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FINAL REPORT

Anaemia in Early Childhood in Cox's Bazar

Understanding Factors Associated with Anaemic to Strengthen Integrated Action for Rohingya Children

This report was produced at the request of UNICEF Bangladesh. It was prepared independently by RISE International Consulting LLC.
Photo credit: News Today. Rohingya children stranded in Myanmar without their parents, United Nations, January 2018.

ANAEMIA IN EARLY CHILDHOOD IN COX'S BAZAR

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ACRONYMS

ACT	Artemisinin-based Combination Therapy
AGP	α-1-acid glycoprotein
AI	Anaemia of inflammation
ANC	Antenatal Care
ARI	Acute Respiratory Infection
BHA	Bureau for Humanitarian Assistance
BMRC	Bangladesh Medical Research Council
BRINDA	Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia
BSFP	Blanket Supplementary Feeding Programme
CAPI	Computer-Assisted Personal Interviewing
CBC	Complete Blood Count
CiC	Camp-in-Charge
CMAMI	Community Management of At-Risk Mothers and Infants
CNVs	community nutrition volunteers
CRP	C-Reactive Protein
CXB	Cox's Bazar
DOB	Date of Birth
EBF	Exclusive Breastfeeding
EFF	egg and flesh food
ECCD	Early Childhood and Care Development
EDTA	Ethylenediaminetetraacetic Acid
EIA	Enzyme Immunoassay
FCS	Food Consumption Score
FCS-N	Food Consumption Score – Nutrition
FDMN	Forcibly Displaced Myanmar Nationals
FGD	focus group discussion
FIES	Food Insecurity Experience Scale
GAM	Global Acute Malnutrition
GoB	Government of Bangladesh

GMP	Growth Monitoring and Promotion
GPS	Global Positioning System
ID	Iron Deficiency
IDA	Iron Deficiency Anaemia
IFA	Iron and Folic Acid
IPHN	Institute of Public Health and Nutrition
ITN	insecticide-treated nets
IYCF	Infant and young child feeding
JRP	Joint Response Plan
KII	Key informant interviews
LPG	liquid propane gas
MAD	minimum acceptable diet
MAM	moderate acute malnutrition
MATC	Medical Assistant Training Course
MC	mega camp
MCH	mean corpuscular haemoglobin
MCV	mean corpuscular volume
MDD	minimum dietary diversity
MMF	minimum meal frequency
MMFF	minimum milk feeding frequency
ODK	Open Data Kit
ORS	oral rehydration solution
OTP	Outpatient Therapeutic Programme
PLW	pregnant and lactating women
PPS	probability proportional to size
PSU	primary sampling unit
QA	quality assurance
QC	quality control
RC	Registered Camp
RDW-CV	red cell distribution width

RME	Relative Margin of Error
RUSF	Ready-to-Use Supplementary Food
RUTF	Ready-to-Use Therapeutic Food
SDG	Sustainable Development Goals
SMART	Standardized Monitoring and Assessment of Relief and Transitions
sTfR	soluble transferrin receptor
SwB	sweet beverage
TIBC	total iron-binding capacity
TSFP	Targeted Supplementary Feeding Programme
UFC	unhealthy food consumption
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children Fund
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WHO	World Health Organization
YLD	years with lived disability
ZVF	zero vegetable or fruit

EXECUTIVE SUMMARY

Anaemia among children under five remains a persistent and complex public health challenge in the Forcibly Displaced Myanmar National (FDMN) population in Cox's Bazar. Despite long-standing investments in food assistance, micronutrient supplementation, and basic health services, recent surveys continue to document a substantial burden of childhood anaemia. However, prevalence estimates alone provide limited guidance for effective programming. In particular, there has been insufficient clarity on the relative contributions of iron deficiency, infection-related inflammation, and broader biological and environmental stressors that shape haemoglobin outcomes in early life.

Objective and Purpose

The primary purpose of this study was therefore to move beyond descriptive reporting and systematically examine the determinants and aetiologies of anaemia among children aged 6–59 months living in the camps. The study aimed to (i) quantify the prevalence and severity of anaemia by age, sex, and camp location; (ii) distinguish nutritional from non-nutritional pathways contributing to anaemia, with particular emphasis on iron deficiency and inflammation; (iii) identify demographic, household, environmental, behavioural, programmatic, and biological predictors of anaemia using both bivariate and multivariate analytical approaches; and (iv) generate actionable, evidence-based insights to inform anaemia prevention and control strategies in a protracted humanitarian setting.

By integrating household survey data with detailed biomarker assessments, the analysis was explicitly designed to support more targeted, biologically informed interventions during the most critical periods of early childhood.

Study Design and Data Collection

The study employed a cross-sectional, mixed-methods design combining quantitative household survey data, biochemical assessment, and qualitative interviews. This integrated approach enabled examination of both distal determinants of anaemia—such as household conditions, caregiving practices, and exposure to services—and proximal biological mechanisms directly affecting haemoglobin production and red blood cell function.

Quantitative data were collected from 933 children aged 6–59 months residing in camps across Ukhiya and Teknaf. A stratified, multi-stage cluster sampling strategy was used to ensure representation across geographic locations and age groups, with deliberate inclusion of infants and young children, who are known to be at highest biological risk of anaemia. One eligible child per household was selected to minimise intra-household correlation. All analyses accounted for the complex survey design.

Trained enumerators administered structured questionnaires to caregivers, capturing information on child demographics, household size and composition, water, sanitation, and hygiene (WASH) conditions, recent morbidity and infection prevention practices, infant and young child feeding (IYCF) behaviours, consumption of fortified foods and supplementary rations, and participation in key health and nutrition services, including deworming and vaccination. These instruments were adapted from standard humanitarian assessment tools and contextualised for the FDMN setting.

Venous blood samples were collected from participating children following established ethical and safety protocols. Laboratory analyses included haemoglobin concentration to classify anaemia severity; iron status indicators such as serum iron, ferritin, and total iron-binding capacity; red blood cell indices (including mean corpuscular volume, mean corpuscular haemoglobin, and red cell distribution width) to characterise anaemia morphology; and markers of inflammation, specifically C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP). Additional haematological parameters, including reticulocyte counts and haemoglobin electrophoresis, were assessed to explore non-nutritional and pathological contributors to anaemia and to rule out major haemoglobinopathies.

Ferritin concentrations were interpreted using both unadjusted thresholds and inflammation-adjusted cut-offs based on WHO and BRINDA guidance, recognising the high prevalence of infection-related inflammation and its tendency to mask iron deficiency. This dual interpretation allowed the study to quantify both apparent and underlying iron deficiency in the population.

Qualitative data were collected in parallel through semi-structured interviews with mothers and caregivers of young children, frontline health and nutrition workers, and programme staff. These interviews explored feeding practices during infancy, perceptions of supplementation and ration access, health-seeking behaviour, and operational constraints affecting service delivery. Qualitative findings were used to contextualise and triangulate quantitative results.

Analytical Approach

Analysis proceeded in three stages: descriptive, bivariate, and multivariate.

Descriptive analyses were first conducted to estimate the prevalence and severity of anaemia and related biological indicators across age groups, sex, and camp locations. Particular attention was paid to age gradients, given the well-documented physiological vulnerability of infancy and early toddlerhood.

Bivariate analyses then examined unadjusted associations between anaemia and a wide range of potential predictors, including demographic characteristics, household and environmental conditions, IYCF practices, dietary diversity, programme exposure, morbidity indicators, and biochemical markers.

Multivariate analysis followed a staged modelling strategy to clarify causal pathways and avoid overadjustment. Three sequential models were developed:

- Model 1 examined demographic, household, environmental, and programmatic determinants of anaemia.
- Model 2 introduced inflammatory biomarkers to assess infection-related contributions.
- Model 3 incorporated direct haematological indicators to examine proximal biological mechanisms of iron availability and erythropoiesis.

Child age was retained as a core control variable across all models, given its strong and consistent association with anaemia in descriptive and bivariate analyses. This approach allowed clearer interpretation of both structural determinants and biological drivers of anaemia risk.

Key Findings

Anaemia prevalence remains high but largely hidden.

Approximately 32–37% of children aged 6–59 months were anaemic, placing anaemia firmly within the WHO category of a moderate public health problem. The overwhelming majority of cases were mild or moderate anaemia, with severe anaemia uncommon. Despite its clinical subtlety, this pattern is epidemiologically significant, given robust evidence linking early-life mild and moderate anaemia to impaired neurodevelopment, increased susceptibility to infection, and growth faltering.

Anaemia is highly concentrated in the first two years of life.

Age emerged as the strongest and most consistent determinant across descriptive, bivariate, and multivariate analyses. In Model 1, infants aged 6–11 months had nearly five times higher odds of anaemia compared with children aged 24–59 months (AOR 4.98), while children aged 12–23 months had four times higher odds (AOR 4.04). In Model 2, which incorporated inflammatory markers, this age gradient persisted (AOR 5.18 for 6–11 months; 3.83 for 12–23 months). In Model 3, after incorporating direct haematological indicators, the age effect attenuated but remained statistically significant (AOR 2.56 for 6–11 months; 2.02 for 12–23 months), indicating that much of early-life vulnerability operates through biological pathways captured in the full model.

These findings confirm infancy and early toddlerhood as the critical vulnerability window for anaemia onset.

Iron deficiency contributes to anaemia—but explains only a minority of cases.

Among children aged 6–23 months, approximately 25% had iron-deficiency anaemia (IDA) when inflammation-adjusted biomarkers were applied. Across the full sample, adjusted IDA accounted for roughly 15% of anaemia cases, indicating that iron deficiency alone does not explain the observed burden.

This helps explain why high coverage of iron-fortified rations and supplementation has not translated into proportional reductions in anaemia prevalence.

Inflammation is widespread and biologically consequential.

Markers of inflammation were elevated in nearly half of all children and in over 60% of children under two years of age. In the fully adjusted haematological model, anaemia was strongly associated with low mean corpuscular haemoglobin (AOR 8.34), low serum iron (AOR 2.45), and elevated reticulocyte counts (AOR 2.15), consistent with impaired erythropoiesis and altered iron metabolism.

CRP and AGP were not independently significant in the final model once haematological indicators were included; however, their high prevalence and modifying role in ferritin interpretation underscore the central importance of inflammation in shaping iron availability and haemoglobin recovery.

Biological markers are more strongly associated with anaemia more strongly than household-level factors.

In structural models focused on demographic, household, environmental, and programmatic variables, few factors beyond age retained independent associations with anaemia. Indicators such as sanitation, water safety perception, deworming, vaccination, household size, IYCF practices, fortified food consumption, and supplementary feeding participation were not independently associated with anaemia once age was controlled for.

In contrast, biomarker-inclusive models explained anaemia risk far more robustly, highlighting the stronger statistical associations for proximal biological indicators compared to distal exposures.

Qualitative findings reinforce early-life vulnerability and systemic constraints.

Caregivers consistently described the complementary feeding period as a time of dietary insufficiency, illness clustering, and caregiving strain. Many reported confusion around supplementation, intermittent adherence to fortified foods, and limited counselling focused specifically on anaemia. Programme stakeholders noted operational challenges, including high staff turnover, limited anaemia-specific diagnostics, and constraints in addressing chronic infection and inflammation within existing service platforms.

Conclusions

The findings indicate that anaemia among children in the FDMN camps reflects a dual aetiology: early-life nutritional vulnerability layered atop sustained inflammatory exposure. Anaemia appears associated with rapid growth demands, recurrent infection, and biological stress in early life.

The persistence of anaemia despite extensive nutrition programming does not reflect programme failure, but rather the limits of iron-centric strategies in contexts where inflammation and infection remain pervasive. Effective anaemia reduction will require earlier intervention—before deficits become biologically entrenched—and a more integrated approach that links nutrition with infection prevention, morbidity management, and service quality.

Implications for Programming

The study points to several strategic implications for humanitarian action:

- Anaemia interventions must prioritise the first 1,000 days, particularly children aged 6–23 months.
- Iron supplementation and fortified foods should be paired with strategies to reduce infection and inflammation, not implemented in isolation.
- Anaemia screening and counselling need to become more age-specific, biologically informed, and symptom-sensitive, even when anaemia is mild.
- Strengthened integration between nutrition, health, and WASH sectors is critical to address anaemia as a multisystem condition rather than a single-nutrient deficiency.

By reframing anaemia as the product of intersecting nutritional and non-nutritional pathways in early childhood, this causal analysis provides a clear evidence base to guide more effective, context-appropriate anaemia prevention and treatment strategies in protracted humanitarian settings.

CHAPTER 1. INTRODUCTION

1.1 Background

The large-scale displacement of the Rohingya population from Myanmar in 2017 led to an unprecedented influx of refugees into Bangladesh. This crisis prompted the development of the Joint Response Plan (JRP) to coordinate humanitarian efforts. Under the leadership of the Government of Bangladesh (GoB), multiple partners, including UN agencies and NGOs, collaborate to provide essential services such as nutrition, healthcare, and protection to the Forcibly Displaced Myanmar Nationals (FDMN).

Cox's Bazar (CXB) district, home to the world's largest refugee camp, hosts the majority of these refugees. As of September 30, 2024, the camps in CXB housed 1,003,394 people, with children making up 52 per cent of the population. The district's 33 camps are densely populated, presenting significant challenges in terms of infrastructure, sanitation, and access to basic services (UNHCR, 2024a). Children under the age of five in CXB face multi-faceted health and nutrition challenges, including infectious diseases due to inadequate vaccination coverage, malnutrition, overcrowding, unsanitary conditions, and lack of access to safe water. Along with unexplained fever, acute respiratory infections, and diarrhoea, nutritional deficiencies are highly prevalent among Rohingya refugees, especially among children.

Recent SMART (Standardized Monitoring and Assessment of Relief and Transitions) surveys conducted in the Kutupalong refugee camp highlight the severity of these issues (UNHCR, 2024b). In children aged 6-59 months, nearly half were found to have anaemia (47.9 per cent), and about one-fourth suffered from Global Acute Malnutrition (GAM). The 2023 Standardized Expanded Nutrition Survey (SENS) results indicate a deteriorating acute malnutrition situation, with a very high prevalence of wasting (15.1 per cent) and chronic malnutrition (stunting) remaining critical at 41.2 per cent (UNHCR, 2024b).

In the context of refugee camps like those in CXB, anaemia is a significant public health concern, particularly among children under five. Recent surveys indicate that the condition, while showing some improvement, continues to be a major concern. The 2023 SENS survey reported an anaemia prevalence of 38.2 per cent among children under five, which is an improvement from the critical levels of 50.3 per cent in 2021. However, it remains near the high threshold of 40 per cent, indicating a medium public health significance (Teketelew et al., 2024).

The displacement has now entered its eighth year, and the Rohingya crisis is widely regarded as a protracted emergency with no foreseeable durable solution. The prolonged nature of the crisis has strained humanitarian resources, increased reliance on food assistance, and contributed to growing vulnerabilities among children, especially in health and nutrition. Seasonal shocks, including monsoon floods, cyclones, fires, and disease outbreaks, have further exacerbated instability in food security and public health, making anaemia an especially difficult problem to address in the refugee camp context.

Against this backdrop, the present causal analysis of anaemia among children under five in FDMN camps seeks to deepen understanding of the drivers of anaemia in this highly vulnerable population and provide evidence for more targeted, technically appropriate responses within the existing humanitarian architecture.

1.2 Prevalence and Causes of Anaemia

At the global level, anaemia reduction is a core target of the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-Being). The WHO has also identified anaemia reduction as a key priority under its Global Nutrition Targets 2025 and 2030. Despite global efforts, progress has been slow, with recent analyses showing that Bangladesh, like many countries in South Asia, is not on track to meet global anaemia reduction targets, with recent national surveys showing only modest declines in childhood anaemia and persistent gaps in micronutrient intake, dietary diversity, and infection control. In this context, understanding and addressing anaemia in emergency settings such as CXB is not only a national concern but also contributes to broader global commitments to child health and nutrition.

Anaemia is a condition characterized by a deficiency of red blood cells or haemoglobin (Hb), which impairs the blood's ability to carry oxygen to the body's tissues (WHO, 2024). In both clinical practice and public health, anaemia is assessed by measuring Hb concentration, which varies by age, sex, pregnancy and health status, and is influenced by elevation above sea level, smoking status, and some genetic variations. In 2024, WHO released updated Hb cutoffs to define anaemia at the individual level following established WHO guideline development procedures (Table 1). Based on the evidence, the cutoff for anaemia for children 6–23 months of age was changed from <110 g/L to <105 g/L (WHO, 2024). Thus, children 6-59 months of age must be considered in two categories: 6-23 months (<105 g/L) and 24-59 months (<110 g/L)[1].

Table 1. Haemoglobin levels (g/L) to diagnose anaemia

Population		Haemoglobin concentration
Children, 6-23 months		<105 g/L
Children, 24-59 months		<110 g/L
Children, 5-11 years		<115 g/L
Children, 12-14 years, non-pregnant girls Children, 12-14 years, boys Adults, 15-65 years, non-pregnant women		<120 g/L
Adults, 15-65 years, men		<130 g/L
Pregnancy	First trimester	<110 g/L
	Second trimester	<105 g/L
	Third trimester	<110 g/L

Source: Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. Geneva: World Health Organization; 2024.

These definitions underpin the classification of anaemia in this study population and are critical for interpreting the prevalence estimates that follow.

Anaemia is a key indicator of overall health, often pointing to underlying issues in the body. It occurs when the production of red blood cells cannot keep up with losses, leading to a shortage. This can result from inadequate red blood cell production caused by poor nutrition (such as iron or vitamin deficiencies), chronic illnesses, or inherited conditions affecting haemoglobin, the oxygen-carrying protein in red blood

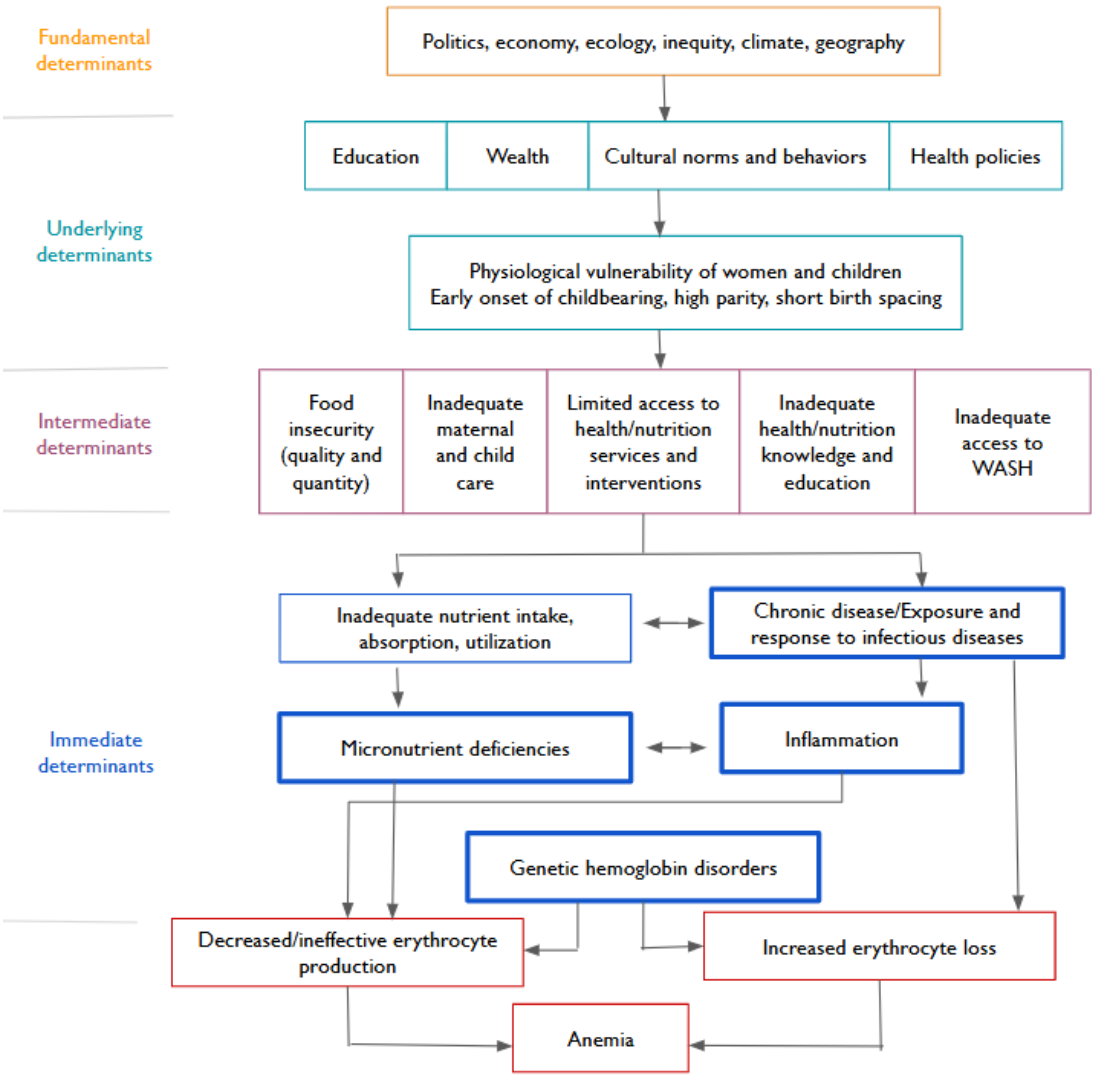
[1] Adjustment for altitude was changed to start at 500 m elevation above sea level compared with the previous 1000 m. The existing classification of public health significance of anaemia prevalence in populations did not change.

cells. Alternatively, anaemia can result from excessive loss of red blood cells due to blood loss, such as from hookworm infections, or their destruction, as seen in malaria. In some cases, both reduced production and increased loss of red blood cells occur simultaneously. By understanding the causes of anaemia, it can serve as a valuable marker for assessing a person's health and identifying potential underlying problems (WHO, 2021).

Anaemia is the consequence of a wide range of causes as well as biological, socioeconomic, and ecological risk factors, which often act concurrently (Hess et al., 2023). Anaemia is frequently classified based on the biological mechanism of causation (e.g., iron deficiency anaemia (IDA), haemolytic anaemia, and anaemia of inflammation (AI)) and/or red blood cell morphology. As **Figure 1** shows, the direct risk factors for anaemia include nutritional deficiencies, disease/infection, and genetic haemoglobin disorders. These determinants (outlined with bold blue borders) are considered primary contributors to anaemia globally. The most widespread and commonly recognized cause of anaemia in children is iron deficiency, which is estimated to contribute to anywhere from about 10 per cent to over 60 per cent of anaemia cases, depending on the context (Chaparro & Suchdev, 2019). Haemoglobinopathies and haemolytic anaemia, neglected tropical diseases, malaria and other infections, inflammation and other nutritional deficiencies all play important roles in anaemia prevalence in children (Yujuan et al., 2024). These direct causes of anaemia are exacerbated by immediate risk factors, underlying risk factors, and fundamental drivers related to broader social inequities.

Anaemia is diagnosed through blood tests. The most common test is a Complete Blood Count (CBC), which measures haemoglobin levels, red blood cell count, and haematocrit. Further tests may include peripheral blood smears to examine the size, shape, and appearance of red blood cells, which can help identify the type of anaemia. Additional diagnostic tools include iron studies, vitamin B12 and folate levels, and markers of inflammation like C-reactive protein or erythrocyte sedimentation rate (Weiss et al., 2019).

The treatment of anaemia depends on its cause. For iron-deficiency anaemia, oral iron supplements and dietary adjustments are commonly recommended to replenish iron stores. If the anaemia is due to vitamin deficiencies, such as B12 or folate deficiency, supplementation or injections are used. In cases of anaemia caused by chronic disease, managing the underlying condition is essential for treatment, and in severe cases, erythropoiesis-stimulating agents or blood transfusions may be necessary. For inherited disorders like sickle cell anaemia or thalassemia, treatments can include medications, blood transfusions, and sometimes bone marrow transplants (Weiss et al., 2019). Addressing anaemia caused by infections, such as malaria or hookworm, requires treating the infection itself in addition to correcting the anaemia (WHO, 2021). In short, effective management of anaemia requires a comprehensive approach tailored to the individual's specific diagnosis and needs.



Source: (Chaparro & Suchdev, 2019).

Figure 1. Conceptual framework for the aetiology of anaemia

Globally, one-fourth of the population, i.e.,1.92 billion people have anaemia, the third leading cause of years with lived disability (YLDs). The global prevalence of anaemia in children under age five years is 43 per cent, but it varies by region and country. Regionally, Africa has the highest prevalence of anaemia (62 per cent) (Gardner, 2023), while the combined prevalence of anaemia across six South and Southeast Asia countries is 57.3 per cent (Sunuwar et al., 2023).

Anaemia remains a significant public health concern in Bangladesh, particularly affecting children and women. The Bangladesh Demographic and Health Survey (BDHS) 2011 reported that 51.3 per cent of children under the age of five were anaemic (National Institute of Population Research and Training (NIPORT) & ICF, 2013). Other national surveys, such as the National Micronutrient Survey (NMS)

2011-12 and 2019-20, reported anaemia prevalence rates of 33.1 per cent and 21.1 per cent, respectively, and iron deficiency rates of 10.7 per cent and 15.1 per cent, respectively among children under five (Naheed, 2022). However, it's important to note that the BDHS surveys after 2011 did not include anaemia testing for children, which limits the ability to make a direct comparison over the years (National Institute of Population Research and Training (NIPORT) & ICF, 2017; National Institute of Population Research and Training (NIPORT) & ICF, 2016, 2024). The decline observed in the NMS suggests a positive trend, but further consistent and comprehensive data would be needed to confirm a sustained national decline in anaemia rates.

