	0.042	2.18 [1.03-4.63]	0.273	1.23 [0.85-1.77]	0.156	1.38 [0.89-2.14]	0.116	2.62 [0.79-8.68]
Inadequate food due to natural disaster (flood, drought)	3451	73	2.1 [1.5-3.1]	2.6	0.453	0.47 [0.06-3.40]	0.876	0.85 [0.12-6.29]	0.810	0.84 [0.20-3.49]	0.411	0.80 [0.48-1.35]	0.426	1.27 [0.70-2.29]	0.710	1.46 [0.20-10.85]
Inadequate food due to inadequate income	3451	162	4.7 [3.5-6.2]	3.4	0.037	2.12 [1.05-4.29]	0.280	1.77 [0.63-5.00]	0.015	2.34 [1.18-4.62]	0.021	1.46 [1.06-2.02]	0.023	1.56 [1.06-2.28]	0.050	2.88 [1.00-8.30]
Inadequate food due to being unemployed	3451	112	3.3 [2.3-4.6]	3.6	0.491	0.61 [0.15-2.50]	0.104	2.38 [0.84-6.74]	0.469	1.41 [0.56-3.55]	0.970	1.01 [0.67-1.51]	0.477	0.82 [0.47-1.42]	0.946	0.93 [0.13-6.89]
Household experienced month(s) of inadequate food because of unexpected crop failure[74]	624	291	46.6 [38.3-55.2]	4.6	0.586	1.26 [0.55-2.90]	0.779	0.86 [0.29-2.51]	0.442	1.35 [0.63-2.91]	0.396	1.15 [0.83-1.60]	0.305	1.23 [0.83-1.83]	0.939	0.95 [0.29-3.16]
Household experienced unexpected death of major livestock	624	332	53.2 [46.6-59.7]	2.7	0.930	0.96 [0.42-2.22]	0.718	1.22 [0.42-3.57]	0.812	0.91 [0.42-1.96]	0.341	0.85 [0.62-1.18]	0.661	1.09 [0.73-1.63]	0.611	0.73 [0.22-2.43]
Household experienced loss of regular job	624	318	51.0 [44.7-57.2]	2.6	0.174	1.83 [0.76-4.38]	0.062	3.41 [0.94-12.40]	0.101	1.98 [0.88-4.47]	0.880	0.98 [0.70-1.35]	0.236	1.27 [0.85-1.90]	0.408	1.69 [0.49-5.82]
Household experienced loss of main income/ major job	624	282	45.2 [37.9-52.8]	3.6	0.133	1.92 [0.82-4.51]	0.413	1.57 [0.53-4.59]	0.119	1.86 [0.85-4.07]	0.407	0.87 [0.6-1.21]	0.074	1.44 [0.96-2.14]	0.228	2.14 [0.62-7.39]
Household experienced severe illness/ injury	624	359	57.5 [51.7-63.1]	2.1	0.463	1.39 [0.58-3.32]	0.960	0.97 [0.33-2.85]	0.476	1.34 [0.60-2.96]	0.666	1.08 [0.77-1.50]	0.221	1.29 [0.86-1.94]	0.692	1.29 [0.37-4.44]

[73] *MAHFP twelve months*

[74] *In the last 12 months. Denominator only represents households with one or more months of inadequate food in the home.*

