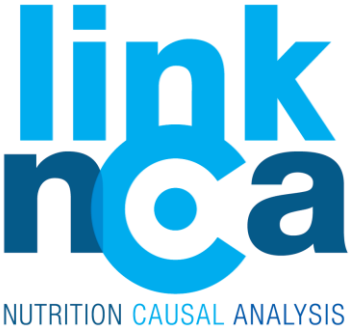
Final report



Quantitative assessment of risk factors of undernutrition based on the Link NCA methodology

August - December 2019

Nayapara Registered Camp, Cox's Bazar, Bangladesh

ACTION AGAINST HUNGER ACTION CONTRE LA FAIM

UNHCR The UN Refugee Agency

WFP

Sida SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

NUTRITION SECTOR

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The assessment was conducted by *Md. Lalan Miah*, Nutrition Assessment Manager, Action Against Hunger Bangladesh and *Chris Coffey*, Independent consultant, under the supervision of *Lenka Blanárová*, Senior Nutrition Assessment Coordinator, Action Against Hunger UK. The study team also appreciates valuable contributions from *Grace Heymsfield*, Link NCA Analyst, Action Against Hunger UK, *Alexandra Humphreys*, Tech RRT Assessment Advisor, Action Against Hunger Canada, *Charles Maughan*, MEAL Advisor, Action Against Hunger UK, *Martin Njoroge*, Nutrition Assessment Coordinator, Action Against Hunger Bangladesh, and *Nicola Giordano*, Head of MEAL Services, Action Against Hunger UK.

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TABLES AND FIGURES

ACRONYMS

AAH/ACF	Action Against Hunger / Action Contre la Faim
ARI	Acute Respiratory Infection
BFSP	Blanket Supplementary Feeding Programme
CI	Confidence Interval
CiC	Camp in Charge
CMAM	Community-Based Management of Acute Malnutrition
CXB	Cox's Bazar
ENA	Emergency Nutrition Assessment
FGD	Focus Group Discussion
FSL	Food Security and Livelihoods
GAM	Global Acute Malnutrition
GCM	Global Chronic Malnutrition
GFD	General Food Distribution
HAZ	Height-for-Age z-score
HB	Haemoglobin
HH	Household
IDDS	Individual Dietary Diversity Score
IOM	International Organization for Migration
IPHN	Institute of Public Health Nutrition
IYCF	Infant and Young Child Feeding
KMS	Kutupalong Makeshift Settlements
KRC	Kutupalong Registered Camp
MCM	Moderate Chronic Malnutrition
MEAL	Monitoring, Evaluation, Accountability and Learning
MNP	Micronutrient Powders
MS	Makeshift Settlements
MUAC	Mid-Upper Arm Circumference
NCA	Nutrition Causal Analysis
NGO	Non-governmental Organisation
NPM	Needs and Population Monitoring
NRC	Nayapara Registered Camp
NRS	Northern Rakhine State
OTP	Outpatient Therapeutic Programme
PLW	Pregnant and Lactating Women
PPS	Probability Proportional to Size
REVA	Rohingya Emergency Vulnerability Assessment
RUSF	Ready-to-Use Supplementary Food
RUTF	Ready-to-Use Therapeutic Food
SAM	Severe Acute Malnutrition
SARPV	Social Assistance and Rehabilitation for the Physically Vulnerable
SC	Stabilisation Centre

SCI	Save the Children International
SCM	Severe Chronic Malnutrition
SE	Standard Error
SIDA	Swedish International Development Cooperation Agency
SLEAC	Simplified Lot Quality Assurance Sampling Evaluation of Access and Coverage
SMART	Standardized Monitoring and Assessment of Relief & Transitions
TSFP	Targeted Supplementary Feeding Programme
UK	United Kingdom of Great Britain and Northern Ireland
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USD	United States Dollars
WASH	Water, sanitation and hygiene
WAZ	Weight-for-age Z-score
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-length/height z-score
WSB	Wheat Soya Blend

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EXECUTIVE SUMMARY

Cox's Bazar District is one of the disaster prone coastal district of Bangladesh with eight Upazilas. It corresponds to an area of 2491.85 sq. km, surrounded by Chittagong district in the north, Bay of Bengal in the south, Bandarban district, Myanmar border (Rakhine State) and the Naf River in the east, the Bay of Bengal in the west.

Nayapara Refugee Camp (hereafter, Nayapara RC) is a government-sponsored Rohingya refugee camp established in 1992. It is located in the Teknaf sub-district (Upazila) of Cox's Bazar and had an estimated population of 27,267 as of 30 September, 2019[1]. Nayapara RC is surrounded by the Nayapara makeshift settlements established to host the Rohingya people after their displacement in 2017.

Rohingya people living in the Cox's Bazar camps have access to humanitarian services provided by UN agencies and several partners across all the sectors. Despite the expansion of multi-sectoral humanitarian support over past seven years (2012-18), undernutrition in registered camps remains a public health concern and the levels of malnutrition have been above the UNHCR standards for refugee camps (GAM> 10%) . For this reason, UNHCR in collaboration with Action Against Hunger and other partners sought to undertake a Link NCA study in Nayapara RC with the objective to deepen the understanding of the root causes of undernutrition in the camp in order to prioritise and adapt ongoing and future interventions to community's most urgent needs and possibly to sustainably reduce undernutrition in the study zone.

KEY FINDINGS

The prevalence of global acute malnutrition (GAM) on the basis of weight-for-height z-score was estimated at 13.3% [IC 95% 10.1-17.4]. The prevalence of severe acute malnutrition (SAM), according to the same criterion, was estimated at 0.0% [IC 95% 0.0-1.1]. The prevalence of global chronic malnutrition (GCM) was estimated to be 39.0 % [IC 95% 33.9-44.4] and 34.1% [IC 95% 29.2-39.4] of children were underweight.

The most vulnerable group for acute malnutrition could not be defined on the basis of available data. The most vulnerable group for underweight, stunting and anaemia were boys. Children younger than 24 months were less likely to be stunted but more likely to be anaemic. Children living in female-headed households were potentially more likely to be stunted while children of younger mothers were more likely to be anaemic.

The calculation of statistical associations between individual risk factors and nutritional status of children in surveyed households allowed to differentiate between the causal mechanisms for each nutritional outcome. A combined pathway for wasting, stunting and underweight and anaemia was also designed to encourage understanding of their overlaps and a development of harmonised multi-sectoral responses.

Wasting and underweight

A dominant pathway to wasting/underweight takes roots in poor birth-spacing, which translates into a heavy workload of women with an effect on adequacy of hygiene and other child care practices, which then lead to an increased risk of contamination and higher vulnerability to diseases, the repetition of which may result in a child's non-optimal growth and development.

[1] Population Factsheet, Rohingya Refugee Response-Bangladesh, UNHCR, 30 September 2019.

Children who were born within 12 months of their older siblings were more likely to be wasted. The same observation was noted for children, whose mothers did not rest more than 7 days after giving birth. On the other hand, children living in households, which indicated a humanitarian assistance as their main source of income, were less likely to be wasted. The same applied to children living in households composed of more than 5 members.

Children of well-nourished mothers were less likely to be wasted or underweight while children suffering from diarrhoea, cough and/or fever were more likely to be wasted or underweight. Children who received micronutrient powders were less likely to be underweight.

Children in were more likely to be underweight if water in their households was stored on the ground and/or if organic waste was observed in the proximity of their play area. On the other hand, children living in households with positive baby WASH practices and/or positive food hygiene practices were less likely to be underweight. Children living in households, which deployed coping strategies more frequently, were more likely to be underweight.

Stunting

As in the case of the causal mechanism for acute malnutrition and underweight, a dominant pathway to stunting takes roots in poor birth-spacing, which translates into a heavy workload of women with an effect on adequacy of hygiene and other child care practices, which then lead to an increased risk of contamination and higher vulnerability to diseases, the repetition of which may result in a child's non-optimal growth and development.

Children whose mothers declared that their last pregnancy was desired were less likely to be stunted. On the other hand, they were more likely to be stunted if they were experiencing cough or breathing difficulties; if their mother indicated a medium to heavy workload; if they were observed crawling in the dirt and/or an animal was observed in their play area. In contrast, children living in households, where positive baby WASH practices were observed were less likely to be stunted along with children who were observed with a clean face, clean clothes and/or recently washed. Children living in households, where positive food hygiene practices were observed, were also less likely to be stunted, unlike children living in households, in which organic waste was observed in the proximity of their play area and/or in households with mud floor, which were more likely to be stunted.

Anaemia

Unlike preceding pathways, the causal mechanism for anaemia appears to be more linked with low diet diversity and, therefore, inadequate infant and young child feeding practices, and limited access/utilisation of health services. Children who consumed more than four food groups were less likely to be anaemic while children of mothers who were pregnant or breastfeeding at the time of the data collection were more likely to be anaemic. Children were less likely to be anaemic if they were dewormed but more likely to be anaemic when suffering from diarrhoea.

An overview of key differences in identified risk factors across nutrition outcomes is provided in the table below. For comparison purposes, findings for both Nayapara RC and Kutupalong MS are provided.

Risk factor	Wasting (WHZ)		Stunting (HAZ)		Underweight (WAZ)		Anaemia (HB)	
	KTP MS	*NYP RC*	*KTP MS*	*NYP RC*	*KTP MS*	*NYP RC*	*KTP MS*	*NYP RC*
Child's gender (male)								
Child's age (<24 months)								
Diarrhoea								

Acute respiratory infections								
Fever								
Vitamin A Supplementation								
Early initiation of breastfeeding								
Child IDDS (>4 food groups)								
Child IDDS (Fruits/Vegetables)								
Mother's age								
Mother's MUAC								
Mother currently pregnant or breast-feeding								
Birth spacing (<12 months)								
HH size: 8-10								
HH size 11+								
Baby WASH								
Food hygiene								
Water storage covered								
Water treatment								
Presence of soap								
Women's workload								
rCSI								

*Red cells designate a risk factor, green cells a protective factor.

KEY RECOMMENDATIONS

Based on these findings, the following activities are recommended to be incorporated into a multisector action plan to address the identified risk factors. The recommendations are presented by thematic area of intervention but must be taken into account dynamically for a better improvement of the nutritional situation in the study zone.

- Strengthen the inter-sectoral approaches in addressing undernutrition in Nayapara RC through an improved collaboration between Health, Nutrition, Food Security and Livelihoods, Water, Sanitation and Hygiene and Protection sectors in developing humanitarian assistance strategies and ensuring accountability in the implementation of the recommendations.

Health & Nutrition

- Continue promoting maternal and child health activities within a 1000 days' window, encouraging women to complete all essential antenatal care visits including vaccination, Vitamin A supplementation and deworming, among others, especially among younger mothers;
- Strengthen maternal and child care practices to improve the adherence to exclusive breastfeeding (EBF) and complementary feeding practices (IYCF).
- Strengthen the integration of community members with a medical diploma and/or exercising a health-related function in the development and dissemination of health messages to targeted populations, ensuring that the messages are adapted to their key concerns. This may include, but not be limited to, messages on appropriate birth-spacing and family planning practices, especially among men as key decision-makers, emphasizing the challenges associated with low birth spacing in Nayapara RC.

Food Security and Livelihoods

- Support the diversification of income opportunities, maximizing market access opportunities and relevant vocational skills training opportunities;
- Support the creation and/or capacity building of households to set up multi-storey and/or box kitchen gardens as avenues for social support and improved dietary diversity;

- Food Security and Nutrition partners to strengthen their collaboration in supporting the beneficiaries in making the right food choices through enhanced SBCC strategy.

Water, Sanitation and Hygiene

- Strengthen the capacity building activities for community hygiene and sanitation committees in order to encourage the maintenance of optimal practices on a community as well as household levels. This may include refresher trainings on latrine cleaning, water point maintenance and/or other issues of public health interest;
- Strengthen the social and behaviour change communications on the importance of environmental hygiene, especially for infants and toddlers.

I. INTRODUCTION

Cox's Bazar District is one of the disaster prone coastal district of Bangladesh with eight upazilas. It corresponds to an area of 2491.85 sq. km, surrounded by Chittagong district in the north, Bay of Bengal in the south, Bandarban district, Myanmar border (Rakhine State) and the Naf River in the east, the Bay of Bengal in the west.

The Rohingya are an ethnic, linguistic Muslim minority from Northern Rakhine State (NRS) of Myanmar that is de jure stateless in accordance with Myanmar's restrictive 1982 citizenship legislation. The systematic and continuous persecution has resulted in Rohingya people frequently seeking safety in Bangladesh over the past five decades.

Ukhiya and Teknaf Upazilas in the Cox's Bazar District host approximately 900,000 Rohingya people. An intensification of violence beginning in August 2017 caused 700,000 Rohingya people to flee northern Rakhine state (NRS) in Myanmar. They joined an existing community of 200,000 Rohingya people in Bangladesh who had fled in earlier waves of displacement. Within Ukhiya and Teknaf, there are two registered camps and numerous other makeshift settlements. Kutupalong Registered Camp (KRC) and Nayapara Registered Camp (NRC) are home to 44,922 refugees. The remainder of the Rohingya population reside in unregistered, makeshift settlements.