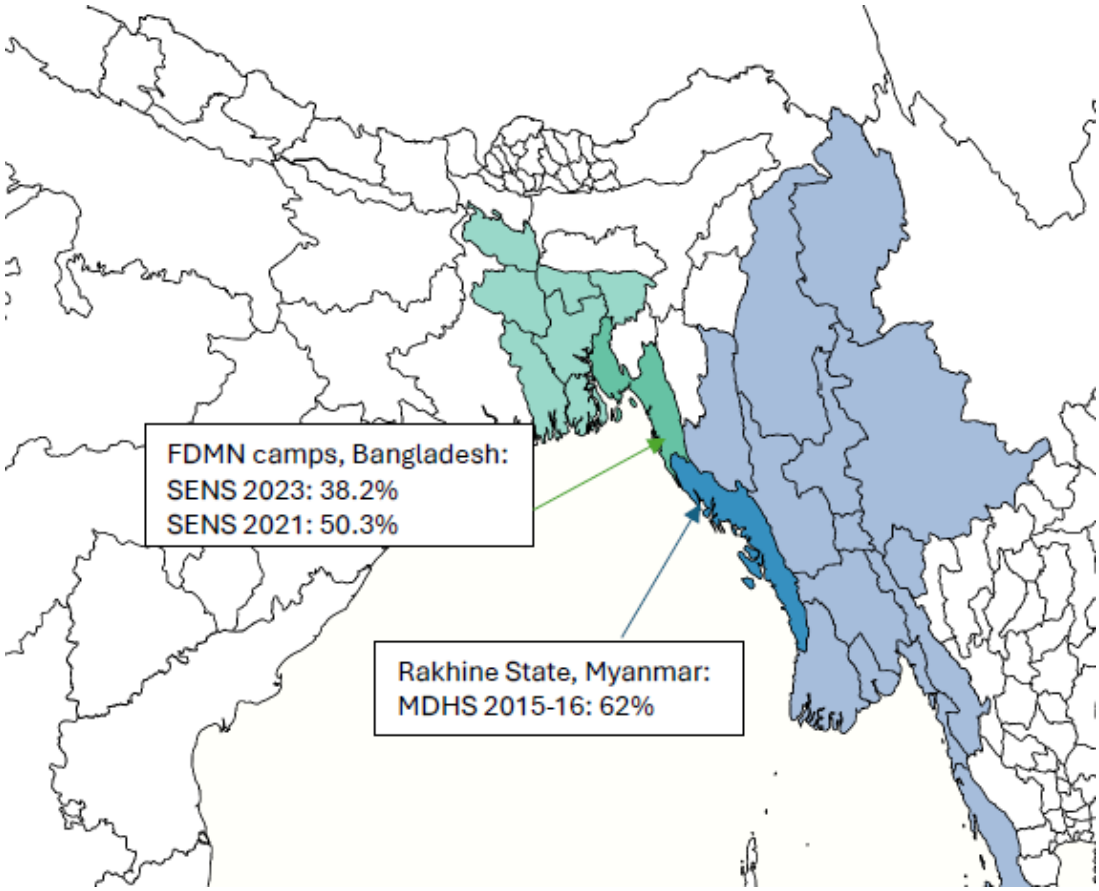


Figure 2. Prevalence of anaemia among children aged 6–59 months in Cox's Bazar Rohingya camps, Bangladesh, and Rakhine State, Myanmar

Anaemia among children under five in FDMN camps has declined from 50 per cent in 2011 to 38.2 per cent in 2023 (UNHCR, 2024b). Despite this improvement, the prevalence remains near the high threshold of 40 per cent, indicating medium public health significance (Teketelew et al., 2024). Children in the FDMN camps were displaced from Myanmar, specifically from the Rakhine state, where the prevalence of anaemia was 62 per cent. However, this information is from two years before the displacement of refugees (Ministry of Health and Sports (MoHS) & ICF, 2017).

In the first survey conducted during the acute phase of the humanitarian response in Rohingya refugee camps (October-November 2017), nearly half of the children (47.9 per cent) had anaemia. The prevalence declined to 32.3 per cent in the second survey (six months later) but rebounded slightly to 39.8 per cent in

the third survey, i.e.,12 months later (Leidman et al., 2020). Overall, it can be inferred that anaemia among Rohingya children remains high.

The Nutrition Sector and its partners, including UNHCR, UNICEF, and WFP, provide comprehensive nutrition services in the FDMN camps as part of their multiyear strategy for 2023-2025. These services include early identification and referral of children with acute malnutrition through a network of community nutrition volunteers (CNVs) and community health and nutrition workers. Prevention services encompass community-based screening, detection, and referral of acutely malnourished children and pregnant and lactating women (PLW), as well as infant and young child feeding (IYCF) education. Micronutrient supplementation involves distributing Vitamin A capsules and deworming children, along with providing iron and folic acid to PLW and adolescent girls. The Blanket Supplementary Feeding Programme (BSFP) and the Targeted Supplementary Feeding Programme (TSFP) address malnutrition prevention and treatment, respectively. Additionally, the Outpatient Therapeutic Programme (OTP) and inpatient treatment for severe acute malnutrition (SAM) are available. Growth monitoring and promotion (GMP), IYCF counselling, and early childhood care and development (ECCD) activities are also provided to support the health and well-being of children in the camps (UNHCR, 2024b).

Despite interventions such as iron-fortified rations (BSFP and TSFP) and high coverage of iron-fortified rations and iron-folic acid (IFA) supplementation for women in FDMN camps, anaemia levels remain high. This suggests gaps in dietary quality, adherence, caregiver knowledge, morbidity profiles, and the ability of the health system to identify and manage underlying causes. In Mega Camps, the prevalence of anaemia is 38.1 per cent among children aged 6-59 months and 56 per cent among children aged 6-23 months. In the Registered Camps, the prevalence of anaemia is 40.1 per cent among children aged 6-59 months and 60 per cent among children aged 6-23 months (UNHCR, 2024b).

The fluctuations in anaemia prevalence over time indicate that, despite efforts to address the issue, the conditions in the camps and the ongoing challenges faced by the displaced population continue to affect the health of these children.

Cox's Bazar hosts one of the largest coordinated nutrition responses globally, bringing together UNICEF, WFP, UNHCR, and NGO partners to deliver an integrated package of preventive and therapeutic services for children and women. The nutrition service landscape in the camps comprises more than 60 facilities providing SAM and MAM treatment, maternal nutrition services, micronutrient supplementation, growth monitoring, and IYCF counselling. Despite substantial progress in service coverage and facility harmonization since 2020, the quality of services continues to vary across camps. Persistent challenges, including high staff turnover, supply chain instability, and fluctuating funding levels, place pressure on the system and contribute to inconsistent follow-up, limited anaemia-focused counselling, and gaps in the early detection and management of iron deficiency among young children.

Consequently, one of the key strategic priorities for the Nutrition Sector for 2023-2025 is to conduct a causal analysis of the high prevalence of anaemia among children under age five. To this end, UNICEF Bangladesh has contracted RISE International Consulting LLC (RISE International) to conduct a causal analysis of anaemia among children under 59 months and provide evidence for a technically appropriate programmatic response, including the design, planning, and implementation of activities. To conduct the

study, RISE International will collaborate with the Institute of Public Health and Nutrition (IPHN) and the Ministry of Health, Government of Bangladesh (GoB), to secure all necessary endorsements.

1.3 Overview of the Study

The complexity of anaemia in emergency settings underscores the need for a robust mixed-methods design. Quantitative biomarker data offer critical insight into biological and nutritional aetiologies, while quantitative and qualitative findings from caregivers and programme stakeholders provide essential context on behavioural norms, health-seeking patterns, intra-household food allocation, supplement acceptability, and operational challenges in service delivery. By integrating these components, the study aims not only to quantify the burden and identify both nutritional and non-nutritional causes, but also to understand why anaemia persists despite substantial investment in nutrition services. This comprehensive design strengthens the ability to identify other contributing factors, deepen the understanding of the diverse and complex drivers of anaemia among children under five in the FDMN camps, and ensure that findings are directly actionable for programme design, service-quality improvement, and policy development.

1.1.1 Study Objectives

The primary objective of this study is to gather comprehensive data on the various causes of anaemia among Rohingya children under five in FDMN camps, with a particular focus on anaemia among children aged 6-59 months.

Specific objectives of the causal analysis include the following:

1. Identify the major causes of anaemia, distinguishing between nutritional and non-nutritional factors, and determine the extent to which these factors contribute to anaemia.
2. Identify key nutritional deficiencies among children with nutritional anaemia and different causes of non-nutritional anaemia.
3. Identify other factors associated with anaemia.

Together, these objectives guide the study's design, data collection, and analysis, and provide the foundation for the evidence-based recommendations presented in later chapters of this report. Ultimately, the results of this study are expected to inform a strategic shift from general nutritional support toward more targeted, anaemia-sensitive interventions tailored to the Rohingya context. By identifying both nutritional and non-nutritional determinants, the study's findings will contribute to the development of evidence-based guidance for improved screening and diagnostic pathways, preventive supplementation strategies, strengthened communication and counselling approaches, and more effective cross-sectoral coordination between health, WASH, and food security actors. Strengthening anaemia-reduction efforts is essential not only for improving child survival, growth, and developmental outcomes but also for building a more resilient and sustainable nutrition response within the broader humanitarian architecture of Cox's Bazar.

CHAPTER 2. METHODOLOGY

This chapter outlines the methodological approach used to conduct the causal analysis of anaemia among children aged 6–59 months in the 33 FDMN camps of Cox's Bazar. A mixed-methods design was employed, combining a population-based quantitative survey with biomarker assessment and qualitative interviews with caregivers and key programme stakeholders. The methodology includes detailed descriptions of the study area and target population, sampling design, data collection procedures, instruments used, fieldwork protocols, ethical considerations, and data quality assurance measures. Together, these components ensure that the study produces robust, representative, and actionable evidence to inform anaemia prevention and treatment strategies in humanitarian settings.

2.1 Study Area and Population

The study was conducted across all 33 Forcibly Displaced Myanmar Nationals (FDMN) camps located in Ukhiya and Teknaf upazilas of Cox's Bazar (CXB) district in Bangladesh. These include the 31 camps that comprise the Kutupalong Mega Camp (MC) complex, which is the largest refugee settlement in the world, as well as the two registered camps (RCs)—Kutupalong RC and Nayapara RC. Together, these camps host more than one million Rohingya refugees who arrived primarily during the 2017 mass displacement from Rakhine State, Myanmar. The camps differ in size, population density, layout, service availability, and accessibility, yet all face significant constraints linked to overcrowding, recurrent hazards, limited infrastructure, and restricted livelihood opportunities.

Within these settings, health and nutrition vulnerabilities remain markedly elevated. The camp environment is characterized by high population density, reliance on humanitarian assistance, recurring disease outbreaks, and seasonal environmental shocks. Nutrition services, delivered through a network of more than 60 facilities supported by UNICEF, WFP, UNHCR, and NGO partners, aim to prevent and manage acute malnutrition among children and women. Despite these interventions, anaemia persists as a major public health concern, particularly among young children.

The target population of this study is children aged 6–59 months residing in the 33 FDMN camps. This age group was selected based on both biological and public health considerations. Most normal-weight, term infants are born with sufficient iron stores to meet their early iron requirements and support haemoglobin synthesis for approximately the first six months of life (Paulley & Duff, 2022). After six months, rapid growth, limited dietary diversity, high infection burdens, and inadequate micronutrient intake substantially increase vulnerability to anaemia. Children 6–59 months are therefore the group most at risk for nutritional anaemia and its developmental consequences.

In addition, anaemia in this age group has been consistently documented as highly prevalent in Cox's Bazar. Recent SENS and SMART surveys report anaemia levels ranging from 38 to 50 percent, underscoring the need for a detailed causal analysis (ENA SMART, 2018; SENS, 2024). Because this age group forms a key public health priority for both national and humanitarian nutrition programmes, understanding anaemia determinants among children aged 6–59 months is essential for designing effective interventions that can be integrated into existing service delivery platforms.

Accordingly, the study's sampling design, field procedures, and biomarker collection strategies were all structured to achieve representative estimates for children 6–59 months across all 33 camps, providing robust evidence for programme planning, policy formulation, and targeted anaemia mitigation strategies.

2.2 Study Design

This study employed a cross-sectional, mixed-methods design to investigate the nutritional and non-nutritional causes of anaemia among children aged 6–59 months residing in the 33 FDMN camps of Cox's Bazar. The design integrates quantitative and qualitative components to generate a comprehensive understanding of the biological, behavioural, environmental, and programmatic factors contributing to anaemia in a complex humanitarian setting.

The quantitative component consisted of a population-based household survey accompanied by venous blood biomarker collection. Within sampled households, data were collected on demographic characteristics, nutritional practices, morbidity history, environmental and WASH factors, and other determinants relevant to anaemia. Biomarker assessment included haemoglobin measurement and laboratory analysis of indicators such as iron status, inflammation markers, and other nutritional parameters. This component provides representative estimates of anaemia prevalence and its underlying biological causes across all 33 camps.

The qualitative component complemented the household survey by capturing lived experiences, perceptions, and contextual drivers that quantitative indicators alone cannot fully explain. Key Informant Interviews (KIIs) were conducted with mothers and caregivers of children aged 6–59 months to understand dietary behaviours, feeding practices, perceptions of anaemia, treatment-seeking patterns, and barriers to prevention and care. Key Stakeholder Interviews (KSIs) were carried out with donors, health workers, programme implementers, and providers of supplementation or fortified products to explore programme delivery, supply chain considerations, coordination mechanisms, and systemic challenges in anaemia management. Together, these qualitative insights deepen understanding of the behavioural, structural, and operational determinants of anaemia.

Using a mixed-methods approach strengthens the causal analysis by enabling triangulation across data sources. Quantitative biomarker findings offer insight into the biological and nutritional pathways of anaemia, while qualitative data provide critical context around household practices, health system constraints, and programme implementation realities. This integrated design ensures that the study not only measures anaemia prevalence and identifies contributing factors, but also explains why anaemia persists despite substantial investments in nutrition services across the camps.

The study design was developed in close consultation with UNICEF and the study steering committee to ensure alignment with programme priorities, global standards, and operational feasibility in the camp environment. This collaborative, mixed-methods approach provides a rigorous foundation for the evidence-based conclusions and recommendations presented in later chapters.

2.3 Sampling Methodology

2.3.1 Quantitative Sampling

A stratified multi-stage cluster sample design was used to obtain a representative sample of Rohingya children aged 6–59 months living in all 33 FDMN camps in Cox's Bazar. The sampling frame for the first stage was constructed from UNHCR block-level population estimates as of 30 November 2024, covering 31 camps in the Kutupalong Mega Camp and the two registered camps (Kutupalong RC and Nayapara RC). The 33 camps were treated as a single analytical domain, with explicit stratification by sub-district (Ukhiya and Teknaf) to improve the precision of overall estimates.

Sample size calculations were based on an anticipated anaemia prevalence of 44.3% among children 6–59 months, a design effect of 2, and a desired relative margin of error of 10% at the 95% confidence level. Allowing for an average household size of 5.0 persons, an estimated 14.7% of the population being children 6–59 months, and a 90% household response rate, the required sample was 1,523 households, expected to yield interviews with approximately 1,006 children aged 6–59 months. For operational reasons and to maintain a fixed number of households per cluster, this translated into 109 clusters, each with 14 households, resulting in a final sample of 1,526 households.

Within each stratum, camp blocks (primary sampling units) were selected using systematic probability proportional to size (PPS) sampling, with the block population as the measure of size. Prior to household selection, a household listing was conducted in each sampled block; very large blocks could be segmented, with one segment then selected at random. From each cluster, 14 households were selected using systematic sampling, and within each sampled household all eligible children aged 6–59 months were included (take-all approach). A reserve sample of 10 additional clusters was also selected proportionally across strata to replace any sampled clusters that might become inaccessible during fieldwork.

More detailed information on the sampling frame, sample size determination, stratification, allocation procedures, and multi-stage selection steps is provided in **Annex B. Sampling Design and Sample Size Calculation.**

Given both the analytical requirements of the anaemia study and the financial constraints during survey planning, the quantitative sampling approach was designed to balance statistical precision, operational feasibility, and cost efficiency. The original sample design called for 1,523 households, calculated to achieve an approximate 10% Relative Margin of Error (RME) for key anaemia indicators across all 33 FDMN camps. To evaluate the implications of reducing the sample under budget limitations, the team conducted a simulation exercise that tested successive 5% reductions in sample size. Accordingly, 1,400 households was identified as the minimum technically acceptable threshold.

Subsequently, the household sampling strategy was tailored to the study's focus on children aged 6–59 months. During the household listing phase, teams created a complete list of all households containing at least one eligible child. These "eligible households" formed the sampling frame, allowing the survey to avoid visiting households without children in the target age group. This approach improved operational efficiency, reduced field costs, and minimized demographic drift, as data collection followed immediately after listing. Quality-control safeguards during listing further supported the assumption that eligibility information remained accurate during interviewing.

The number of households selected per cluster was determined using parameters reflecting expected blood-draw success, usable sample rates, average number of eligible children per household, and

anticipated response rates. Using these inputs, the required number of households per cluster ($n_{(c)}$) was calculated using the following formula:

$$n_c = \frac{I_c}{(P_o \times P_u \times C_{hh} \times P_{hh} \times R_{hh})}$$

Based on these parameters, the number of households required per cluster was 10 households. With 102 clusters sampled, this yields the necessary ~925 completed child interviews for the survey.

Overall, the quantitative sampling approach reflects a careful balance between methodological rigor and real-world operational constraints, ensuring that the final sample remains both feasible and statistically robust.

2.3.2 Qualitative Sampling

The qualitative component of the study was designed to complement the quantitative findings by capturing the perspectives, experiences, and contextual realities that shaped anaemia-related behaviours and service uptake among the Rohingya population. Given the complexity of nutritional and non-nutritional drivers of anaemia—including dietary norms, caregiving practices, illness management, supplement adherence, and programme accessibility—a purposive sampling strategy was adopted. This approach allowed for the deliberate selection of information-rich participants whose insights were essential for understanding the multidimensional nature of anaemia in the camps. Purposive sampling was particularly appropriate in the humanitarian context of Cox's Bazar, where heterogeneity in programme exposure, demographic characteristics, and access to services required targeted selection to ensure meaningful representation.

Two categories of qualitative interviews were included: KIIs with caregivers and KSIs with service providers, donors, and programme actors. Together, these groups offered a holistic understanding of both community-level behaviours and system-level constraints within the nutrition and health service landscape.

Key Informant Interviews. A total of 18 KIIs were conducted with mothers of children under five, as they were the primary caregivers responsible for feeding practices, health-seeking behaviour, and supplement administration. KIIs were distributed proportionally across the two strata to reflect population size and operational diversity: 14 interviews in Ukhiya—randomly selected from its 26 camps—and 4 interviews in Teknaf, randomly selected from its seven camps. To ensure representation of both Registered Camps (RCs), sampling deliberately included at least one KII each in Kutupalong RC and Nayapara RC. This stratified purposive approach ensured that KIIs captured variability in caregiving environments, service access, and dietary practices across different camp types and geographies.

Key Stakeholder Interviews. To understand system-level bottlenecks, programme constraints, and cross-sectoral coordination challenges, nine KSIs were undertaken with institutional actors engaged in anaemia prevention and treatment. These included three donors involved in funding nutrition and health interventions, three providers of supplementation or iron-fortified products (including programme managers overseeing distribution and adherence monitoring), and three antenatal care (ANC) or health-facility-based workers responsible for screening, counselling, and case management. These stakeholders

provided critical insights into supply chain conditions, programme design, operational barriers, and opportunities to strengthen anaemia-specific interventions.

The qualitative sample design ensured that the study captured both demand-side perspectives (caregiver behaviours, knowledge, and constraints) and supply-side insights (programme design, resource availability, and coordination). This dual lens enabled identification of gaps between service provision and community needs and helped explain quantitative findings related to dietary inadequacy, supplement uptake, operational challenges, and persistent anaemia trends. Details on the content of qualitative tools and the sampling distribution are summarised in **Table 2.**

Table 2. Interview content and sampling strategy for qualitative interviews

Category	Respondents	Sampling Approach
Mothers/caregivers of children under five	18 KIIs across 33 camps (including both Ukhiya and Teknaf, plus Kutupalong RC & Nayapara RC)	Proportional allocation: 14 KIIs in Ukhiya (randomly selected from 26 camps); 4 KIIs in Teknaf (randomly selected from 7 camps). Ensured inclusion of Kutupalong RC and Nayapara RC.
Donors	Officials from four major UN agencies involved in nutrition, health, and humanitarian programming	4
Providers of supplementation/iron fortified products	Staff responsible for delivering supplementation and fortified food programs	3
ANC & Health System Actors (PLW, Supervisors)	Pregnant/lactating women receiving ANC services; site supervisors and nutrition supervisors overseeing maternal–child health activities	3

2.4 Questionnaire and Instruments

The study tools were developed through a collaborative and iterative process involving the anaemia study steering committee, UNICEF, sectoral partners, and technical experts from RISE International Consulting. The quantitative questionnaire, qualitative interview guides, and associated documentation were finalised through multiple rounds of technical review to ensure scientific rigour, contextual relevance, and alignment with global standards for anaemia assessment. Standardised documentation was prepared to ensure that all partners maintained a consistent understanding of procedures, indicators, and data collection protocols.

2.4.1 Survey Questionnaire

The quantitative questionnaire was designed to capture both nutritional and non-nutritional determinants of anaemia among children aged 6–59 months. It consisted of structured modules that collected household, caregiver, and child-level information aligned with the study's research objectives. The final questionnaire incorporated elements from SMART, SENS, DHS, and WHO anaemia assessment

guidance, and was translated into Bangla. The questionnaire was structured to answer the study's core research questions:

- What was the prevalence of anaemia among children aged 6–59 months in the FDMN camps?
  Measured via venous blood biomarkers and integrated with demographic and morbidity data.
- What were the primary causes of anaemia—nutritional, non-nutritional, or mixed?
  Assessed using indicators of iron deficiency, vitamin B12 and folate deficiency, inflammation, infection, and genetic conditions (e.g., thalassemia screening where applicable).
- What was the relative contribution of nutritional versus non-nutritional drivers?
- What were the key micronutrient deficiencies (iron, vitamin B12, folate) among children with nutritional anaemia?
  Informed by biomarker panels processed through laboratory analysis.
- What were the potential non-nutritional causes of anaemia
  Informed by infection- and inflammation-related anaemia and illness-related complications.
- What household, environmental, and behavioural factors were associated with anaemia?
  Including IYCF practices, health-seeking behaviour, morbidity history, WASH exposures, mosquito net usage, and dietary diversity.

The survey questionnaire consisted of six structured modules that was designed to capture the nutritional, non-nutritional, environmental, and health-related determinants of anaemia among children aged 6–59 months (See **Annex G**).

Module 1: Household roster and demographics captured a complete roster of all household members, including age, sex, relationship to the household head, and educational status. This roster allowed enumerators to identify eligible children aged 6–59 months and provided a demographic profile essential for analysing household composition. The module also documented basic socioeconomic characteristics, including household arrival to the camps.

Module 2: Dwelling characteristics gathered information on the physical structure of the shelter, including wall, roof, and floor materials, as well as key WASH indicators such as the main drinking water source, sanitation facilities, and waste disposal practices. Household assets and selected environmental conditions were also recorded to establish a socioeconomic and exposure profile. These data helped contextualise environmental risk factors such as crowding, contamination, and poor hygiene that may contribute to infection-related or inflammation-mediated anaemia among young children.

Module 3: Household food consumption (FCS and FCS-N) assessed household-level dietary patterns through the Food Consumption Score (FCS) and the Food Consumption Score–Nutrition (FCS-N). Caregivers were asked about the frequency of consumption of standard food groups over the previous seven days, enabling calculation of both caloric adequacy and nutrient-dense food intake. This module provided essential information on household diet quality, diversity, and potential nutrient gaps that may contribute to iron deficiency.

Module 4: Child health and mosquito net use collected data on morbidity and illness symptoms among children aged 6–59 months, including recent episodes of diarrhoea, fever, respiratory illness, and other

health conditions. Caregivers were also asked about mosquito net ownership and use the previous night to capture malaria-related anaemia risk, even though malaria prevalence in CXB is low. The module enabled assessment of infection burdens, care-seeking patterns, and exposure to conditions that may drive non-nutritional anaemia or exacerbate nutritional deficiencies.

Module 5: Child nutrition and supplementary food programme participation documented the child's enrolment in targeted food distribution or supplementary feeding programmes (e.g., BSFP, TSFP, OTP) and use of specialised nutritious foods. Questions assessed frequency of consumption of these products, reasons for non-participation and sharing practices within the household. This module allowed the study to examine linkages between programme utilisation, dietary adequacy, and anaemia outcomes.

Module 6: Venous blood sample collection recorded information related to biomarker collection. Enumerators and lab technicians documented eligibility, consent for the venous blood draw, and whether the sample was successfully collected. Laboratory identifiers for lavender-top and serum tubes were noted to support tracking of samples to the laboratories in Dhaka. This module formed the biological foundation of the study's mixed-methods design.

2.4.2 Qualitative Instruments and Tools

The qualitative instruments for this study were developed to complement the quantitative questionnaire by generating deeper insight into the behavioural, social, and operational factors influencing anaemia among children aged 6–59 months in the Rohingya camps (See **Annex F**). All tools were designed collaboratively with UNICEF and RISE International. Draft guides were reviewed, refined, and finalised through a structured consultative process to ensure that they reflected the study objectives, were contextually appropriate, and adhered to ethical and humanitarian research standards. The finalised tools included semi-structured interview guides for both KIIs with caregivers and KSIs with institutional actors. These guides were translated into Bangla where needed, and back-translated for accuracy and standardisation.

The KII guide was designed to collect rich, narrative data from mothers and primary caregivers of children aged 6–59 months. It included open-ended questions exploring caregivers' knowledge and perceptions of anaemia, dietary practices within the household, barriers to providing nutrient-rich foods, experiences accessing supplementation programmes, reasons for interrupted adherence to specialised nutritious foods, and patterns of health-seeking during child illness. Questions also explored intra-household food allocation, cultural norms around feeding young children, environmental pressures (e.g., fuel scarcity, mobility restrictions), and experiences interacting with nutrition and health service providers. The semi-structured design allowed interviewers to follow emerging themes while ensuring consistency across respondents.

The KSI guide was tailored for programme stakeholders directly involved in anaemia mitigation, including donors, providers of supplementation and fortified products (e.g., BSFP/TSFP partners), and ANC or health facility staff. The tool covered system-level themes such as funding flows, supply chain reliability for iron-containing commodities, programme implementation challenges, adherence monitoring mechanisms, screening practices, and coordination between health, nutrition, and WASH sectors. Stakeholders were also asked about operational bottlenecks, staffing and capacity constraints, outreach strategies, community engagement efforts, and perceived gaps in the current anaemia response. This tool

was essential for understanding structural and programmatic issues that shape—as well as constrain—the effectiveness of anaemia interventions.

Across both KIIs and KSIs, all qualitative instruments included structured probes to ensure coverage of key analytical areas: perceptions of child nutrition; awareness of anaemia symptoms and causes; experience with health and nutrition services; barriers to utilisation; and recommendations for improvement. The tools also included sections to capture contextual factors such as seasonality, food availability, household workload, decision-making dynamics, and environmental constraints within the camps. Interviewers were trained extensively on these instruments to ensure consistent delivery, ethical engagement, and accurate capture of participant narratives.

Together, the qualitative tools provided a robust framework for exploring both community-level experiences and system-level constraints. Their design ensured alignment with the study's overarching objectives to understand why anaemia persists, how families navigate feeding and care practices, and where programme and service gaps continue to undermine anaemia prevention and treatment in the Rohingya response.

2.4.3 Supporting Documentation

To support consistent implementation, a comprehensive set of field materials, household listing forms, assignment sheets, informed consent statements, and standard operating procedures (SOPs) for venous blood collection, transfer and storage were developed in English. These materials standardised data collection processes, ensured ethical compliance, and provided guidance for quality assurance throughout fieldwork.

2.4.4 Programming for Electronic Data Capture

The survey used a fully electronic data collection system, relying on computer-assisted personal interviewing conducted on handheld tablets provided by UNICEF. Following finalisation of the questionnaire, the tool was translated from English into Bangla and programmed into an Open Data Kit (ODK) application hosted on the Kobo Toolbox platform. RISE International's local partner, Mitra and Associates developed the ODK programme, configured the Kobo Toolbox server, and ensured that all skip patterns, validation checks, and data fields reflected the final structure of the survey instruments.