Household was victim of violence/ crime	624	16	2.6 [1.4-4.8]	1.7	0.548	1.89 [0.24-14.99]	0.009	9.17 [1.76-47.84]	0.004	8.52 [2.01-36.08]	0.193	1.98 [0.71-5.54]	0.070	2.60 [0.93-7.30]	0.183	4.24 [0.51-35.39]
Household experienced storms/ cyclone	624	106	17.0 [12.5-22.6]	2.8	0.292	0.45 [0.11-1.97]	*Perfect collinearity*		0.070	0.16 [0.02-1.16]	0.196	0.74 [0.47-1.16]	0.361	0.77 [0.44-1.35]	0.491	0.48 [0.06-3.82]
Household experienced month(s) of inadequate food because of drought	624	90	14.4 [10.8-19.0]	2.1	0.833	0.88 [0.25-3.01]	0.401	0.42 [0.05-3.22]	0.225	0.40 [0.09-1.74]	0.139	0.69 [0.43-1.12]	0.705	0.89 [0.50-1.60]	*Perfect collinearity*	
Household experienced floods	624	51	8.2 [5.3-12.4]	2.6	0.107	2.51 [0.82-7.70]	*Perfect collinearity*		0.995	1.00 [0.23-4.39]	0.244	0.69 [0.37-1.29]	0.943	1.03 [0.50-2.11]	0.902	1.14 [0.14-9.08]
Household experienced earthquake	624	68	10.9 [7.0-16.6]	3.6	0.004	3.90 [1.54-9.86]	0.610	0.59 [0.08-4.57]	0.098	2.23 [0.86-5.79]	0.401	0.79 [0.46-1.36]	0.342	1.34 [0.73-2.44]	0.436	1.85 [0.39-8.76]
Household experienced land sliding	624	100	16.0 [11.6-21.8]	3.1	0.187	1.91 [0.73-4.96]	0.577	1.45 [0.39-5.32]	0.191	1.82 [0.74-4.44]	0.887	0.97 [0.62-1.52]	0.298	1.31 [0.79-2.20]	0.314	2.00 [0.52-7.66]
Household experienced water scarcity	624	178	28.5 [21.8-36.4]	4.2	0.846	1.09 [0.44-2.71]	0.032	3.26 [1.11-9.58]	0.260	1.57 [0.72-3.45]	0.405	1.16 [0.81-1.67]	0.129	1.39 [0.91-2.13]	0.919	0.93 [0.24-3.56]
Household experienced fire	624	16	2.6 [1.3-5.0]	1.9	*Perfect collinearity*						0.320	0.56 [0.18-1.76]	0.494	0.59 [0.13-2.65]	*Perfect collinearity*	
Land ownership: Dwelling	3451	2418	70.1 [65.9-74.0]	7.0	0.297	1.28 [0.81-2.02]	0.439	1.28 [0.68-2.42]	0.466	1.18 [0.76-1.83]	0.277	1.09 [0.93-1.28]	0.181	1.15 [0.94-1.41]	0.969	0.99 [0.47-2.08]
Land ownership: Agriculture	3451	1367	39.6 [35.4-44.0]	6.9	0.868	1.04 [0.69-1.56]	0.189	1.45 [0.83-2.51]	0.328	1.22 [0.82-1.81]	0.870	1.01 [0.87-1.17]	0.650	0.96 [0.79-1.12]	0.703	0.87 [0.43-1.78]
Land ownership: Land for dwelling & agriculture	3451	1228	35.6 [31.4-40.0]	7.2	0.699	1.08 [0.72-1.64]	0.180	1.46 [0.84-2.54]	0.424	1.18 [0.79-1.76]	0.896	1.01 [0.87-1.17]	0.850	0.98 [0.81-1.19]	0.529	0.79 [0.37-1.66]
Assets owned: At least one bicycle	3451	139	4.0 [3.1-5.3]	2.8	0.309	1.55 [0.67-3.60]	0.477	0.49 [0.07-3.55]	0.620	1.26 [0.50-3.18]	0.279	0.81 [0.56-1.18]	0.640	0.89 [0.55-1.44]	0.153	2.40 [0.72-7.95]
Assets owned: At least one car	3451	68	2.0 [1.3-3.1]	3.6	0.979	1.02 [0.25-4.22]	*Perfect collinearity*				0.022	0.49 [0.27-0.90]	0.010	0.16 [0.04-0.65]	*Perfect collinearity*	
Assets owned: At least one truck	3451	39	1.1 [0.7-1.9]	2.9	*Perfect collinearity*						0.927	0.97 [0.49-1.93]	0.174	0.44 [0.14-1.44]	*Perfect collinearity*	
Assets owned: At least one wooden or steel bed	3451	1717	49.8 [44.3- 55.3]	10.9	0.130	0.73 [0.49-1.10]	0.070	0.59 [0.33-1.04]	0.012	0.60 [0.40-0.89]	0.000	0.76 [0.66-0.87]	0.000	0.64 [0.53-0.77]	0.012	0.37 [0.17-0.80]
Assets owned: At least one mattress	3451	1557	45.1 [39.7-50.7]	11.0	0.429	0.85 [0.57-1.27]	0.092	0.60 [0.34-1.09]	0.021	0.61 [0.41-0.93]	0.001	0.78 [0.67-0.90]	0.000	0.69 [0.57-0.84]	0.041	0.45 [0.21-0.97]
Assets owned: At least one gas/ electric stove	3451	387	11.2 [8.3-15.0]	9.8	0.312	0.69 [0.33-1.42]	0.090	0.18 [0.02-1.31]	0.165	0.55 [0.24-1.27]	0.000	0.49 [0.37-0.63]	0.000	0.39 [0.26-0.57]	0.166	0.24 [0.03-1.79]
Assets owned: At least one fuel efficient wood stove	3451	2022	58.6 [52.5-64.4]	13.2	0.830	0.96 [0.64-1.43]	0.008	0.47 [0.27-0.82]	0.125	0.74 [0.50-1.09]	0.450	0.95 [0.82-1.09]	0.214	0.89 [0.74-1.07]	0.902	0.96 [0.48-1.92]
Assets owned: At least one generator, electricity	3451	168	4.9 [3.7-6.3]	3.1	0.697	0.82 [0.30-2.25]	0.755	0.80 [0.19-3.32]	0.353	0.58 [0.18-1.85]	0.000	0.44 [0.30-0.66]	0.001	0.36 [0.19-0.67]	0.625	0.61 [0.08-4.47]
Assets owned: At least one piece of farming machinery	3451	168	4.9 [3.4-6.9]	5.7	0.558	1.29 [0.55-2.98]	0.372	1.60 [0.57-4.52]	0.416	1.39 [0.63-3.05]	0.161	0.78 [0.55-1.10]	0.104	0.67 [0.41-1.09]	0.634	0.62 [0.08-4.53]
Assets owned: At least one fridge	3451	60	1.7 [1.1-2.7]	2.8	0.574	0.57 [0.08-4.12]	0.871	1.18 [0.16-8.76]	0.830	1.17 [0.28-4.91]	0.001	0.27 [0.12-0.60]	0.117	0.48 [0.19-1.20]	*Perfect collinearity*	
Assets owned: At least one table	3451	2,654	76.9 [73.3-80.2]	5.9	0.421	0.83 [0.53-1.31]	0.207	0.68 [0.38-1.24]	0.045	0.65 [0.43-0.99]	0.000	0.70 [0.59-0.83]	0.000	0.61 [0.50-0.75]	0.157	0.59 [0.29-1.22]