Rohingya people living in the Cox's Bazar camps have access to humanitarian services provided by UN agencies and several partners across all the sectors. Food assistance is supported World Food Program (WFP), which addresses the daily food security needs through e-Voucher programmes[2]. The voucher system enables the community to access at least 19 food types with a pre-determined monthly voucher value. The encampment policy restricts the community members from leaving the camps, while due to limited livelihoods opportunities, most of the Rohingya population rely on humanitarian assistance to meet their basic needs.

Prior to this assessment, the most recent SMART survey was conducted in Nayapara registered camp (round three) in November 2018. Its key results are presented in Table 1 while trends of global acute malnutrition from 2013 to 2018 are presented in Figure 1 below.

Survey Indicator	Nayapara RC Round 3 (Nov 1 – 8, 2018)
GAM/SAM (WHZ) children 6-59 months	12.1% [9.1-15.9] 0.9% [0.3-2.5]
GAM/SAM (MUAC) children 6-59 months	3.7% [2.2-6.2] 0.3% [0.1-1.6]
Stunting Global/Severe children 6-59 months	38.3% [33.4-43.5] 8.1% [5.6-11.4]
Low Women's MUAC/ PLW MUAC MUAC <210 mm	1.3% [0.7-2.4] 1.9% [0.5-6.7]
Anaemia (Hb<11.0g/dL) children 6-59 months	38.1% [33.2-43.3]
Any anaemia (Hb<12.0 g/dl) Women 15-49 (non PLW)	22.8% [18.0-28.2]
Children 6-59 months received Vitamin A in past 6 months	93.6% [90.5-95.7]
Diarrhoea children 6-59 months	25.2% [21-30]
Mortality (CDR & U5DR)	0.21 [0.11-0.39] 0.56 [0.19-1.64]

[2] Provision of rice, lentils and oil, accompanied by complementary food vouchers to ensure dietary diversity within beneficiary households.

Table 1: Key findings of SMART Nutrition Assessment, Round three, Nayapara Registered Camp, 2018.[3]

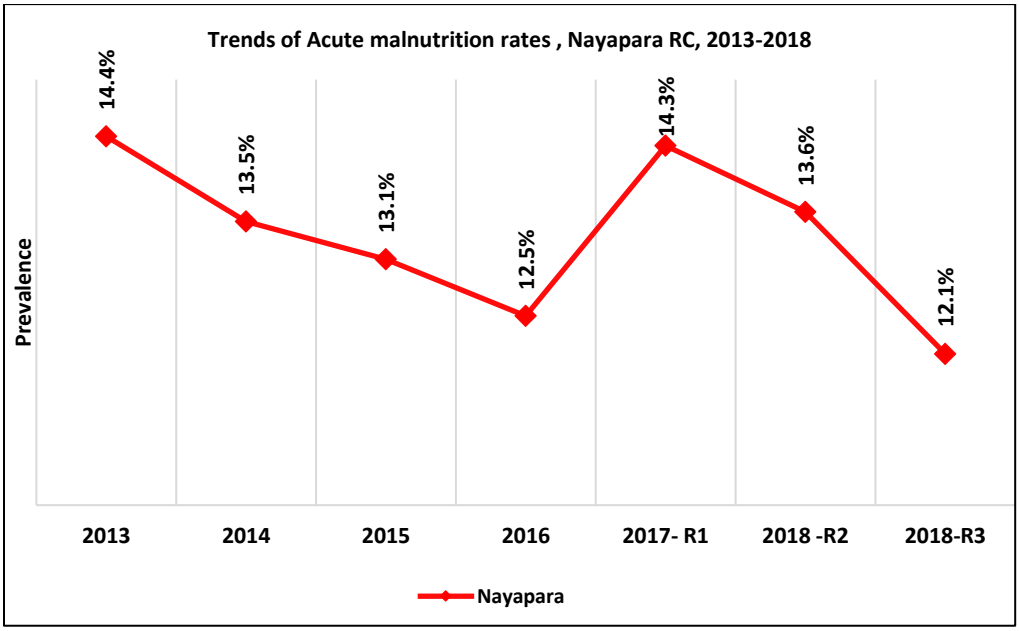


Figure 1: Trends of Global Acute Malnutrition Prevalence (2013-2018), Nayapara Registered Camps

The nutrition sector is implementing interventions which entail both curative and preventive components with a strategy to reduce mortality and the burden of malnutrition through prevention, control and treatment of acute malnutrition, blanket supplementary feeding programmes and anaemia prevention and control programmes and infant and young child feeding programmes. The major humanitarian interventions at the time of the assessment were:

- Implementation of Therapeutic Feeding Programme; Stabilisation Centre (SC) for severely acutely malnourished children (0-59 months) with medical complications, Outpatient Therapeutic Programme (OTP) for Severely malnourished children (6-59 months) without medical complications;
- Targeted supplementary feeding programme (TSFP) for moderately malnourished children aged 6-59 months and chronically ill patients such as those with tuberculosis;
- Blanket Supplementary Feeding Programme (BFSP) for children aged 6-59 months and Pregnant and Lactating Women;
- Growth Monitoring of children between 0 to 59 months, community screening and referral of acutely malnourished children (6-59 months);
- Micronutrient powder (MNP) distribution and promotion aiming at preventing anaemia among children 6-23 months and Iron Folic and Calcium supplementation for Pregnant and Lactating Women (PLW);
- Support to lactating women through breastfeeding corner;
- Health promotion, nutrition education, awareness sessions and community mobilisation on IYCF, balanced and diversified diet importance, MNP, importance and malnutrition prevention etc.
- Food assistance through e-Voucher modality.

[3] Source: Nutrition Cluster, Emergency Nutrition and Health Assessment Round 3, October-November 2018: https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/2018/12/181223-ENA-R3-MS-%26-NYP-Prelim-Results_NUT_SECTOR_DEC2_2018.pdf

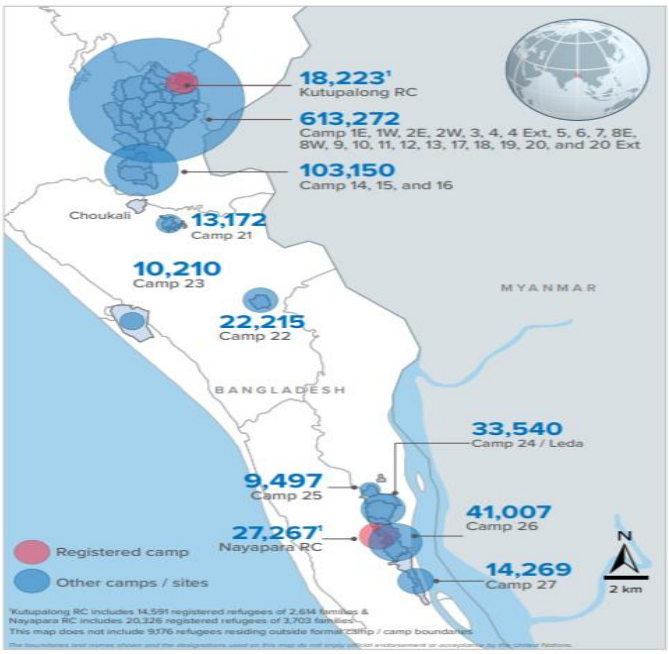
Assessment justification

The findings of several nutrition surveys conducted from 2006 to 2018 in Kutupalong and Nayapara registered camps indicate persistent levels of wasting that have remained higher than the UNHCR thresholds of ten per cent for refugee camps, as per SMART SENS guidelines, considered also 'high' per the WHO classification.[4]

The 2017 influx brought about changes in GAM prevalence even within the established population. Rates increased from 12.7 to 24.3% in KRC and from 12.2 to 14.3% in NRC. Since 2012 the global acute malnutrition rates have remained at around 13%. The most recent SMART[5] conducted in the two registered camps also indicated no significant reduction in the malnutrition rates.

Despite the expansion of multi-sectoral humanitarian support over past seven years (2012-18), undernutrition in registered camps remains a public health concern. Therefore, there is a need for further investigation of underlying causes of malnutrition in order to improve nutrition security programming in these locations. The findings of the assessment will be used by the nutrition sector and other relevant sectors in Cox's Bazar to sustainably reduce malnutrition in Nayapara registered camp.

Assessment Zone



Nayapara Registered Camp (Nayapara RC) is a government-sponsored Rohingya refugee camp established in 1992. It is located in the Teknaf sub-district (Upazila) of Cox's Bazar and had an estimated population of 27,267 as of 30 September, 2019[6]. Nayapara RC is divided into two parts: Part I includes blocks A, B, C, D and E while Part II includes block H and I, both of which are surrounded by the Nayapara makeshift settlements formed after the displacement of Rohingya people in 2017.

Figure 2: Population Factsheet, Rohingya Refugee Response-Bangladesh, UNHCR, 30 September 2019

[4] De Onis M, Borghi E, Arimond M, et al. Prevalence thresholds for wasting, overweight and stunting in children under 5 years. Public Health Nutrition. 2019 Jan; 22(1):175-179.
[5] Round 1 SMART survey, Kutupalong RC, Oct-Nov 2017 & Round 3 SMART survey, Nayapara RC, Oct-Nov 2018.
[6] Population Factsheet, Rohingya Refugee Response-Bangladesh, UNHCR, 30 September 2019.

II. ASSESSMENT OBJECTIVES

Main objective

The main objective of this assessment was to identify the major risk factors of undernutrition, both wasting and stunting, in Nayapara Registered Camp (NRC). The findings from this assessment will be used to develop recommendations for necessary adjustments in future programming in order to sustainably address the burden of malnutrition in the camp.

Specific objectives

The assessment aimed to answer the following study questions:

1. To identify and categorize risk factors responsible for the undernutrition among the population in the assessment zone and to estimate the prevalence of these risk factors;
2. To compare the risk factors identified in the assessment zone with the risk factors identified in Kutupalong makeshift settlements[7];
3. To develop recommendations to improve nutrition security programs in the target area and to support the development of a comprehensive, multi-sectoral strategy.

III. METHODOLOGY

A Link NCA study 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[8].

Originally, this assessment was meant to be conducted as a Link NCA study, following the precisely defined methodological guidelines. However, following a series of administrative constraints, followed by Covid-19 global emergency, it was not possible to conduct the study as planned. Considering that the quantitative data had been conducted during round 4 of the SMART Nutrition Survey, the commissioning organisations agreed to proceed with analyses and to reclassify this study as a quantitative assessment of risk factors of undernutrition. In contrast to a standard Link NCA study, this assessment does not include a qualitative component, which is an integral part of each and allows to study interactions between different risks factors in a given context. In consequence, this assessment was not able to answer a series of Link NCA study questions, namely:

1. To understand how risk factors responsible for the undernutrition 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 undernutrition cases in the target area;
2. To understand how risk factors responsible for the undernutrition among the population in the target area have evolved over time and evolve in different seasons;
3. To identify vulnerable groups for each major risk factor of undernutrition among the population;
4. To identify and map the interventions of operational actors in the target area and analyse the perception and degree of adequacy and appropriation by communities of the current humanitarian operational response in relation to causes of undernutrition;

[7] Link NCA Nutrition Causal Analysis for Kutupalong Makeshift Settlements, Cox's Bazar, Bangladesh, 2019.
[8] For more information about the methodology, please refer to www.linknca.org.

5. To identify the needs and capacities of communities to respond to the identified underlying mechanisms;
6. To identify with the communities, the levers and barriers likely to influence the main causal mechanisms of undernutrition.

In other words, this assessment only allowed to identify the risk factors of undernutrition based on the quantitative data collection while the categorisation of risk factors took into consideration secondary data sources and scientific literature to better estimate their potential impact on the incidence of undernutrition in Nayapara registered camp.

A. KEY STAGES

Preparatory phase (August- September 2019)

The main objective of a preparatory phase was to define key parameters of the assessment, including its objectives, geographical coverage and feasibility. A preliminary secondary data and literature review was conducted in order to define the structure of the assessment. Considering new methodological advancements[9] and a lack of availability certain key indicators for the assessment zone, an option comprising a SMART Nutrition Survey, a Risk Factor Survey and a qualitative inquiry – was selected. This phase also included preparation and planning stages necessary for any type of assessment (such as, the development of Terms of Reference, resource mobilisation as well as a recruitment of an assessment team.

Identification of hypothesised risk factors and causal pathways (September 2019)

The key responsibility of the assessment team at this stage was to gather an overall understanding of a local context and to identify a set of risk factors and their interactions, which could potentially trigger undernutrition among the target population in the assessment zone. The identification of hypothesised risk factors and causal pathways was based on a systematic literature review (using the Link NCA Pathways to Undernutrition module and all grey literature available locally), supported by a series of exploratory interviews with key informants, such as representatives of relevant governmental institutions, non-governmental organisations and academia with an in-depth knowledge or work experience in the assessment zone. The identified hypothesised risk factors were presented, examined and validated for field testing during the Initial Technical Workshop, which took place in Cox's Bazar in September 2019.