Extensive testing of the electronic questionnaire was undertaken prior to field deployment. This included functionality checks, verification of question routing, assessment of range and consistency checks, and simulation of full interviews to ensure smooth data flow. Feedback from RISE International and UNICEF was incorporated iteratively, resulting in refinements to both the content and the technical implementation of the instrument. The electronic tools were further validated during the pretest, which assessed the clarity of question wording, system usability, and the reliability of digital data capture.

Overall, the ODK-based system ensured high data quality, minimized interviewer error, and enabled real-time monitoring of field progress.

2.4.5 Pretesting of Survey Questionnaire

Prior to full-scale data collection, extensive preparatory work was undertaken to adapt, refine, and pretest all data collection instruments. The structured household questionnaire, initially developed in English, was translated into Bangla and programmed into tablets using the Open Data Kit (ODK) platform to

ensure seamless digital administration in the field. This phase also included the development and translation of qualitative interview guides, consent scripts, and biomarker collection forms.

A comprehensive pretest was conducted outside the designated survey clusters to safeguard sample integrity while replicating real operational conditions. The pretest involved administering the draft questionnaire to at least 20 households representing the key respondent categories relevant to the study. These households were selected from FDMN camp settings but were not included in the final sample. The objective was to assess the clarity, cultural appropriateness, sequencing, and interpretability of questions; evaluate skip patterns and digital logic; and test the reliability of data capture processes. Interviewers recorded real-time challenges and respondent feedback, and all findings were systematically reviewed. Necessary revisions to question wording, skip structures, and device programming were made in close consultation with UNICEF and RISE International.

The pretest was implemented by a dedicated team consisting of two female interviewers, two male interviewers, and one trained health technician responsible for venous blood collection procedures. A field supervisor provided continuous oversight to ensure adherence to ethical standards, consent processes, and operational protocols. The pretesting phase spanned seven days: four days of in-house training, two days of supervised field practice, and one day dedicated to review and debriefing. This process enabled the team to identify operational inefficiencies, refine interview pacing, address phrasing or translation issues, and confirm the feasibility of data collection protocols under real-world conditions.

Overall, the pretesting process played a critical role in validating the survey tools, identifying logistical constraints, and strengthening data collection protocols. The refinements made during this phase ensured that the final instruments were contextually appropriate, operationally feasible, and capable of generating high-quality data for the anaemia causal analysis.

2.4.6 Ethical Approval

All field activities were conducted only after the study obtained formal ethical approval from the Bangladesh Medical Research Council (BMRC). Mitra and Associates, on behalf of RISE International, prepared and submitted the full ethics application, including the protocol, survey instruments, qualitative guides, informed consent scripts, and data protection procedures in Bangla and English. The BMRC approval confirmed that the study met national and international standards for research involving human participants, particularly vulnerable populations such as refugee children. The research team adhered strictly to the approved protocol.

2.4.7 Recruitment of Field Staff

The recruitment of field personnel, including listers, listing supervisors, quality control officers, household survey supervisors, female interviewers, and health technicians, was carried out by Mitra and Associates using a structured, multi-stage process. While the direct hiring and training of staff were managed by Mitra, the consortium provided oversight to ensure that recruitment adhered to pre-established standards and reflected best practices for large-scale nutrition and biomarker surveys.

Mitra drew on its existing pool of experienced quality control officers who had previously demonstrated strong technical skills and professionalism. To supplement this pool, additional personnel were recruited through public advertisements placed in national daily newspapers. Applicants were assessed based on

maturity, communication skills, educational background, and their ability to stay in the field for approximately one month of continuous work. The minimum educational qualification for interviewers, supervisors, and listers was a bachelor's degree from a recognized university, though this requirement was occasionally relaxed for candidates with extensive field experience. Health technicians were required to have completed a three-year Medical Assistant Training Course (MATC) from an accredited institution to ensure safe and accurate venous blood collection.

Recruitment occurred in two phases. The first phase focused on hiring listers and quality control officers for the household listing operation. The second phase involved recruiting the main data collection teams, supervisors, interviewers, and additional quality control officers, to conduct household interviews and venous blood collection. This phased approach ensured that experienced and adequately prepared personnel were available for each stage of the survey.

CHAPTER 3. TRAINING AND DATA COLLECTION

3.1 Training of Field Staff

A comprehensive series of training programmes was implemented to ensure that all field personnel were fully equipped to carry out the survey with technical accuracy, ethical integrity, and contextual sensitivity. Four major training programmes were conducted: household listing training, enumerator training, health technician (biomarker) training, and qualitative researcher training. These trainings were coordinated by Mitra and Associates with oversight and technical contributions from UNICEF and remote participation from RISE International. The combined training approach ensured that every category of field staff—listers, supervisors, interviewers, moderators, quality control officers, and health technicians—developed the competencies needed to navigate the operational complexities of data collection in the FDMN camps.

3.1.1 Listing Training

The household listing training was carried out on 17–18 June 2025 in Cox's Bazar and brought together 32 UNICEF volunteers who had been selected for the listing operation. Mitra and Associates organised and facilitated the two-day programme, which combined one full day of classroom instruction with a half-day of supervised field practice and a half-day debrief. Trainers from Mitra, with support from UNICEF staff, introduced participants to the objectives of the anaemia study, the sampling design, and the central role of listing in ensuring the accuracy of cluster-level sampling. Trainees were taught how to navigate the selected enumeration areas, confirm geographical boundaries, produce detailed sketch maps, and complete the household listing forms in accordance with formats prescribed by RISE International. The sessions also covered interviewing techniques needed to identify all children under five in each household and to accurately record ages, dates of birth, and sex. During the field practice exercise in nearby segments of the camps, volunteers applied these skills under supervision, mapping and listing households and documenting eligible children. This practical component allowed for the correction of errors, refinement of instructions, and endorsement of best practices for the main listing operation.

3.1.2 Enumerator Training

Survey data collection training for enumerators took place over seven days from 22–28 June 2025 in Cox's Bazar. The programme was designed to provide interviewers with the technical, ethical, and operational skills required to administer the questionnaire and manage household interactions in the camps. The training schedule included three days of intensive classroom sessions, two days of supervised field practice, and a final day of debriefing and evaluation. The training curriculum included modules on survey methodology, ethical research conduct, informed consent, and interviewing techniques. Enumerators were trained to administer all modules of the questionnaire, including the household roster, dwelling characteristics, food consumption, child health, nutrition programme enrolment, and biomarker procedures in collaboration with health technicians. Sessions emphasised rapport-building, cultural sensitivity, non-leading questioning, child-safeguarding principles, and correct navigation of skip patterns and data validation checks on the ODK platform.

Training methods included lectures, group discussions, classroom exercises, mock interviews, and practice with tablets to ensure mastery of digital data collection. Field practice sessions allowed trainees to conduct real interviews in non-sample areas, observed closely by trainers from Mitra and UNICEF.

Daily feedback sessions supported continuous refinement of interviewer skills, questionnaire flow, and error detection. At the end of the programme, participants completed a competency assessment. Performance determined their deployment roles: top scorers were appointed as Quality Control Officers, followed by supervisors and interviewers. Trainees who did not meet the minimum competency threshold were not deployed. Following questionnaire refinements recommended by UNICEF, an additional field practice took place on 5 July 2025, followed by a debrief on 6 July, ensuring that enumerators were fully prepared before the launch of main data collection.

3.1.3 Health Technician Training

A dedicated three-day biomarker training was conducted from 24–26 June 2025 for health technicians responsible for venous blood collection and the handling of biological samples. The training combined a full day of classroom instruction with two days of hands-on field practice. Sessions were facilitated jointly by international and national experts and included both remote instruction on global best practices, biomarker protocols, and ethical considerations, and in-person demonstrations and practical exercises. The curriculum covered venous blood draw procedures in young children, correct identification of veins, maintaining a calm child-friendly environment, biosafety and infection control, universal health precautions, avoidance of needle-stick injuries, and procedures for sample processing, labelling, and maintaining the cold chain. Health technicians practiced sample collection using actual equipment, piloted field workflows with enumerators, and received real-time feedback during supervised field exercises in camp settings. The debriefing session addressed challenges encountered during practice, reinforced technical accuracy, and validated the readiness of technicians to collect high-quality biomarker data in alignment with WHO (2024) recommendations.

3.1.4 Qualitative Training

Prior to qualitative data collection, a two-day training programme was organised to prepare the qualitative research team for KII and KSI interviews. The programme combined conceptual instruction with mock interviews and was facilitated by experts from RISE International and Mitra's. Training sessions focused on the principles of qualitative inquiry, including building trust, asking open-ended and probing questions, maintaining neutrality, managing sensitive conversations, and documenting responses thoroughly. Special attention was given to ethical considerations, confidentiality, and cultural sensitivity in engaging mothers of young children, donors, health workers, and programme staff. Through structured role-play, trainees practiced interviewing techniques, received feedback on probing and narrative capture, and refined their interviewing flow. By the end of the training, the team demonstrated the skills needed to conduct respectful and in-depth qualitative interviews aligned with the objectives of the study.

All study team members, including enumerators, supervisors, field technicians, and laboratory personnel, underwent comprehensive human subjects research training prior to deployment. This training covered a brief history of human subject protections, the core elements of informed consent, and strict confidentiality requirements, with particular emphasis on safeguarding vulnerable populations such as young children. Building on these foundations, UNICEF provided specialised sessions on nutrition-specific ethics, child protection principles, and appropriate communication strategies for engaging caregivers in the FDMN camps. Health technicians additionally received instruction on ethical protocols related to venous blood collection, including explaining risks, ensuring voluntary participation, and maintaining the dignity and comfort of both children and caregivers. Collectively, these trainings ensured

that all field staff were fully prepared to uphold the rights, welfare, and safety of participants throughout the data collection period.

3.2 Data Collection

Data collection for the anaemia study combined several sequential components: supervised field practice, household listing and mapping, construction of the sampling frame, quantitative household and child interviews, qualitative interviews, and venous blood collection with subsequent laboratory processing. All activities were implemented under close supervision by Mitra and Associates, with technical oversight from UNICEF and RISE International.

3.2.1 Field Practice

Before launching full-scale data collection, supervised field practice sessions were conducted on 25 and 26 June 2025 in two selected camps in Ukhiya: Hakim Para (Camp 14) and Jamtoli (Camp 15). These exercises were designed to give enumerators and health technicians first-hand experience in implementing the full survey workflow, including household listing, questionnaire administration, and venous blood collection under real camp conditions. Four designated clusters (100, 102, 103 and 104) were selected to reflect typical camp layouts and operational challenges.

Field staff were organised into two complete teams, each comprising one supervisor, five to six interviewers, one health technician, and one blood carrier, with a laboratory in-charge overseeing sample handling. A monitoring team—including a medical doctor, a microbiologist, and three senior field monitoring officers—provided technical oversight and ensured adherence to ethical and biomedical protocols. Across the two days, the teams completed interviews in 44 households and collected 36 venous blood samples from eligible children. The field practice strengthened skills in navigation of camp environments, rapport-building with caregivers, management of refusals or child distress, and coordination between interviewers and health staff. Lessons from these exercises informed minor adjustments to logistics and reinforced readiness for the main survey.

3.2.2 Household Listing and Mapping

The household listing and mapping operations were carried out from 19–30 June 2025 and covered 102 clusters across Nayapara, Kutupalong, and other selected camps. The primary objective of this phase was to generate a reliable and up-to-date sampling frame of households with children under five years of age, which would form the basis for subsequent selection of survey households and children for anaemia testing.

Under the supervision of Mitra and Associates, trained UNICEF volunteers visited every household in the selected clusters and conducted a complete census of all children aged five years or younger. For each household, the name of the household head and the age, sex, and date of birth of all under-five children were recorded. At the same time, sketch maps were prepared to capture the physical layout of each cluster, including roads, paths, landmarks, and the location of dwellings. This dual process—census listing and mapping—created a detailed operational blueprint for field teams and a robust sampling frame for the study.

Households identified as having at least one child under five were then flagged as “eligible households.” From this subset, those with children aged 6–59 months formed the core target population for venous

blood collection. The listing operation took longer than initially anticipated due to population mobility and the need to cover all structures in each cluster, but strong supervision ensured completeness and internal consistency of the listing database.

Quality assurance was a central feature of the listing process. Listing Quality Control Officers (QCs) planned and supervised the work of listers, conducted random spot checks to confirm that visits had actually occurred, independently re-listed segments for cross-validation, and revisited a sample of listed households to verify recorded information (e.g., ages and dates of birth). When errors or omissions were detected, QCs implemented corrective measures on the spot and, where necessary, reported serious issues to UNICEF to preserve data integrity. This rigorous system resulted in a high-quality sampling frame for the survey.

3.2.2.1 Construction of the Sampling Frame and Selection of Households and Children

The listing exercise provided an ordered list of households for each sampled cluster to serve as a household sampling frame. Using an equal probability variant of systematic sampling (fractional interval systematic sampling), the study randomly selected the households to conduct interviews for the survey in each sampled cluster.

Once household listing was completed for all 102 clusters, the information was consolidated into a master listing database. Within each cluster, the list of households with under-five children was organised into an "under-5 sub-frame." From this, households with at least one child aged 6–59 months were identified as eligible for the anaemia survey. This eligibility-based sub-frame was used to select survey households, ensuring that all sampled households contained at least one child in the target age group.

Within each cluster, the 10 households were selected using fractional interval systematic sampling from the complete list of "under-5 households." Households were assigned serial numbers in listing order, a random start was generated, and sample points were calculated at fixed intervals. Each sample point was then rounded up to the nearest whole number, producing a self-weighting, statistically rigorous sample. For example, in a cluster with 59 under-5 households, sample points generated from a random start of 2.2 and an interval of 5.9 yielded selected households with serial numbers 3, 9, 14, 20, …, 50, 56. This method ensures that households are well distributed across the cluster and that each eligible household has a known probability of selection.

Within sampled households, all children aged 6–59 months were eligible for interview and venous blood collection. Interviewers confirmed the presence and age of each child with the caregiver, and, where consent was obtained, these children were included in both the questionnaire modules relevant to child health and nutrition and in blood sampling. If a child was absent, ill, or if the caregiver declined participation, the non-participation and its reasons were recorded systematically.

3.2.3 Quantitative Survey Data Collection

Household and child data collection took place between 7 July and 2 August 2025 across the 102 clusters. In accordance with the sample design, 10 households per cluster were scheduled for interview, yielding a total of 1,020 assigned households. Of these, 794 household interviews were completed and 226 were incomplete, resulting in an overall household response rate of approximately 78 per cent. The main

reasons for non-response included repeated absence of household members at the time of visit, outright refusals, and other logistical constraints.

Among the surveyed households, 1,136 children aged 6–59 months were identified. Interviews were completed for 933 children, while 203 remained incomplete, corresponding to a child-level response rate of 82 per cent. The data collection teams consisted of 10 trained female enumerators, supported by two supervisors and one female Quality Control Officer, with two senior officials overseeing the entire field operation to maintain quality standards.

All interviews were conducted face-to-face using the structured questionnaire programmed into tablets via the ODK platform. Enumerators obtained informed consent, administered the appropriate modules to mothers or primary caregivers, and coordinated with health technicians for blood collection when consent for phlebotomy was provided.

Informed consent was carefully adapted to the local context. Given the low literacy levels among camp residents, the research team relied on oral consent procedures rather than written forms. Enumerators introduced themselves, explained the purpose and voluntary nature of the study, and clarified the rights of participants, including the right to withdraw at any stage without consequence. The content of the consent form, including collection of venous blood draw and any associated risks was read aloud in Bangla, and participants were encouraged to ask questions.

Supervisors conducted daily briefings, reviewed completed questionnaires, monitored adherence to skip patterns and consent procedures, and provided immediate feedback to address any systematic errors. Regular quality checks ensured consistency, completeness, and adherence to the survey protocol.

Table 3 presents a summary of data collection methods, target respondent and collection site.

Table 3. Data collection methods, respondents, and sites of data collection

Collection	Methods	Survey Modules/Qualitative topics	Respondent	Collection Site
Survey	Survey questionnaire	Household roster and demographics; dwelling and WASH characteristics; food consumption (FCS and FCS-N); child morbidity and use of mosquito nets; child nutrition and enrolment in supplementary food programmes.	Mothers/caregivers of children under-five	Household
Other Biomarkers	Venous blood sample	Collected in red top (serum) and purple top tubes (EDTA) for haemoglobin and other anaemia-related biomarkers.	Children 6-59 months	Household (transported to field and central lab for testing)
Key Informant Interviews	Qualitative tool and guide	Caregivers' knowledge and perceptions of anaemia; dietary practices and household food access; use of and experience with	Mothers/caregivers of children under-five	Household

Collection	Methods	Survey Modules/Qualitative topics	Respondent	Collection Site
		supplementary foods and nutrition services; barriers and facilitators to preventing and treating anaemia; experience of care.		
Key Stakeholder Interviews	Qualitative tool and guide	For donors: funding priorities for anaemia and nutrition programming, perceived programme impact, and key challenges or constraints to sustaining or scaling support. For all respondents (donors, service providers, ANC/health workers): organisation of anaemia screening and treatment services; delivery and coverage of supplementation/iron-fortified products; collaboration and coordination between agencies; data use for programme adaptation; and future plans or strategies for anaemia programming.	Donors Providers of supplementation/iron fortified products ANC/health workers in health centres	Stakeholder location (arranged prior to the interviews)

3.2.4 Qualitative Data Collection

To complement the quantitative survey with in-depth contextual understanding, qualitative data collection was carried out between 13 and 21 July 2025. During this period, 18 KIIs were conducted with mothers of children under five years across a diverse set of camps, including multiple camps in the Kutupalong Mega Camps (e.g., Camps 1E, 2E, 3, 4 Extension, 6, 7, 8W, 11, 13, 15, 17, 18, 20, 22, 25 and 27) as well as Kutupalong RC and Nayapara RC. These interviews explored caregivers' experiences with child feeding, dietary diversity, perceptions of anaemia, barriers to accessing nutrition and health services, and responses to supplementation or treatment.

In parallel, 10 Key Stakeholder Interviews (KSIs) were conducted with donors and programme actors. Donor respondents included representatives from UNICEF, UNHCR, WFP, and WHO, while service providers comprised staff from SHED, Gonoshasthaya Kendra (GK), and Concern Worldwide, along with pregnant and lactating women (PLW) and nutrition supervisors from programme sites. These interviews provided insights into programme design, funding priorities, supply-chain constraints, service delivery challenges, and coordination across agencies.

All qualitative interviews were carried out by trained staff who had previously participated in a dedicated qualitative training that emphasised open-ended interviewing, ethical conduct, and cultural sensitivity. Interviews were conducted in Bangla, audio-recorded with consent, and supplemented by detailed field notes. Recordings were subsequently transcribed in Bangla and translated into English, with all personal identifiers removed. The complete set of transcripts was submitted to RISE International for thematic analysis.

3.2.5 Blood Collection and Transfer of Samples to Field Laboratory

This section describes the standardized procedures used for the collection, labelling, storage, transportation, and laboratory processing of venous blood samples from children aged 6–59 months. Developed jointly by Mitra and Associates, UNICEF, and partner institutions, and refined through field practice in the FDMN camps of Cox's Bazar, these procedures were designed to protect the safety and dignity of participants and field staff, maintain sample integrity, and ensure reliable laboratory results under demanding humanitarian conditions. The blood collection workflow was structured to guarantee systematic identification, full traceability, and continuous cold-chain maintenance. During the household survey, interviewers identified eligible children, obtained informed consent for both the interview and venous blood draw, and then issued a token bearing each child's unique ID. Caregivers were subsequently instructed to bring the child, together with the token, to a designated collection point, either UNICEF's Integrated Nutrition Centre (Suji Khana) or, in some cases, the residence of the local block leader (Majhi), where trained health technicians carried out venous blood collection according to the standardized protocol.

Before fieldwork, the two field supervisors conducted a comprehensive inspection of all blood-collection supplies to ensure completeness, organization, and compliance with biosafety standards. This included verifying the availability of all blood collection tools (butterfly needles, Vacutainer holders, syringes, red- and purple-top tubes), personal protective equipment (gloves, masks, face shields, sanitizer, gowns), sanitation materials (alcohol swabs, chlorhexidine wipes, gauze, cotton, tourniquets, rexine sheets, bandages, kidney trays, sharps containers), labelling and documentation supplies (waterproof labels, barcodes, markers, tracking sheets), and all cold-chain equipment (insulated cool boxes, ice packs, thermometers, and back-up storage). Supervisors also confirmed that biohazard waste containers and disposal bags were in place to ensure safe handling and disposal of all materials during the blood collection process.

3.2.5.1 Venous blood collection

At the collection sites, health technicians trained in paediatric phlebotomy conducted the blood draws while working closely with caregivers to minimise distress and uphold ethical standards. The process began when caregivers arrived with eligible children and presented the identification token issued during the household interview, which the technician used to label both the red-top and purple-top tubes for full traceability. After confirming eligibility and obtaining specific consent for venous blood collection, technicians explained the procedure in simple, reassuring terms to the caregiver and, when possible, to the child. Children were seated securely—usually on the caregiver's lap—while the technician arranged all necessary supplies within easy reach, including fitting the butterfly needle into the Vacutainer holder and placing the collection tube loosely in position until venous access was achieved.

The venous blood draw followed a standardized sequence grounded in universal precautions and paediatric phlebotomy protocols. First, each child's identity was verified using the token, and the child was seated securely on the caregiver's lap while the technician provided reassurance and monitored comfort throughout the procedure. The technician sanitized their hands, donned a fresh pair of gloves, and renewed all PPE and hand hygiene between each draw. Suitable veins (antecubital fossa or on the back of the hand) were identified through palpation, often aided by a tourniquet and, when necessary, a vein-

finder device to improve visibility in young children. The puncture site was prepared using 70% alcohol swabs in an outward circular motion; if re-palpation was needed, the site was re-cleaned and dried with sterile gauze before proceeding.

For venipuncture, the technician fixed the vein by pressing gently about 1 cm below the intended entry point, removed the needle shield, and inserted the needle at approximately a 15° angle with the bevel facing up, aligning it with the direction of the vein. The vacuum tube was then advanced into the holder to puncture the stopper and initiate blood flow. When correctly positioned, blood flowed freely into the tube; if not, the technician made one or two gentle adjustments to locate the vein. A total of 7 mL of blood was collected, divided between a red-top serum tube (5 mL) and a purple-top EDTA tube (2 mL). The EDTA tube was gently inverted several times to ensure proper mixing with the anticoagulant.

To minimize harm, no more than two venipuncture attempts were permitted. If two attempts failed, the procedure was discontinued. Likewise, if a child became highly distressed or if the caregiver expressed significant concern, the technician slowed the process, provided reassurance, and postponed or cancelled the blood draw when necessary. All sharps were disposed of immediately in puncture-proof containers, and the overall approach reflected strict adherence to the "do no harm" principle, prioritizing safety, comfort, and ethical care over sample completion.

3.2.5.2 Post-collection handling and on-site storage

Upon completion of the blood draw, the needle was withdrawn in a single deliberate motion and sterile gauze was immediately placed over the puncture site, with direct pressure applied for at least two minutes to achieve haemostasis. Once bleeding had stopped, a sterile adhesive bandage was applied, and the tourniquet was released promptly. Technicians briefly monitored the child for any immediate adverse reactions before concluding the procedure. All used needles, tubing, and sharps were discarded immediately into puncture-proof sharps containers, in strict adherence to universal precautions. Blood was collected in two tubes following a fixed sequence: the red-top tube (5 mL) was filled first for serum-based analyses, followed by the purple-top EDTA tube (2 mL) for haematological testing, which was gently inverted 5–6 times to mix the blood with the anticoagulant without causing haemolysis. Each tube was labelled with a unique sample ID and cross-checked against the blood tracking form, which logged the ID, time of collection, and cool box temperature. Tubes were then placed upright in insulated cool boxes containing ice packs to maintain a stable temperature of approximately 3–8°C until transfer to the field laboratory. In keeping with ethical safeguards, if two venipuncture attempts were unsuccessful, the procedure was discontinued to minimise harm and distress.

3.2.5.3 Transport of samples to the field laboratory

All blood samples were transported the same day from camp-based collection points to the temporary field laboratory, typically within three to four hours of collection, using CNG/auto-rickshaws under strict cold-chain conditions. Before departure, the laboratory technician or sample carrier verified that all tubes were correctly logged on the specimen tracking form—including sample IDs, collection times, and cooler box temperatures.

Upon arrival at the field laboratory, staff cross-checked each tube against the tracking forms and identification tokens, inspected sample condition, and recorded cooler box and refrigerator temperatures to confirm cold-chain integrity. Unique sample IDs were immediately entered into the laboratory register

to ensure complete traceability. Within the field laboratory, purple-top (CBC) tubes were stored at or below 7°C and either analysed within 48–72 hours or prepared for onward shipment to Dhaka for further haematological testing. Red-top (serum) tubes were centrifuged at 3,000 rpm for 10 minutes, after which serum was aliquoted into labelled Eppendorf tubes—0.5 mL stored at –20°C for AGP testing at icddr,b, and 1.0 mL stored for biochemical analyses at Popular Diagnostic Centre. Serum samples designated for Popular Diagnostic Centre ("P") were dispatched every other day under cold-chain conditions, while those destined for icddr,b ("I") were batched and shipped on dry ice every two weeks. Mitra and Associates coordinated all logistics, with routine quality assurance checks conducted by Mitra, UNICEF, and RISE International to ensure strict adherence to biosafety and sample-handling protocols.

3.2.5.4 Transfer of samples to the central laboratories

Transporting specimens from Cox's Bazar to Dhaka constituted a critical stage in the biomarker workflow, requiring strict adherence to biosafety and cold-chain protocols to ensure the reliability of laboratory results. All shipments were handled by an experienced sample handler through S.A. Paribahan, a courier service familiar with biological materials, and were accompanied by comprehensive specimen logs documenting sample IDs, dates and times of dispatch, and temperature records. To safeguard sample integrity throughout transit, the Triple Packaging System was rigorously applied. Each Vacutainer tube served as the primary container, securely capped, clearly labelled, and wrapped in absorbent material to contain potential leakage. These were placed inside a leak-proof secondary container, either a sealed biohazard bag or a rigid plastic tube carrier, with each tube individually cushioned to prevent contact and breakage. Both were then enclosed within a rigid outer shipping box marked with orientation arrows and sender/recipient information, lined with foam or bubble wrap to reduce vibration and maintain thermal stability.

From the field laboratory, Mitra and Associates arranged regular shipments of samples to Popular Diagnostic Centre in Dhaka every one to two days, depending on sample volume. Each consignment, typically containing 50–70 samples, was transported in insulated cool boxes under strict cold-chain conditions. Upon arrival, laboratory personnel verified sample IDs against tracking forms, recorded cool box temperatures, and inspected tubes for cracks, leakage, or haemolysis. At Popular Diagnostic Centre, purple-top EDTA tubes underwent analyses including complete blood count (CBC), reticulocyte count, haemoglobin electrophoresis, and peripheral blood smears (PBS). Red-top serum aliquots were analysed for serum iron, total iron-binding capacity (TIBC), vitamin B12, folate, serum ferritin, and C-reactive protein (CRP). Any compromised samples, most commonly due to haemolysis, were deemed unfit for analysis and excluded.