Assets owned: At least one piece of gold	3451	1428	41.4 [37.9-45.0]	4.6	0.989	1.00 [0.67-1.50]	0.251	0.71 [0.40-1.27]	0.257	0.79 [0.52-1.19]	0.000	0.75 [0.65-0.87]	0.000	0.69 [0.57-0.84]	0.105	0.53 [0.25-1.14]
Assets owned: At least one radio/ cassette	3451	533	15.4 [13.5-17.6]	2.8	0.015	1.79 [1.12-2.87]	0.350	1.40 [0.69-2.81]	0.117	1.48 [0.91-2.42]	0.064	0.83 [0.67-1.01]	0.233	0.85[0.65-1.11]	0.967	0.98 [0.38-2.55]
Assets owned: At least one video player/ recorder	3451	788	22.8 [19.9-26.1]	4.8	0.573	1.14 [0.72-1.81]	0.949	0.98 [0.50-1.92]	0.884	0.97 [0.60-1.56]	0.000	0.60 [0.50-0.72]	0.003	0.70 [0.55-0.88]	0.292	0.60 [0.23-1.56]
Assets owned: At least one TV	3451	1131	32.8 [29.2-36.6]	5.5	0.745	1.07 [0.70-1.63]	0.943	0.98 [0.54-1.77]	0.695	0.92 [0.60-1.41]	0.000	0.59 [0.50-0.69]	0.000	0.61 [0.50-0.75]	0.079	0.45 [0.19-1.10]
Assets owned: At least one satellite dish	3451	440	12.8 [10.7-15.1]	3.8	0.101	1.55 [0.92-2.60]	0.088	0.29 [0.07-1.20]	0.094	0.52 [0.24-1.12]	0.000	0.52 [0.41-0.66]	0.000	0.51 [0.37-0.72]	0.128	0.21 [0.03-1.56]
Assets owned: At least one sewing machine	3451	477	13.8 [11.6-16.4]	4.3	0.330	1.30 [0.77-2.22]	0.710	0.85 [0.36-2.00]	0.384	0.75 [0.40-1.42]	0.000	0.67 [0.54-0.84]	0.001	0.60 [0.44-0.82]	0.432	0.62 [0.19-2.04]
Assets owned: At least one solar panel	3451	2,406	69.7 [64.7-74.4]	9.9	0.837	1.05 [0.68-1.62]	0.408	1.31 [0.69-2.46]	0.727	1.08 [0.70-1.66]	0.097	1.14 [0.98-1.34]	0.771	1.03 [0.84-1.26]	0.697	0.87 [0.42-1.79]
Assets owned: At least one boat with motor	3451	86	2.5 [1.5-4.1]	5.8	0.722	1.24 [0.38-3.99]	*Perfect collinearity*		0.600	0.68 [0.17-2.83]	0.422	0.82 [0.51-1.33]	0.439	0.78 [0.41-1.47]	*Perfect collinearity*	
Assets owned: At least one boat without motor	3451	33	1.0[0.6-1.6]	2.3	0.045	3.44 [1.03-11.45]	0.455	2.16 [0.29-16.36]	0.294	2.19 [0.51-9.47]	0.325	0.67 [0.30-1.49]	0.395	1.44 [0.62-3.33]	*Perfect collinearity*	
Assets owned: At least one fish/ aquaculture pond	3451	62	1.8 [1.3-2.6]	2.0	*Perfect collinearity*		0.789	1.31 [0.18-9.77]	0.649	0.63 [0.09-4.63]	0.274	0.73 [0.41-1.29]	0.100	0.46 [0.18-1.16]	*Perfect collinearity*	
Assets owned: At least one fish net	3451	486	14.1 [11.3-17.4]	6.7	0.048	0.46 [0.21-0.99]	0.618	0.80 [0.34-1.90]	0.185	0.64 [0.33-1.24]	0.202	0.87 [0.71-1.08]	0.004	0.64 [0.48-0.87]	0.102	0.19 [0.03-1.39]
Below average categories of assets owned[75]	3451	1929	55.9 [51.6-60.1]	6.5	0.962	0.99 [0.66-1.48]	0.158	1.52 [0.85-2.74]	0.128	1.37 [0.91-2.07]	0.000	1.68 [1.45-1.95]	0.000	1.98 [1.62-2.40]	0.005	3.60 [1.48-8.75]
GENDER																
Mother currently 18 years old or younger	3451	76	2.2 [1.6-3.0]	1.8	0.892	0.91 [0.22-3.75]	0.789	1.31 [0.18-9.77]	0.244	2.04 [0.62-6.75]	0.003	0.39 [0.21-0.72]	0.340	0.71 [0.35-1.43]	*Perfect collinearity*	
Mother: Highest achieved education, elementary	3451	526	16.3 [13.7-19.3]	5.1	0.802	1.07 [0.63-1.82]	0.140	1.61 [0.85-3.05]	0.068	1.54 [0.97-2.44]	0.000	1.42 [1.18-1.71]	0.000	1.57 [1.25-1.97]	0.032	2.26 [1.07-4.78]
Woman: Highest achieved education, high school/ Vocational or higher	3451	1026	29.7 [26.6-33.1]	4.5	0.440	0.84 [0.53-1.32]	0.951	1.02 [0.56-1.87]	0.274	0.77 [0.49-1.22]	0.826	0.98 [0.84-1.15]	0.052	0.82 [0.66-1.00]	0.074	0.42 [0.16-1.09]
Mother: No formal education	3451	27	0.8 [0.4-1.4]	2.6	0.177	2.72 [0.64-11.66]	*Perfect collinearity*		0.685	1.52 [0.20-11.64]	0.769	0.88 [0.39-2.02]	0.887	0.93 [0.32-2.67]	*Perfect collinearity*	
Respondent makes own decision for her earnings	3451	343	9.9 [8.4-11.7]	2.6	0.518	0.79 [0.38-1.63]	0.281	0.52 [0.16-1.69]	0.116	0.51 [0.22-1.18]	0.123	0.82 [0.64-1.05]	0.903	1.02 [0.75-1.38]	0.209	0.28 [0.04-2.05]
Respondent is involved in the decision for her earnings	3451	1426	41.3 [37.8-45.0]	4.7	0.682	1.09 [0.73-1.63]	0.595	0.86 [0.49-1.51]	0.332	1.21 [0.82-1.80]	0.111	1.13 [0.97-1.30]	0.794	1.03 [0.85-1.23]	0.410	1.33 [0.67-2.65]
Woman's income is more than her husband's[76]	3435	192	5.6 [4.5-7.0]	2.6	0.800	0.89 [0.36-2.21]	0.189	1.88 [0.73-4.80]	0.910	1.05 [0.45-2.44]	0.043	0.71 [0.51-0.99]	0.062	0.64 [0.41-1.02]	0.522	0.52 [0.07-3.84]

[75] *Mean: 5.5; Minimum: 0, Maximum: 17.*
[76] *Denominator excludes single and widowed mothers.*