Primary data collection (September-November 2019)

The Link NCA methodology relies on a triangulation of both qualitative and quantitative data. The quantitative data collection, which comprised of an anthropometric data collection and the Risk Factor Survey was conducted between 5 and 15 October 2019, integrated into an annual SMART survey. It consisted of anthropometric measurements and 41 indicators, covering all risk factors identified and validated in preceding stages. The questionnaires were deployed on mobile devices and the collected data was uploaded and compiled in a Kobo Toolbox.[10]

The qualitative data collection, although planned for October 2019 and later rescheduled for March 2020, could not be conducted. With the aim to utilise the already collected quantitative data, the study was reclassified as a quantitative assessment of risk factors of undernutrition.

[9] For example, integration of statistical associations' calculations (prevalence of wasting/stunting in relation to identified risk factors) with an aim to enrich the data analysis/triangulation for a more precise definition of local causal pathways.
[10] Free tool for data collection in harsh environments, www.kobotoolbox.org.

Synthesis of results (June 2020)

Upon the completion of a data collection stage, the assessment team conducted a series of analyses to determine the presence and/or absence of significant statistical associations between anthropometric measurements of children 6-59 months and other indicators collected in respective households. Due to a suspended qualitative inquiry, a description of dynamic relationships between various risk factors and a categorisation of risk factors according to their relative impact on undernutrition could not be produced.

B. SAMPLING FOR QUANTITATIVE SURVEY

Sample size

The sample size for the anthropometric data collection was calculated using ENA for SMART software (version 9 July 2015). As specified by SMART guidelines, the precision level is 3.5 per cent. A 12 per cent global acute malnutrition (GAM) prevalence was estimated using the SMART Survey conducted in October to November 2018. A design effect of 1 was also calculated on the basis of the simple random sampling. This resulted in a sample size of 331 children and 535 households.

GAM estimated (%)	Precision	Group effect	Sample size-children	Average household size	Population <5 years old (%)	Non-response (%)	Sample size households
12	3.5	1	331	5.4	12.8	4	535

Table 2: Parameters of the quantitative survey

Sampling method

The quantitative data collection sampling frame followed a simple random sampling method. Households were selected randomly from a list of all registered households residing within the boundary the registered camp area. Lists of registered refugee households were provided by UNHCR. It was anticipated that each team would be able to visit ten households per day. All children zero to 59 months and all women 13 to 49 years within selected households were eligible for measurement.

C. QUANTITATIVE DATA COLLECTION

Team composition and training

The quantitative data collection team was composed of six teams of five enumerators (one measurer, one measurer assistant, one haemoglobin measurer and two interviewers) and a survey supervisor. There were six supervisors from nutrition sector partners - Action Against Hunger (2), WFP (2), SARPV (2), SCI (1)) – who were responsible for methodology compliance and quality assurance of each team. The block leaders in each sampled cluster was recruited to facilitate the survey team's work and to ensure community acceptance. Additionally one community nutrition volunteer from implementing partners from each cluster was engaged to support assessment team as well as to identify household and community sensitization. Prior to the commencement of data collection, all team members received a seven day residential training, which took place in Cox's Bazar from 15 to 22 September 2019. The training included, among others, modules on survey methodology, anthropometric measurements using the SMART methodology and an

administration of household questionnaires using mobile devices. All team members participated in a standardisation test and a pilot test of all data collection tools for quality assurance purposes.

Data collection tools

The quantitative data was collected via an electronic questionnaire downloaded onto mobile devices. The questionnaire covered all areas of interest linked with validated hypothesised risk factors. It was composed of sub-sections pertaining to a head of household, a caregiver of a child under five years of age or such child. One sub-section was dedicated to observations of caregiver care practices or household hygiene and sanitation practices. The survey was translated into Chittagonian/Rohingya. In addition, for all children aged 6-59 months, anthropometric measurements, such as height/length, weight, mid-upper arm circumference (MUAC) and a presence of oedema, were recorded, as per the SMART methodology guidelines. The height/length was measured using standard height boards provided by UNICEF. The weight was measured by using SECA electronic scale that allowed for double measurement and recorded to the nearest 0.1kg. MUAC was measured using three coloured standardised tapes supported by Action Against Hunger. MUAC readings were recorded to the nearest 0.1cm. Oedema was diagnosed by applying a moderate finger pressure on the top of the feet. The child was recorded as oedematous only if both feet clearly had oedema. Anaemia was measured using a HemoCue Hb 301. Anaemia testing kits were supplied by UNHCR.

Main challenges for quantitative data collection

- Respondent fatigue – Temperatures averaged over 30°C during the quantitative data collection period. As a result of travelling times of over four hours, it was unavoidable for the survey to be administered during the hottest periods of the day. Towards the end of each survey respondents were sometimes tired and reluctant to participate. This may have limited the quality of data collection.
- Long travel hours- Long travel hours and related logistic challenges to/from Cox's Bazar to Nayapara RC, including the movement within the site was exhaustive for the survey team and increased the survey fatigue on the survey team side.

D. DATA MANAGEMENT AND ANALYSIS

The quantitative data was collected via an electronic questionnaire downloaded onto mobile devices. All data was exported in the form of an Excel spreadsheet and analysed with STATA software (16.0). The anthropometric data was analysed using ENA for SMART software (11th January 2020 version).

Logistic and linear regression models were developed to determine whether the hypothesised risk factors were associated with nutritional status. The four dependent variables considered in the quantitative analysis are GAM (WHZ), stunting (HAZ), underweight (WAZ) and child anaemia (HB).

E. ETHICAL CONSIDERATIONS

The following provisions were respected during the course of this assessment:

a. All relevant authorities, including the Institute of Public Health Nutrition (IPHN), were duly informed about the study by Action Against Hunger and expressed their agreement with the study implementation;

b. The participants were selected equitably and their informed consent was sought to ensure that they participate in the study voluntarily;
c. The anonymity of participants was ensured during all stages of the study (data collection, data analysis and data storage). Their names were not collected nor shared;
d. All children aged 6-59 months who were identified as suffering from acute malnutrition and/or other medical condition were referred to the nearest health facility for appropriate treatment.

F. STUDY LIMITATIONS

- Correlations: 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 prioritisation of current and future interventions.
- Lack of qualitative data: Due to constraints to conduct a qualitative inquiry, which is normally an integral part of a standard Link NCA study, this assessment does not include any qualitative data. The content of this report is based solely on the findings of the Risk Factor Survey. As a consequence, authors of this report are only to describe observed trends without being able to explain them or to contextualise them properly.

IV. FINDINGS

Hypothesised risk factors

The identification of hypothesised risk factors was based on a systematic literature review (using the Link NCA Pathways to Undernutrition module and all grey literature available locally), supported by a series of exploratory interviews with key informants, such as representatives of relevant governmental institutions, non-governmental organisations and/or academia with an in-depth knowledge or work experience in the zone of study. The identified hypothesised risk factors were presented, examined and validated for field testing during the Initial Technical Workshop, which took place in Cox's Bazar on 19 September 2019.

All of the 19 hypothesised risk factors were retained for field-testing. Technical experts were afterwards invited to categorize risk factors according to their anticipated contribution to undernutrition in the zone of study on the scale from one (risk factor expected to contribute marginally to undernutrition) to five (risk factor expected to contribute substantially to undernutrition). The results of this exercise are presented in the table below.

	Hypothesis	Average score
A	Use of traditional health providers	3.0
B	Limited access to health services	3.5
C	Low birth spacing / unwanted pregnancies*	3.7
D	Parental stress*	3.9
E	Non-optimal breast-feeding practices*	3.8
F	Non-optimal breast-feeding practices	3.5
G	Low quality of interactions between a care provider and a child*	3.2
H	Low dietary diversity*	3.5
I	Low diversity, access and availability of income sources for households*	3.3
J	Malfunctioning market or supply system	2.8
K	Low coping capacities	2.8
L	Low access and availability of water (quality and quantity)*	3.5
M	Non-optimal water management	3.3
N	Poor sanitation practices*	3.7
O	Poor hygiene practices*	3.5
P	Heavy workload of women	3.3
Q	Low female autonomy / Low decision-making power*	3.2
R	Early marriages and/or early pregnancies	3.3
S	Low nutritional status of women*	3.8

Table 3: Hypothesized risk factors validated for field-testing during Initial Technical Workshop, including technical experts rating

A. HEALTH

Child illnesses and therapeutic itineraries

More than a half of children in surveyed households (52.1% [CI 95% 46.7-57.5]) were reported to have had fever during 14 days preceding the data collection. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed significant associations between these factors, which means that children suffering from diarrhoea were significantly more likely to be wasted and underweight[11]. No associations were observed for stunting and anaemia (Cf: Annex B). By comparison, the same pattern was also observed in Kutupalong MS[12].

Almost one third of children in surveyed households (28.5% [CI 95% 23.6-33.4])[13] suffered from diarrhoea during 14 days preceding the data collection. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed significant associations between these factors, which means that children suffering from diarrhoea were significantly more likely to be wasted, underweight and anaemic[11] and potentially more likely to be stunted[14] (Cf: Annex B). By comparison, no significant associations with diarrhoea were observed in Kutupalong MS[12].

Additional analyses with diarrhoea as outcome revealed that children living in households who observed only one positive food hygiene practice (Cf: Hygiene practices) were more likely to suffer from diarrhoea. The quality of housing, such as mud floors, did not seem to have an impact on the incidence of the condition. The same trend was observed with respect to child cleanliness, meaning that the observation of optimal baby WASH practices did not increase or decrease child's odds of suffering from diarrhoea.

Approximately 8% of children in surveyed households (7.9% [CI 95% 5.0-10.8])[13] were experiencing cough, difficulties breathing or fever. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed significant associations between these factors, which means that children suffering from acute respiratory infections were significantly more likely to be wasted, stunted or underweight[11]. No association was observed for anaemia (Cf: Annex B). By comparison, no significant associations with diarrhoea were observed in Kutupalong MS[12].

A majority of children suffering from either of these conditions were reportedly treated at a health facility, namely 72.7% [IC 96% 65.9-79.4] of children with fever, 66% [IC 95% 56.2-75.7] of children with diarrhoea and 65.4% [IC 95% 45.8-85] of children with cough or breathing difficulties. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children with fever, whose parents sought medical care at a health facility were significantly less likely to be stunted[11]. No other significant

[11] P-value <0.05.
[12] Please refer to Final report: Link NCA Nutrition Causal Analysis for Kutupalong Makeshift Settlements, Cox's Bazar, Bangladesh, 2019.
[13] Please note that unlike in SMART Round 4 final report (Emergency Nutrition Assessment Report, Nayapara and Kutupalong Registered Rohingya Refugee Camps and Makeshift Settlements, October 2019), this estimation of prevalence is not based on a total number of surveyed households but only on a number of households with children under 5 years of age. For this reason, some discrepancies between two reports might be observed.
[14] P-value <0.1.

associations were observed for other nutrition outcomes and/or conditions (Cf: Annex B). By comparison, no significant associations with sought care were observed in Kutupalong MS[12].

Measles vaccination, vitamin A supplementation, micronutrient powders and deworming

About two thirds of children aged 9-59 months (70.7% [IC 95% 65.3-75.5][13] were vaccinated against measles at the time of the data collection [15] . Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed a counter-intuitive relationship between these indicators, meaning that children who were vaccinated against measles were potentially more likely to be wasted and underweight[14]. No associations were observed for stunting and anaemia (Cf: Annex B). By comparison, children who were vaccinated against measles in Kutupalong MS were less likely to be wasted[12].

Vitamin A supplementation reached only 15.8% [IC 95% 11.8-19.7][1316] of surveyed children while about a half (40.6% [IC 95% 35.3-45.9])[13] received micronutrient powders. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household did not reveal any significant association between Vitamin A supplementation and nutrition outcomes while children who received micronutrient powders were significantly less likely to be underweight[11] (Cf: Annex B). By comparison, children who received Vitamin supplementation in Kutupalong MS were less likely to be anaemic while no associations were detected for micronutrient powders[12].

In the six months prior to the data collection, 60.8% [IC 95% 55.5-66.1] of children in the sample had been dewormed. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed a significant association, which means that children who were dewormed were significantly less likely to be anaemic[11] (Cf: Annex B). By comparison, children who were dewormed in Kutupalong MS were equally less likely to be anaemic and also less likely to be wasted[12].

Birth spacing and family planning

Per the Link NCA Risk Factor Survey, the average size of household in Nayapara RC is 6.9 members[13]. Only 2.8% [IC 95% 1.2-4.4] of surveyed households were composed of one to three members. The majority of households (61.6% [IC 95% 56.7-66.4]) had four to seven members and another fourth of households (25.7% [IC 95% 21.4-30] had eight to ten members. The remaining 9.9% [IC 95% 7-12.9] of households had more than 11 members. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in households composed of more than five members were significantly less likely to be wasted[11] (Cf: Annex B). By comparison, children who lived in households with eight to ten members in Kutupalong MS were less likely to be anaemic[12]. These counter-intuitive findings warrant further investigation. One possible explanation is that larger families have access to more income streams and are therefore able to achieve greater dietary diversity.