Serum aliquots designated for AGP testing were shipped separately to the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). Because AGP reagents are imported, icddr,b noted that analysis would begin two to three months after receipt. Serum aliquots were stored at ≤ –20°C in the field laboratory and shipped on dry ice at approximately –50°C to maintain viability. Two consignments were sent resulting in a total of 933 serum samples successfully delivered for AGP analysis. Upon arrival, icddr,b staff inspected each sample for frozen-state integrity, evidence of thawing, haemolysis, and labeling accuracy, documenting and excluding any specimens that did not meet quality standards.

3.2.6 Data Quality Control and Supervision

Ensuring high-quality data was a central priority of the survey, and a multi-layered quality assurance system was established to uphold accuracy, reliability, and adherence to protocol throughout the data collection period. Quality assurance was implemented through rigorous supervision, continuous monitoring, structured verification, and coordinated oversight between Mitra and Associates, UNICEF, and RISE International.

3.2.6.1 Integrated supervision structure

Each field team operated under the daily supervision of a designated Field Supervisor, who was responsible for verifying interviewer performance, ensuring timely completion of assignments, and resolving operational difficulties in real time. In addition to this direct oversight, senior officials and technical advisors from both Mitra and UNICEF conducted regular field visits. Their role was to observe interviews, review biomarker procedures, reinforce adherence to guidelines, and troubleshoot emerging challenges. RISE International provided continuous technical support for majority of the fieldwork and monitored household interviewing and blood sample collection activities, participated in debriefings, and ensured that enumerators and health technicians followed correct methodological and ethical procedures.

3.2.6.2 Quality Control Officers and Monitoring Protocols

Quality Control Officers (QCs) formed a core layer of the supervision structure. A female QC officer was specifically deployed to ensure adherence to gender-sensitive protocols, confirm that enumerators visited the correct households, and verify that interviews were conducted with eligible caregivers. QCs implemented a systematic verification process that included:

- **Re-interviews:** Approximately 8% of sampled households were revisited to verify the consistency of responses with the original interview.
- **Direct observations:** Around 20% of interviews were observed in real time to assess interviewer conduct, probing techniques, and adherence to skip patterns.
- **Questionnaire checks:** Roughly 30% of completed questionnaires were reviewed daily to identify missing data, errors, or inconsistencies.

When discrepancies were identified, the QC compared the re-interview and original data, discussed the issue with the interviewer, and determined the underlying cause. Corrective measures were implemented immediately, ranging from individualized feedback to targeted refresher training, to prevent repeated errors.

3.2.6.3 Fieldwork Quality Processes

Enumerators followed a structured protocol at each sampled household. They introduced themselves, obtained informed consent, and administered the questionnaire in a respectful and neutral manner. Before leaving the household, they reviewed each section for completeness, accuracy, and adherence to skip patterns. To facilitate phlebotomy, enumerators provided caregivers with a token containing each eligible child's unique ID and instructed them to bring the child to the designated location for venous blood draw (typically a UNICEF Integrated Nutrition Centre or, in some cases, the Majhi's residence).

Field Supervisors and QCs worked closely with enumerators to ensure proper delivery of questions, maintain rapport with respondents, and address difficulties such as refusals or incomplete responses.

Supervisors also oversaw health technicians, ensuring safe and appropriate venous blood collection, correct labelling, and cold-chain compliance. Any deviations observed during biomarker collection were addressed immediately.

3.2.6.4 Senior Oversight and Independent Monitoring

Beyond field supervisors and QCs, senior professionals from Mitra and Associates undertook independent verification visits across multiple clusters. These visits served to independently observe interviews and sample collection, validate the functioning of cold-chain processes, confirm that daily targets and protocols were being followed, and provide immediate solutions where operations were stalled or inconsistent. UNICEF also engaged in active monitoring throughout the data collection period. UNICEF staff observed survey administration, sample collection, storage, and internal laboratory handling, and provided constructive feedback directly to field teams.

3.2.6.5 Daily Debriefings and Real-Time Adjustments

At the end of each day, Field Supervisors prepared concise reports summarizing completed interviews, non-response cases, phlebotomy challenges, and operational issues. These were discussed during structured daily debriefing sessions organized by Mitra and Associates. These meetings served as an essential mechanism for continuous learning and adjustment. Enumerators, supervisors, and health technicians were encouraged to share experiences, identify barriers, and propose solutions.

These debriefings functioned as a continuous quality-improvement cycle allowing immediate corrections to errors, ensuring convergence on best practices, and strengthening coordination among team members.

Together, the layered supervision system, systematic validation procedures, independent monitoring, and daily feedback cycles ensured that both survey and biomarker data met the highest standards of accuracy, integrity, and methodological rigour.

3.2.7 Challenges Encountered During Data Collection

Several operational, logistical, and clinical challenges affected both the household survey and blood collection components, contributing to non-completion in some cases despite multiple follow-up attempts. The unique conditions of the Rohingya camps in Cox's Bazar, characterised by dense terrain, steep hilly pathways, monsoon-related disruptions, fluid household movement, and complex humanitarian coordination, further shaped field operations. The field teams implemented a range of mitigation strategies to address these constraints wherever possible.

- Household access issues. Some selected households were repeatedly found locked or vacant, often due to work-related absence, visits to other camps, or temporary relocations. In other cases, neighbours could not confirm the household's whereabouts. Some sampled structures housed multiple families, complicating respondent identification.
  Mitigation: Supervisors scheduled multiple return visits, including early mornings and late afternoons, when families were more likely to be home. Community volunteers assisted in identifying households and confirming temporary movements.
- Refusals and survey fatigue. A proportion of caregivers declined participation in the interview or venous blood draw, citing fear of needles, mistrust regarding blood use, perceived pain for the

child, or general fatigue from frequent surveys conducted by different agencies.
Mitigation: Enumerators provided clear, simple explanations, addressed misconceptions, and emphasised voluntary participation. Female enumerators were prioritised for interview assignments to improve comfort levels, particularly among mothers.

- Illness among respondents or children. Some caregivers were too ill or cognitively impaired to respond. Likewise, venous blood could not be collected from children who were acutely unwell or febrile.
  Mitigation: Teams made follow-up visits once the caregiver or child had recovered; clinical judgement guided whether blood collection was appropriate.
- Child absence or non-cooperation. Eligible children were sometimes away at madrasa classes, play areas, or visiting relatives. Among those present, distress, crying, or excessive movement—especially among children under 12 months—prevented safe venipuncture.
  Mitigation: Technicians allowed longer calming periods, used caregiver involvement to reassure children, and postponed procedures when necessary. Return visits were attempted when children were not initially available.
- Technical difficulties in venipuncture. Thin, fragile, or difficult-to-locate veins made venous access challenging, even with a vein finder. Blood was sometimes obtained from one eligible child in a household but not another. A small number of samples were compromised by haemolysis.
  Mitigation: Health technicians used paediatric phlebotomy techniques, rotated staff for difficult cases, and strictly limited attempts to two per child to avoid harm.
- Environmental constraints and long-distance travel. Slippery terrain, waterlogging, and hilly topography slowed movement, especially during monsoon rains. Many households were located up steep embankments or deep inside narrow lanes, requiring teams to walk long distances while carrying equipment and cool boxes, increasing fatigue and reducing daily productivity.
  Mitigation: Teams adjusted walking routes, relied on additional field assistants to help carry equipment, and strategically scheduled clusters to balance heavy and light travel days.
- Camp-level security and movement restrictions. Occasional security incidents, administrative restrictions, or temporary closures of specific blocks halted field operations and limited movement.
  Mitigation: Supervisors coordinated closely with Camp-in-Charge (CiC) authorities, adjusted plans as needed, and resumed work as soon as clearance was granted.
- Space and privacy limitations. Shelters were often crowded and lacked suitable space for private interviews or safe blood collection.
  Mitigation: Interviews were conducted in quiet outdoor spaces when appropriate, and phlebotomy was centralised in designated sites such as Suji Khana centres or Majhi houses to ensure privacy, adequate lighting, and stable seating.
- Communication challenges despite Rohingya proficiency. Most enumerators were able to communicate effectively in the Rohingya dialect; however, variations in pronunciation, idioms,

and locally specific terms sometimes required repetition or rephrasing to ensure understanding—particularly in discussions of dietary recall or supplement use.

Mitigation: Enumerators refined wording based on local expression, used locally familiar terms, and, when needed, verified responses through probing to ensure accuracy.

Despite these challenges, the teams implemented systematic mitigation strategies to reduce non-response, maximise survey coverage, and uphold ethical, safety, and quality standards. As a result, the majority of interviews and venous blood samples were successfully collected, labelled, stored, and transported according to protocol, supporting high-quality biomarker analysis.

CHAPTER 4. DATA MANAGEMENT AND ANALYSIS

Data management for the survey followed a structured, multi-layered system designed to ensure accuracy, security, and readiness for analysis. All procedures, from digital data capture in the field to verification, encryption, cleaning, and qualitative transcription, adhered to international standards for research conducted in humanitarian contexts. The approach combined rigorous technological safeguards with daily supervisory oversight to ensure the reliability and confidentiality of both quantitative and qualitative datasets.

4.1 Data Management Procedures

4.1.1 Management of Survey Data

The survey utilized an electronic data collection system implemented through computer-assisted personal interviewing on encrypted handheld tablets. The finalized questionnaire was programmed into an ODK application hosted on Kobo Toolbox. Mitra and Associates developed the ODK program, configured the Kobo server, and conducted iterative testing to validate skip logic, constraints, and module sequencing. Feedback from RISE International was incorporated to refine usability and strengthen field performance.

During fieldwork, all data collected on tablets were stored in encrypted files and backed up automatically on the supervisor's secure digital card to eliminate the risk of data loss. After each interview, encrypted records were transmitted from the enumerator's device to the supervisor's tablet. Supervisors then conducted daily reviews of the data, checking completeness, skip-pattern accuracy, internal consistency, and alignment with field protocols, before transferring the encrypted data to the central office's offline Kobo Toolbox server via a secure file transfer protocol. This multi-tiered system of encryption, device-level backup, and supervised transmission strengthened data security and minimized the risk of recording or syncing errors.

Subsequent data cleaning was conducted jointly by Mitra and Associates and RISE International. The process included structural checks on variable linkages across modules, frequency checks and outlier detection, validation of ranges and permissible values, and correction of inconsistencies identified through field notes or QC verification. "Other-specify" responses were reviewed and recoded systematically. This comprehensive cleaning process ensured full integrity of the analytical dataset.

4.1.2 Management of Qualitative Data

Qualitative data were managed with equal rigor. All in-depth interviews and key informant discussions were audio-recorded using secure devices. Recordings were transcribed verbatim, and interviews conducted in Rohingya or Bangla were translated into English with careful attention to preserving linguistic nuance, cultural meaning, and context-specific expressions. Transcripts were then cleaned to remove all personal identifiers, ensuring full confidentiality.

The research team reviewed all transcripts to familiarize themselves with emerging themes, including dietary practices, beliefs about anaemia, perceived barriers to prevention and treatment, caregiving challenges, access to services, and community-level perspectives. These thematic insights supported triangulation with quantitative findings and enriched the interpretation of survey results.

4.1.3 Confidentiality and Data Protection

Strict confidentiality safeguards were applied across all stages of the study. Each household and participant was assigned a unique identification code used uniformly across survey instruments, biomarker records, and analytical files in place of personal information. Names and other identifying details did not appear in the electronic dataset and remained only on physical consent forms stored securely in locked cabinets accessible only to authorized staff.

Electronic tablets were password-protected, and all data transfers were encrypted. The Kobo Toolbox server was secured with restricted access controls, and all paper-based records, including consent forms and household listings, were stored in secure, locked facilities. Analyses and reporting were conducted exclusively using anonymized datasets, and laboratory datasets were merged only through unique ID codes to maintain confidentiality.

4.2 Data Analysis Procedures

4.1.4 Sample Weighting

To ensure that the survey results accurately represent all households and children living in the FDMN camps, sampling weights were created and applied during analysis. Because the survey used a complex design—with different stages of selection and varying probabilities of being chosen, weights were calculated to correct for these differences and for any households or children who did not participate. The weighting process included: calculating each unit's probability of selection; adjusting for missing population information; compensating for household and blood-draw non-response; and trimming extremely large weights to avoid distortion in the results. Three final weights were produced, one for households, one for all children aged 6–59 months, and one for children who completed the venous blood draw. **Annex C** provides details on the steps undertaken to produce the sampling wights. These weights ensure that the survey findings are statistically reliable, representative of the population, and suitable for valid comparisons and policymaking.

4.1.5 Laboratory Testing

Laboratory analyses were conducted to assess the biological determinants of anaemia among children aged 6–59 months, using a combination of haematological, biochemical, and inflammation-related biomarkers. All testing followed standardized operating procedures provided by Mitra & Associates, UNICEF, and the participating laboratories. Equipment and reagents used for CBC, serum ferritin, vitamin B12, folate, CRP, TIBC, haemoglobin electrophoresis, and AGP testing followed the specifications outlined in the "Equipment Specification and Laboratory Procedures for Testing Blood Samples" document (2025). Laboratory assays were performed at two accredited facilities in Dhaka: Popular Diagnostic Centre, which conducted most haematological and micronutrient assays, and icddr,b, which performed AGP testing. **Annex D** presents the equipment and assays used in testing at the two facilities.

At the field laboratory, red-top tubes were centrifuged at 3,000 rpm for 10 minutes and serum aliquots were stored at −20 °C until transport. Purple-top EDTA tubes were refrigerated immediately at ≤7 °C. Both serum and whole blood samples were shipped under strict cold-chain conditions, using insulated

containers and the triple packaging system, with continuous monitoring of temperatures from collection to laboratory receipt.

4.1.6 Quantitative Data Analysis

Quantitative analysis was conducted using Stata (version 18), employing design-based survey commands to account for the complex sampling structure of the study. All statistical procedures incorporated the final trimmed sampling weights, stratification variables, and cluster identifiers to ensure unbiased population-level estimates for households and children aged 6–59 months in the FDMN camps. Prior to analysis, Mitra & Associates and RISE International conducted a comprehensive data cleaning process that included verification of skip patterns, handling of out-of-range values, resolving inconsistencies between modules, harmonizing variable formats, and linking child-, household-, and biomarker-level datasets. Standardized do-files were developed to ensure reproducibility and consistent application of cleaning and analytical steps.

In Stata, survey design elements were declared using the svyset command, enabling the production of valid estimates and confidence intervals.

The quantitative analysis followed a structured and comprehensive plan designed to capture multiple dimensions of child health, nutrition, and anaemia. Descriptive statistics were generated using trimmed sampling weights to provide population-representative estimates of household and child-level indicators. These analyses summarized household socioeconomic characteristics, recent child morbidity, breastfeeding and IYCF practices, dietary diversity indicators, WASH conditions, mosquito net use, and participation in nutrition or health programmes. Together, these indicators provided the contextual foundation for understanding nutritional vulnerabilities in the FDMN settlements.

Food Consumption Score (FCS) and Food Consumption Score–Nutrition (FCS-N) were calculated in accordance with both the World Food Programme (WFP) global guidelines and the Cox's Bazar–specific thresholds. Weighted mean FCS values, as well as distributions across "poor," "borderline," and "acceptable" categories, were produced to assess household-level food access. FCS-N indicators—including protein-rich, heme-rich, and micronutrient-rich food consumption frequencies—were also calculated. These results were examined across age groups, sex, and camp strata to identify possible dietary disparities across subpopulations.

To accurately estimate iron deficiency in settings with high inflammation, ferritin levels were adjusted using the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anaemia (BRINDA) regression-correction method. This approach applied linear regression models using CRP and AGP concentrations as covariates, producing inflammation-adjusted ferritin values across the entire biomarker continuum rather than applying categorical adjustment factors. The adjusted ferritin values were then used to classify iron deficiency based on WHO cutoffs (<12 µg/L for young children), improving the validity of population estimates in this humanitarian context.

Subsequent analyses examined associations between anaemia and potential determinants. Weighted cross-tabulations and design-adjusted chi-square tests assessed bivariate relationships across demographic, dietary, health, and household characteristics. Continuous biomarkers were analysed using survey-adjusted means, with log transformations applied to correct skewed distributions when appropriate. To

identify independent predictors of anaemia and iron deficiency, survey-adjusted logistic regression models were estimated using Stata's svy: logistic command. These models incorporated a range of demographic, morbidity, dietary, WASH, socioeconomic, and inflammation-related variables to distinguish factors most strongly associated with poor outcomes.

Finally, subgroup analyses were conducted to identify patterns of vulnerability across children of different ages (6–11, 12–23, and 24–59 months), by sex, and across camp (Ukhiya and Teknaf). Analyses were also stratified by inflammation status to determine whether relationships differed between inflamed and non-inflamed children. All analytic outputs underwent multiple rounds of review internally and with UNICEF to ensure validity, alignment with WHO and BRINDA guidance, and methodological rigor consistent with global nutrition surveillance standards.

4.1.7 Qualitative Data Analysis

Qualitative analysis followed a rigorous, systematic approach designed to generate in-depth insights into caregivers' experiences, perceptions of anaemia, barriers to prevention and treatment, and stakeholder perspectives on programme implementation. All audio-recorded interviews were transcribed verbatim. Interviews conducted in Bangla or Rohingya were translated into English with careful attention to preserving cultural nuance, idiomatic expressions, and context-specific terminology. Prior to analysis, all transcripts were cleaned, anonymized, and checked for accuracy against the original recordings.

A thematic content analysis approach was used. The study team began with an initial review of transcripts to familiarize themselves with emerging ideas and to identify recurring concepts related to dietary practices, health-seeking behaviour, access to services, caregiver knowledge, treatment adherence, and structural barriers within the camp system. A preliminary coding framework was developed and refined iteratively through team discussions. Codes were then systematically applied to all transcripts, and themes were grouped into higher-level categories that reflected the social, behavioural, and institutional factors shaping anaemia-related outcomes in the camps.

Matrices and analytic summaries were produced to compare themes across respondent groups, including caregivers, health workers, programme implementers, and donors. These cross-comparisons highlighted both consensus and divergence in perspectives on causes of anaemia, accessibility of preventive and treatment services, and programmatic challenges such as supply availability, operational constraints, and communication gaps. Integration of qualitative findings with quantitative results will support a richer interpretation of the drivers of child anaemia and inform actionable programmatic recommendations for UNICEF and partners.

CHAPTER 5. STUDY FINDINGS

This chapter presents the key findings from the household survey, biomarker testing, and qualitative interviews conducted across the 33 Rohingya camps in Cox's Bazar. Results are structured to provide a comprehensive picture of the demographic, socioeconomic, dietary, health, and biological determinants of anaemia among children aged 6–59 months. Quantitative estimates are weighted and adjusted for the survey's complex sample design, while biomarker indicators reflect BRINDA-adjusted values where relevant.

To enhance interpretation and programmatic relevance, quantitative findings are triangulated with insights from KIIs and KSIs, capturing perspectives from caregivers, ANC providers, supplementation programme staff, and donors. This mixed-methods approach helps explain not only what the data show, but why certain patterns emerge—particularly in relation to dietary constraints, service delivery gaps, and systemic challenges in the humanitarian context.

Where applicable, results are benchmarked against previous assessments, including the 2023 SENS Survey in Cox's Bazar (UNHCR, Concern Worldwide) and earlier REVA assessments, to contextualize trends, continuity, and emerging vulnerabilities in the Rohingya refugee population. These integrated results chapter therefore provides a holistic understanding of the multifaceted drivers of anaemia and nutrition outcomes in the camps.

5.1 Household Characteristics

5.1.1 Household Sampled

A total of 794 households were successfully interviewed across the 33 FDMN camps, yielding an overall response rate of 77.8% (**Table 4**). This level of participation is consistent with response patterns observed in previous large-scale assessments in Cox's Bazar, including SENS 2023 (78%) and REVA-5 (approximately 80%).

Table 4. Number of households surveyed and response rate in Cox's Bazar, 2025

Characteristics	Ukhiya	Teknaf	Total
Household Interviews and Response Rate			
Household sampled	830	190	1,020
Households interviewed	657	137	794
Household response rate	79.2	72.1	77.8

Response rates were somewhat higher in Ukhiya (79.2%) compared with Teknaf (72.1%), a difference that reflects longstanding variations in household availability, mobility restrictions, and population density between the two subdistricts. These patterns have been documented in multiple rounds of REVA assessments and continue to shape operational realities for data collection across the camps.

Qualitative interviews support this pattern, with several field teams noting that "*in some parts of Teknaf, people move frequently between shelters or stay with relatives, which makes it harder to find them at home*."

5.1.2 Household Size and Demographic Structure

Household composition closely mirrored the demographic structure of Rohingya settlements. The mean household size is 5.8 members, identical in both Ukhiya and Teknaf and consistent with similar averages reported in SENS 2023 (5.6 members) and REVA-7 (5.5 members). Most households comprised 5–7 members, reflecting the continued prevalence of extended family living arrangements driven by social norms, constrained shelter availability, and economic interdependence within families. None of the households consisted of a single individual, while around 12% were large households with 7 or more members, a pattern that aligns with historical data from prior assessments.

Table 5 shows that women and men are nearly equally represented within households, with 51.1% females and 48.9% males, indicating a balanced demographic distribution.

Table 5. Sex distribution of household members by upazila in Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
	%	95% CI	n	%	95% CI	n	%	95% CI	N
Females	43.0	[41.3 - 44.7]	1,921	8.0	[6.7 - 9.6]	405	51.1	[49.8 - 52.3]	2,326
Males	41.7	[40.1 - 43.4]	1,864	7.2	[6.2 - 8.4]	375	48.9	[47.7 - 50.2]	2,239
Females 6-59 mo.	42.0	[39.0 - 45.1]	464	8.3	[6.7 - 10.2]	105	50.3	[47.4 - 53.3]	569
Males 6-59 mo.	42.4	[39.5 - 45.4]	474	7.2	[6.1 - 8.6]	94	49.7	[46.7 - 52.6]	568

Among children aged 6–59 months, sex ratios are similarly equitable, with 50.3% female and 49.7% male children, consistent with expected population profiles and in line with findings from SENS 2023.

5.1.2 Age Distribution of Children 6-59 months

As expected from the sampling design, nearly all interviewed households had at least one eligible child aged 6–59 months. The age distribution of these children followed the established demographic pattern observed in UNHCR population statistics and previous nutritional assessments. One-third of children are aged 6–23 months (approximately 10.5% are aged 6–11 months, 22.9% are 12–23 months), and the majority, that is, 66.2% were 24–59 months.

Table 6. Percentage of households with eligible children, by age group, in Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
Children's Age	%	95% CI	n	%	95% CI	n	%	95% CI	N
6-59 months	84.5	[82.2 - 86.6]	938	15.5	[13.4 - 17.8]	199	100	[100]	1,137
6-23 months	34.6	[31.9 - 37.3]	322	27.5	[22.0 - 33.2]	55	33.4	[31.0 - 35.9]	377
6-11 months	10.9	[9.4 - 12.7]	105	8.7	[5.9 - 12.6]	17	10.5	[9.2 - 12.1]	122
12-23 months	23.6	[21.0 - 26.5]	217	18.8	[14.6 - 24.2]	38	22.9	[20.6 - 25.4]	255
24-59 months	65.4	[62.7 - 68.1]	616	72.5	[66.8 - 78.0]	144	66.6	[64.1 - 69.0]	760

This age structure is consistent with UNHCR's 2024 Population Factsheet and reflects the natural aging of the cohort that arrived in Bangladesh predominantly during and shortly after 2017. Teknaf hosted a higher proportion of older children (72.5%) compared to Ukhiya (65.4%), aligning with historical settlement trends and fewer recent arrivals in Teknaf (**Table 6**).

5.1.3 Education Levels of Adults in the Household

Educational attainment among adults remained extremely low, reflecting decades of restricted access to formal education for Rohingya communities. In Ukhiya, 11.3% of adults reported no education, while 2.1% reported the same in Teknaf (**Table 7**). The largest share of adults had primary incomplete

schooling (44.1% in Ukhiya and 73% in Teknaf), while only 16.9% had completed secondary education or higher.

Qualitative findings strongly reinforce the consequences of low literacy. Caregivers frequently describe difficulties reading dosage instructions, understanding nutrition counselling, or tracking follow-up appointments. One mother explained, *"I cannot read the health card, so I just try to remember what the nurse said."* Frontline health workers similarly note that *"low literacy makes counselling difficult—sometimes mothers forget the instructions by the time they reach home."* These insights help clarify the persistent gaps in treatment adherence and health comprehension observed in the camps.

Table 7. Educational attainment of adult household members in Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
Education	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**N**
No education	11.3	[9.2 - 14.0]	89	2.1	[1.3 - 3.4]	20	13.4	[11.0 - 16.3]	109
Primary incomplete	44.1	[40.3 - 48.1]	343	7.3	[5.6 - 9.6]	64	51.5	[47.4 - 55.5]	407
Primary complete	7.6	[5.6 - 10.3]	58	2.1	[1.2 - 3.9]	18	9.7	[7.4 - 12.7]	76
Secondary incomplete	13.9	[11.8 - 16.3]	107	2.9	[2.0 - 4.4]	27	16.9	[14.5 - 19.5]	134
Secondary complete or higher	7.8	[5.8 - 10.5]	59	0.7	[0.3 - 1.5]	5	8.5	[6.5 - 11.2]	64

5.1.4 Migration and Arrival to the Camps

Households showed remarkable demographic stability, with 98% of children having arrived in Bangladesh before 2024 and only about 2% arriving afterward. This aligns with UNHCR operational data indicating minimal new influxes in recent years.

Qualitative interviews also highlighted this stability; caregivers consistently described their families as having lived in the camps for several years, with few reporting recent arrivals. Many expressed a sense of long-term displacement and uncertainty, reinforcing the protracted nature of the humanitarian situation.

5.1.4 Ownership of Household Assets

The asset ownership in the camps remains extremely limited, reflecting the restricted economic environment and the longstanding reliance on humanitarian assistance. Access to basic electrical infrastructure is almost non-existent: less than 1% of households report having electricity in either Ukhiya or Teknaf. Television, radio, DVD players, refrigerators, and other appliances are similarly rare, underscoring both structural constraints and the absence of household-level power sources.

By contrast, small, low-cost assets, particularly those distributed through humanitarian programs, are more common. Solar fans represent one of the most widely owned items: 77.3% in Ukhiya and 71.1% in Teknaf, aligning with previous REVA and SENS findings in which solar-operated devices consistently dominate asset profiles because of their practicality and program distribution patterns. Similarly, mobile phone ownership is high, reported by 74.4% of households in Ukhiya and 43.6% in Teknaf. Less than half of the households have at least one watch (45.1%). Ownership of higher-value transport assets (bicycles, motorbikes, CNG vehicles, or rickshaws) is essentially zero.

Qualitative findings reinforce and contextualize the quantitative asset patterns. Caregivers frequently describe the scarcity of household assets as both a reflection of poverty and a product of camp regulations

restricting economic activity. Many note that the little they own, such as solar fans or mobile phones, comes from NGO distributions rather than personal purchase.