Woman's income is more or approximately the same as her husband[76]	3435	425	12.4 [10.7-14.2]	2.5	0.309	0.70 [0.35-1.40]	0.485	1.31 [0.61-2.82]	0.799	0.92 [0.50-1.71]	0.294	0.89 [0.71-1.11]	0.404	0.88 [0.66-1.18]	0.134	0.22 [0.03-1.60]
Woman makes the decision for how her husband's earnings are used76	3435	443	12.9 [11.0-15.0]	3.1	0.498	1.21 [0.69-2.12]	0.727	0.86 [0.36-2.03]	0.812	0.93 [0.51-1.68]	0.097	0.83 [0.67-1.03]	0.645	1.07 [0.81-1.40]	0.252	0.43 [0.10-1.82]
Woman is involved in the decision for how her husband's earnings are used76	3435	2268	66.0 [62.6-69.3]	4.5	0.345	0.82 [0.54-1.24]	0.622	1.16 [0.64-2.11]	0.938	0.98 [0.65-1.49]	0.897	0.99 [0.85-1.15]	0.304	0.90 [0.75-1.10]	0.418	1.37 [0.64-2.97]
Respondent makes decision for her healthcare	3451	593	17.2 [15.2-19.3]	2.6	0.586	0.86 [0.49-1.49]	0.678	0.85 [0.40-1.82]	0.524	0.84 [0.49-1.44]	0.220	0.89 [0.73-1.07]	0.928	0.99 [0.78-1.26]	0.108	0.31 [0.07-1.29]
Respondent is involved in the decision for her healthcare	3451	1949	56.5 [52.9-60.0]	4.5	0.154	0.75 [0.50-1.11]	0.190	0.69 [0.40-1.20]	0.330	0.82 [0.56-1.22]	0.622	1.04 [0.90-1.20]	0.115	0.86 [0.72-1.04]	0.351	0.72 [0.36-1.43]
Respondent makes decisions about major household decisions	3451	846	24.5 [22.0-27.2]	3.2	0.754	0.93 [0.58-1.49]	0.213	0.63 [0.31-1.30]	0.249	0.75 [0.46-1.22]	0.000	0.70 [0.59-0.83]	0.088	0.83 [0.66-1.03]	0.050	0.30 [0.09-1.00]
Respondent is involved in decisions about major household decisions	3451	1963	56.9 [53.5-60.2]	4.0	0.784	0.95 [0.63-1.41]	0.028	0.54 [0.31-0.94]	0.293	0.81 [0.55-1.20]	0.972	1.00 [0.86-1.15]	0.216	0.89 [0.74-1.07]	0.784	0.91 [0.46-1.81]
Respondent makes decisions about visits to her family or relatives	3451	760	22.0 [19.9-24.4]	2.6	0.153	0.67 [0.39-1.16]	0.882	1.05 [0.55-2.02]	0.566	0.87 [0.53-1.41]	0.740	1.03 [0.87-1.22]	0.583	1.06 [0.85-1.32]	0.176	0.48 [0.17-1.38]
Respondent is involved in decisions about visits to her family or relatives	3451	2113	61.2 [58.0-64.4]	3.9	0.612	1.11 [0.73-1.69]	0.985	1.01 [0.57-1.77]	0.470	1.16 [0.77-1.75]	0.360	0.93 [0.81-1.08]	0.523	0.94 [0.78-1.13]	0.433	0.76 [0.38-1.51]
Respondent makes decision about the well-being of children	3451	1058	30.7 [28.1-33.3]	2.9	0.903	1.03 [0.67-1.58]	0.583	0.84 [0.45-1.56]	0.667	0.91 [0.59-1.40]	0.788	0.98 [0.84-1.14]	0.131	1.16 [0.96-1.41]	0.237	0.60 [0.26-1.39]
Respondent is involved in decisions about the well-being of children	3451	2657	77.0 [74.2-79.6]	3.6	0.588	0.88 [0.56-1.40]	0.305	0.73 [0.40-1.34]	0.352	0.81 [0.52-1.26]	0.691	1.04 [0.87-1.23]	0.542	0.94 [0.75-1.16]	0.588	0.79 [0.37-1.72]
Woman not involved in any surveyed decisions[77]	3451	464	13.5 [11.1-16.1]	4.8	0.609	1.16 [0.66-2.02]	0.631	1.21 [0.56-2.58]	0.724	1.11 [0.63-1.93]	0.437	1.09 [0.88-1.34]	0.084	1.25 [0.97-1.61]	0.417	1.45 [0.59-3.52]
Desires future pregnancy	3160	1726	54.6 [51.7-57.5]	2.8	0.646	1.10 [0.73-1.67]	0.717	1.11 [0.63-1.96]	0.752	1.07 [0.71-1.60]	0.036	0.85 [0.73-0.99]	0.209	0.88 [0.73-1.07]	0.824	1.09 [0.53-2.24]
Currently taking contraceptives or other means to delay pregnancy	3435	1094	31.9 [28.7-35.2]	4.3	0.109	1.40 [0.93-2.11]	0.039	0.48 [0.24-0.96]	0.747	0.93 [0.61-1.42]	0.129	0.89 [0.76-1.04]	0.134	0.86 [0.70-1.05]	0.359	1.39 [0.69-2.80]
Does not desire future pregnancy and not taking contraceptives	3150	906	28.8 [26.2-31.5]	2.8	0.187	0.72 [0.44-1.17]	0.428	1.27 [0.70-2.31]	0.829	0.95 [0.61-1.49]	0.007	1.25 [1.06-1.47]	0.030	1.26 [1.02-1.54]	0.515	0.75 [0.32-1.76]

[77] *Decision for own earnings, decision for husband's earnings, decision for own healthcare, major household decisions, well-being of children*