While a desire to carry a child might be a sensitive subject in the Rohingya community, 89.6% [IC 95% 86.3-92.9] of women in surveyed households declared that their most recent pregnancy was desired. Only 3.8% [IC 95% 0.8-6.9] of children were born within 12 months of their older sibling and another 25.5% [IC 95% 18.6-32.4] of children were born within 24 months of their older sibling. Mean birth-spacing was estimated at 30.7 [IC 95% 28.9-32.5] months. Subsequent

[15] Per card confirmation and/or caregiver recall.
[16] Recall period for Vitamin A supplementation was between the beginning of Ramadan (May 2019) and survey data collection (October 2019). Last vitamin A campaign was conducted between 18 and 27 March 2019.

analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of mothers desiring their most recent pregnancy were significantly less likely to be stunted while children who were born within 12 months of their older sibling were significantly more likely to be wasted[11] (Cf: Annex B). By comparison, neither desired pregnancy nor birth-spacing were significantly linked with nutrition outcomes in Kutupalong MS despite lower mean length of space between births (2.4 years) and higher percentage of children born within 12 months of their older sibling (8.41%)[12].

Prenatal care and childbirth

Per Link NCA Risk Factor Survey data, 85.9% [IC 95% 82.1-89.7] of women in the sample had at least one prenatal care appointment during their most recent pregnancy. All women declared to be assisted while giving birth while only 14.7% [IC 95% 10.8-18.5] of them admitted giving birth at home. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household did not reveal any significant associations between these indicators (Cf: Annex B). By comparison, a similar trend was observed in Kutupalong MS, although a significantly larger proportion of women (90.6%) gave birth to their most recent child at home [12].

In addition, 4.8% [IC 95% 1.7-7.9] of women could rest less than 7 days after giving birth. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of these women were significantly more likely to be wasted[11] (Cf: Annex B).

B. NUTRITION AND CARE PRACTICES

Nutrition of pregnant and lactating women

The average MUAC measurement for women included in the Link NCA Risk Factor Survey sample was 276.5 mm [IC 95% 272.6-280.4], i.e. about 12 mm more than women measured in Kutupalong MS. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of mothers with a higher MUAC were significantly less likely to be wasted and underweight[11] (Cf: Annex B). By comparison, in Kutupalong MS, maternal MUAC was significantly associated with underweight and anaemia and potentially linked with stunting[12].

Breastfeeding practices

The early initiation of breastfeeding in Nayapara RC was estimated at 78.8% [IC 95% 72.7-84.8]. All mothers with children under 6 months of age reported an exclusive breastfeeding. The continuation of breastfeeding at one year was estimated at 95.7% [IC 95% 86.6-104.7]. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household did not reveal any significant associations between these indicators meaning that children of mothers who did not observe optimal breastfeeding practices were not statistically more or less likely to be wasted, stunted, underweight or anaemic(Cf: Annex B). By comparison, in Kutupalong MS, children who were breastfed early were less likely to be anaemic[12].

It might be interesting to note that 70.4% [IC 95% 65.5-75.4] of women in the survey sample were pregnant or breastfeeding at the time of the data collection. Children of these mothers were significantly more likely to be anaemic[11] (Cf: Annex B).

Infant and young child feeding practices

Per the Link NCA Risk Factor Survey data, 63.7% [IC 95% 58.5-68.9] of children consumed more than four food groups. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that such children were significantly more likely to be stunted and less likely to be anaemic[11] (Cf: Annex B). The counter-intuitiveness of the former finding warrants further investigation. By comparison, children who had consumed at least four food groups in Kutupalong MS were less likely to be wasted, underweight, or anaemic[12].

Other care practices

Per the Link NCA Risk Factor Survey data, 94.8% [IC 95% 92.4-97.2] of children were observed to be under a mother's watch during the data collection. 88.4% [IC 95% 84.9-91.9] of mothers talked to their child; 84.1% [IC 95% 80.1-88.1] of mothers smiled at their child and 67.6% [IC 95% 62.5-72.7] of mothers interacted with him/her. Only 6.7% [IC 95% 4-9.5] of mothers were seen to spank their child during the data collection. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed no significant associations between these indicators, meaning that children of mothers who did not display appropriate child-caregiver interactions were not more or less likely to be wasted, stunted, underweight or anaemic (Cf: Annex B). However, children of mothers who interacted with a child during the data collection were potentially less likely to be wasted or stunted[14]. By comparison, a similar trend was observed in Kutupalong MS, however, a proportion of children spanked during the data collection was almost threefold in Kutupalong MS[12].

Additional analyses revealed that a score of child-caregiver interactions increased as a parental stress index score decreased. This means that children of mothers who were experiencing a higher degree of stress were less likely to engage in optimal child-caregiver interactions (Cf: Annex B).

C. FOOD SECURITY AND LIVELIHOODS

Income generating activities

Per the Link NCA Risk Factor Survey, 47.6% [IC 95% 42.6-52.5] of sampled households relied on humanitarian assistance as their main source of income. This is about 35% less than a reported dependence on humanitarian assistance in Kutupalong MS (82.4%). Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in households with humanitarian assistance as their main source of income were significantly less likely to be wasted[11] (Cf: Annex B). By comparison, no significant relationship was observed in Kutupalong MS. A potentially protective relationship was observed only between humanitarian assistance and stunting[12].

Coping strategies

About one tenth of households included in the Link NCA Risk Factor Survey (10.4% [IC 95% 7.4-13.5]) reported selling or exchanging food aid. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in households selling or exchanging aid were potentially more likely to be anaemic[14] (Cf: Annex B). By comparison, no significant or potential relationship was observed in Kutupalong MS [12].

In addition, a mean rCSI score among households in Nayapara RC was 11.1 [IC 95% 10.1-12.2]. Subsequent analyses considering anthropometric measurements and haemoglobin levels of

children in the household revealed that as the rCSI score in respective households increased, children's HAZ or WAZ decreased. This means that children living in households who deployed coping strategies more frequently were more likely to be stunted or underweight[11] (Cf: Annex B). Only 1.8% [IC 95% -0.2-3.9] of surveyed households used the most severe coping strategy (reservation of adult meals for children) 5 or more times during the recall week.

D.WATER, SANITATION AND HYGIENE

Water availability and access

An estimated 93.6% [IC 95% 91.2-96.1] of households in Nayapara RC have access to a functioning tube well or hand pump. However, 68.2% [IC 95% 63.6-72.8] of households mentioned experiencing a barrier of access, out of which 8.6% [IC 95% 5.2-12] and 14.9% [IC 95% 10.6-19.2] of households identified distance and waiting times, respectively, as the primary barriers of access. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed no significant associations between these indicators, which means that children living in households with an impaired access to water are not more or less likely to be wasted, stunted, underweight or anaemic (Cf: Annex B). By comparison, a similar trend was observed in Kutupalong MS[12].

Quality of water

About two thirds of households (64.4% [IC 95% 59.6-69.1]) in the survey sample stored water on the ground while an estimated 88.3% [IC 95% 85.1-91.5] of households covered the water storage unit to protect water quality. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in households, which stored water on the ground were significantly more likely to be underweight[11] and potentially more likely to be stunted[14]. On the other hand, children living in households, which did not cover a water container were not significantly more or less likely to be wasted, stunted, underweight or anaemic (Cf: Annex B). By comparison, children in Kutupalong MS, living in households, where the water storage unit was covered, were less likely to be underweight[12].

Interestingly, only 23.7% [IC 95% 19.4-27.9] of households in Nayapara RC treated water at household level. This is almost 9% less than a proportion of households treating water in Kutupalong MS. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in water-treating households were significantly more likely to be wasted[11] (Cf: Annex B). A counter-intuitive nature of this finding warrants further investigation. By comparison, children in Kutupalong MS, living in households, which treated water, were more likely to be anaemic[12].

Hygiene practices

The importance of the presence of soap and/or environmental hygiene in general should be considered within a of environmental enteropathy disease (EED), which is an enteric disease caused by a continued exposure to faecal microorganisms due to poor environmental conditions at the household level- such as animal and human faeces as well as pollution and contamination from water, soil, air and food. It is considered as an entry point for chronic undernutrition because this condition would reduce the system's capacity to absorb nutrients.

Per the Link NCA Risk Factor Survey, 72.4% [IC 95% 67.9-76.8] of children in sampled households were observed having a clean face, 61% [IC 95% 56.1-65.9] of children were observed having clean clothes and only 30.7% [IC 95% 26.1-35.4] of them were seen as recently washed.

Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children who were observed with a clean face, clean clothes or recently washed were significantly less likely to be stunted[11] (Cf: Annex B). By comparison, no such observations were recorded in Kutupalong MS[12].

In addition, in 20.7% [IC 95% 16.6-24.7] of households an animal was observed in a child's play area while in 14% [IC 95% 10.5-17.4] of them animal faeces were visible. In 38.4% [IC 95% 33.6-43.3] of households a child was observed crawling in the dirt. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children crawling in the dirt and/or living in households where an animal was observed in child's play area were significantly more likely to be stunted[11] and potentially more likely to be underweight[14]. Additionally, latter children we also potentially more likely to be anaemic (Cf: Annex B).

All data combined, as a number of positive baby WASH practices in surveyed households increased, a child's HAZ or WAZ also increased. This means that optimal hygiene practices with respect to children's cleanliness and/or cleanliness of their environment decrease their chances of stunting or underweight (Cf: Annex B).

As to food hygiene, in 16.8% [IC 95% 13.1-20.5] of surveyed households free range animals were observed in the kitchen area and/or house; in 12% [IC 95% 8.7-15.2] of households food was observed uncovered or on the floor and in 30% [IC 95% 25.5-34.6] of households organic waste was observed within 10 m of the main dwelling. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in households where kitchen was observed in the proximity of the house were significantly more likely to be stunted or underweight[11]. They were also potentially more likely to be anaemic (Cf: Annex B).

All data combined, as a number of positive food hygiene practices in surveyed households increased, a child's HAZ or WAZ also increased. This means that optimal food hygiene practices decrease child's chances of stunting or underweight (Cf: Annex B).

Sanitation

Nearly all [99.7% [99.2-100.2] of households in Nayapara RC reported using an improved sanitation facility. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household showed perfect collinearity (Cf: Annex B). By comparison, children in Kutupalong MS, living in households with access to an improved sanitation facility were not more or less likely to be wasted, stunted, underweight or anaemic[12].

An availability of mosquito net was recorded in 95.1% [IC 95% 92.1-98.1][13] of surveyed households; mud floor was observed in 21.4% [IC 95% 17.3-25.4] of households and durable roofing in only 3.8% [IC 95% 1.9-5.7] of them. Almost all households (98.5% [IC 95% 97.3-99.7]) declared using LPG as a household energy source. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children living in houses with mud flooring were significantly more likely to be stunted[11] while children living in housing with durable roofing were potentially less likely to be underweight[14] (Cf: Annex B). No similar observations were recorded in Kutupalong MS[12].

E. GENDER

Early marriage and early pregnancy

The Link NCA Risk Factor survey estimated that the average age of marriage for women in Nayapara RC was 16.6 [IC 95% 16.4-16.9] years old. This figure corresponds to an average age of marriage for women in Kutupalong MS (16.9 years). Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed no association between these indicators, meaning that the mean age at which women marry appears to be unrelated to any of the studies nutrition outcomes (Cf: Annex B). By comparison, the same pattern was also observed in Kutupalong MS[12].

The average age of mothers in Nayapara RC was 27.4 years [IC 95% 26.7-28.2], which also compares with the respective variable in Kutupalong MS (27 years). Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of younger mothers were more likely to suffer from anaemia[14] (Cf: Annex B). By comparison, the same pattern was also observed in Kutupalong MS[12].

Only 1.3% [IC 95% 0.2-2.4] of mothers in the sample were less than 18 years old. However, 32.6% [IC 95% 27.9-37.2] of women admitted giving birth to their first child before they reached 18 years of age. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of mothers under 18 years of age were more likely to suffer from anaemia[14] (Cf: Annex B). By comparison, no such observation was recorded in Kutupalong MS[12].

Female autonomy and decision making power

Per the Link NCA Risk Factor Survey data, 36.4% [IC 95% 31.6-41.2] of households in Nayapara RC were female-headed. Children living in these households were potentially more likely to be stunted[14] (Cf: Annex B). It was also estimated that 15.9% [IC 95% 11.9-19.9] of women across all surveyed households were able to make market-related decisions; 13.5% [IC 95% 9.7-17.2] of them could make decisions with regards to their earnings and 6.1% [IC 95% 3.5-8.7] could make decisions about their husband's earnings. 12.5% [IC 95% 8.9-16.1] of women in the sample confirmed a right to make decisions related to their health. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed no significant associations between these indicators and nutrition outcomes of children in the household[11] (Cf: Annex B)). By comparison, the same pattern was also observed in Kutupalong MS [12].