Qualitative interviews help illuminate these patterns. Caregivers note that solar fans are essential for coping with heat inside tarpaulin shelters—*"without the fan, the children cannot sleep in the afternoon"*—and that mobile phones serve as a crucial link to health workers, appointment reminders, and distribution updates. Many clarify that most household assets are not purchased but received from NGOs or shared across extended families. One respondent stated, *"We don't buy these things; they come from distributions. If something breaks, we just manage without it."*

Women commonly explain that mobile phones are essential for contacting community health workers, receiving reminders about clinic appointments, and coordinating food or cash distributions. In the absence of electricity, phones are often shared within extended households or charged at small vendor stalls for a fee.

5.1.5 Electricity and Cooking Fuel

Household access to electricity remains extremely limited: <1% of households report any type of in-house electricity connection. These findings mirror REVA-7 and SENS 2023, where electricity access was also reported at under 1%. Instead, families rely overwhelmingly on solar-powered devices (chiefly solar fans and small solar chargers) and on solar streetlights installed by humanitarian agencies for basic nighttime visibility.

Cooking fuel availability is more uniform across households. Nearly all households (98.4%) rely on liquid propane gas (LPG) as the primary cooking fuel—consistent with the government and humanitarian policy shift toward LPG adoption implemented in 2019–2020. This transition was designed to reduce deforestation, improve indoor air quality, and reduce the time women spend collecting firewood, and the survey findings confirm near-universal uptake.

In the qualitative interviews, the shift to LPG is repeatedly mentioned as a significant improvement in daily life, reducing the burden on women who previously spent hours collecting firewood and decreasing household smoke exposure. As one caregiver shared, *"Before LPG, we walked very far for wood. Now cooking is easier—but when the cylinder is delayed, it becomes very difficult."* However, caregivers also note that occasional delays in cylinder exchanges can disrupt meal preparation, particularly for young children.

Use of alternative fuels (wood, charcoal, kerosene, or agricultural residue) is negligible, and qualitative data indicate that when such fuels are used, it is typically due to temporary LPG shortages or delayed cylinder replacement cycles.

Finally, respondents emphasize that shelters are overcrowded, which shapes decisions about cooking location, asset placement, and child safety. Even when households report "owning" items such as wardrobes or chargers, they often describe these as shared across extended family networks.

5.1.6 Ownership of Mosquito Net

Table 8 shows that mosquito net ownership is effectively universal across the surveyed camps, with 99.9% of households reporting possession of at least one net. Coverage is identical in Ukhiya and Teknaf, reflecting sustained success of routine LLIN distribution campaigns led by UNHCR, IOM, and health

sector partners. This level of coverage mirrors findings from SENS 2023 and recent REVA rounds, all of which have consistently documented near-universal net ownership in the Rohingya response. Although almost all households own a net, the quantity of nets available varies substantially by household size.

Approximately one quarter of households (23.9%) own only one net, nearly half (48.1%) own two, and just over a quarter (28.1%) possess three or more. The distribution of nets shows slight geographic variation: households in Teknaf are somewhat more likely to own two nets, whereas those in Ukhiya have a marginally higher share of households with three or more. When adjusted for household size, however, adequate mosquito net coverage, defined as at least one net per two household members, remains relatively low at 23.3%, suggesting that while nets are nearly universal, they may not be sufficient in number to fully protect every member of large households. As one mother in Ukhiya explained, *"We have two nets for eight people. The children sleep first, and we squeeze ourselves around them. Every night we adjust."*

Qualitative interviews strongly reinforced this pattern, with caregivers frequently describing strategies used to maximize limited resources. Many reported sleeping in shifts or sharing tightly crowded sleeping spaces. One caregiver noted, *"Sometimes all three of my children sleep under one net with me. If one child moves, all of us wake up."* Others expressed anxiety about the risk of mosquito-borne diseases: *"When the net tears, we fix it with anything—thread, pins, even cloth strips. We cannot sleep without it,"* said a mother in Teknaf.

Table 8. Household ownership, quantity, and type of mosquito nets in Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
Net Ownership	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**N**
Own mosquito net	99.9	[99.1 - 100.0]	657	99.9	[99.1 -100.0]	134	99.9	[99.1 - 100.0]	791
Number of nets owned									
0 net	-	-	0	-	-	0	-	-	0
1 net	23.6	[20.3 - 27.1]	192	25.5	[18.1 - 34.6]	33	23.9	[20.8 - 27.2]	192
2 nets	47.7	[43.8 - 51.7]	378	49.9	[42.8 - 57.0]	67	48.1	[44.6 - 51.6]	378
≥ 3 nets	28.7	[25.2 - 32.5]	222	24.6	[18.6 - 31.7]	34	28.1	[24.9 - 31.4]	222
Adequate coverage[1]	24.2	[20.5 - 28.3]	657	18.7	[12.6 - 26.7]	134	23.3	[20.0 - 27.0]	791
Brand of mosquito net owned									
LLIN	81.1	[77.8,84.1]	531	81.1	[78.1,83.8]	109	81.1	[78.1,83.8]	640
PermaNet	75.9	[71.9 - 79.5]	499	71.7	[62.7 - 79.3]	97	75.3	[71.7 - 78.6]	596
Dara Plus	1.3	[0.6 - 2.6]	9	1.8	[0.5 - 6.4]	9	1.3	[0.7 - 2.5]	11
Interceptor G2	0.2	[0.0 - 1.6]	1	1.8	[0.5 - 6.8]	2	0.5	[0.1 - 1.5]	3
Other LLIN	14	[11.4 - 17.1]	90	11.5	[6.0 - 20.8]	15	13.7	[11.2 - 16.5]	105
Other type/non-LLIN	0.9	[0.4 - 2.0]	6	1.8	[0.5 - 5.9]	3	1	[0.5 - 2.0]	9
Household sprayed	1.4	[0.6 - 3.4]	9	1.3	[0.5 - 3.5]	2	1.4	[0.6 - 3.0]	11

[1]Adequate coverage (≥ 1 ITN for every 2 household members)
Key: LLIN = Long-lasting insecticide treated net

Most mosquito nets in circulation are long-lasting insecticide-treated nets (LLINs), with 81.1% of households reporting ownership of at least one LLIN (**Table 8**). This proportion is nearly identical across the two subdistricts, indicating a uniform distribution pattern. Among LLIN brands, PermaNet remains the dominant type, found in roughly three-quarters of households (75.3%). Other brands, such as Interceptor G2 and Dara Plus, appear only in minimal proportions, each representing 2% or less, reflecting the concentrated procurement patterns of humanitarian actors. As one frontline provider stated,

"Mothers always ask for LLINs because they know it protects the children. They trust the branded nets more."

Despite strong ownership, the proportion of households reporting spraying with insecticides remains very low (1.4%) though this estimate is not statistically reliable due to the small number of cases. Caregivers explained that home-based spraying is perceived as unsafe, inaccessible, or unnecessary when relying on LLINs. One caregiver remarked, *"Sprays smell strong and make the children cough. We prefer the nets—they are safer for us."*

Overall, both quantitative and qualitative findings underscore a critical gap between net ownership and adequate coverage, especially for large households where net sharing is unavoidable. The high reliance on LLINs reflects the success of mass distribution programs, yet the qualitative insights highlight ongoing vulnerabilities linked to overcrowding, damaged nets, and insufficient quantities. These realities underscore the importance of continued LLIN replenishment, monitoring of net condition, and integration of community messaging to support appropriate net use and maintenance within densely populated shelters.

5.2 Water, Sanitation and Hygiene

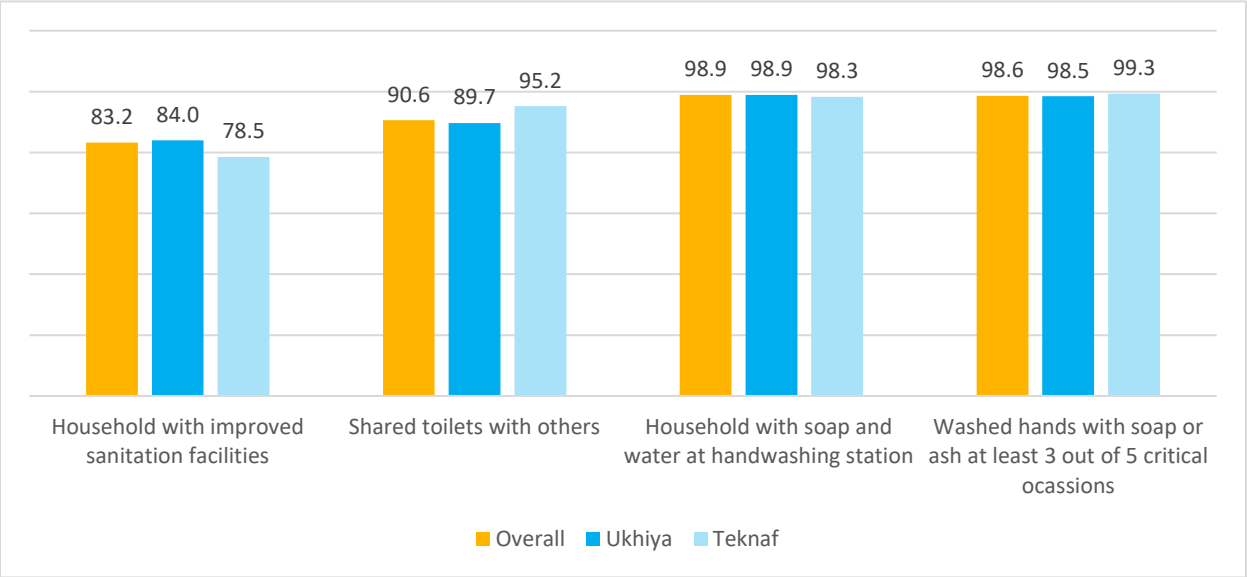
5.2.1 Sanitation Facilities

Access to improved sanitation is relatively strong across the camps: 83.2% of households report using an improved sanitation facility (**Figure 3**). Coverage is slightly higher in Ukhiya (84.0%) than in Teknaf (78.5%), reflecting the more extensive WASH infrastructure historically established in the larger Ukhiya camps. These levels are broadly consistent with findings from SENS 2023, which also reported high (99%), but uneven, access to improved sanitation across sites.

The vast majority of households rely on pit latrines, with 81.0% in Ukhiya and 74.6% in Teknaf using pit latrines with slabs. Open-pit or without slab latrines remain more common in Teknaf (21.5%) than Ukhiya (16.0%), suggesting that infrastructure quality varies by camp and that some areas, particularly in Teknaf, remain more vulnerable to sanitation-related hazards.

Shared latrine use is nearly universal, with 90.6% of households using shared facilities. On average, each latrine serves approximately seven households, though congestion is higher in Uhkiya compared to Teknaf. Qualitative interviews confirm that toilet sharing is an accepted reality of camp life. Caregivers frequently describe queuing at peak hours and concerns about safety and privacy; one mother explained, *"At night we do not go alone. We take someone with us because the latrine is shared by many families."*

Figure 3. Coverage of key household WASH indicators by upazila (Ukhiya and Teknaf), Cox's Bazar, 2025



5.2.2 Handwashing Practices

Household-level access to handwashing facilities with both soap and water is nearly universal, reported by 99% of households in both Ukhiya and Teknaf (**Figure 3**). SENS 2023 reported that 95.8% of households had soap and water at the handwashing station.

Self-reported adherence to handwashing at critical moments (after defecation, before eating, before preparing food, after cleaning a child, and before feeding children) is also high, with 98.6% of respondents saying they wash with soap at least three of the five recommended moments. While these self-reported levels may overestimate actual behaviour, qualitative data suggest that hygiene messaging has indeed become deeply internalized. Mothers repeatedly emphasize the importance of soap: *"We always keep soap near the latrine. The children know they must wash their hands."* However, several caregivers also noted sporadic soap shortages toward the end of distribution cycles, which could temporarily affect hygiene practices: *"Sometimes the soap finishes early. Then we have to wait for the next distribution or share with neighbours."*

5.2.3 Disposal of Children's Faeces

Safe disposal practices for children's stools are widely adopted. Nearly 83% of households report that children use a latrine or their stools are disposed of in a latrine. This practice is slightly more common in Teknaf (85.6%) than in Ukhiya (82.7%).

Table 9 also shows that unsafe disposal, including throwing stools into fields or bushes, remains relatively low (around 5.9%), but qualitative data suggest that it still occurs among a subset of very young children who cannot yet use child-friendly latrines.

Table 9. Distribution of child faeces disposal practices by upazila, Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
Disposal of Faeces	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**N**
Used toilet or latrine	82.7	[79.2 - 85.8]	545	85.6	[76.6 - 91.5]	111	83.2	[79.9 - 85.9]	656
Field, bush or river	6.1	[4.3 - 8.5]	39	4.6	[2.3 - 9.1]	8	5.9	[4.3 - 8.0]	47
Buried	1.0	[0.4 - 2.6]	6	-	-	0	0.9	[0.3 - 2.2]	6
Trash or rubbish	3.7	[2.4 - 5.8]	24	6.4	[2.8 - 13.7]	10	4.1	[2.8 - 6.1]	34
Other	6.4	[4.6 - 8.9]	44	3.4	[1.1 - 9.9]	5	6.0	[4.3 - 8.2]	49

Some caregivers explained that holding infants over a latrine is difficult due to fear of them slipping; as one put it, *"The baby is too small; we cannot hold him safely over the hole, so sometimes we throw the stool in a plastic bag."* These narratives point toward ongoing needs for improved child-friendly sanitation options and targeted hygiene counselling for caregivers of infants.

Taken together, WASH indicators demonstrate a generally strong sanitation and hygiene environment across camps, supported by long-term humanitarian investment in infrastructure and behaviour change. However, high levels of latrine sharing and variation in sanitation quality between Ukhiya and Teknaf signal areas for continued improvement. Qualitative findings particularly highlight how overcrowding, security concerns, and inconsistent soap availability can undermine otherwise strong adherence to hygiene practices.

5.2.4 Household Drinking Water

The drinking water situation in the FDMN camps remains one of the strongest components of the humanitarian response, with universal access to improved drinking water sources (100%) across all surveyed households. Every household in both Ukhiya and Teknaf reports relying on an improved water source, reflecting the extensive investment made by WASH partners since 2017 and consistent with the most recent SENS and REVA assessments (99.9%). The types of improved sources accessed differ between Ukhiya, where are most likely to obtain water from NGO-installed tap stands (57.4%) or tube wells and boreholes (33.7%), whereas Teknaf households depend overwhelmingly on permanent tap stands (86.3%). The minimal reliance on tube wells in Teknaf likely reflects the upazila's differing terrain and water-table dynamics. Smaller proportions of households (around 6% overall) access water through

Table 10. Household drinking water sources by upazila in Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Total		
Household Drinking Water	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**N**
Improved source	100	[100.0]	658	100	[100.0]	134	100	[100.0]	791
Piped into dwelling	3.1	[1.7 - 5.4]	20	2.1	[0.6 - 6.7]	3	2.9	[1.7 - 4.9]	23
Piped to yard/plot	0.1	[0.0 - 1.0]	1	-	-	0	0.1	[0.0 - 0.9]	1
Piped to neighbour	-	-	0	0.7	[0.1 - 4.8]	1	0.1	[0.0 - 0.7]	1
Public tap/standpipe	0.3	[0.1 - 1.1]	2	-	-	0	0.2	[0.1 - 0.9]	2
Tube well or borehole	33.7	[27.2 - 40.9]	217	2.8	[1.1 - 6.6]	4	29.0	[23.5 - 35.2]	221
Permanent tap of NGO	57.4	[50.1 - 64.4]	381	86.3	[68.1 - 94.9]	118	61.8	[55.3 - 67.9]	499

piped connections from host community systems, reflecting the proximity of some camps to Bangladeshi villages. No households report using unimproved or surface water, indicating that the shift to improved infrastructure has been fully consolidated across the camps.

5.2.5 Availability of Water from Source

Despite the widespread use of shared water points, households generally experience reliable access throughout the year. Nearly 91% of families report that water is available year-round, and 86.7% indicate that water was available every day during the two weeks preceding the survey. These figures demonstrate the consistent functioning of the piped and borehole systems that form the backbone of camp water supply. Caregivers across camps describe water points as dependable, noting that interruptions are infrequent and short-lived. One mother in Teknaf explained, "*We never worry about having water. Even in the hot months, the tap is always running."* However, some respondents also remarked on occasional fluctuations in water pressure and morning congestion at popular tap stands. As one caregiver in Ukhiya described, *"The tap is close, but early in the day there is always a long line, so we try to go at different times."*

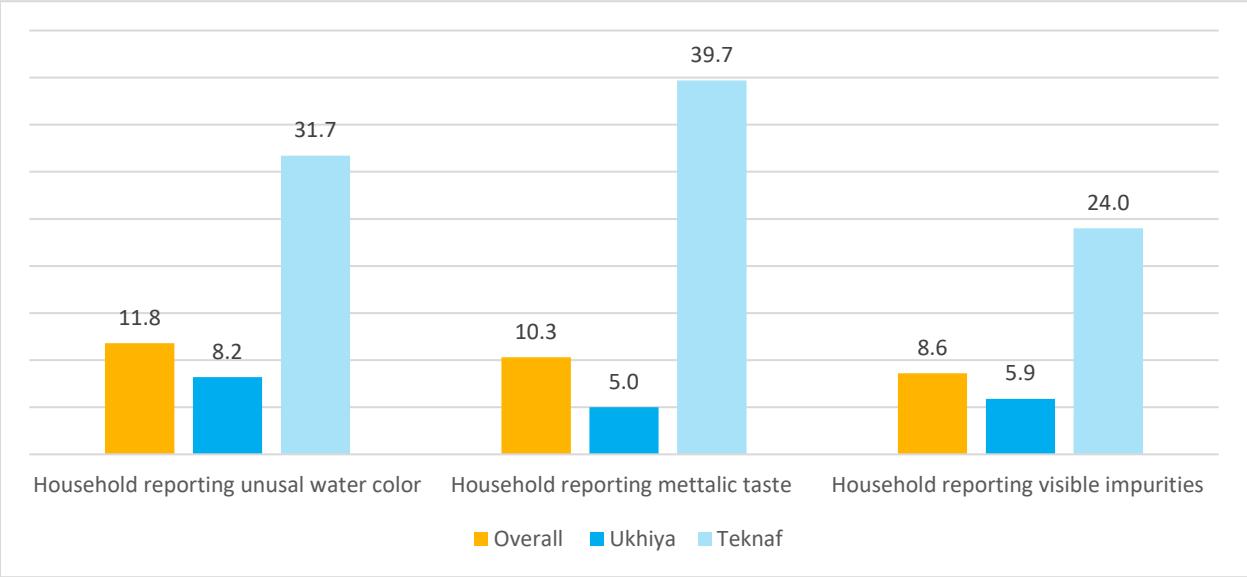
5.2.6 Location of Water Source

The physical placement of water sources further illustrates the communal nature of water use. Only 6.9% of households report accessing water inside their dwelling, while 17.9% collect water from within their own yard or plot. The large majority, more than 75.2%, rely on communal tap stands located outside the immediate household space. This pattern is characteristic of the camp infrastructure design, where shared tap points serve clusters of shelters. Caregivers note that proximity is generally adequate, but some highlight safety concerns for nighttime water collection, especially for women and adolescent girls. The widespread installation of solar-powered streetlights has mitigated these concerns, yet occasional reports of poorly lit pathways arose in qualitative discussions.

5.2.7 Water Quality Perception

Although households overwhelmingly rely on improved sources, concerns about water quality persist and are more pronounced in Teknaf. Overall, 8.6% of households report visible impurities such as dirt, sand, or floating particles in their drinking water. A similar proportion (10.3%) describe a metallic taste, often attributed to minerals or potential arsenic presence, while 11.8% report unusual discoloration such as yellow or brown water. These issues are significantly more common in Teknaf, where 24% of households report visible impurities compared with only 5.9% in Ukhiya (**Figure 4**).

Figure 4. Percentage of households reporting selected drinking water quality concerns, by upazila, Cox's Bazar, 2025



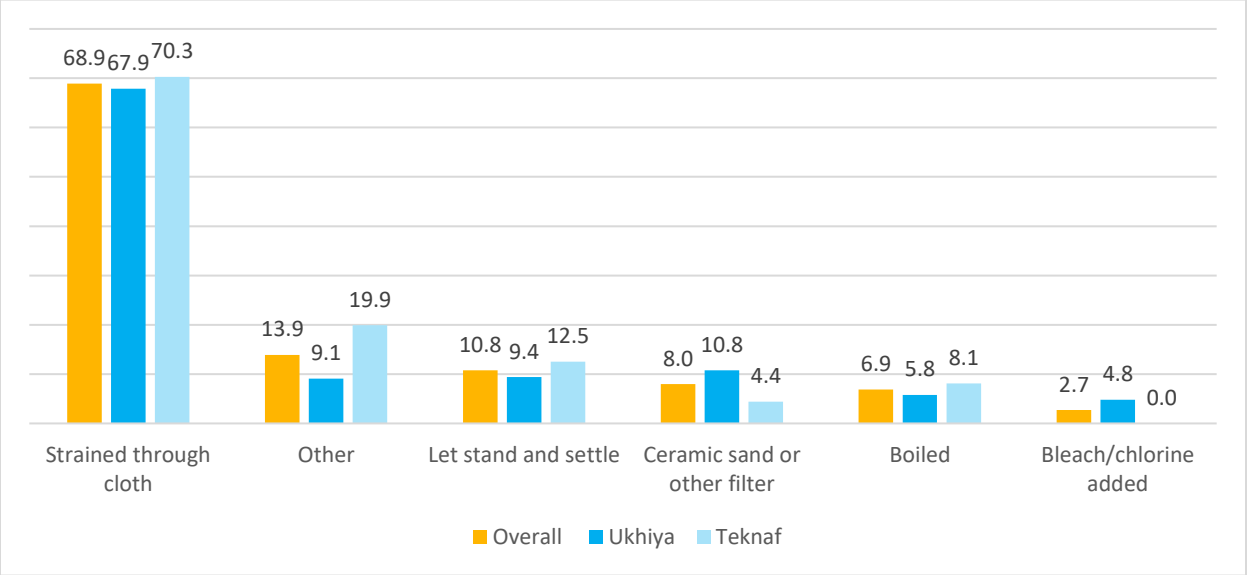
Caregivers also mention that sensory attributes vary between tap stands, prompting some households to avoid taps perceived as lower quality. As one mother explained, *"Some taps give clear water, others look dirty. We walk a little more to the one that looks cleanest."* Despite these concerns, 93.1% of households consider their water safe for consumption, suggesting that sensory concerns do not necessarily translate into perceived health risks.

Reports of water-related health problems are relatively low, with only 4.2% of households indicating that someone in the household experienced illness they attributed to drinking water. This aligns with broader public health surveillance in the camps, where diarrheal disease trends have declined over recent years due to improvements in WASH infrastructure and hygiene promotion. Qualitative narratives indicate that caregivers often attribute gastrointestinal symptoms to food or seasonal illness rather than water unless discoloration or strong odour is present.

5.2.8 Treatment of Drinking Water

Household water treatment is not widespread, likely due to high confidence in the safety of improved sources. **Figure 5** shows that the most common practice, reported by 68.9% of households, is straining water through a cloth, a method used primarily to remove visible debris rather than disinfect. More advanced treatment practices such as boiling (6.9%) or using bleach/chlorine (2.7%) remain rare, reflecting both the high perceived safety of tap water and/or limited availability or cost constraints of treatment supplies. About 11% of households report using ceramic or sand filters, typically those who received filters through NGO distribution programs. Qualitative interviews reveal a consistent view that treatment is generally unnecessary. *"The water from the tap is clean. We only strain it to remove small things,"* one mother from Ukhiya explained. Others noted that straining is essential for protecting young children from stomach discomfort, underscoring the role of traditional, low-cost filtration methods.

Figure 5. Distribution of household drinking water treatment methods, by upazila, Cox's Bazar, 2025



Overall, the drinking water environment in the camps is strong and reflects significant progress in WASH service delivery. Universal access to improved sources and high reliability are major achievements. However, the persistent reports of sensory water quality concerns, particularly in Teknaf, highlight the need for continued water safety monitoring, targeted maintenance of tap stands, and community communication addressing quality and safety.

5.3 Household Food Consumption

5.3.1 Food Consumption Score

The Food Consumption Score results indicate that household dietary consumption patterns remain relatively stable across the camps, with nearly all households meeting the acceptable consumption threshold. The mean FCS is 63.7 (95% CI: 62.6–64.8), with households in Ukhiya reporting slightly higher dietary diversity (mean 64.3) than those in Teknaf (60.3). Despite this variation, the proportion of households with inadequate food consumption is extremely low: 0% of households fall into the poor FCS category, and only 1.4% fall into the borderline category under the WFP global thresholds (**Table 11**).

Table 11. Food Consumption Score (FCS) by upazila and classification thresholds, Cox's Bazar, 2025

Characteristics	Ukhiya			Teknaf			Overall		
FCS	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**N**
Mean score	64.3	[63.1 - 65.5]		60.3	[57.7 - 62.8]		63.7	[62.6 - 64.8]	791
Food Consumption Score (FCS) - WFP Global									
Poor, FCS 0-21	-	-	0	-	-	0	-	-	0
Borderline, FCS 21.5-35	1.5	[0.8 - 2.9]	10	0.7	[0.1 - 4.7]	1	1.4	[0.7 - 2.5]	11
Acceptable, FCS >35	98.5	[97.1 - 99.2]	647	99.3	[95.3 - 99.9]	133	98.6	[97.5 - 99.3]	780
Food Consumption Score (FCS) - CXB Specific									
Poor, FCS 0-28	0.1	[0.0 - 0.7]	1	-	-	0	0.1	[0.0 - 0.6]	1

Characteristics	Ukhiya			Teknaf			Overall		
Borderline, FCS 28.5-42	2.5	[1.3 - 4.7]	16	3.2	[1.3 - 8.1]	4	2.6	[1.5 - 4.5]	20
Acceptable, FCS >42	97.4	[95.2 - 98.6]	640	96.8	[91.9 - 98.7]	130	97.3	[95.4 - 98.4]	770

These values closely mirror findings from REVA-7, where mean FCS hovered around 62–65, and SENS 2023, which similarly reported high FCS mean (63) despite persistent dietary monotony.

When applying the CXB–specific thresholds, designed to adjust for high oil and sugar consumption, the proportion of borderline households increases marginally to 2.6%, yet still reflects widespread acceptable food consumption (97.3%). These findings are consistent with previous assessments such as REVA-7 and SENS 2023, which similarly observed high FCS levels following the scale-up of assistance packages over the past five years.

Qualitative findings further contextualize these patterns. Caregivers frequently describe their diets as "repetitive but enough," noting that while food quantity is generally sufficient, variety is constrained by available assistance and household purchasing power. As one mother explained, *"We cook the same things every week because that is what we receive. The children eat, but they get bored."* This sentiment aligns with the quantitative evidence showing high FCS values driven largely by staple consumption rather than a broad diversity of nutrient-dense foods. Caregivers frequently describe receiving enough *"food to fill stomachs"* but not foods that *"help children grow strong."* One mother explained, *"We always have rice and lentils. Oil is easy. But eggs, meat—those are not regular for us."*

5.3.2 Food Consumption Score – Nutrition

The Food Consumption Score–Nutrition provides additional granularity by examining weekly consumption of nutrient-dense food groups, including protein-rich, vitamin A–rich, and heme-iron–rich foods. These categories are particularly relevant for analysing the dietary determinants of child anaemia.