Migrated before childbirth	3451	259	7.5 [6.3-8.9]	2.2	0.878	0.94 [0.43-2.05]	0.888	0.92 [0.28-2.98]	0.521	0.74 [0.30-1.85]	0.000	0.49 [0.36-0.68]	0.006	0.55 [0.36-0.84]	*Perfect collinearity*	
Migrated after childbirth	3451	14	0.4 [0.2-0.8]	1.4	*Perfect collinearity*						0.767	0.84 [0.26-2.68]	0.389	0.41 [0.05-3.13]	*Perfect collinearity*	
Migrated before and/or after childbirth	3451	273	7.9 [6.7-9.4]	2.2	0.762	0.89 [0.41-1.93]	0.825	0.88 [0.27-2.84]	0.455	0.71 [0.28-1.76]	0.000	0.51 [0.37-0.69]	0.004	0.54 [0.36-0.82]	*Perfect collinearity*	
Mother: Currently married	3451	3405	98.7 [98.1-99.1]	1.5	0.555	0.65 [0.16-2.72]	0.062	0.25 [0.06-1.08]	0.075	0.33 [0.10-1.12]	0.960	0.98 [0.53-1.83]	0.270	0.67 [0.33-1.36]	*Perfect collinearity*	
Mother: Widowed	3451	11	0.3 [0.0-0.8]	1.9	*Perfect collinearity*						0.038	3.69 [1.08-12.63]	0.075	3.06 [0.89-10.49]	*Perfect collinearity*	
WASH																
Water treatment (any)	3451	3076	89.1 [85.8-91.8]	8.2	0.070	2.31 [0.93-5.71]	0.445	1.49 [0.53-4.17]	0.088	2.07 [0.90-4.76]	0.101	0.83 [0.66-1.04]	0.183	0.83 [0.62-1.09]	0.389	1.88 [0.45-7.88]
Water treatment: boil	3451	2803	81.2 [76.3-85.3]	11.9	0.664	0.90 [0.54-1.47]	0.353	1.46 [0.66-3.27]	0.743	1.09 [0.65-1.83]	0.651	1.04 [0.87-1.25]	0.200	0.86 [0.69-1.08]	0.398	0.71 [0.32-1.58]
Water treatment: chlorine	3451	28	0.8 [0.5-1.3]	1.8	0.194	2.62 [0.61-11.19]	0.507	1.98 [0.26-14.93]	0.065	3.17 [0.93-10.75]	0.675	0.84 [0.37-1.91]	0.765	1.16 [0.44-3.06]	0.188	3.90 [0.51-29.56]
Water treatment: straining through a cloth	3451	460	13.3 [10.9-16.2]	5.2	0.037	1.71 [1.03-2.82]	0.337	1.43 [0.69-2.96]	0.107	1.52 [0.91-2.54]	0.420	0.92 [0.74-1.13]	0.376	1.13 [0.87-1.46]	0.391	1.48 [0.61-3.60]
Water treatment: filter	3451	86	2.5 [1.9-3.4]	2.0	*Perfect collinearity*						0.043	0.59 [0.35-0.98]	0.285	0.70 [0.36-1.35]	*Perfect collinearity*	
Water treatment: Composite filters	3451	56	1.6 [1.0-2.7]	3.9	*Perfect collinearity*						0.084	0.57 [0.30-1.08]	0.023	0.19 [0.05-0.80]	*Perfect collinearity*	
Water treatment: Let it stand and settle	3451	53	1.5 [0.9-2.5]	3.3	0.001	4.50 [1.88-10.80]	0.208	2.54 [0.60-10.81]	0.013	3.64 [1.29-8.77]	0.337	1.32 [0.75-2.31]	0.933	0.97 [0.45-2.07]	0.002	6.69 [1.98-22.64]
Improved water source: Summer	3381	2444	72.3 [67.4-76.7]	9.3	0.960	1.01 [0.65-1.58]	0.017	0.50 [0.29-0.88]	0.266	0.79 [0.52-1.20]	0.249	0.91 [0.78-1.07]	0.459	0.93 [0.76-1.14]	0.452	0.76 [0.37-1.57]
Improved water source[78]: Rainy season	3400	2465	72.5 [67.5-77.0]	9.8	0.650	1.11 [0.70-1.76]	0.221	0.70 [0.39-1.24]	0.775	0.94 [0.61-1.45]	0.624	0.96 [0.82-1.13]	0.946	0.99 [0.81-1.22]	0.998	1.00 [0.46-2.16]
Improved water source: Winter	3402	2502	73.5 [68.7-77.9]	9.6	0.823	1.05 [0.67-1.67]	0.165	0.66 [0.37-1.18]	0.775	0.94 [0.61-1.45]	0.495	0.94 [0.80-1.11]	0.574	0.94 [0.77-1.16]	0.794	1.11 [0.50-2.47]
Improved water source: Three listed seasons	3381	2369	70.1 [65.0-74.7]	9.9	0.889	0.97 [0.63-1.50]	0.043	0.56 [0.32-0.98]	0.298	0.80 [0.53-1.21]	0.390	0.93 [0.80-1.09]	0.599	0.95 [0.78-1.16]	0.399	0.74 [0.36-1.50]
Basic sanitation facilities[79]	3451	1998	57.9 [53.7-62.0]	6.3	0.915	0.98 [0.65-1.47]	0.519	0.83 [0.48-1.45]	0.209	0.78 [0.53-1.15]	0.113	0.89 [0.77-1.03]	0.378	0.92 [0.77-1.11]	0.264	0.68 [0.34-1.34]
Owns water pot/ container for storage	3451	1919	55.6 [50.0-61.1]	11.2	0.326	1.23 [0.82-1.85]	0.781	0.92 [0.53-1.60]	0.751	0.94 [0.63-1.39]	0.088	0.88 [0.76-1.02]	0.030	0.82 [0.68-0.98]	0.399	0.74 [0.37-1.48]
Water storage condition: Clean	1919	1418	73.9 [68.7-78.5]	6.2	0.864	1.05 [0.58-1.91]	0.872	1.07 [0.45-2.55]	0.534	1.22 [0.65-2.29]	0.001	0.69 [0.56-0.86]	0.147	0.81 [0.61-1.08]	0.112	0.45 [0.17-1.21]
Water storage condition: Unclean, uncovered and no handle	1919	290	15.1 [11.1-20.2]	7.9	0.148	0.51 [0.20-1.27]	0.744	1.18 [0.44-3.13]	0.730	0.87 [0.41-1.87]	0.000	1.72 [1.33-2.23]	0.036	1.42 [1.02-1.97]	0.270	1.90 [0.61-5.93]

[78] *Variable generated by MMR analyses. This includes piped water into dwelling or to yard/plot, public tap/standpipe, tube well/borehole, protected dug well, protected spring or bottled purified water.*

[79] *Basic sanitation requirements refer to households that have an improved toilet or latrine for household members that is not shared with other households and that is functional at the time of visit.*

Reported yes: 'Do you ever use soap to wash your hands?'	3451	3185	92.3 [89.5-94.4]	7.5	0.827	1.09 [0.50-2.38]	0.291	2.15 [0.52-8.91]	0.430	1.40 [0.61-3.24]	0.019	0.73 [0.57-0.95]	0.165	0.80 [0.58-1.10]	0.335	2.67 [0.36-19.59]
Soap present at the place of handwashing	3162	2622	82.9 [79.8-85.7]	4.9	0.325	1.36 [0.74-2.52]	0.415	0.75 [0.38-1.49]	0.638	0.88 [0.53-1.48]	0.000	0.59 [0.49-0.71]	0.005	0.71 [0.56-0.90]	0.232	0.61 [0.27-1.37]
Main material of the house roof: Palm or plastic/ tarpaulin	3451	401	11.6 [8.5-15.8]	11.3	0.836	1.07 [0.58-1.97]	0.600	0.78 [0.31-1.98]	0.644	1.15 [0.64-2.04]	0.026	1.28 [1.03-1.59]	0.023	1.36 [1.04-1.77]	0.506	1.38 [0.53-3.60]
Main material of the house roof: Palm	3451	361	10.5 [7.4-14.6]	11.8	0.567	1.20 [0.65-2.21]	0.761	0.87 [0.34-2.20]	0.407	1.28 [0.72-2.27]	0.015	1.33 [1.06-1.66]	0.006	1.46 [1.11-1.92]	0.371	1.55 [0.59-4.04]
Fixed handwashing facility in dwelling or in yard/plot	3451	1670	48.4 [43.7-53.1]	8.0	0.304	0.81 [0.54-1.21]	0.776	0.92 [0.53-1.60]	0.907	0.98 [0.66-1.44]	0.548	0.96 [0.83-1.10]	0.171	0.88 [0.73-1.06]	0.996	1.00 [0.50-1.98]
Received sanitation sensitization in the last 6 months	3451	673	19.5 [15.8-23.8]	9.0	0.358	1.25 [0.78-2.01]	0.170	1.53 [0.83-2.81]	0.357	1.24 [0.79-1.95]	0.018	1.24 [1.04-1.48]	0.573	1.07 [0.85-1.34]	0.836	0.91 [0.7-2.21]
QUESTIONS POSED ONLY TO CHILDREN <24 MONTHS[80]																
Risk factor *Logistics regression*					Wasting *Children 0-24 months*		MUAC <125mm *Children 6-24 months*		Wasting by MUAC and/or W/H *Children 6-24 months*		Stunting *Children 0-24 months*		Underweight *Children 0-24 months*		WaST *Children 0-24 months*	
Indicator	N	n	Proportion of analyzed sample [95% CI]	Design effect	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]	P-value	Odds Ratio [95% CI]
Measles [maternal report and/or at least one dose recorded, children 12-24 months]	289	213	73.7 [67.7-78.9]	1.2	0.305	0.45 [0.10-2.06]	0.431	0.60 [0.17-2.12]	0.355	0.61 [0.22-1.72]	0.816	1.07 [0.62-1.83]	0.394	1.39 [0.65-2.95]	0.149	0.17 [0.02-1.89]
Penta-3 [maternal report and/or at least one dose recorded, children 12-24 months]	319	298	93.4 [89.8-95.8]	1.1	*Perfect collinearity*		0.806	0.77 [0.10-6.26]	0.798	1.31 [0.17-10.31]	0.405	1.49 [0.58-3.80]	0.767	1.21 [0.34-4.26]	*Perfect collinearity*	
BCG [scar confirmation and/or recorded in vaccination book, children 12-24 months]	356	299	84.0 [79.2-87.8]	1.2	0.705	1.50 [0.18-12.24]	0.931	0.93 [0.20-4.38]	0.530	1.61 [0.36-7.20]	0.846	0.94 [0.53-1.69]	0.615	1.23 [0.55-2.76]	0.478	0.49 [0.07-3.51]
BCG [scar confirmation, maternal report, and/or recorded in vaccination book, children 12-24 months]	356	324	91.0 [87.4-93.6]	1.0	*Perfect collinearity*						0.626	0.83 [0.39-1.76]	0.915	1.06 [0.39-2.87]	*Perfect collinearity*	
Rubella [maternal report and/or at least one dose	349	106	30.4 [25.2-36.1]	1.3	0.235	0.28 [0.03-2.28]	0.126	0.20 [0.03-1.57]	0.073	0.26 [0.06-1.13]	0.855	1.04 [0.66-1.66]	0.060	0.51 [0.25-1.03]	0.853	1.30 [0.08-21.05]