Women's workload and parental stress

About a half of mothers in surveyed households (46.5% [IC 95% 41-51.9]) reported a medium to heavy workload. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household revealed that children of mothers with medium or heavy workload were significantly more likely to be stunted[11] (Cf: Annex B). In addition, as a woman's workload increased, her child's HAZ or WAZ decreased, which means that a child whose mother experiences a medium or heavy workload is significantly more likely to be stunted or underweight[11], indicating a mother's increasing workload may negatively affect her child's care. A similar trend was observed in Kutupalong MS in relation to stunting[12].

Per the Link NCA Risk Factor Survey data, an average Parental Stress Index score was 45.2 [IC 95% 44.7-45.7] on a scale from 18 to 90. Considering that a higher score indicates a higher level

of parental stress, it is possible to conclude that an average level of parental stress in Nayapara RC oscillates within the middle range of the scale. Subsequent analyses considering anthropometric measurements and haemoglobin levels of children in the household suggest that children of mothers who perceived an increased level of stress are potentially more likely to be stunted[14] (Cf: Annex B).

In addition, while 80.1% [IC 95% 75.8-84.5] of respondents in surveyed households declared to feel safe in Nayapara RC, a difference between a mean parental index scores for women who feel safe in the camp and those who do not feel safe is statistically significant. In other words, the perception of safety of one's environment reflects on their stress index score, meaning that women who do not feel safe are more likely to experience higher level of stress. The stress is also likely to increase with an increasing age.

A detailed look at the data for each of 18 questions of the parental stress index revealed at children of parents who would not do anything for their child were significantly more likely to be anaemic[11]. On the other hand, children of parents who felt that their children were an important source of affection for them were potentially less likely to be stunted[14]. Children of mothers who felt that having children meant less choices and/or control over their life were potentially more likely to be wasted.

F. UNDERNUTRITON

Results from anthropometric data

The anthropometric data collection findings revealed a prevalence of global acute malnutrition (GAM) on the basis of weight-for-height z-score at 13.3% [IC 95% 10.1-17.4]. The prevalence of severe acute malnutrition (SAM), according to the same criterion, was estimated at 0.0% [IC 95% 0.0-1.1]. The prevalence of global chronic malnutrition (GCM) was estimated to be 39.0 % [IC 95% 33.9-44.4] and 34.1% [IC 95% 29.2-39.4] of children were underweight.

References	Indicators		Results [CI 95%]
WHZ	Z-scores and/or oedema (N =331)	Global Acute Malnutrition W/H <-2 z and / or oedema	13.3% [10.1-17.4]
		Severe Acute Malnutrition W/H <-3 z and / or oedema	0.0 % [0.0-1.1]
HAZ	Z-scores (N =328)	Global Chronic Malnutrition H / A <-2 z	39.0% [33.9-44.4]
		Severe Chronic Malnutrition H/A <-3z	5.2% [3.3-8.1]
WAZ	Z-scores (N =331)	Global Underweight W/A <-2z	34.1% [29.2-39.4]
		Severe Underweight W/A< -3z	4.8% [3.0-7.7]
MUAC	Age = 6-59 months (N =331)	Global Acute Malnutrition (MUAC <125mm) and/or oedema	2.7% [1.4-5.1]
		Severe Acute Malnutrition (MUAC <115mm) and/or oedema	0.0% [0.0-1.1]

Table 4: Summary of anthropometric results

The prevalence of global acute malnutrition, on the basis of weight for height z-score, was estimated at 14.8% [IC 95% 10.2-21.1] for boys compared to 11.8% [IC 95% 7.8-17.6] for girls. However, this difference is not statistically significant [p=0.4223]. When comparing the prevalence of acute malnutrition in children 6-23 months vs. children 24-59 months, children 6-23 months had a higher GAM (16.7% vs 11.4%) but again the difference was not statistically significant (p=0.1913).

The prevalence of global chronic malnutrition was also higher for boys (compared to girls) at 44.7% vs 33.5% while the difference was statistically significant (p=0.037). When comparing the prevalence of chronic malnutrition in children 6-23 months vs. 24-59 months, children 24-59 months had a much higher odds of being stunted and the difference was statistically significant.

Prevalence by W/H	Total (n=331)		Boys (n=162)		Girls (n=169)	
	% [95% CI]	n	% [95% CI]	N	% [95% CI]	N
Prevalence GAM	13.3% [10.1-17.4]	44	14.8% [10.2-21.1]	24	11.8% [7.8-17.6]	20
Prevalence MAM	13.3% [10.1-17.4]	44	14.8% [10.2-21.1]	24	11.8% [7.8-17.6]	20
Prevalence SAM	0.0% [0.0-1.1]	0	0.0% [0.0-2.3]	0	0.0% [0.0-2.2]	0
Prevalence by H/A	Total (n=328)		Boys (n=161)		Girls (n=167)	
	% [95% CI]	n	% [95% CI]	N	% [95% CI]	N
Prevalence GCM	39.0% [33.9-44.4]	128	44.7% [37.3-52.4]	72	33.5% [26.8-41.0]	56
Prevalence MCM	33.8% [28.9-39.1]	111	39.1% [31.9-46.8]	63	28.7% [22.4-36.0]	48
Prevalence SCM	5.2% [3.3-8.1]	17	5.6% [3.0-10.3]	9	4.8% [2.4-9.2]	8

Table 5: Prevalence of Global Acute Malnutrition (GAM) and Global Chronic Malnutrition (GCM) disaggregated by sex according to the SMART nutritional survey

The overall prevalence of anaemia (Hb<11.0 g/dL) among children 6-59 months was 39.4% [IC 95% 34.3-44.8], which is almost in the category of "High (≥40%)" according to WHO classification.

G. SUMMARY OF RESULTS

As the qualitative study could not be conducted, causal pathways usually co-drafted by communities were fully replaced by UNICEF conceptual framework to create a basis for an adaptation of causal mechanisms, taking into consideration the findings of the Link NCA Risk Factor Survey, for the following nutrition outcomes: wasting, stunting, underweight and anaemia. By differentiating between the causes of nutritional deficiencies, this exercise highlights how response strategies need to be tailored to the respective types of undernutrition.

Figure 3 depicts a causal mechanism for acute malnutrition and underweight, highlighting the risk factors with a significant statistical association with any of these nutritional outcomes. The most vulnerable group for acute malnutrition could not be defined on the basis of available data. The most vulnerable group for underweight were boys. The same trend was observed in Kutupalong MS[12].

A dominant pathway to wasting/underweight takes roots in poor birth-spacing, which translates into a heavy workload of women with an effect on adequacy of hygiene and other child care practices, which then lead to an increased risk of contamination and higher vulnerability to diseases, the repetition of which may result in a child's non-optimal growth and development.

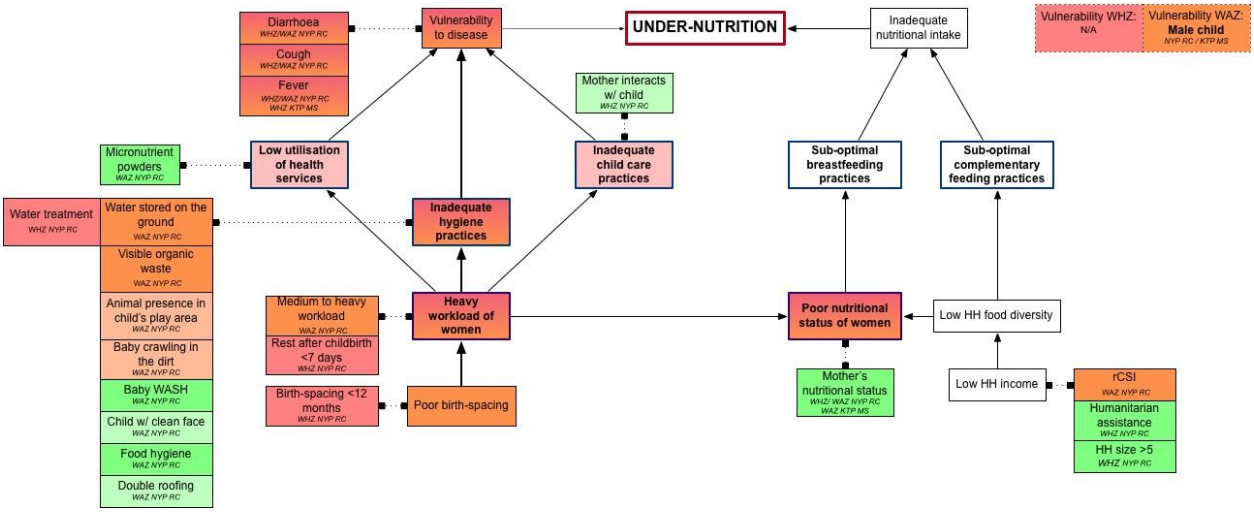


Figure 3: Causal pathway for wasting and underweight[17]

Although the supporting evidence differs, the causal mechanism for acute malnutrition and underweight is principally similar to the one in Kutupalong MS. The key difference lies in a clear accentuation of personal and environmental hygiene risk factors, which were almost absent in Kutupalong MS, and a scarce evidence at the level of infant and young child feeding practices. For the sake of comparison between two locations, risk factors demonstrating a significant statistical relationship with wasting and/or underweight in Kutupalong MS were integrated into a causal mechanism for Nayapara RC, if a respective factor demonstrated a significant statistical relationship with either of nutrition outcomes in Nayapara RC.

Children who were born within 12 months of their older siblings were significantly more likely to be wasted[11]. The same observation was noted for children, whose mothers did not rest more than 7 days after giving birth[11]. On the other hand, children living in households, which indicated a humanitarian assistance as their main source of income, were significantly less likely to be wasted[11]. The same applied to children living in households composed of more than 5 members[11]. Although this observation might seem counter-intuitive, one possible explanation is that larger families could have access to more income streams and are therefore able to achieve greater dietary diversity. The available data suggests that children living in households, which deployed coping strategies more frequently, were significantly more likely to be underweight[11].

Children of well-nourished mothers were significantly less likely to be wasted or underweight in Nayapara RC while they were also less likely to be underweight in Kutupalong MS[11]. Children suffering from diarrhoea, cough and/or fever were significantly more likely to be wasted or

[17] Cells highlighted in dark red signify risk factors with a significant link to acute malnutrition (p value <0.05) while cells highlighted in light red signify risk factors with a potential link to acute malnutrition (p value <0.1). Cells highlighted in dark orange signify risk factors with a significant link to underweight (p value <0.05) while cells highlighted in light orange signify risk factors with a potential link to underweight (p value <0.1). Cells highlighted in both dark red and dark orange signify risk factors with a significant link to acute malnutrition AND underweight (p value <0.05). Cells highlighted in dark green signify protective factors (p value <0.05) while cells highlighted in light green signify risk a potentially protective risk factor (p value <0.1).

underweight in Nayapara RC while a significant association in Kutupalong MS was only noted for fever and wasting[11].

Children in Nayapara RC were significantly more likely to be underweight if water in their households was stored on the ground and/or if organic waste was observed in the proximity of their play area[11]. They were potentially more likely to be underweight if an animal was observed in their play area and/or if they were observed to crawl in the dirt[14]. On the other hand, children living in households with positive baby WASH practices were significantly less likely to be underweight[11] or potentially less likely to be underweight if they were observed with a clean face[14]. In addition, children living in households, in which positive food hygiene practices were observed, were significantly less likely to be underweight[11] or potentially less likely to be underweight if they lived in a house with double roofing[14]. Children who received micronutrient powders were significantly less likely to be underweight[11].

Figure 4 depicts a causal mechanism for chronic malnutrition, highlighting the risk factors with a significant statistical association with this nutritional outcome. The most vulnerable group for chronic malnutrition were also boys. Children younger than 24 months were less likely to be stunted while children living in female-headed households were potentially more likely to be stunted[14].