5.3.2.1 Protein-Rich Foods

Households report comparatively high consumption of protein-rich foods, with 92.3% consuming such foods on at least 7 days per week. This reflects consistent intake of lentils, an inexpensive, widely distributed protein source in food assistance packages. Only 7.7% consume protein occasionally (1–6 days), and nearly none report zero consumption. Teknaf exhibits slightly lower adequacy (84.8%) than Ukhiya (93.7%), though overall protein consumption is strong (**Figure 6**).

Qualitative data reinforces this trend. Caregivers consistently mention lentils as a central protein source, with many describing them as *"the food children eat every day."* However, several caregivers also note that lentils alone are insufficient to support child health. As one mother stated, *"Dal is the main thing we have, but the doctor says meat or fish is better for blood. Those are too expensive."* This distinction between availability of plant-based protein and unaffordability of animal-source protein has implications for anaemia. Several caregivers mentioned prioritizing eggs for young children: *"Even if we don't have much, we try to give one egg when the child is sick or weak."*

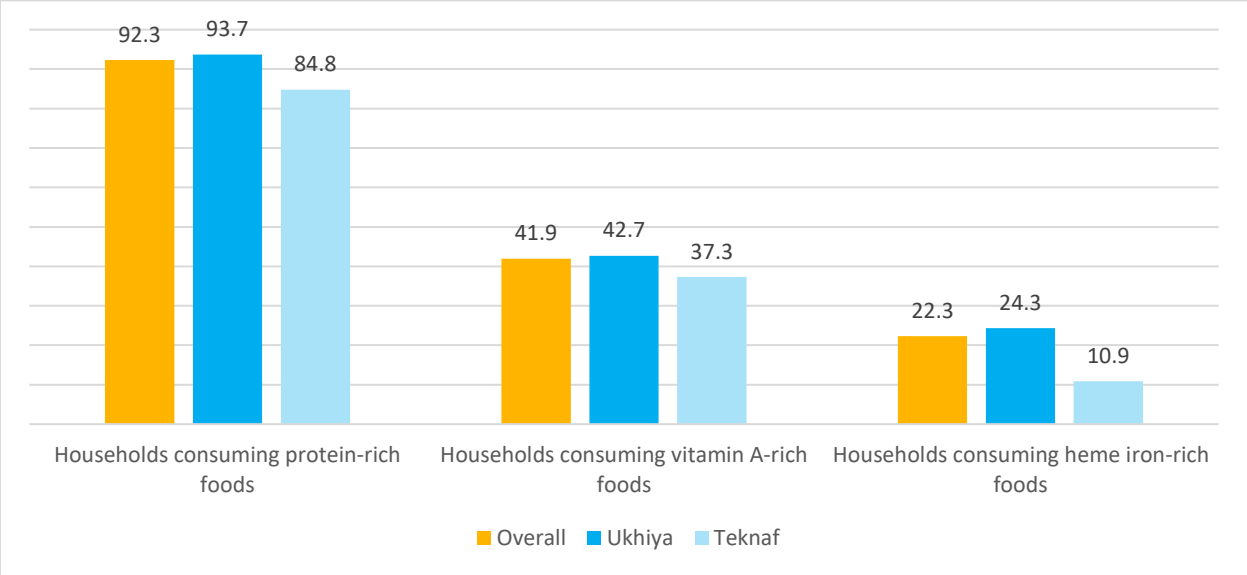
5.3.2.2 Vitamin A–Rich Foods

Table 5 also shows that vitamin A consumption is noticeably weaker than protein intake. Only 41.9% of households consume vitamin A–rich foods 7 days/week, while 55.5% consume them just 1–6 days

weekly. A small proportion (2.7%) report no consumption at all. These foods typically include green leafy vegetables, orange-fleshed vegetables, and fortified oil.

Qualitative findings reveal that vitamin A–rich foods are generally more accessible through both rations and markets, but availability fluctuates seasonally. Health workers emphasized that demand for leafy vegetables increases during periods of child illness, but affordability remains a barrier: *"Mothers know vegetables are good, but if prices rise even a little, they stop buying them."*

Figure 6. Percentage of households consuming selected nutrient-rich foods daily (7 days in the past week), by upazila, Cox's Bazar, 2025



5.3.2.3 Heme-Iron–Rich Foods

The most significant nutritional gap appears in the consumption of heme-iron foods. Only 22.3% of households consume heme-iron foods at adequate frequency (7 days/week). Consumption at adequate frequency is higher in Ukhiya compared to Teknaf (24.3% and 10.9%, respectively). The majority (77.3%) consume these foods only 1–6 days per week, and <1% report never consuming them (**Figure 6**). These findings reflect well-documented constraints on animal-source foods in Rohingya camps, where high costs and limited access restrict consumption.

Caregivers repeatedly describe meat, fish, and liver as "special foods for children" but unaffordable for regular consumption. One caregiver shared, *"Maybe once a month we buy fish. If there is sickness, we try to buy liver, but only if we have money that week."* Donors and programme staff echoed these concerns, noting that economic constraints, lack of income-generating opportunities, and reliance on cash transfers limit households' ability to diversify diets beyond basic staples.

Across the FCS and FCS-N indicators, a clear pattern emerges, that is, while households meet basic caloric and food frequency needs, nutritional quality remains constrained, particularly for micronutrient-rich foods. High FCS scores mask underlying vulnerabilities in nutrient adequacy, especially related to

iron-rich foods—a finding also highlighted in SENS 2023. The limited consumption of heme-iron foods corresponds closely to the high prevalence of anaemia observed in biomarker data.

Qualitative findings strengthen this interpretation. Caregivers widely recognize the importance of nutrient-rich foods but cite cost, market restrictions, and seasonal availability as barriers. Health workers note that even when micronutrient powders or iron supplements are distributed, caregivers sometimes struggle with adherence due to limited dietary diversity. As one ANC provider remarked, *"Supplements help, but without good food, the improvements are slow."*

The FCS and FCS-N findings demonstrate that food access is sufficient for survival but insufficient for optimal child nutrition or reduction of anaemia, highlighting the need for strengthened nutrition-sensitive and nutrition-specific interventions across the camps.

5.4 Child Health, Morbidity and Treatment-Seeking

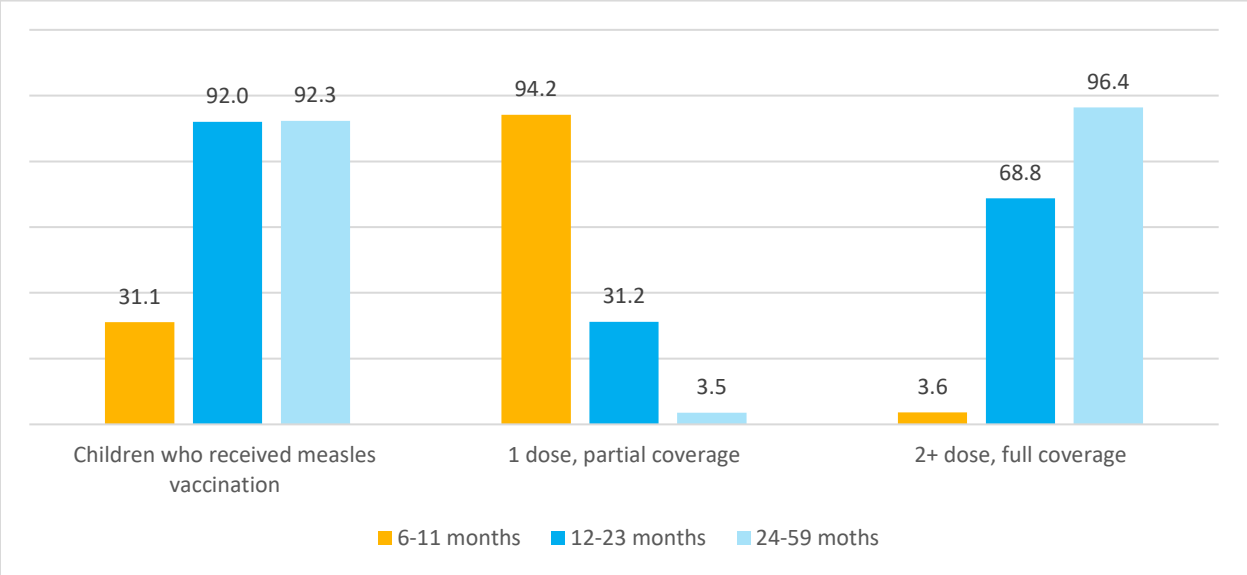
5.4.1 Measles Vaccination

Measles vaccination coverage among Rohingya children remains high in 2025, reflecting the continued effectiveness of Expanded Programme on Immunization (EPI) activities and ongoing mass vaccination campaigns within the camps. Overall, 85.8% of children aged 6–59 months are reported to have received a measles vaccine dose. This level of coverage is broadly consistent with findings from SENS 2023, which documented measles vaccination rates of around 87–89%, and aligns with long-term trends observed in REVA-5 and REVA-7, where coverage regularly exceeded 80% due to intensive outreach efforts and repeated campaign rounds following the major measles outbreaks of 2017–2018 (Salma, 2019; WHO, 2018).

Vaccination uptake is slightly higher in Teknaf (88.9%) compared with Ukhiya (85.2%). Although both subdistricts perform strongly, Teknaf's slightly higher coverage may reflect its smaller geographic footprint and more concentrated population, making house-to-house follow-up easier for health workers. Qualitative interviews with EPI staff support this interpretation, with one health worker noting: *"In Teknaf, we can cover all blocks in one round; in Ukhiya, it takes more time and more reminders to reach every household."*

Figure 7 shows that the partial vaccination (one dose only) remains relatively low at 13.8%, indicating that the majority of vaccinated children receive the full two-dose schedule. Full coverage (≥2 doses) is nearly identical between Ukhiya (85.7%) and Teknaf (88.2%), reinforcing that once children enter the vaccination pathway, completion rates are strong. Measles vaccination does not differ meaningfully by sex. Girls have an 88.1% coverage rate and boys 85.5%, mirroring patterns from SENS 2023 and REVA assessments, which consistently found no gender disparities in immunization uptake. These findings reinforce that vaccination services in the camps are generally equitable and not influenced by gender-based care-seeking preferences. Caregivers also emphasized this point during interviews: *"For injections, we take both boys and girls. It's the same for all children."*

Figure 7. Measles vaccination status (any dose, partial, and full coverage) among children by age group in Cox's Bazar, 2025



As expected, vaccination coverage increases with age. Only 31.1% of children aged 6–11 months have received the measles vaccine, reflecting the recommended administration age and the fact that many infants had not yet reached the eligible age at the time of survey. Coverage rises sharply to 92.0% among children 12–23 months and remains high (92.3%) among those aged 24–59 months. These patterns match those reported in SENS 2023, where coverage among infants was significantly lower simply due to age eligibility rather than access barriers.

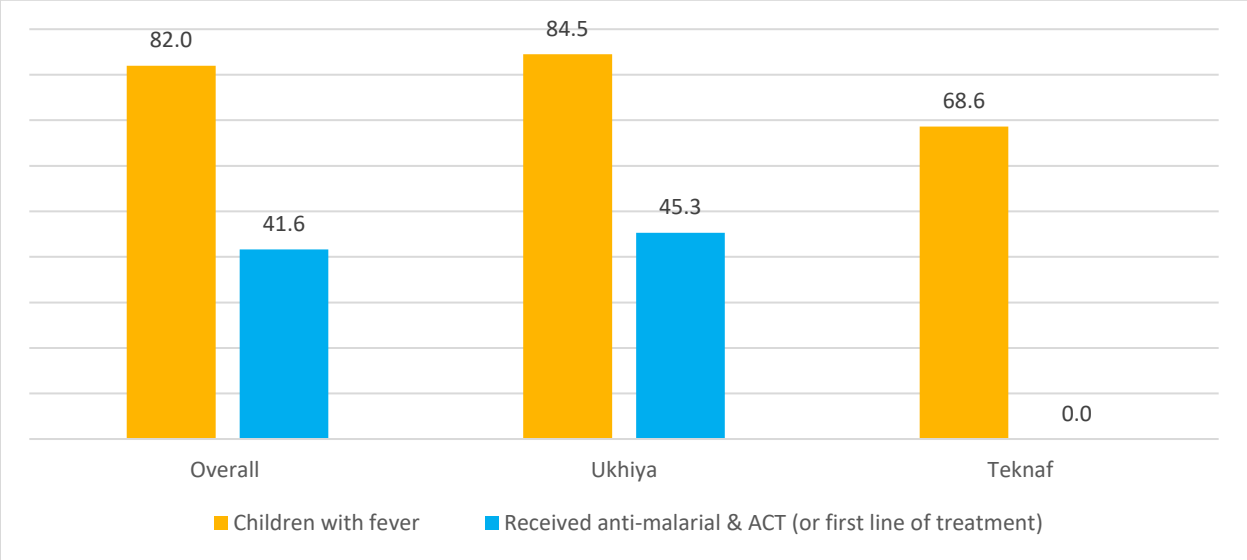
5.4.2 Use of Mosquito Nets

Mosquito net use among children aged 6–59 months is nearly universal, with 99.6% having slept under a net the night before the survey. This exceptionally high coverage is consistent across subdistricts, sex, and all age groups, reflecting the long-standing success of LLIN distribution campaigns in the camps and mirroring results from REVA-7 (>98%). The widespread availability of nets, combined with strong community awareness of mosquito-borne disease risk, has contributed to this sustained high adherence. Qualitative interviews reinforce this pattern, with caregivers frequently emphasizing that sleeping without a net is not acceptable. As one mother stated, *"Without the net, the mosquitoes disturb all night. The children cannot rest."* Even though caregivers occasionally mention torn nets or cramped spaces that complicate hanging the nets, these challenges have not reduced overall usage.

5.4.3 Fever

Fever is one of the most commonly reported childhood illnesses in the camps. Overall, 82% of children aged 6–59 months experienced fever in the two weeks prior to the survey, with higher levels in Ukhiya (84.5%) than Teknaf (68.8%) (**Figure 8**). The burden is highest among the youngest children, particularly those aged 6–11 months (88.5%), reflecting their heightened vulnerability to infectious diseases.

Figure 8. Reported childhood fever and coverage of antimalarial (ACT/first-line) treatment by upazila, Cox's Bazar, 2025

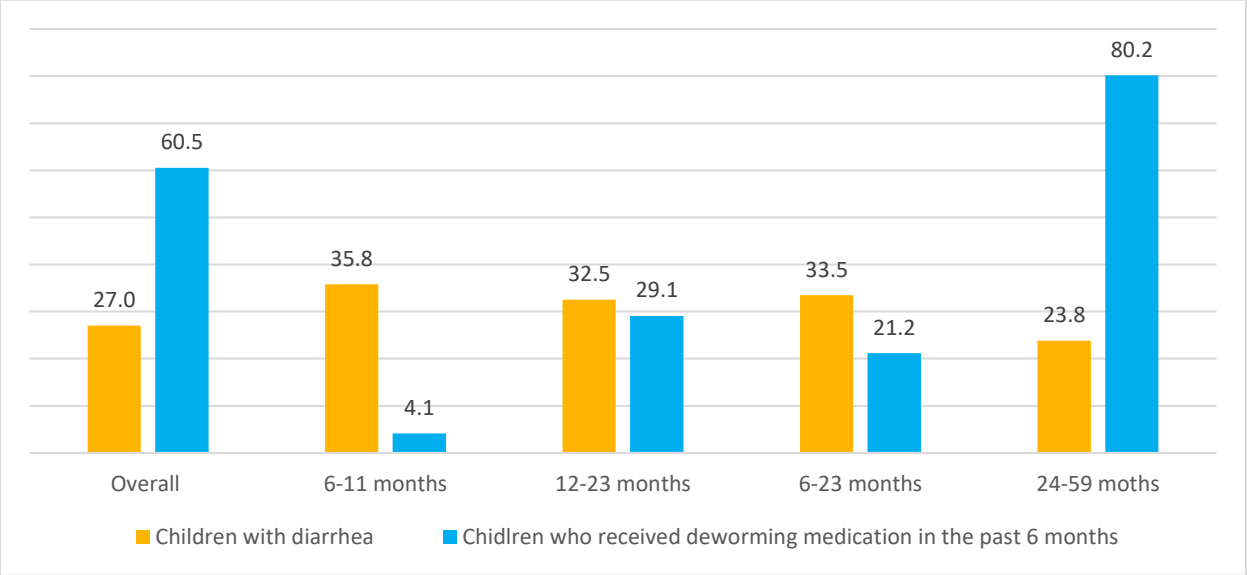


Treatment-seeking patterns indicate that caregivers often navigate a combination of formal and informal sources of care. Approximately 41.6% of febrile children received antimalarials or ACT, despite malaria being extremely rare in Cox's Bazar. This finding points to a reliance on presumptive treatments or the use of broad-spectrum medicines recommended by informal drug vendors. In qualitative interviews, caregivers frequently described fever as an illness requiring immediate action, sometimes leading to overtreatment: *"When he has fever, I go to the shop first. They give a tablet to make it go away quickly."* Health workers expressed similar concerns, noting that unnecessary use of antimalarials remains common due to misconceptions about fever causes.

5.4.4 Diarrhoea

Diarrhoea affects more than one-quarter of children in the camps, with an overall prevalence of 27%. The burden is higher in Ukhiya (28.1%) than in Teknaf (21.1%), reflecting known differences in environmental conditions, WASH infrastructure, and population density. As documented in SENS 2023 and earlier REVA assessments, diarrhoea prevalence peaks during early childhood, especially between 6–23 months, when children are exposed to complementary foods and environmental contaminants. The current findings are consistent with these historical patterns: 35.8% of infants aged 6–11 months experienced diarrhoea, with the prevalence gradually declining as children mature (**Figure 9**). NOTE. The study did not include stool-based parasitological testing

Figure 9. Prevalence of diarrhoea among children and coverage of deworming medication, by age group, Cox's Bazar, 2025



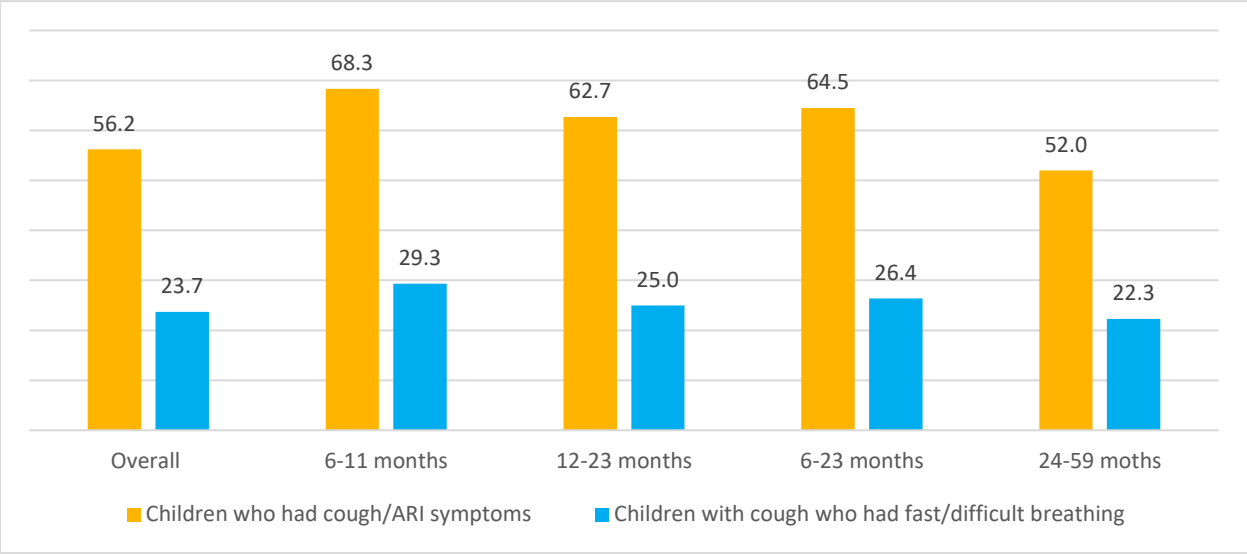
Encouragingly, treatment-seeking practices align with global recommendations. Among children with diarrhoea, almost 50% received ORS and 41.1% received ORS with zinc. Few (9.2%, n<30) received no treatment at all, similar to REVA-5 findings, in which 10–12% of children reportedly did not receive any therapy. Caregivers consistently emphasized ORS as a trusted intervention: "The health worker showed me how to mix the ORS. Now we always keep some in the house." Health workers noted steady improvements in ORS uptake but mentioned periodic zinc shortages in some camps. Overall, diarrhoea treatment patterns suggest strong familiarity with recommended management and effective communication between health actors and caregivers.

5.4.5 Acute Respiratory Infection Symptoms

Respiratory illnesses remain a major source of morbidity among Rohingya children. More than half (56.2%) of children reported cough and/or difficulty breathing in the two weeks preceding the survey, with higher prevalence in Ukhiya (59.4%) compared with Teknaf (38.7%). These results closely mirror SENS 2023, which identified ARI as one of the most common childhood conditions in the camps. The burden is particularly high among male children (60.0%) and those aged 6–11 months (68.3%), who are more susceptible to respiratory pathogens. Almost quarter of children (23.7%) had cough with fast or difficult breathing in the past two weeks (Figure 10).

Qualitative findings highlight that caregivers often view cough and respiratory symptoms as an unavoidable part of life in the camps, particularly during seasonal changes. As one mother explained, "All the children cough when the weather changes. We only worry when the breathing becomes heavy." Health workers confirmed that care-seeking often occurs late, typically only when symptoms escalate, contributing to clinic overcrowding and delays in case management. Shelter congestion, poor ventilation, damp sleeping spaces, and monsoon humidity were repeatedly mentioned as drivers of recurrent respiratory illness.

Figure 10. Percentage of children reporting cough or ARI symptoms and fast/difficult breathing, by age group, Cox's Bazar, 2025



5.4.6 Skin Conditions

Skin diseases affect 44% of all children, posing a substantial burden that is strongly linked to environmental conditions. Prevalence is slightly higher in Ukhiya (45.0%) compared with Teknaf (38.1%), though elevated levels are reported across all age groups. These findings are almost identical to SENS 2023, which documented skin disease prevalence between 42–45%, and consistent with REVA-7 trends showing persistent dermal conditions in areas with limited drainage, water stagnation, and high humidity. Skin diseases is highest in the younger children, 6-23 months (46%) compared to older children 24-59 months (43.1%). Caregivers frequently described the recurrent nature of skin problems, often attributing them to children's unavoidable exposure to sand, mud, and contaminated water. One caregiver noted, *"Even after treatment, the rash comes back because they play outside in dirty places."* Health workers similarly highlighted that environmental factors, crowding, and constrained hygiene options, rather than lack of care-seeking, drive the persistence of skin infections.

5.5 Child Nutrition

5.5.1 Breastfeeding

Breastfeeding initiation, measured by the proportion of children aged 6–23 months who were ever breastfed, continues to be nearly universal across the camps. This indicator reflects cultural norms around infant feeding, and the survey finds that 93.3% of children have been breastfed at some point, with comparable levels across Ukhiya (93.0%) and Teknaf (94.9%). These figures mirror the findings of SENS 2023 and earlier REVA rounds, all of which consistently documented breastfeeding initiation above 90%. Qualitative interviews reinforced this pattern: caregivers described breastfeeding as an unquestioned practice passed through generations. As one mother noted, *"Every baby drinks mother's milk first — that is our way."* Health workers similarly reported that refusal to breastfeed is extremely rare, occurring only in cases of maternal illness.

Continued breastfeeding among children aged 12–23 months, assessed based on whether breastmilk was consumed in the previous 24 hours, also remains high at 83.1% overall. Ukhiya households reported slightly higher continuation rates (84.3%) than Teknaf (74.3%). This practice is strongly reflected in caregiver narratives, where breastfeeding is often described as both a nutritional safety net and a coping mechanism in contexts of food insecurity. One caregiver explained, "Even if food is not enough some days, breastfeeding keeps the child strong." Despite challenges reported by mothers, including fatigue, competing responsibilities, and limited space, breastfeeding continuation remains a major nutritional strength in the camps.

5.5.2 Complementary Feeding

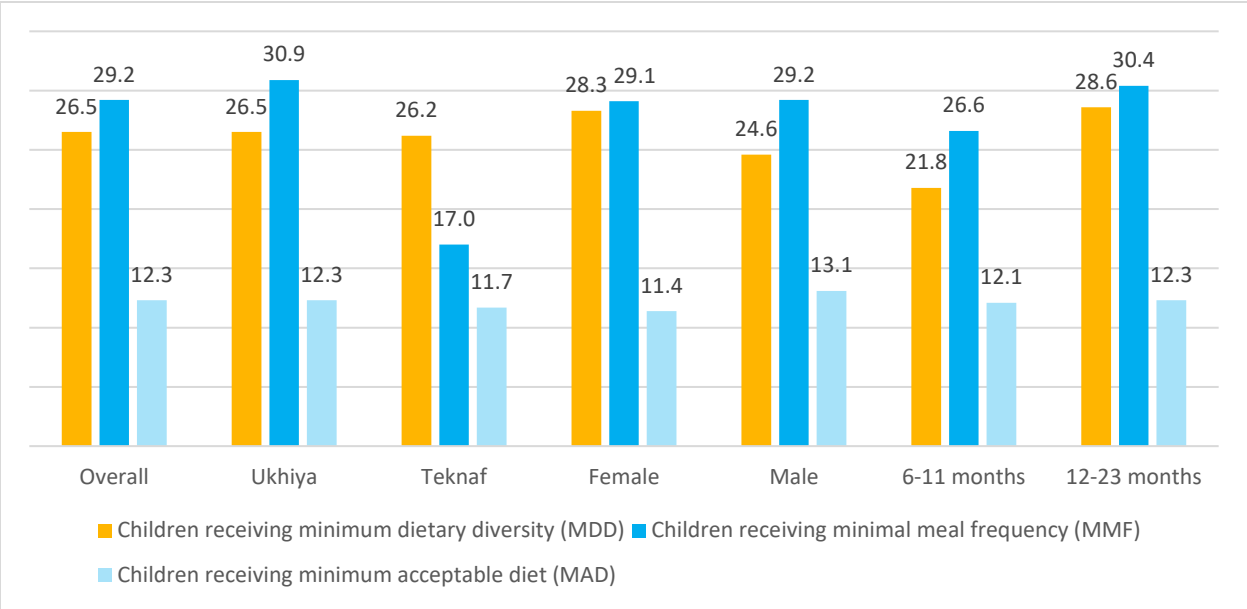
The timely introduction of complementary foods, measured among infants aged 6–8 months, is another key WHO infant and young child feeding indicator. This survey finds that 78.2% of infants receive solid, semi-solid, or soft foods, with higher levels in Ukhiya (80.2%) compared with Teknaf (63.3%). These results are consistent with SENS 2023, which reported complementary feeding initiation between 75% and 80%, and show an improvement relative to earlier REVA rounds where initiation hovered closer to 70%. Caregivers interviewed typically described starting with mashed rice, lentils, or khichuri at around six months, with one mother saying, *"At six months, we begin giving soft rice so the child learns to eat."* Health workers noted that concerns about choking or digestion occasionally delay introduction, especially among first-time mothers, but such hesitation appears relatively limited.