[80] *Information collected through the survey questionnaire that relate to indicators for nutrition, infant and young child feeding (IYCF) as well as child health was asked for all children under two years of age in respective households.*

recorded in vaccination book, children 12-24 months]																
Polio [maternal report and/or at least one dose recorded in vaccination book, children 12-24 months]	333	308	92.5 [88.9-95.0]	1.1	0.661	0.62 [0.07-5.19]	0.216	0.37 [0.08-1.79]	0.158	0.39 [0.10-1.44]	0.438	1.42 [0.59-3.41]	0.580	1.42 [0.41-4.93]	0.130	0.15 [0.01-1.74]
Vitamin A supplementation in the last year[81]	867	295	34.0 [30.3-38.0]	1.5	0.935	0.97 [0.43-2.18]	0.815	1.08 [0.58-2.02]	0.733	1.10 [0.64-1.89]	0.528	1.11 [0.80-1.53]	0.442	0.83 [0.52-1.33]	0.232	1.73 [0.70-4.26]
Deworming[82]	339	105	31.0 [25.6-36.9]	1.3	0.681	1.36 [0.32-5.78]	0.845	1.13 [0.33-3.84]	0.814	1.13 [0.41-3.10]	0.722	0.92 [0.57-1.47]	0.759	1.10 [0.59-2.04]	0.715	1.26 [0.36-4.44]
Child had experienced illness before	1860	1318	70.9 [68.4-73.2]	1.4	0.058	0.60 [0.35-1.01]	0.946	1.03 [0.43-2.49]	0.934	1.03 [0.48-2.23]	0.000	2.14 [1.55-2.95]	0.032	1.56 [1.04-2.36]	0.240	1.91 [0.65-5.64]
Health seeking in the event of illness	1318	968	73.4 [70.0-76.6]	1.9	0.580	1.25 [0.56-2.77]	0.181	1.83 [0.76-4.43]	0.348	1.40 [0.69-2.85]	0.725	1.06 [0.77-1.46]	0.713	0.92 [0.60-1.42]	0.983	1.01 [0.36-2.82]
Payment needed for treatment	968	680	70.3 [66.0-74.2]	2.0	0.259	0.64 [0.30-1.39]	0.860	1.07 [0.49-2.35]	0.946	1.02 [0.51-2.04]	0.396	0.86 [0.60-1.22]	0.533	1.18 [0.71-1.96]	0.657	0.78 [0.26-2.34]
Borrow/ take a loan for the payment	680	531	78.1 [73.2-82.3]	2.1	0.313	2.15 [0.49-9.50]	0.022	0.38 [0.16-0.87]	0.155	0.57 [0.26-1.24]	0.467	1.20 [0.73-1.98]	0.113	0.62 [0.35-1.12]	0.964	1.04 [0.21-5.03]
Diarrhea [most recent sickness]	1318	108	8.2 [6.6-10.1]	1.4	0.521	1.41 [0.49-4.08]	0.776	0.86 [0.30-2.47]	0.718	1.16 [0.51-2.66]	0.079	1.52 [0.95-2.42]	0.348	1.35 [0.72-2.55]	0.709	1.32 [0.30-5.79]
+ > 1 child under 5	1318	66	5.0 [3.8-6.5]	1.2	0.873	1.13 [0.26-4.79]	0.891	1.09 [0.32-3.65]	0.501	1.39 [0.53-3.65]	0.278	1.39 [0.77-2.52]	0.146	1.72 [0.83-3.57]	0.888	0.86 [0.11-6.53]
Fever [most recent sickness]	1318	800	60.7 [57.1-64.2]	1.8	0.772	0.91 [0.46-1.77]	0.488	1.27 [0.65-2.46]	0.838	1.06 [0.60-1.87]	0.197	1.21 [0.90-1.63]	0.444	1.17 [0.78-1.74]	0.460	1.44 [0.55-3.81]
+ > 1 child under 5	1318	478	36.3 [33.3-39.4]	1.4	0.169	1.59 [0.82-3.10]	0.413	0.75 [0.37-1.50]	0.672	0.88 [0.49-1.58]	0.042	1.35 [1.01-1.80]	0.050	1.47 [1.00-2.17]	0.038	2.80 [1.06-7.40]
Pneumonia [most recent sickness]	1318	244	18.5 [15.9-21.5]	1.8	0.454	0.69 [0.27-1.80]	0.987	0.99 [0.43-2.29]	0.868	1.06 [0.52-2.17]	0.044	0.66 [0.45-0.99]	0.124	0.64 [0.37-1.13]	0.367	0.51 [0.12-2.21]
+ > 1 child under 5	1318	148	11.2 [9.3-13.5]	1.5	0.279	0.45 [0.11-1.90]	0.329	1.57 [0.64-3.85]	0.866	1.08 [0.45-2.60]	0.291	0.77 [0.48-1.25]	0.238	0.65 [0.32-1.32]	0.301	0.34 [0.05-2.59]
Use of government facility during last illness	1443	644	44.6 [39.8-49.6]	3.6	0.101	1.68 [0.90-3.13]	0.357	0.72 [0.36-1.45]	0.877	1.04 [0.62-1.77]	0.816	1.03 [0.82-1.29]	0.348	1.66 [0.57-4.82]	0.348	1.66 [0.57-4.82]
Use of drug store during last illness	1443	243	16.8 [13.7-20.5]	3.0	0.207	0.51 [0.18-1.45]	0.678	1.20 [0.51-2.78]	0.939	0.97 [0.48-1.96]	0.182	1.22 [0.91-1.64]	0.281	1.22 [0.85-1.76]	0.349	0.38 [0.05-2.90]
Introduction of colostrum "in the first few days" – Children 0-24 months	1849	1567	84.8 [82.5-86.7]	1.6	0.978	1.01 [0.49-2.08]	0.689	1.20 [0.50-2.88]	0.238	1.68 [0.71-3.98]	0.959	0.99 [0.70-1.41]	0.824	1.06 [0.65-1.71]	*Perfect collinearity*	
Introduction of colostrum "in the first few days" – Children 0-6 months	1098	927	84.4 [81.7-86.8]	1.4	0.634	1.26 [0.49-3.27]	0.654	1.63 [0.19-13.59]	0.437	2.29 [0.28-18.56]	0.825	0.93 [0.49-1.77]	0.908	0.96 [0.46-1.99]	*Perfect collinearity*	