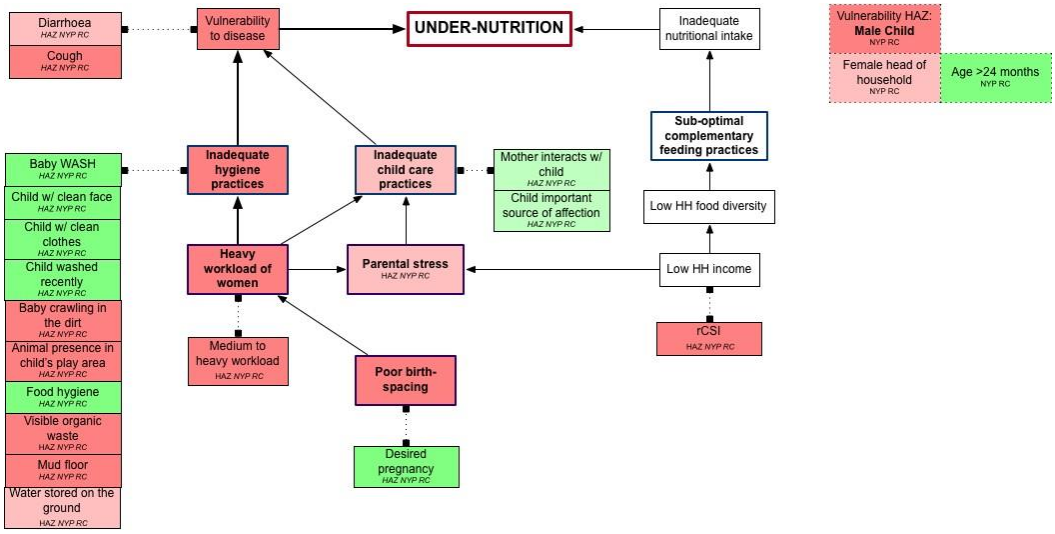


Figure 4: Causal pathway for stunting[18]

As in the case of the causal mechanism for acute malnutrition and underweight, the causal mechanism for chronic malnutrition is principally similar to the one in Kutupalong MS. The key difference lies in a clear accentuation of personal and environmental hygiene risk factors, which were almost absent in Kutupalong MS, and a potential contribution of parental stress to inadequate childcare practices. The evidence at the level of infant and young child feeding practices in both locations is scare and/or non-existent.

A dominant pathway to stunting takes roots in poor birth-spacing, which translates into a heavy workload of women with an effect on adequacy of hygiene and other child care practices, which

[18] Cells highlighted in dark red signify risk factors with a significant link to chronic malnutrition (p value <0.05) while cells highlighted in light red signify risk factors with a potential link to chronic malnutrition (p value <0.1). Cells highlighted in dark green signify protective factors (p value <0.05) while cells highlighted in light green signify risk a potentially protective risk factor (p value <0.1).

then lead to an increased risk of contamination and higher vulnerability to diseases, the repetition of which may result in a child's non-optimal growth and development.

Children whose mothers declared that their last pregnancy was desired were significantly less likely to be stunted[11]. They were potentially less likely to be stunted[14] if they were observed interacting with their mothers during the enumerator's stay in the household and/or if a mother indicated that a child is an important source of their affection[19].

On the other hand, children whose mothers were experiencing an increased level of stress were potentially more likely to be stunted[14]. They were significantly more likely to be stunted[11] if their mother indicated medium to heavy workload; if they were observed crawling in the dirt and/or an animal was observed in their play area. In contrast, children living in households, where positive baby WASH practices were observed were significantly less likely to be stunted[11] along with children who were observed with a clean face, clean clothes and/or recently washed. Children living in households, where positive food hygiene practices were observed were also significantly less likely to be stunted[11], unlike children living in households, in which organic waste was observed in the proximity of their play area and/or in households with mud floor, which were significantly more likely to be stunted[11].

Children suffering from diarrhoea were potentially more likely to be stunted[14] while children experiencing cough or breathing difficulties were significantly more likely to be stunted[11].

Figure 5 depicts a causal mechanism for anaemia, highlighting the risk factors with a significant statistical association with this nutritional outcome. The most vulnerable group for anaemia were also boys, children younger than 24 months and children of younger mothers. The last two categories overlap with the findings from Kutupalong MS.[12]

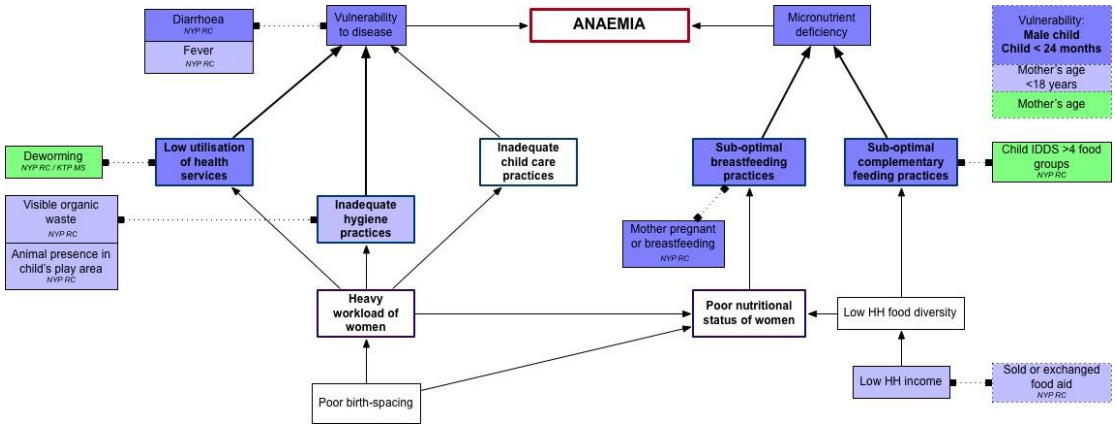


Figure 5: Causal pathway for anaemia[20]

Similarly to preceding pathways, the causal mechanism for anaemia shares resemblance to the one in Kutupalong MS. The two locations share three risk factors in the health and nutrition sector. Children in both Nayapara RC and Kutupalong MS were significantly less likely to be anaemic[11] if they were dewormed in the six months preceding the data collection. The same observation applied to children who consumed more than four food groups[11]. On the other hand, children of

[19] Child-caregiver interactions observation and Parental Stress Index, respectively.

[20] Cells highlighted in dark purple signify risk factors with a significant link to anaemia (p value <0.05) while cells highlighted in light purple signify risk factors with a potential link to anaemia (p value <0.1). Cells highlighted in dark green signify protective factors (p value <0.05) while cells highlighted in light green signify risk a potentially protective risk factor (p value <0.1).

mothers who were pregnant or breastfeeding at the time of the data collection were significantly more likely to be anaemic[11].

Unlike in Kutupalong MS, children suffering from diarrhoea were significantly more likely to be anaemic[11] while children with fever were potentially more likely to be anaemic[14]. In addition, children living in households where organic waste and/or animal was observed in the proximity of child's play area were potentially more likely to be anaemic[14]. The same observation applied to children living in households who admitted to selling or exchanging food aid.

Combined causal mechanism for all nutritional outcomes

Figure 6 summarises all previously detailed pathways in order to highlight potential overlaps and encourage a development of harmonised multi-sectoral responses. A combined pathway confirms that nutrition outcomes in Nayapara RC (with the exception of anaemia) are significantly influenced by risk factors in the sector of water, sanitation and hygiene, namely risk factors linked with environmental and food hygiene, which lead to an increased risk of contamination and higher vulnerability to diseases, the repetition of which may result in a child's non-optimal growth and development. In addition, heavy workload of women may result in inadequate childcare practices and/or poor nutritional status of women with a rippled effect on their capacities to observe optimal breastfeeding practices.

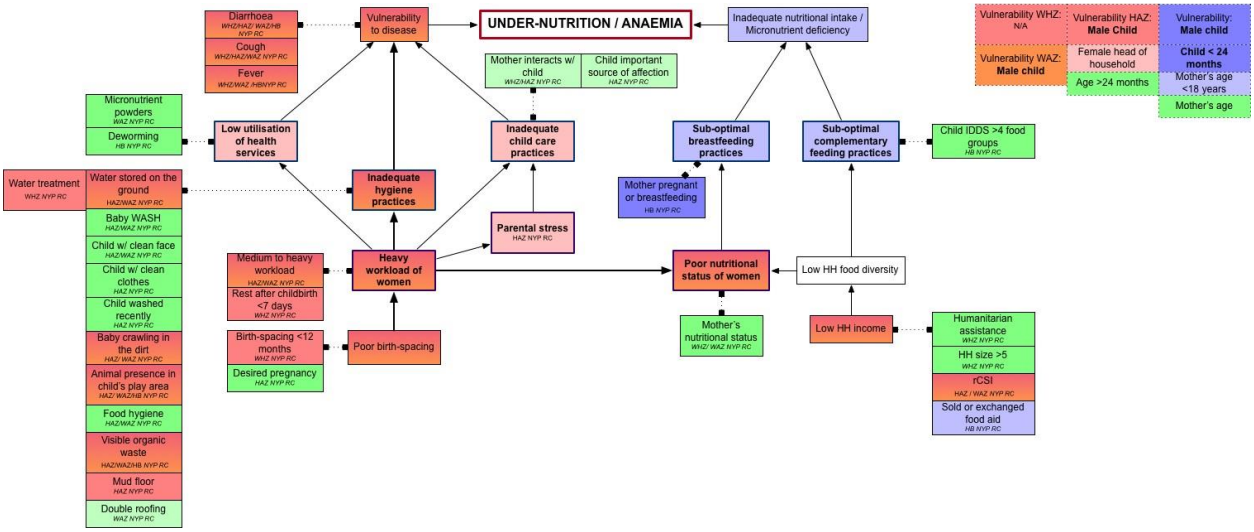


Figure 6: Causal pathway for all nutritional outcomes combined[21]

Per available data, anaemia in Nayapara RC appears to be more linked with inadequate access to food and, therefore, inadequate infant and young child feeding practices.

Conclusions and recommendations

The analyses undertaken in this quantitative assessment of risk factors of undernutrition based on the Link NCA methodology identified 19 risk factors that may affect the incidence of

[21] Cells highlighted in dark purple signify risk factors with a significant link to either of nutritional outcomes (p value <0.05) while cells highlighted in light purple signify risk factors with a potential link (p value <0.1). The applicable nutritional outcome is specified in the cell itself: WHZ signifying wasting, HAZ signifying stunting, WAZ signifying underweight and A signifying anaemia. Cells highlighted in dark green signify protective factors (p value <0.05) while cells highlighted in light green signify risk a potentially protective risk factor (p value <0.1). The applicable nutritional outcome is also specified in the cell itself using the same key.

undernutrition in the study zone. Based on the findings of the Link NCA Risk Factor Survey, major risk factors include environmental and food hygiene, heavy workload of women and inadequate childcare and/or infant and young child feeding practices.

Based on these findings, the following activities are recommended to be incorporated into a multisector action plan to address the identified risk factors. The recommendations are presented by thematic area of intervention but must be taken into account dynamically for a better improvement of the nutritional situation in the study zone.

- Strengthen the inter-sectoral approaches in addressing undernutrition in Nayapara RC through an improved collaboration between Health, Nutrition, Food Security and Livelihoods, Water, Sanitation and Hygiene and Protection sectors in developing humanitarian assistance strategies and ensuring accountability in the implementation of the recommendations.

Health & Nutrition

- Continue promoting maternal and child health activities within a 1000 days' window, encouraging women to complete all essential antenatal care visits including vaccination, Vitamin A supplementation and deworming, among others, especially among younger mothers;
- Strengthen maternal and child care practices to improve the adherence to exclusive breastfeeding (EBF) and complementary feeding practices (IYCF).
- Strengthen the integration of community members with a medical diploma and/or exercising a health-related function in the development and dissemination of health messages to targeted populations, ensuring that the messages are adapted to their key concerns. This may include, but not be limited to, messages on appropriate birth-spacing and family planning practices, especially among men as key decision-makers, emphasizing the challenges associated with low birth spacing in Nayapara RC.

Food Security and Livelihoods

- Support the diversification of income opportunities, maximizing market access opportunities and relevant vocational skills training opportunities;
- Support the creation and/or capacity building of households to set up multi-storey and/or box kitchen gardens as avenues for social support and improved dietary diversity;
- Food Security and Nutrition partners to strengthen their collaboration in supporting the beneficiaries in making the right food choices through enhanced SBCC strategy.

Water, Sanitation and Hygiene

- Strengthen the capacity building activities for community hygiene and sanitation committees in order to encourage the maintenance of optimal practices on a community as well as household levels. This may include refresher trainings on latrine cleaning, water point maintenance and/or other issues of public health interest;
- Strengthen the social and behaviour change communications on the importance of environmental hygiene, especially for infants and toddlers.