Among non-breastfed children, the minimum milk feeding frequency indicator, which requires at least two milk feeds per day, was extremely low at 2.3%. This aligns with patterns from SENS 2023 and REVA-7, where the same indicator remained below 5%. The low value primarily reflects the fact that almost all children continue to breastfeed; for the very small number who do not, access to appropriate milk substitutes is limited. Qualitative findings underscore this constraint, with mothers frequently stating that formula or cow's milk is unaffordable. As one caregiver put it, *"If we cannot breastfeed, what milk can we buy? It is too costly."* Health workers expressed concern about this gap but noted that the continued high rates of breastfeeding substantially mitigate its nutritional consequences.

Minimum meal frequency (MMF), which assesses whether a child received the age-appropriate number of solid or semi-solid feedings in the previous day, remains low at 29.2% overall (47.3% in SENS 2023). Ukhiya shows somewhat better performance (30.9%) than Teknaf (17.0%). Caregivers often spoke about irregular feeding schedules due to competing household demands, insufficient food, or lack of time. One mother explained, *"Sometimes I am cooking or fetching water… the child must wait until I return."* These qualitative insights help explain why MMF remains persistently low despite strong breastfeeding practices.

Dietary diversity, measured through the minimum dietary diversity (MDD) indicator requiring consumption of at least five food groups, remains limited at 26.5%, showing almost no change from SENS 2023 (26.9%). Both subdistricts perform similarly, suggesting that constraints are structural rather than location specific. Interviews with caregivers highlighted economic barriers to purchasing diverse foods such as eggs, fish, fruits, or meat. As one mother stated, *"The child wants different foods, but we cannot buy them every day."* This reliance on a restricted food basket dominated by rice, lentils, potatoes, and oil continues to limit children's dietary diversity.

Figure 11. Coverage of key IYCF indicators (MDD, MMF, and MAD) among children, by selected characteristics, Cox's Bazar, 2025



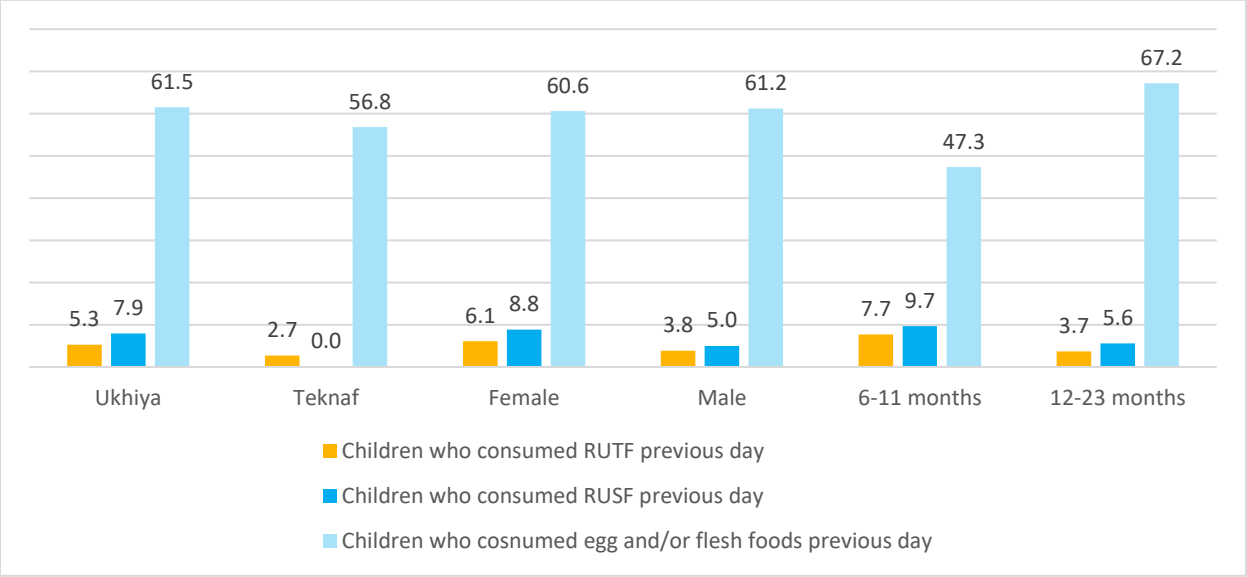
The minimum acceptable diet (MAD), a composite indicator that requires meeting both MDD and MMF, is achieved by only 12.3% of children. This figure aligns with SENS 2023 (16.5%) and demonstrates a persistent gap in the quality and adequacy of complementary feeding over time. Caregivers consistently expressed awareness of recommended feeding practices but described being unable to implement them due to financial constraints. One mother reflected, *"We know what foods are good… but without money, how can we give them?"* This disconnect between knowledge and practice is a recurrent theme in nutrition research among displaced populations and remains evident in the Rohingya camps.

5.5.3 Consumption of Desirable and Undesirable Foods

Children's consumption of nutrient-dense foods shows important variation across food groups, reflecting both household food availability and caregivers' feeding practices. The aggregated "desirable" and "undesirable" food categories are analytic groupings created for this study; however, interpretation is more meaningful when examining the individual food items that contribute to these groups, particularly ready-to-use therapeutic foods (RUTF), ready-to-use supplementary foods (RUSF), and consumption of eggs, flesh foods, vegetables, fruits, and sugary or unhealthy items.

Consumption of fortified therapeutic or supplementary foods remains relatively limited. Only 4.9% of children consumed RUTF on the previous day, with slightly higher intake in Ukhiya (5.3%) compared with Teknaf (2.7%). RUSF consumption is somewhat higher at 6.9%, with 7.9% in Ukhiya and none in Teknaf. Qualitative interviews confirm that caregivers generally receive RUTF or RUSF only when the child is enrolled in a programme, and supplies are not used for routine feeding. As one mother explained, *"They give this food only when the child is sick or weak, we cannot get it otherwise."* Health workers noted that correct programme targeting and ration control may explain the low prevalence in the general population.

Figure 12. Reported previous-day consumption of RUTF, RUSF, and animal-source foods among children, by location, sex, and age group, Cox's Bazar, 2025

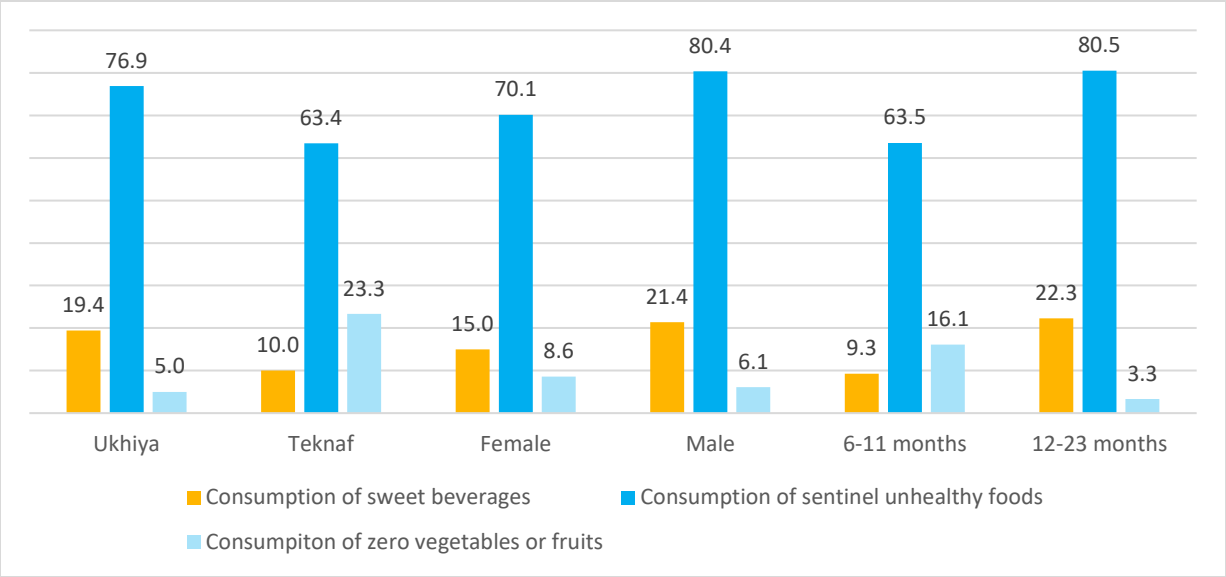


Consumption of eggs or flesh foods — a key marker of protein and micronutrient adequacy — was reported by 60.9% of children. This indicator shows variation across areas: 61.5% in Ukhiya and 56.8% in Teknaf, with similar intake among boys and girls. These values are higher than SENS 2023, where egg and fish consumption was 51.8%. Caregivers often described eggs as one of the most accessible nutrient-rich foods: *"When we can afford something good for the child, we buy eggs first."* However, affordability remains a barrier, with several mothers emphasising that rising prices limit consistent consumption, especially of meat or fish.

Consumption of "undesirable" foods was very high, driven primarily by the widespread intake of "sentinel unhealthy foods," which refers to items like packaged snacks, chips, biscuits, instant noodles, and other ultra-processed products commonly sold in camp markets. The survey finds that 75.1% of children consumed such items the previous day, with slightly higher rates in Ukhiya (76.9%) compared with Teknaf (63.4%). This pattern mirrors findings from SENS 2023, which also documented high exposure to low-cost, energy-dense processed snacks (54.5%). Caregivers frequently acknowledged reliance on these foods due to convenience and the influence of older siblings. As one mother explained, *"These small packets are cheap….the child asks for them, so we give sometimes."* Health workers expressed concern that these snacks displace healthier foods, especially when household food diversity is already low.

Sweet beverage consumption, including sugary tea, sweetened drinks, and commercially flavoured beverages, is also common. Across the camps, 18.2% of children consumed a sweetened drink the previous day, with notable differences between Ukhiya (19.4%) and Teknaf (10.0%). Mothers often described using sweetened tea or flavoured drinks to calm children or accompany meals. One caregiver stated, *"If the child refuses food, a little sweet tea helps them eat."* This practice mirrors patterns observed in other camp settings where sweetened beverages are used as a low-cost appetite stimulant.

Figure 13. Percentage of children consuming sweet beverages, sentinel unhealthy foods, or no fruits or vegetables on the previous day, by selected characteristics, Cox's Bazar, 2025



Failure to consume vegetables and fruits, a negative indicator of dietary quality, affected 7.4% of children overall, although Teknaf reported a substantially higher proportion (23.3%) compared with Ukhiya (5.0%). These findings align with SENS 2023, which highlighted persistent gaps in access to fresh produce across the camps. Caregivers described vegetables and fruits as among the least affordable items in camp markets. As one mother remarked, *"Fish and eggs we buy sometimes, but fruits… only if someone is sick."* The mismatch between the nutritional needs of young children and the economic realities of displaced households continues to limit progress on improving diet quality.

Overall, the consumption patterns of desirable nutrient-dense foods show modest strengths, particularly in egg and flesh food intake, but therapeutic foods remain restricted to treatment programmes, and intake of vegetables and fruits is insufficient for a significant share of children. Meanwhile, widespread consumption of unhealthy processed snacks and sweet beverages reflects deep structural challenges around food affordability, market dynamics, and child feeding norms.

5.6 Iron-Fortified Foods and Supplementary Foods/Rations

5.6.1 Iron-Fortified Foods and Supplements

Iron-fortified food and supplement coverage among mothers remains high, reflecting the continued prioritization of maternal micronutrient support across the humanitarian response. Among mothers of children aged 6–59 months, 78.9% report having received iron-fortified rations (such as fortified rice), with similar coverage between Ukhiya and Teknaf. Nearly all mothers, that is, 97.8% report having received some form of iron-fortified food, indicating exceptionally broad reach of ration-based fortification strategies. Qualitative interviews reinforce this pattern: caregivers describe fortified rice as *"the one thing we always receive"*, with many noting that distribution is predictable even when other services fluctuate.

Coverage of IFA supplementation for mothers, however, reflects more program variability. Only 76.6% of surveyed mothers report receiving IFA tablets from any programme in the past 30 days, with Teknaf showing somewhat higher receipt than Ukhiya. The majority of IFA recipients reported consuming tablets the day before the survey (76.6%), an encouraging sign of adherence. Nonetheless, the average number of tablets received is only 17.8, indicating that many mothers receive less than a full monthly course (**Table 12**). This aligns with caregiver narratives highlighting irregular supply: *"Sometimes they give the tablets, sometimes not. If the clinic is crowded, they say to come next week."* Health staff also described inconsistent stock levels and high demand among pregnant and lactating women, which can stretch supply chains.

Table 12. Coverage of iron-fortified foods, iron and folic acid (IFA) supplementation, and vitamin A among mothers and children, by selected characteristics, Cox's Bazar, 2025

Characteristics	Overall	Ukhiya	Teknaf	Female	Male	6-11 mo.	12-23 mo.	24-59 mo.
Mothers who received iron-fortified foods and supplements								
Received iron-fortified rations (Pusti-rice)	78.9	79.6	74.7	79.3	78.5	78.8	77.7	79.3
Received iron-fortified foods	97.8	98.5	93.7	98.0	97.6	95.0	97.2	98.4
Received IFA tablets from any programme in the past 30 days	76.6	80.0	62.9	76.5	76.9	47.7	78.2	77.8
Number of tablets received (mean)	17.8	19.2	12.3	18.1	17.5	19.1	19.5	17.4
Consumed IFA tablets a day before the survey	76.6	80.0	62.9	76.5	76.9	47.7	78.2	77.8
Received iron-fortified ration and/or iron and folic acid (IFA)	3.1	3.0	3.9	1.9	5.0	-	-	4.0
Children who received iron-fortified foods and supplements								
Consumed iron-fortified foods	95.3	96.4	89.2	95.5	95.1	80.8	94.0	98.1
Received iron syrup/tablets in the past 12 months	4.6	3.6	10.2	4.9	4.3	4.3	4.3	4.4
Consumed the iron syrup/tablets	5.3	4.1	11.7	5.7	4.8	5.2	5.6	5.2
Received a Vitamin A capsule in the last 6 months (after Dec 2024)	80.7	89.4	33.4	81.2	80.1	70.7	81.3	82.0

Only 1.9% of mothers report receiving IFA combined with folic acid or iron-fortified rations as part of a coordinated programme package. This low figure underscores fragmentation across maternal nutrition programmes, a challenge echoed in qualitative interviews where mothers expressed uncertainty about which supplements come from which agency and how frequently they should expect them. Caregivers in qualitative interviews often struggled to distinguish between IFA, vitamin A, MNPs, and fortified blended foods, referring to all supplements simply as *"vitamins"* or "*strong tablets."* Several mothers noted that distributions occur at different times and from different providers, making it unclear which items are meant to form a combined package. As one caregiver explained, *"They give many things—tablets,*

powder—but I don't know which one belongs together." These factors suggest that the very low reporting rate likely reflects both limited programme integration and challenges in supplement identification and recall during the survey interview.

In addition, he availability of multiple, overlapping iron and folic-acid products in local pharmacies, without clear guidance on complementary use, contributes to caregiver confusion and inconsistent supplementation practices. The photo below shows examples of iron- and folic-acid–containing products observed in local pharmacies, including standalone folic acid tablets, multi-micronutrient iron supplements, and ferric maltol formulations. The wide variety of formulations and packaging illustrates the complexity caregivers face when attempting to determine which products should be taken together or separately.

Iron-fortified food consumption among young children is high and more consistent than maternal supplementation patterns. A striking 95.3% of children 6–59 months are reported to have consumed iron-fortified foods (primarily fortified rice), closely mirroring maternal receipt. This nearly universal coverage represents one of the most stable components of the food assistance system — consistent with REVA-7 findings, which similarly documented fortified rice consumption above 90% among refugee households.

In contrast, the use of iron syrups/tablets for children remains very low: only 4.6% received iron supplements in the past year, and 5.3% consumed iron syrups/tablets. These levels are consistent with SENS 2023, which also found <10% coverage of direct iron supplementation for children — reflecting global guidance discouraging universal iron syrup distribution in infection-prone, high-inflammation settings unless anaemia programming is tightly monitored. Products observed in local pharmacies indicate that child supplementation is

limited to vitamin B12 and zinc formulations (**Photo on the right**), rather than iron-containing or broader multi-micronutrient supplements.

By comparison, Vitamin A supplementation is substantially higher: 80.7% of children received a vitamin A capsule in the preceding six months (post-December 2024), slightly lower to SENS findings (91.7%) but reflecting strong outreach coverage through routine EPI and campaign-style delivery. Caregivers referenced Vitamin A distribution as a familiar service: *"They told us it helps the eyes and keeps children strong. They give it two times a year."*

Demographic differences are minor but notable. Children aged 24–59 months have the highest fortified-food consumption (98.1%) and the highest Vitamin A coverage (82.0%), reflecting their greater engagement with routine services (Table 12). Younger children, especially those aged 6–11 months, have lower exposure to iron-fortified programmes: only 80.8% had consumed fortified foods, and Vitamin A coverage was 70.7%. Qualitative findings deepen understanding of these trends. Many mothers described ration sharing within extended families, "the rice is for everyone, not only the child", which may dilute the micronutrient benefit for young children despite high reported consumption. Health workers also noted poor adherence to iron syrup due to taste, gastrointestinal side effects, and fears about fever: *"Mothers think the iron makes the child sick, so they stop."* This helps explain why high coverage of fortified food does not translate into widespread supplementation uptake.

5.6.2 Supplementary Feeding Programmes

The proportion of mothers reporting enrolment in, or receipt of rations from, a supplementary feeding programme (BSFP/TSFP) in the past three months is 24.6%, with nearly identical levels in Ukhiya (24.5%) and Teknaf (24.3%). This means that roughly one in four mothers with children aged 6–59 months is currently receiving targeted nutritional support, a figure that is notably lower than the levels documented in SENS 2023, where mother-level BSFP/TSFP contact was estimated closer to 30–35%, depending on camp. The consistently modest enrolment reflects ongoing challenges in ensuring programme coverage among women who may be nutritionally vulnerable but fall outside strict eligibility criteria.

By contrast, receipt of rations through ancillary channels, specifically rations from semolina/nutrition programs, is considerably higher, with 73.5% of mothers overall reporting receipt of rations from e-vouchers or other nutrition programmes. This pattern is consistent across sites, with Ukhiya at 73.7% and Teknaf at 71.6%, suggesting that while specialized supplementary programmes may have limited coverage, more general nutrition assistance reaches a significantly broader population. Qualitative findings echo this distinction: many caregivers described the e-voucher system as predictable and widely accessible, whereas BSFP/TSFP enrolment was perceived as selective and episodic. As one mother put it, *"The card [e-voucher] always gives food, but TSFP is only when they say the child is thin."*

These findings suggest that maternal access to supplementary food support is shaped less by geographic differences and more by programme design, particularly screening thresholds, seasonal caseload variations, and differing operational footprints of implementing partners. Health workers interviewed frequently referenced these structural determinants, explaining that enrolment depends on anthropometric eligibility or pregnancy/lactation status, while household-level food support continues independently

through e-voucher systems. One worker summarized the issue succinctly: *"Most women get food, but fewer get nutrition treatment unless they qualify."*

Table 13. Enrolment and consumption patterns of BSFP, TSFP, and OTP rations among eligible children, disaggregated by location, sex, and age group, Cox's Bazar, 2025

Characteristics	Overall	Ukhiya	Teknaf	Female	Male	6-11 mo.	12-23 mo.	24-59 mo.
Children 6-23 months who enrolled/consumed BSFP								
Enrolled in BSFP	87.7	88.2	84.4	83.2	92.3	82.3	90.0	n/a
Consumed by intended child	17.0	16.8	17.9	15.1	18.6	13.9	18.1	n/a
Shared with others in household	**79.5**	80.0	75.9	82.4	76.9	82.5	78.3	n/a
Not consumed/not fed by child	2.1	1.9	3.9	1.8	2.4	1.3	2.5	n/a
Ration not available at household	1.4	1.3	2.2	0.7	2.1	2.3	1.1	n/a
Children 6-59 months who enrolled/received/consumed TSFP								
Enrolled in TSFP	18.7	13.6	7.4	17.6	8.2	17.6	10.9	32.1
Received TSFP in past 3 months	15.5	16.3	10.8	17.7	13.2	13.9	9.2	26.5
Consumed by intended child	59.3	55.3	46.6	57.3	50.6	75.1	42.7	63.5
Shared with others in household	**35.8**	34.2	53.4	31	42	20.4	43.8	36.5
Not consumed/not fed by child	0.8	1.8	0.0	2.6	0	4.5	0.0	0
Ration not available at household	4.1	8.8	0.0	9.1	7.3	0.0	13.5	0
Children 6-59 months who enrolled/received/consumed OTP								
Enrolled in OTP	4.7	4.0	11.4	7.1	2.7	7.7	3.7	4.5
Consumed by intended child	48.8	41.9	100	63.4	26.7	57	45.4	44.5
Shared with others in household	**47.4**	58.1	-	36.6	73.3	43	54.6	38.2
Not consumed/not fed by child	3.9	0.0	0.0	0.0	0.0	0.0	0.0	17.4
Ration not available at household	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 13 shows that child-level participation in supplementary feeding programmes displays a markedly different pattern. Overall, 93.5% of children aged 6–59 months received BSFP/TSFP/OTP rations in the past three months, with slightly higher coverage in Ukhiya (94.8%) than Teknaf (84.1%). This is consistent with SENS 2023 that reported that 93.5% children received rations from BSFP/TSFP or OTP. The coverage level suggests that a significant proportion of children are interfacing with supplementary nutrition services, either through blanket distribution programmes or targeted treatment initiatives.

Among the 6–23 month subgroup, enrolment in BSFP is particularly high at 87.7% overall, and 88.2% in Ukhiya and 84.4% in Teknaf (**Table 13**). This reflects the policy focus on young children, who are universally eligible for BSFP regardless of nutritional status. Importantly, however, only 17% of BSFP rations were consumed by the intended child, while 79.5% were shared with other household members. Caregivers consistently explained this sharing dynamic during interviews: *"How can we give only to one child? All children eat from the same pot."* Sharing is a long-recognized pattern in Rohingya households and highlights the tension between individual-targeted supplementation and collective household food insecurity.

For TSFP, which is designed for children with acute malnutrition, 18.7% of children aged 6–59 months had been enrolled in the past three months, with similar levels across subdistricts (Ukhiya 13.6%, Teknaf

7.4%). More than half of TSFP rations (59.3%) were consumed by the intended child, while 35.8% were shared—again pointing to household-level coping behaviours. Less than one percent reported the ration not being consumed by the intended child at all, with some caregivers reporting worry about side effects, difficulty feeding the child the prescribed product, or family-level pressure to redistribute. A mother in Camp 7 described this tension: "*The child doesn't like the taste. My other children eat it instead."*

Reported enrolment of children in OTP is very low, at 4.7% overall, with similar levels in Ukhiya (4.0%) and Teknaf (11.4%, though based on a very small sample and therefore statistically unreliable). Because OTP participation is driven exclusively by programme enrolment rather than population-wide eligibility, these figures reflect only the subset of households with children who were directly enrolled in the past three months. Among these households, 48.8% reported that the ration was consumed by the intended child, while 47.4% reported sharing with other household members (Table 13). As with BSFP and TSFP rations, these results illustrate a persistent pattern of intra-household sharing, which caregivers described as unavoidable: *"If there is food in the house, everyone will eat from it."* Due to very small case numbers (n=23), OTP-related estimates should be interpreted cautiously, with limited ability to detect meaningful differences across age or sex subgroups.

Across all programmes, ration unavailability at home at the time of survey reporting is low (<4%, depending on programme), suggesting that most rations are used fairly quickly after receipt, whether by the intended recipient or the wider household. Qualitative interviews reinforce this pattern, with caregivers noting that supplementary foods rarely "stay in the house" because they are either immediately consumed or shared widely.

5.7 Anaemia and Biochemical Indicators

Anaemia in Rohingya children remains a multifactorial condition shaped by overlapping nutritional deficiencies and non-nutritional factors such as inflammation and infection. The biochemical profile from this survey provides a detailed picture of these aetiologies, showing distinct patterns by age, sex, and subdistrict, while aligning with caregiver and provider narratives describing persistent challenges in dietary quality, morbidity, and micronutrient access. The interpretation of iron status relies on ferritin values appropriately adjusted for inflammation using CRP and AGP, consistent with WHO and BRINDA recommendations. This adjustment is essential in settings like Cox's Bazar, where inflammation is widespread and can mask true iron deficiency.

5.7.1 Anaemia Prevalence and Severity

Haemoglobin deficiency (any anaemia) is defined as Hb <10.5 g/dL for children 6–23 months and Hb <11.0 g/dL for children 24–59 months. Overall, 32% of children aged 6–59 months meet the criteria for haemoglobin deficiency. Prevalence is higher in Teknaf (39%) than Ukhiya (31%) and is slightly higher among boys (34%) than girls (30%). Anaemia shows a strong age pattern, with the highest prevalence in infancy. More than half of children aged 6–11 months (55%) are anaemic, declining to 42% among children 12–23 months, and further to 27% among children 24–59 months. When examined within age strata, 45% of children aged 6–23 months have haemoglobin <10.5 g/dL, compared with 27% of children aged 24–59 months who have haemoglobin <11.0 g/dL. This pattern indicates that the burden of anaemia is concentrated in the first two years of life.