[81] *Children 6-24 months*
[82] *Children 12-24 months*

Early initiation of breastfeeding	1858	1369	73.7 [71.0-76.2]	1.7	0.306	0.75 [0.43-1.30]	0.040	2.68 [1.04-6.87]	0.143	1.68 [0.84-3.37]	0.323	1.16 [0.86-1.56]	0.445	1.17 [0.78-1.74]	0.615	0.70 [0.17-2.81]
Early initiation of breastfeeding: Children 0-6 months	1105	801	72.5 [69.1-75.7]	1.6	0.375	0.74 [0.37-1.45]	0.367	2.64 [0.32-21.84]	0.215	3.73 [0.47-29.91]	0.689	0.90 [0.54-1.51]	0.299	1.41 [0.74-2.71]	*Perfect collinearity*	
Exclusively breastfed	1863	492	26.4 [23.9-29.1]	1.7	0.064	0.58 [0.32-1.03]	*Perfect collinearity*		0.014	0.23 [0.07-0.75]	0.000	0.66 [0.54-0.81]	0.036	0.76 [0.58-0.98]	0.045	0.13 [0.02-0.95]
Introduction to complementary foods: 6-8 months	446	411	92.2 [89.4-94.3]	0.9	0.807	1.29 [0.17-10.07]	*Perfect collinearity*		0.237	3.37 [0.45-25.35]	0.400	0.67 [0.27-1.70]	0.085	0.41 [0.15-1.13]	0.236	0.25 [0.03-2.47]
Early introduction of complementary foods (< 6 months)	948	367	38.7 [34.6-43.0]	1.8	0.134	1.70 [0.85-3.42]	*N/A*				0.711	0.90 [0.51-1.58]	0.574	0.84 [0.45-1.56]	*Perfect collinearity*	
IDDS: Acceptable[83]	916	229	25.0 [22.0-28.3]	1.2	0.747	0.86 [0.34-2.16]	0.391	0.72 [0.34-1.52]	0.667	0.87 [0.47-1.62]	0.012	1.53 [1.10-2.13]	0.951	1.02 [0.63-1.64]	0.820	1.21 [0.23-6.28]
IDDS: All seven food groups	916	9	1.0 [0.5-1.9]	1.0	*Perfect collinearity*		0.351	2.74 [0.33-22.72]	0.530	1.97 [0.24-16.25]	0.440	1.76 [0.42-7.44]	0.977	1.03 [0.13-8.34]	*Perfect collinearity*	
Minimum meal frequency[84]	872	553	63.4 [59.6-67.0]	1.3	0.458	1.37 [0.59-3.17]	0.195	1.57 [0.79-3.09]	0.286	1.36 [0.77-2.41]	0.003	0.63 [0.46-0.86]	0.274	0.79 [0.51-1.21]	0.251	3.46 [0.42-28.90]
Continued breastfeeding: 12-15 months	68	43	63.2 [51.2-73.9]	1.0	0.301	0.27 [0.02-3.18]	0.279	0.36 [0.06-2.30]	0.250	0.39 [0.08-1.93]	0.695	1.24 [0.42-3.66]	0.698	0.78 [0.22-2.77]	*Perfect collinearity*	
Reasons for discontinuing breastfeeding: Breastmilk not sufficient	163	37	22.7 [16.2-30.8]	1.3	*Perfect collinearity*						0.620	1.21 [0.56-2.61]	0.514	0.68 [0.22-2.15]	*Perfect collinearity*	
Reasons for discontinuing breastfeeding: Child was not satisfied with only breast milk	163	105	64.4 [56.1-72.0]	1.2	0.663	1.66 [0.17-16.37]	0.501	2.14 [0.23-19.61]	0.562	1.62 [0.2-8.32]	0.531	0.81 [0.41-1.58]	0.702	0.84 [0.34-2.07]	*Perfect collinearity*	
Postnatal health check within 48 hours	1859	457	24.6 [21.5-28.0]	2.7	0.399	0.76 [0.40-1.44]	0.603	0.82 [0.39-1.73]	0.715	0.89 [0.47-1.67]	0.463	0.89 [0.66-1.20]	0.034	0.62 [0.40-0.97]	0.364	0.38 [0.05-3.06]
Travel time to ANC during dry season: Less than or equal to 1 hour	1646	1414	85.9 [82.9-88.5]	2.8	0.767	1.13 [0.50-2.53]	0.691	0.84 [0.36-1.96]	0.548	0.80 [0.39-1.64]	0.878	1.03 [0.69-1.53]	0.862	1.05 [0.62-1.78]	0.384	0.49 [0.10-2.44]
Travel time to ANC during rainy season: Less than 1 hour	1646	1378	83.7 [80.6-86.4]	2.6	0.719	1.15 [0.54-2.46]	0.393	0.72 [0.33-1.54]	0.223	0.67 [0.35-1.28]	0.699	1.08 [0.74-1.57]	0.685	0.91 [0.56-1.46]	0.123	0.32 [0.08-1.36]
Loaned/ borrowed to attend ANC	1682	174	10.3 [8.6-12.5]	1.8	0.337	1.45 [0.68-3.13]	0.335	1.51 [0.65-3.50]	0.662	1.19 [0.55-2.59]	0.705	0.92 [0.58-1.44]	0.912	0.97 [0.53-1.75]	0.847	1.23 [0.15-10.06]
Traditional Myanmar medicine in past 24 hours	1863	112	6.0 [4.7-7.6]	1.7	0.065	2.15 [0.95-4.85]	0.111	2.41 [0.82-7.12]	0.305	1.75 [0.60-5.13]	0.752	0.92 [0.53-1.58]	0.645	1.17 [0.60-2.30]	0.523	1.97 [0.24-15.92]