V. ANNEXES

A. SAMPLING FRAMEWORK FOR COLLECTING ANTHROPOMETRIC DATA & INVESTIGATION OF RISK FACTORS

Block name	Total # households	Total # selected households
Block B	524	76
Block C	610	83
Block D	515	70
Block E	548	93
Block H	852	120
Block I	381	56
Block P	271	37
Total	3,701	535

B. CALCULATIONS OF STATISTICAL ASSOCIATIONS BETWEEN HYPOTHETICAL RISK FACTOR AND ANTHROPOMETRIC MEASURES AND ANAEMIA IN CHILDREN IN SAMPLED HOUSEHOLDS

Logistic regressions				GAM		Stunting		Underweight		Anaemia	
Risk factors	N	n	Prevalence [95%CI]	p-value	OR [CI-95%]	p-value	OR [CI-95%]	p-value	OR [CI-95%]	p-value	OR [CI-95%]
Child Gender (Male)	393	200	50.9% [45.9-55.9]	0.477	1.26 [0.67-2.38]	0.019	1.73 [1.10-2.74]	0.046	1.61 [1.01-2.56]	0.011	1.79 [1.15-2.80]
Household head Gender- Female	393	143	36.4% [31.6-41.2]	0.624	1.18 [0.61-2.26]	0.063	1.56 [0.98-2.50]	0.265	1.31 [0.81-2.12]	0.797	0.94 [0.59-1.49]
HH size: 1-3	393	11	2.8% [1.2-4.4]	0.629	1.47 [0.31-7.04]	0.179	2.29 [0.68-7.67]	0.116	2.64 [0.79-8.85]	0.676	1.29 [0.39-4.33]
HH size: 4-7	393	242	61.6% [56.7-66.4]	0.477	1.27 [0.65-2.48]	0.512	0.86 [0.54-1.36]	0.577	1.15 [0.71-1.84]	0.463	0.84 [0.54-1.33]
HH size: 8-10	393	101	25.7% [21.4-30]	0.873	1.06 [0.52-2.16]	0.512	0.84 [0.50-1.41]	0.444	0.81 [0.48-1.39]	0.852	1.05 [0.64-1.73]
HH size 11+	393	38	9.9% [7-12.9]	0.117	0.2 [0.03-1.50]	0.219	1.6 [0.76-3.37]	0.437	0.72 [0.31-1.66]	0.491	1.3 [0.62-2.74]
HH size >8	393	139	35.6% [30.9-40.4]	0.365	0.73 [0.36-1.45]	0.88	1.04 [0.65-1.66]	0.24	0.74 [0.46-1.22]	0.554	1.15 [0.73-1.82]
HH size >5	393	261	66.4% [61.6.7-70.9]	0.012	0.44 [0.23-0.83]	.994	0.10 [0.61-1.61]	.14	0.70 [0.44-1.13]	0.138	0.71 [0.45-1.12]
Age (<24 months)	393	181	46.1% [41.1-51]	0.175	1.56 [0.82-2.96]	0	0.36 [0.21-0.60]	0.184	0.72 [0.44-1.17]	0	3.3 [2.07-5.28]
Mother's age (<18 years)	393	5	1.3% [0.2-2.4]	0.105	4.51 [0.73-27.78]	0.488	0.46 [0.05-4.15]	0.702	1.42 [0.23-8.65]	0.978	1.03 [0.17-6.23]
Mother's age birth (<18 years)	393	128	32.6% [27.9-37.2]	0.454	1.28 [0.67-2.43]	0.78	1.07 [0.67-1.70]	0.52	1.17 [0.73-1.87]	0.088	1.48 [0.94-2.33]
HH > 1 child ≤59 months	393	220	56.2% [51.3-61.2]	0.968	0.99 [0.52-1.87]	0.737	1.08 [0.68-1.71]	0.189	0.73 [0.46-1.17]	0.831	1.05 [0.67-1.64]
Main source of income (NGO assistance)	393	187	47.6% [42.6-52.5]	0.026	0.46 [0.24-0.91]	0.252	1.3 [0.83-2.06]	0.12	0.69 [0.43-1.10]	0.956	0.99 [0.63-1.54]
Received food aid sold or exchanged	393	40	10.4% [7.4-13.5]	0.529	1.35 [0.53-3.46]	0.889	1.05 [0.51-2.17]	0.841	0.93 [0.44-1.96]	0.085	1.84 [0.92-3.69]
Diarrhoea	330	94	28.5% [23.6-33.4]	0.002	2.74 [1.43-5.25]	0.068	1.59 [0.97-2.62]	0.006	2.02 [1.23-3.34]	0.007	1.95 [1.20-3.18]
Diarrhoea: Sought care @ health centre	94	62	66% [56.2-75.7]	0.093	2.77 [0.84-9.08]	0.227	0.58 [0.24-1.40]	0.399	1.46 [0.61-3.51]	0.775	0.88 [0.37-2.08]
Cough, difficulties breathing & fever	330	26	7.9% [5-10.8]	0.041	2.64 [1.04-6.70]	0.027	2.55 [1.12-5.81]	0.016	2.71 [1.20-6.08]	0.122	1.89 [0.84-4.22]
Cough: Sought care @ health centre	26	17	65.4% [45.8-85]	0.593	0.62 [0.10-3.66]	0.209	3.06 [0.53-17.46]	0.899	0.9 [0.18-4.56]	0.345	0.44 [0.08-2.39]

Fever	330	171	52.1% [46.7-57.5]	0.022	2.2 [1.12-4.33]	0.987	1 [0.64-1.58]	0.024	1.72 [1.07-2.76]	0.879	0.97 [0.62-1.51]
Fever: Sought care @ health centre	172	125	72.7% [65.9-79.4]	0.145	2.14 [0.77-5.98]	0.014	0.42 [0.21-0.84]	0.415	0.75 [0.38-1.49]	0.062	2.01 [0.97-4.18]
Micronutrient powders	330	133	40.6% [35.3-45.9]	0.372	0.74 [0.38-1.44]	0.586	0.88 [0.55-1.40]	0.026	0.57 [0.35-0.94]	0.986	1 [0.63-1.57]
Vitamin A Supplementation	330	52	15.8% [11.8-19.7]	0.371	1.44 [0.65-3.21]	0.694	0.88 [0.47-1.66]	0.279	1.7 [0.99-3.01]	0.437	0.78 [0.42-1.45]
Measles immunization (card & recall) 9-59m	307	217	70.7% [65.3-75.5]	0.072	2.19 [0.92-5.14]	0.512	.84 [0.51-1.4]	0.056	1.7 [0.93-3.00]	0.787	0.93 [0.56-1.54]
Deworming (6-59m)	329	200	60.8% [55.5-66.1]	0.831	0.93 [0.49-1.78]	0.757	1.08 [0.67-1.72]	0.386	0.81 [0.51-1.30]	0.001	0.46 [0.29-0.73]
Child IDDS score (>4 food groups)	333	212	63.7% [58.5-68.9]	0.724	0.89 [0.46-1.71]	0.005	2.03 [1.24-3.34]	0.726	1.09 [0.67-1.77]	0.003	0.5 [0.32-0.79]
Early initiation of breastfeeding	179	141	78.8% [72.7-84.8]	0.348	0.58 [0.18-1.82]	0.387	1.78 [0.48-6.62]	0.529	0.72 [0.26-1.99]	0.628	0.79 [0.30-2.07]
Exc. breastfeeding at 6 mnths	59	59	100%								
Continuation of breastfeeding at 1 year	23	22	95.7% [86.6-104.7]								
Mother of child currently pregnant or breast-feeding	328	230	70.4% [65.5-75.4]	0.27	1.52 [0.72-3.22]	0.307	0.77 [0.47-1.27]	0.545	1.17 [0.70-1.96]	0.001	2.52 [1.48-4.28]
ANC consultation during last pregnancy	327	280	85.9% [82.1-89.7]	0.378	0.69 [0.30-1.59]	0.506	1.26 [0.64-2.48]	0.222	1.57 [0.76-3.24]	0.377	1.35 [0.69-2.62]
Place of Birth (Home)	327	48	14.7% [10.8-18.5]	0.526	0.73 [0.27-1.95]	0.577	0.83 [0.43-1.60]	0.278	0.68 [0.34-1.37]	0.416	1.3 [0.69-2.42]
Assistance at last birth	327	327	100%								
Caregiver rest after childbirth (<7days)	187	8	4.8% [1.7-7.9]	0.018	5.32 [1.33-21.28]	0.11	3.01 [0.78-11.68]	0.114	2.98 [0.77-11.55]	0.822	0.86 [0.22-3.30]
Desired pregnancy	327	292	89.6% [86.3-92.9]	0.397	1.7 [0.50-5.82]	0.028	0.45 [0.22-0.91]	0.704	0.87 [0.41-1.82]	0.381	1.4 [0.66-2.99]
Birth spacing (<12 months)	157	5	3.8% [0.8-6.9]	0.019	7.39 [1.38-39.42]	0.3	0.32 [0.04-2.78]	0.4	2.02 [0.39-10.37]	0.827	0.82 [0.15-4.65]
Birth spacing (<24 months)	157	40	25.5% [18.6-32.4]	0.727	1.2 [0.43-3.34]	0.145	1.72 [0.83-3.56]	0.562	1.25 [0.59-2.64]	0.443	0.74 [0.35-1.59]
Decision maker-Mother: Market	327	51	15.9% [11.9-19.9]	0.366	0.64 [0.24-1.70]	0.121	1.62 [0.88-2.96]	0.783	0.91 [0.48-1.73]	0.63	1.16 [0.64-2.12]
Decision maker-Mother: Earnings	327	44	13.5% [9.7-17.2]	0.991	1.01 [0.40-2.54]	0.926	0.97 [0.49-1.90]	0.928	0.97 [0.49-1.92]	0.573	1.2 [0.63-2.29]
Decision maker-Mother: Male Earnings	327	19	6.1% [3.5-8.7]	0.631	0.69 [0.16-3.10]	0.537	1.34 [0.52-3.45]	0.798	1.13 [0.44-2.93]	0.592	1.28 [0.52-3.19]
Decision maker-Mother: Woman's Health	327	40	12.5% [8.9-16.1]	0.833	1.11 [0.44-2.80]	0.527	1.24 [0.63-2.45]	0.799	1.09 [0.55-2.19]	0.098	1.74 [0.90-3.37]

Observations: Mother watches Child	327	309	94.8% [92.4-97.2]	.		0.71	0.82 [0.28-2.36]	0.125	3.25 [0.72-14.67]	0.311	1.83 [0.57-5.87]
Observations: Mother talks to Child	327	289	88.4% [84.9-91.9]	0.954	0.97 [0.36-2.65]	0.937	0.97 [0.47-2.00]	0.171	1.78 [0.78-4.05]	0.256	1.54 [0.73-3.26]
Observations: Mother interacts with Child	327	221	67.6% [62.5-72.7]	0.055	0.53 [0.28-1.01]	0.096	0.66 [0.41-1.08]	0.356	0.79 [0.49-1.30]	0.169	1.4 [0.87-2.28]
Observations: Mother smiles at Child	327	275	84.1% [80.1-88.1]	0.424	1.49 [0.56-4.00]	0.572	1.2 [0.63-2.29]	0.091	1.85 [0.91-3.78]	0.251	1.46 [0.77-2.77]
Observations: Mother spanks Child	327	21	6.7% [4-9.5]	0.516	1.46 [0.47-4.52]	0.316	1.56 [0.65-3.74]	0.682	1.21 [0.49-2.98]	0.292	1.59 [0.67-3.80]
Safety in Camp	327	261	80.1% [75.8-84.5]	0.14	2.08 [0.79-5.52]	0.551	1.2 [0.66-2.16]	0.825	1.07 [0.59-1.93]	0.537	1.2 [0.68-2.11]
Safety outside Camp	327	161	49.5% [44.1-55]	0.108	1.71 [0.89-3.27]	0.41	0.83 [0.52-1.30]	0.722	0.92 [0.58-1.46]	0.452	1.19 [0.76-1.86]
Baby WASH Observation: Child with clean face	387	280	72.4% [67.9-76.8]	0.939	1.03 [0.52-2.03]	0.004	0.5 [0.31-0.80]	0.075	0.64 [0.39-1.05]	0.211	0.74 [0.46-1.19]
Baby WASH Observation: Child with clean clothes	387	236	61% [56.1-65.9]	0.636	1.17 [0.61-2.23]	0.005	0.51 [0.32-0.81]	0.275	0.77 [0.48-1.23]	0.856	0.96 [0.61-1.50]
Baby WASH Observation: Child washed recently	387	118	30.7% [26.1-35.4]	0.484	0.76 [0.35-1.65]	0.025	0.52 [0.30-0.92]	0.597	0.86 [0.50-1.49]	0.425	1.23 [0.74-2.05]
Baby WASH Observation: Animal in play area	387	80	20.7% [16.6-24.7]	0.361	1.4 [0.68-2.88]	0.024	1.85 [1.09-3.17]	0.09	1.6 [0.93-2.75]	0.073	1.62 [0.96-2.75]
Baby WASH Observation: Animal excrement in play area	387	54	14% [10.5-17.4]	0.444	0.68 [0.25-1.82]	0.429	.28 [0.69-2.38]	0.512	1.23 [0.66-2.32]	0.82	0.93 [0.50-1.73]
Baby WASH Observation: Baby crawling in the dirt	393	150	38.4% [33.6-43.3]	0.355	0.73 [0.38-1.42]	0.012	1.81 [1.14-2.87]	0.09	1.5 [0.94-2.39]	0.232	1.31 [0.84-2.06]
Food hygiene Observation: free range animals in the kitchen or entering the house	393	66	16.8% [13.1-20.5]	0.805	0.9 [0.38-2.13]	0.222	1.44 [0.80-2.58]	0.586	1.18 [0.65-2.15]	0.177	1.49 [0.84-2.64]
Food hygiene Observation: Food uncovered or on the floor	393	47	12% [8.7-15.2]	0.326	1.56 [0.64-3.80]	0.27	1.48 [0.74-2.96]	0.499	1.27 [0.63-2.58]	0.488	0.78 [0.38-1.58]
Food hygiene Observation: Organic waste within 10 m	393	117	30% [25.5-34.6]	0.556	1.23 [0.62-2.44]	0.017	1.83 [1.12-2.99]	0.002	2.24 [1.36-3.69]	0.052	1.62 [1.00-2.64]
Availability of a mosquito net in HH	205	194	95.1% [92.1-98.1]			0.415	0.55 [0.13-2.30]	0.595	1.56 [0.30-7.97]	0.943	0.95 [0.22-4.11]
Quality of housing: mud floor	393	84	21.4% [17.3-25.4]	0.783	1.11 [0.52-2.38]	0.001	2.59 [1.51-4.44]	0.109	1.56 [0.91-2.70]	0.664	0.89 [0.51-1.53]
Durable roofing	393	14	3.8% [1.9-5.7]			0.604	0.73 [0.22-2.39]	0.075	0.16 [0.02-1.20]	0.787	1.16 [0.39-3.43]