[83] *Defined as four or more of the seven food groups. Children 6-<24 months.*
[84] *Children 6-<24 months*

Vitamins, Minerals, Supplements in the past 24 hours	1861	186	10.0 [8.4-11.9]	1.7	0.195	1.62 [0.78-3.34]	0.178	0.37 [0.09-1.56]	0.521	0.73 [0.29-1.88]	0.330	0.80 [0.51-1.25]	0.882	0.96 [0.54-1.70]	*Perfect collinearity*
Low birth weight	760	102	13.4 [11.1-16.1]	1.1	0.362	0.51 [0.12-2.18]	*Perfect collinearity*		0.409	0.42 [0.05-3.27]	0.276	0.67 [0.33-1.38]	0.938	1.04 [0.39-2.74]	*Perfect collinearity*

ANNEX B: LINEAR REGRESSION

Statistical associations between risk factors and wasting, stunting and underweight demonstrated by linear regression

Risk factor *Linear Regression*					GAM [W/H] *Children 0-59 months*			GAM [MUAC] *Children 0-59 months*			Stunting [H/A] *Children 0-59 months*			Underweight [W/A] *Children 0-59 months*		
Indicator	n	Mean [95% CI]	Standard error	Design Effect	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE
QUESTIONS POSED FOR ALL CHILDREN <59 MONTHS																
Child age [months]	3451	22.2[21.6-22.9]	0.29	0.9	0.000	-0.014	0.001	0.000	0.040	0.001	0.000	-0.042	0.001	0.000	-0.033	0.000
Mother's age [years]	3451	28.9[28.6-29.2]	0.16	2.4	0.002	-0.009	0.003	0.059	0.008	0.004	0.005	-0.011	0.004	0.000	-0.014	0.003
Mother's MUAC [cm]	3451	25.3[24.6-26.1]	0.38	1.5	0.619	0.001	0.001	0.675	0.001	0.002	0.825	<0.001	0.001	0.605	0.001	0.001
Number of people in the household [#]	3451	6.5[6.4-6.7]	0.09	4.3	0.446	-0.005	0.007	0.355	-0.009	0.010	0.003	-0.030	0.010	0.004	-0.025	0.009
MAHP [0-12 months]	3451	11.6[11.5-11.7]	0.05	6.7	0.014	0.035	0.014	0.008	0.053	0.020	0.005	0.057	0.020	0.001	0.059	0.017
Tropical Livestock Units[85]	3380	0.9[0.8-1.0]	0.05	4.2	0.986	<0.000	0.011	0.939	0.001	0.016	0.426	-0.013	0.016	0.350	-0.013	0.014
MDDW [min. 0- max. 10 groups]	3451	4.1[4.0-4.2]	0.06	4.9	0.001	0.034	0.011	0.000	0.065	0.015	0.000	0.082	0.015	0.000	0.076	0.013
HDDS [min. 0- max. 12 groups]	3451	6.6[6.4-6.7]	0.08	5.2	0.005	0.023	0.008	0.000	0.052	0.012	0.000	0.084	0.012	0.000	0.068	0.010
Categories of assets owned [min. 0- max 25]	3451	5.4[5.2-5.7]	0.14	8.2	0.000	0.037	0.006	0.000	0.043	0.008	0.000	0.072	0.008	0.000	0.072	0.007
Decision involvement: [min. 0- max.5]	3380	2.8[2.7-2.9]	0.07	5.6	0.552	0.006	0.011	0.480	0.011	0.015	0.836	<0.000	0.015	0.982	<.000	.012
Distance to water facilities [meters]	3115	3.9[3.2-4.5]	0.32	6.8	0.155	-0.004	0.003	0.549	0.002	0.004	0.057	-0.007	0.004	0.034	-0.007	0.003
Distance to latrine [meters]	3379	25.8[23.7-27.8]	1.05	4.2	0.018	-0.001	0.001	0.002	-0.003	0.001	0.145	-0.001	0.001	0.004	-0.002	0.001
Maternal BMI: pregnant women excluded	3033	21.8[21.6-22.0]	0.10	4.1	0.000	0.01	0.007	0.000	0.091	0.009	0.000	0.035	0.010	0.000	0.064	0.008
Maternal BMI: PLW's excluded	269	22.5[22.0-22.9]	0.23	1.7	0.055	0.034	0.018	0.004	0.082	0.028	0.468	-0.019	0.026	0.514	0.013	0.020
Months of iron folic acid supplementation	2731	3.8[3.6-4.1]	0.12	4.4	0.630	0.003	0.007	0.104	0.016	0.010	0.014	0.024	0.010	0.009	0.022	0.008
Amount of money the woman is in control over [MMK]	3451	14228.0[11297.1 -17159.0]	1486.5	1.7	0.120	<0.001	<0.000	0.119	<0.001	<0.00 1	0.413	<0.001	<0.001	0.191	<0.001	<0.001
QUESTIONS POSED FOR ALL CHILDREN <24 MONTHS																
Prenatal consultations [#]	1863	4.3[4.0-4.5]	0.12	2.8	0.209	0.010	0.008	0.063	0.020	0.010	0.058	0.020	0.010	0.010	0.023	0.009
Days after delivery: Health check	1068	9.6[8.0-11.1]	0.76	2.4	0.955	<0.000	0.002	0.007	0.008	0.003	0.209	-0.004	0.003	0.319	-0.002	0.002
Checkup frequency: Within 2 weeks of delivery	1324	2.7[2.4-2.9]	0.12	2.5	0.001	0.035	0.011	0.022	0.034	0.015	0.000	0.055	0.015	0.000	0.058	0.013

[85] 0.5*livestock_cows_ln+livestock_sheep_ln *0.1+livestock_poultry_ln*0.01+livestock_pigs_ln*0.2+livestock_horses_ln*.8

IDDS Score [scale, min 0- max 7], children 6-24 months	916	2.5[2.4-2.6]	0.06	1.4	0.164	-0.031	0.022	0.000	0.095	0.024	0.000	-0.119	0.027	0.033	-0.050	0.023
Age stopped breastfeeding [months]	377	11.5[10.6-12.3]	0.43	2.0	0.422	0.006	0.007	0.201	0.014	0.011	0.524	-0.007	0.011	0.968	>0.000	0.008
Vitamin A supplementation: frequency in past year	1778	0.5[0.4-0.6]	0.05	0.9	0.241	-0.011	0.009	0.033	0.027	0.013	0.027	-0.028	0.129	0.065	-0.020	0.011