Energy Source (LPG)	393	387	98.5% [97.3-99.7]	0.499	0.45 [0.05-4.47]	0.674	1.63 [0.17-15.84]	0.763	1.42 [0.15-13.80]	0.561	1.96 [0.20-19.09]
Barrier to accessing water (any)	393	268	68.2% [63.6-72.8]	0.824	0.93 [0.47-1.81]	0.78	0.93 [0.58-1.51]	0.268	0.76 [0.47-1.24]	0.913	0.97 [0.61-1.56]
Water access barrier (distance)	268	23	8.6% [5.2-12]	0.263	0.31 [0.04-2.41]	0.591	1.29 [0.50-3.32]	0.255	0.52 [0.17-1.61]	0.299	0.59 [0.22-1.59]
Water access barrier (long waiting time)	268	39	14.9% [10.6-19.2]	0.385	1.55 [0.58-4.14]	0.156	1.72 [0.81-3.65]	0.127	1.8 [0.85-3.81]	0.376	0.7 [0.32-1.53]
Water Source (tubewell/ handpump)	393	367	93.6% [91.2-96.1]	0.971	1.02 [0.29-3.60]	0.294	0.63 [0.26-1.50]	0.866	1.08 [0.43-2.72]	0.639	1.24 [0.51-3.00]
Water stored on the ground	393	253	64.4% [59.6-69.1]	0.907	1.04 [0.54-2.01]	0.053	1.61 [0.99-2.61]	0.023	1.78 [1.08-2.94]	0.631	1.12 [0.71-1.77]
Water storage covered	393	347	88.3% [85.1-91.5]	0.926	1.05 [0.39-2.84]	0.807	0.92 [0.45-1.85]	0.36	0.72 [0.36-1.45]	0.824	0.93 [0.47-1.83]
Water treatment	393	93	23.7% [19.4-27.9]	0.002	2.88 [1.48-5.57]	0.414	0.8 [0.46-1.38]	0.456	1.22 [0.72-2.09]	0.576	0.86 [0.51-1.45]
Improved sanitation facility	393	391	99.7% [99.2-100.2]								
Women's workload (medium to heavy)	327	152	46.5% [41-51.9]	0.596	1.19 [0.63-2.24]	0.002	2.05 [1.29-3.27]	0.297	1.28 [0.80-2.04]	0.924	1.02 [0.65-1.60]
rCSI 4 (food reserved for children) 5-7 d/w	163	2	1.8% [-0.2-3.9]								
rCSI 1, 2,3 & 5	240	10	4.2% [1.6-6.7]	0.987	0.98 [0.12-8.34]	0.338	2 [0.48-8.26]	0.605	0.65 [0.13-3.32]	0.21	0.26 [0.03-2.14]

Linear regressions

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factors:	N	Mean [95%CI]	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE
Mother's age (years)	328	27.4 [26.7-28.2]	0.37	0.12	0.01	0.01	0.171	-0.011	0.01	0.983	0	0.01	0.014	0.024	0.01
Mother's age at marriage (years)	327	16.6 [16.4-16.9]	0.12	0.424	-0.016	0.02	0.654	-0.011	0.03	0.363	-0.019	0.02	0.343	0.029	0.03
Mother's MUAC (mm)	326	276.5 [272.6-280.4]	1.98	0.008	0.003	0.00	0.62	0.001	0.00	0.027	0.003	0.00	0.671	0.001	0.00
Women workload scale (1-4)	327	2.4 [2.3-2.6]	0.06	0.545	-0.026	0.04	0	-0.241	0.05	0.001	-0.155	0.04	0.995	0	0.06
Birth spacing (<1, 1-2, 2-3, 3-4, >4 years)	157	3.1 [3.0-3.3]	0.07	0.647	0.032	0.07	0.133	0.119	0.08	0.303	0.067	0.07	0.715	-0.037	0.10
rCSI	163	11.1 [10.1-12.2]	0.54	0.704	0.004	0.01	0.001	-0.046	0.01	0.042	-0.022	0.01	0.794	-0.004	0.02
Parental Stress Index	327	45.2 [44.7-45.7]	0.27	0.394	-0.008	0.01	0.088	-0.019	0.01	0.117	-0.015	0.01	0.319	0.013	0.01
1.Parent happy in role as a parent	327	1.5 [1.4-1.5]	0.03	0.624	0.039	0.08	0.647	0.046	0.10	0.582	0.046	0.08	0.889	-0.017	0.12
2.Parent would do anything for the child(ren) if necessary	327	4.5 [4.5-4.6]	0.03	0.678	-0.032	0.08	0.835	0.02	0.10	0.943	-0.006	0.08	0.015	-0.276	0.11
3.Parent feels caring for child(ren) sometimes takes more time and energy than necessary	327	4.2 [4.2-4.3]	0.03	0.971	-0.003	0.08	0.8	0.027	0.11	0.878	0.013	0.09	0.638	0.059	0.13
4.Parent sometimes worry on whether enough is done for the child(ren)	327	3.5 [3.4-3.6]	0.06	0.378	0.037	0.04	0.84	0.011	0.05	0.517	0.028	0.04	0.423	0.05	0.06
5.Parent feels close to child(ren).	327	1.6 [1.5-1.6]	0.03	0.668	0.035	0.08	0.231	0.122	0.10	0.354	0.078	0.08	0.106	-0.195	0.12
6.Parent enjoys spending time with child(ren).	327	1.6 [1.5-1.6]	0.03	0.749	0.029	0.09	0.223	0.137	0.11	0.383	0.082	0.09	0.749	0.043	0.13
7.Parent feels child(ren) is an important source of affection	327	1.6 [1.5-1.6]	0.03	0.701	0.034	0.09	0.086	0.194	0.11	0.232	0.112	0.09	0.297	-0.14	0.13

8.Parent feels having child(ren) gives more certain/ optimistic view for the future	327	2 [1.9-2.0]	0.04	0.149	-0.099	0.07	0.898	-0.011	0.09	0.305	-0.073	0.07	0.473	-0.073	0.10
9.Parent feels the major source of stress in life is child(ren).	327	2.2 [2.1-2.3]	0.05	0.882	-0.007	0.05	0.268	-0.07	0.06	0.495	-0.036	0.05	0.657	-0.033	0.08
10.Parent feels having child(ren) leaves little time/ flexibility in life.	327	2.4 [2.3-2.5]	0.06	0.283	-0.047	0.04	0.715	0.02	0.06	0.645	-0.021	0.05	0.43	0.052	0.07
11.Parent feels having child(ren) has been a financial burden.	327	2.3 [2.2-2.4]	0.05	0.903	0.005	0.05	0.875	-0.009	0.06	0.854	0.009	0.05	0.737	-0.022	0.07
12.Parent feels it's difficult to balance responsibilities because of child(ren)	327	2.5 [2.4-2.6]	0.06	0.645	-0.019	0.04	0.23	-0.064	0.05	0.232	-0.052	0.04	0.44	-0.048	0.06
13.Parent feels the behaviour of child(ren) is often embarrassing/ stressful	327	2.5 [2.4-2.6]	0.06	0.182	-0.056	0.04	0.32	-0.053	0.05	0.161	-0.061	0.04	0.589	0.034	0.06
14.Parent feels if had it to do over again, may decide not to have child (ren).	327	3 [2.8-3.1]	0.07	0.512	-0.022	0.03	0.264	-0.046	0.04	0.212	-0.043	0.03	0.843	0.01	0.05
15.Parent feels overwhelmed by responsibility of being a parent	327	4.3 [4.3-4.4]	0.03	0.247	-0.093	0.08	0.201	-0.128	0.10	0.078	-0.147	0.08	0.418	0.096	0.12
16.Parent feels having child(ren) has meant having too few choices/little control over life	327	2.5 [2.3-2.6]	0.06	0.098	-0.07	0.04	0.744	-0.018	0.05	0.204	-0.056	0.04	0.733	0.022	0.06
17.Parent feels satisfied as a parent	327	1.6 [1.6-1.7]	0.03	0.518	-0.05	0.08	0.892	0.013	0.10	0.609	-0.041	0.08	0.365	0.104	0.11
18.Parent finds their child(ren) enjoyable	327	1.5 [1.5-1.6]	0.03	0.368	-0.08	0.09	0.254	0.127	0.11	0.997	0	0.09	0.698	-0.051	0.13

Combined score Child-caregiver interactions + nutritional outcomes

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factor	N	Mean [95%CI]	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE
Mother child interactions observed	327	3.4 [3.3-3.5]	0.06	0.669	-0.022	0.05	0.636	-0.020	0.04	0.213	-0.076	0.06	0.669	-0.022	0.05

Combined Baby WASH score + nutritional outcomes

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factor	N	Mean [95%CI]	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE
Positive child WaSH practices observed	387	3.9 [3.7-4.1]	0.07	0.872	-0.005	0.03	0.001	0.130	0.04	0.034	0.067	0.03	0.641	0.021	0.05

Combined Food hygiene score + nutritional outcomes

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factor	N	Mean [95%CI]	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE
Positive food hygiene practices observed	387	2.4 [2.3-2.5]	0.04	0.316	0.056	0.06	0.034	0.149	0.07	0.04	0.120	0.06	0.292	0.088	0.08

Household size + nutritional outcomes

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factor	N	Mean [95%CI]	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE
Household size	393	6.9 [6.7-7.1]	.123	0.063	0.033	0.02	0.463	0.017	0.02	0.113	0.030	0.02	0.111	-0.042	0.03

Birth space continuous + nutritional outcomes

				GAM (WHZ)			Stunting (HAZ)			Underweight (WAZ)			Anaemia (HB)		
Risk factor	N	Mean [95%CI]	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE	P-val.	Coeff.	SE
Birth space (months)	393	30.7 [28.9-32.5]	.913	0.929	-0.001	0.01	0.174	0.009	0.01	0.591	0.003	0.01	0.691	-0.003	0.01

Mother's age + Child cleanliness (Baby WASH)

	Positive child WaSH practices observed		
Risk factor	p-val.	Coeff.	SE
Mother's age	0.207	-0.016	0.01

Household size + Parental stress

	Parental Stress Index		
Risk factor	p-val.	Coef.	SE
House hold size	0.454	0.083	0.11

Age of mother + Parental stress

	Parental Stress Index		
Risk factor	P val.	Coef.	SE
Mother's age (years)	<.001	0.158	0.04

Reduced Coping Strategy Index + Parental stress

	Parental Stress Index		
Risk factor	p-val.	Coef.	SE
Reduced Coping Strategy Index	0.175	0.077	0.06

Child-caregiver interactions + Parental stress

	Parental Stress Index		
Risk factor	p-val.	Coef.	SE
Mother child interactions observed	<.001	-1.445	0.23

Combined Food hygiene score + Diarrhoea

	Diarrhoea	
Risk factor Positive food hygiene practices observed	P Val.	OR [CI-95%]
0	0.635	1.41 [0.34-5.85]
1	0.011	2.65 [1.25-5.64]
2	0.95	0.98 [0.55-1.72]
3		Base

Quality of housing + Diarrhoea

	Diarrhoea	
Risk factor	P Val.	OR [CI-95%]
Mud floor	0.539	1.19 [0.67-2.12]
Durable roofing	0.244	0.4 [0.08-1.84]

Child cleanliness (Baby WASH) + Diarrhoea

	Diarrhoea	
Risk factor Positive child WaSH practices observed	P val.	OR [CI-95%]
0	0.424	0.4 [0.04-3.78]
1	0.342	0.5 [0.11-2.08]
2	0.427	1.44 [0.58-3.54]
3	0.443	0.72 [0.32-1.64]

4	0.577	0.78 [0.33-1.85]
5	0.163	0.53 [0.22-1.28]
6		Base

Safety in camp + Parental stress

	Parental stress Index	
Risk factor Feel Safe in the Camp	Mean (Stress score)	p value
No	43.5 [42.4-44.7]	
Yes	45.6 [45.0-46.2]	
Difference	2.1 [-3.4--0.7]	0.002