Mild anaemia is defined as Hb 9.5–10.4 g/dL (6–23 months) and Hb 10.0–10.9 g/dL (24–59 months). Mild anaemia affects 22% of children aged 6–59 months, making it the most common severity category. Prevalence is again highest among infants and young children. Among 6–11-month-olds, 37.6% have

Figure 14. Prevalence and severity of anaemia among children aged 6–59 months, by location and sex, Cox's Bazar, 2025

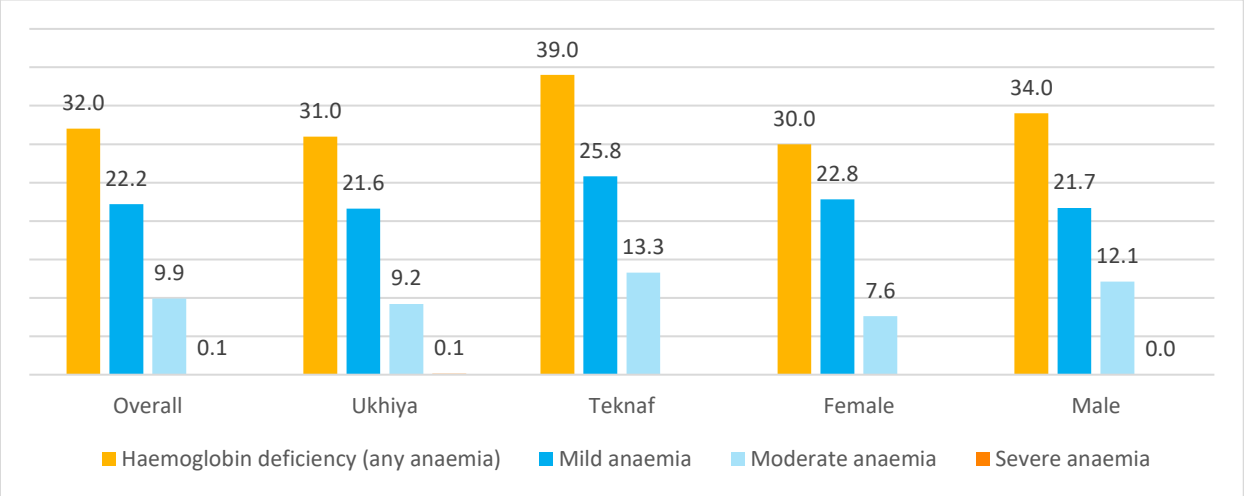
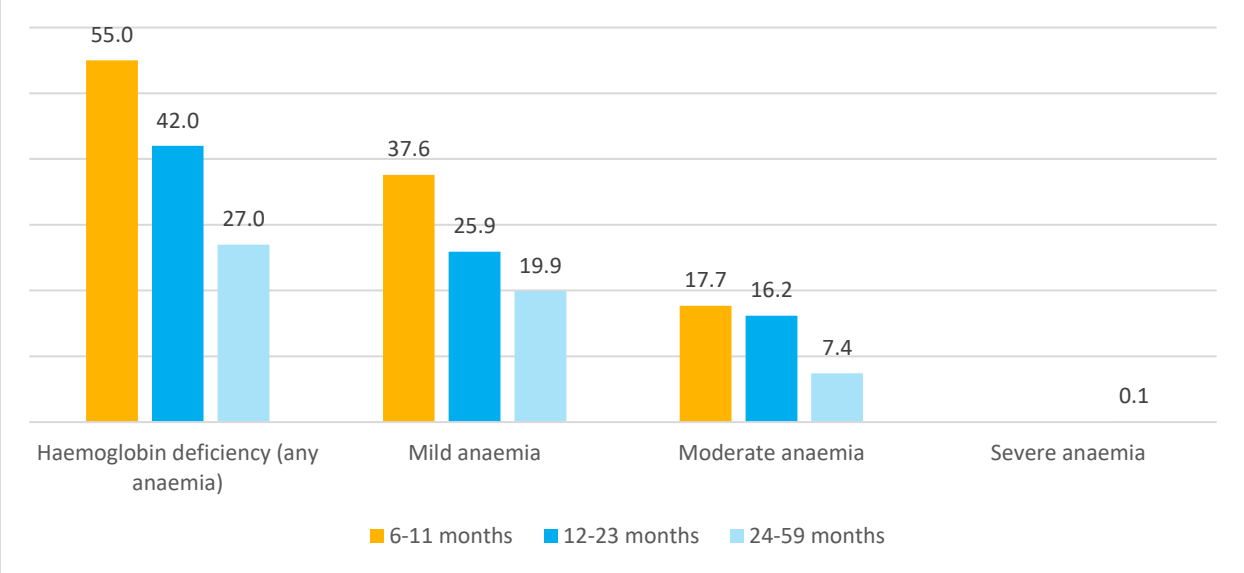


Figure 15. Prevalence and severity of anaemia among children aged 6–59 months, by age group,



Cox's Bazar, 2025

mild anaemia, followed by 25.9% among children 12–23 months, and 19.9% among children 24–59 months. Within age-specific definitions, 28.5% of children aged 6–23 months have haemoglobin between 9.5–10.4 g/dL, while 19.9% of children aged 24–59 months have haemoglobin between 10.0–10.9 g/dL. Mild anaemia is similarly prevalent among girls and boys and does not differ substantially by camp.

Moderate anaemia is defined as Hb 7.0–9.4 g/dL (6–23 months) and Hb 7.0–9.9 g/dL (24–59 months). Moderate anaemia affects 9.9% of children aged 6–59 months. As with overall anaemia, prevalence is substantially higher in younger children. Approximately 17.7% of infants aged 6–11 months and 16.2% of children aged 12–23 months have moderate anaemia, compared with 7.4% among children aged 24–59 months. Using age-specific thresholds, 16.5% of children aged 6–23 months have haemoglobin levels between 7.0–9.4 g/dL, while 7.4% of children aged 24–59 months have haemoglobin between 7.0–9.9 g/dL. Moderate anaemia is more common among boys than girls and is slightly more prevalent in Teknaf than in Ukhiya. Severe anaemia is defined uniformly as Hb <7.0 g/dL for all ages. Severe anaemia (Hb <7.0 g/dL) is extremely rare, affecting approximately 0.1% of children. No meaningful differences are observed by age, sex, or camp, indicating that life-threatening anaemia is uncommon in this population.

Mean haematocrit is 36.7% overall, supporting the haemoglobin findings. HCT is lowest among infants (34.9% in 6–11 months) and increases steadily with age to 37.2% among children 24–59 months, reflecting age-related improvements in red cell mass and oxygen-carrying capacity. Differences by sex and residence are minimal. See Annex **E1, E3** and **E5** for more details.

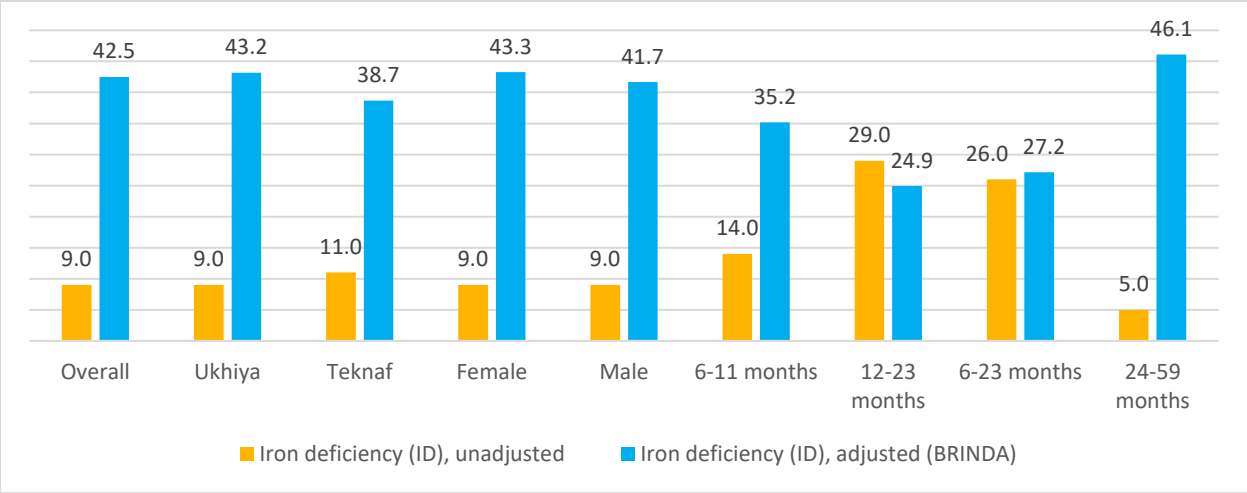
While haemoglobin deficiency affects nearly one-third of children overall, the observed age-gradient—with disproportionately high prevalence and greater severity among infants and younger children—suggests that anaemia in this population is not driven by a single mechanism. The predominance of mild and moderate anaemia, alongside the near-absence of severe cases, further indicates a largely chronic rather than acute process. Importantly, haemoglobin concentration alone cannot distinguish between nutritional iron deficiency, anaemia of inflammation, or other non-nutritional causes. To better understand the underlying drivers of anaemia in this setting, subsequent analyses therefore examine iron status biomarkers, markers of infection and inflammation, and red blood cell indices, allowing for differentiation between nutritional and non-nutritional aetiologies of anaemia and for identification of age-specific risk pathways.

> **Anaemia affects about 1 in 3 children in the camps.**
> **The problem is most severe in the first two years of life.**
> **More than half of infants aged 6–11 months are anaemic.**
> **The risk drops as children grow older.**
> **This means the first 1,000 days (pregnancy to age 2) are the most critical window for prevention.**

5.7.2 Nutritional Anaemia: Iron Deficiency and Iron-Deficiency Anaemia

Based on unadjusted ferritin concentrations <12 µg/L, a conventional threshold used to indicate depleted body iron stores in children, 9.0% of children are iron-deficient. Iron deficiency is highly age-dependent: prevalence is 14.0% in children 6–11 months and peaks at 29.0% in children 12–23 months, before declining sharply to 5.0% among children 24–59 months (**Figure 16**). This age pattern reflects the period of rapid growth and high iron requirements in infancy and early toddlerhood. Sex differences are minimal (9.0% in both girls and boys), while Teknaf shows a slightly higher prevalence (11.0%) than Ukhiya (9.0%).

Figure 16. Prevalence of iron deficiency among children aged 6–59 months, before and after BRINDA adjustment, by selected characteristics, Cox's Bazar, 2025



When anaemia and low ferritin are combined, unadjusted iron-deficiency anaemia (IDA), defined here as the coexistence of low haemoglobin, indicating reduced oxygen-carrying capacity, and low ferritin, indicating depleted iron stores, affects 6.6% of all children 6–59 months. This burden is strongly concentrated in younger children: 15.2% of children 6–23 months have unadjusted IDA compared (**Figure 17**) with only 2.5% of children 24–59 months (**Figure 18**). Among infants and young toddlers, IDA prevalence reaches 16.3% in Teknaf and 15.6% overall at 12–23 months, highlighting the nutritional vulnerability of this age group during the transition from breast milk to complementary feeding.

Figure 17. Prevalence of iron-deficiency anaemia (IDA) among children aged 6–23 months, before and after BRINDA adjustment, by selected characteristics, Cox's Bazar, 2025

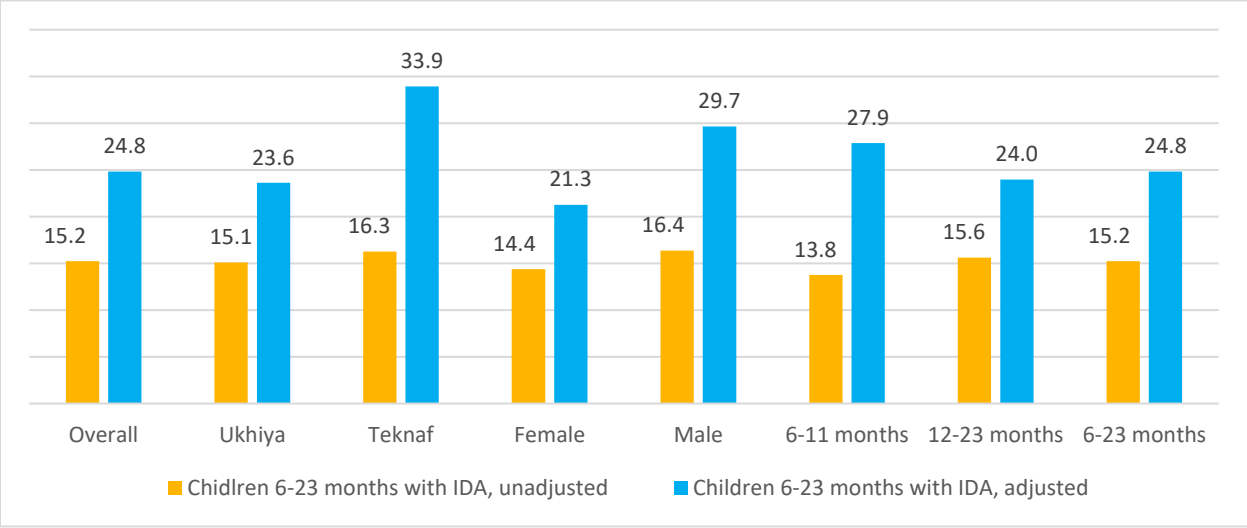
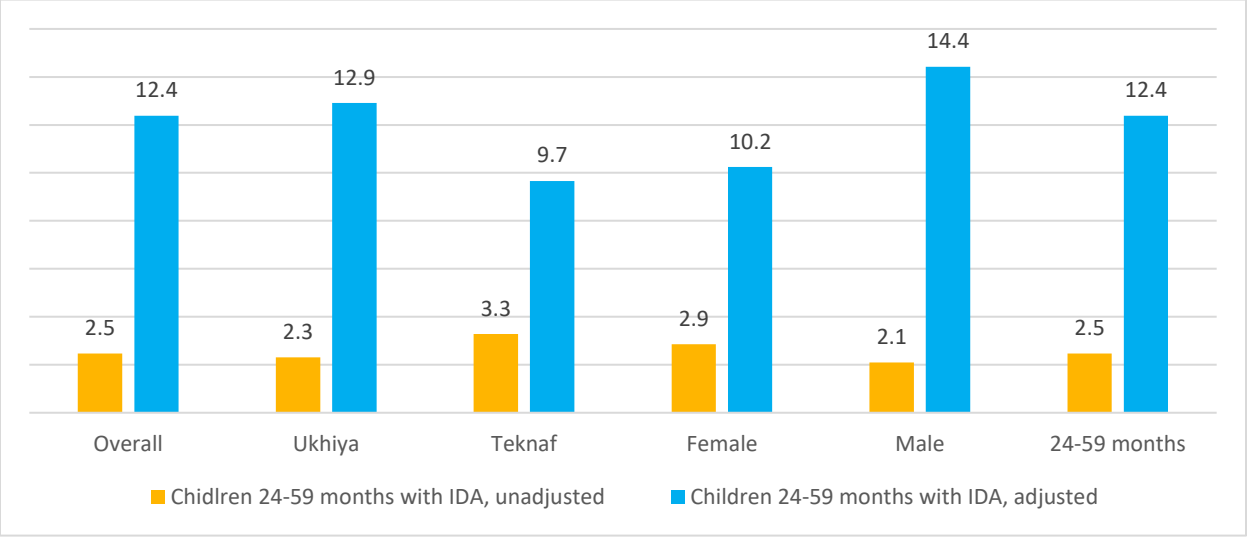


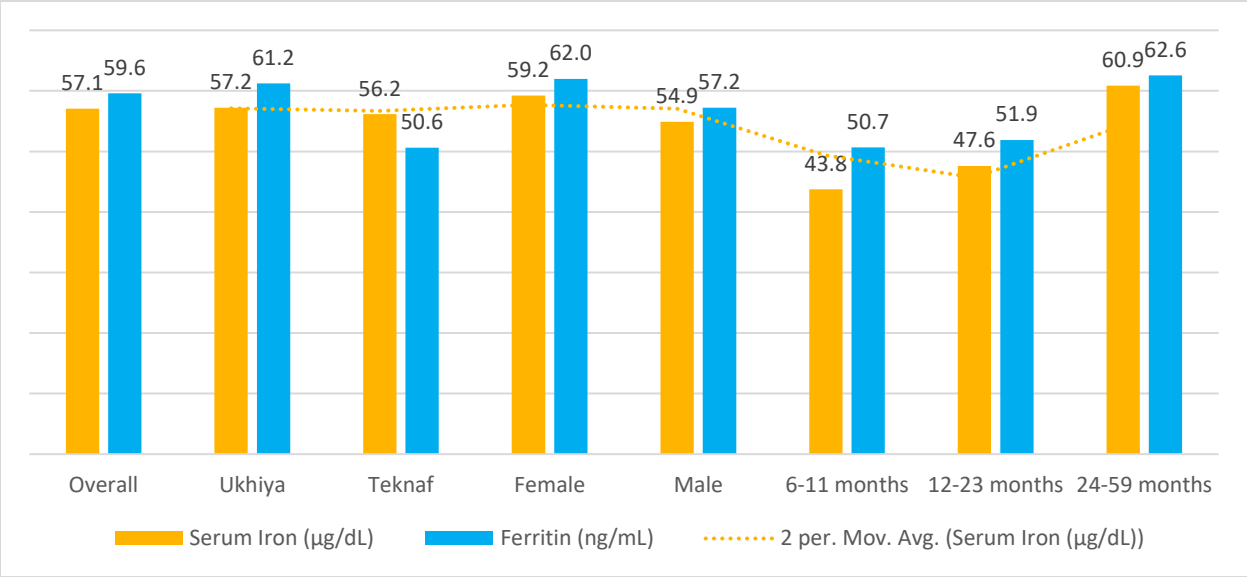
Figure 18. Prevalence of iron-deficiency anaemia (IDA) among children aged 24–59 months, before and after BRINDA adjustment, by selected characteristics, Cox's Bazar, 2025



After accounting for inflammation using the WHO ferritin adjustment (ferritin <30 µg/L), a higher threshold applied because inflammation artificially elevates ferritin concentrations even when iron stores are low, the estimated burden of iron-deficiency anaemia increases substantially. Adjusted IDA affects 14.8% of all children 6–59 months. Among children 6–23 months, nearly one in four (24.8%) meet the adjusted IDA definition (**Figure 17**), compared with 12.4% of children 24–59 months (**Figure 18**). This increase after adjustment aligns with the high levels of inflammation observed in the population and indicates that iron deficiency contributes to a sizable, but not exclusive, share of anaemia.

Mean iron biomarkers reinforce this interpretation. Mean serum iron, which reflects the amount of circulating iron immediately available for red blood cell production, is 57.1 µg/dL overall but is markedly lower among infants 6–11 months (43.8 µg/dL) and rises steadily with age to 60.9 µg/dL in children 24–59 months. Mean ferritin, a marker of iron storage, shows a similar age pattern, increasing from 50.7 ng/mL in infants to 62.6 ng/mL in older children (**Figure 19**), while total iron-binding capacity, an indirect indicator of iron demand and transferrin availability, is highest in the youngest age groups (349–358 µg/dL in children under two years), consistent with increased physiological iron requirements during periods of rapid growth. See **Annex E2, E4** and **E6** for more details.

Figure 19. Mean serum iron and ferritin concentrations among children aged 6–59 months, by location, sex, and age group, Cox's Bazar, 2025



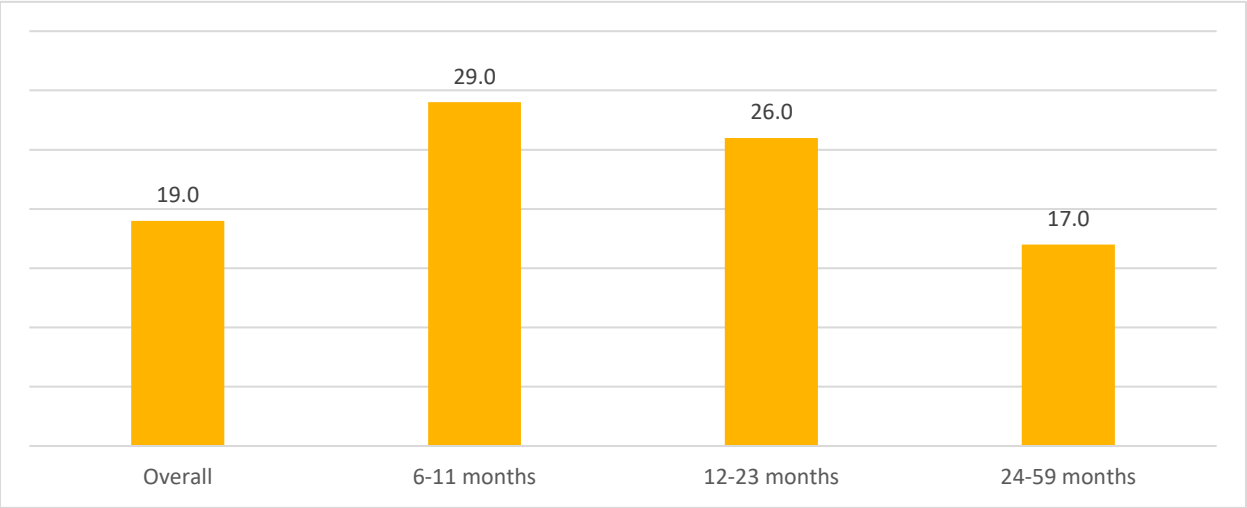
These findings demonstrate that iron deficiency plays a significant role in childhood anaemia—particularly in children under two years of age, but does not fully account for the overall burden observed. Even after adjusting iron biomarkers for inflammation, a substantial proportion of anaemic children do not meet criteria for iron deficiency, indicating that non-nutritional factors likely contribute materially to anaemia in this setting. To better understand this residual burden, the analysis next examines markers of inflammation, infection, and red blood cell morphology, which provide insight into anaemia associated with inflammatory processes, recurrent infection, and altered erythropoiesis, beyond classical micronutrient deficiencies.

> **Iron deficiency is important, especially for children under 2.**
> **But iron deficiency does not explain all anaemia cases.**
> **Even where iron supplementation exists, many children remain anaemic.**
> **This suggests that iron alone is not sufficient to solve the problem.**

5.7.3 Non-Nutritional Anaemia and Inflammation

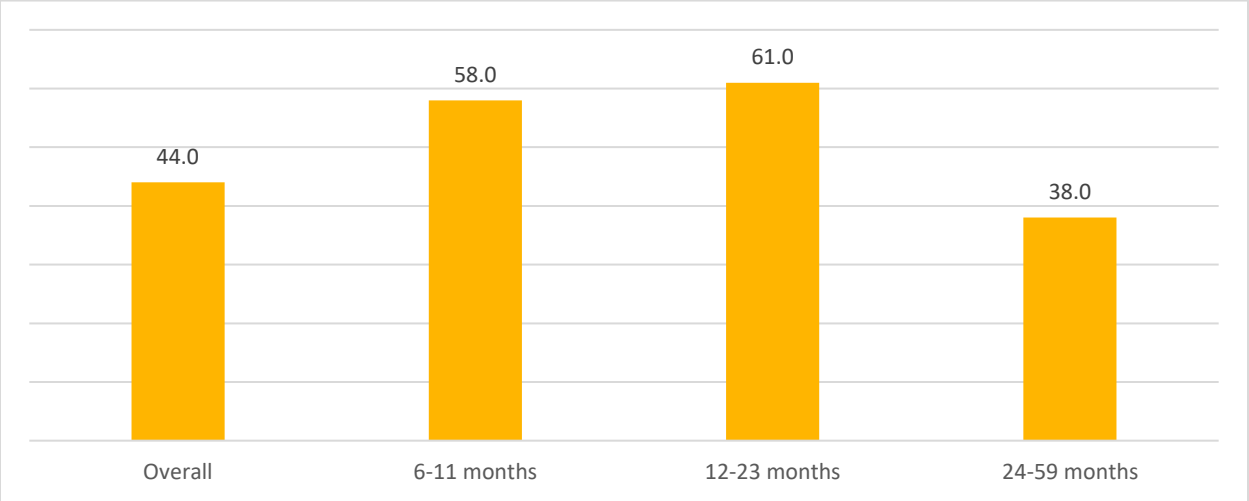
Indicators of inflammation are common and provide critical context for interpreting anaemia in this population. C-reactive protein (CRP) is an acute-phase protein that rises in response to **recent** infection or tissue inflammation and reflects short-term inflammatory processes. Elevated CRP (≥5 mg/L) is observed in 19.0% of children overall, with the highest prevalence among infants aged 6–11 months (29.0%), declining to 17.0% among children 24–59 months (**Figure 20**).

Figure 20. Prevalence of elevated C-reactive protein (CRP) among children aged 6–59 months, overall and by age group, Cox's Bazar, 2025



Alpha-1-acid glycoprotein (AGP), by contrast, reflects more **chronic or prolonged** inflammation and remains elevated for longer periods following infection. AGP ≥1 g/L affects 44.0% of all children and exceeds 58–61% among those under two years of age (**Figure 21**). Together, these markers indicate that a large proportion of young children experience ongoing inflammatory stress. Such inflammation can suppress red blood cell production (erythropoiesis) and artificially elevate ferritin concentrations, thereby obscuring underlying iron deficiency if not properly accounted for.

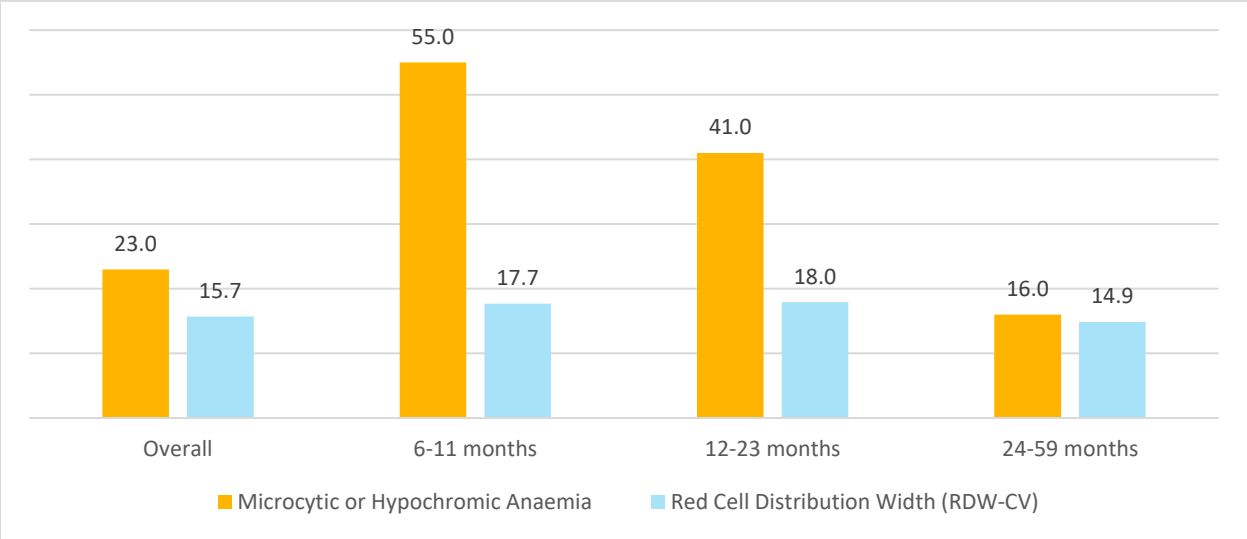
Figure 21. Prevalence of elevated α-1-acid glycoprotein (AGP) among children aged 6–59 months, overall and by age group, Cox's Bazar, 2025



Red blood cell indices offer further insight into the physiological nature of anaemia beyond iron status alone. Microcytic or hypochromic anaemia, defined by a low mean corpuscular volume (MCV <70 fL) or low mean corpuscular haemoglobin (MCH <23 pg), reflects the presence of smaller or less haemoglobin-

dense red blood cells. These patterns are commonly associated with iron-restricted erythropoiesis but can also arise from inflammation or impaired iron utilization rather than true iron deficiency. Overall, microcytic or hypochromic anaemia affects 23.0% of children, but the burden is heavily concentrated in early childhood: 55.0% of infants aged 6–11 months and 41.0% of children aged 12–23 months are affected, compared with 16.0% among children 24–59 months.

Figure 22. Prevalence of microcytic or hypochromic anaemia and elevated red cell distribution width (RDW-CV) among children aged 6–59 months, overall and by age group, Cox's Bazar, 2025



Mean MCV increases markedly with age, from 72.2 fL in infants to 79.9 fL in older children, while mean MCH follows a similar trajectory, rising from 21.4 pg to 24.6 pg. In parallel, red cell distribution width (RDW-CV), which reflects variability in red blood cell size and is often elevated when multiple pathological processes affect blood formation, is highest among young children (17.7–18.0% in those under two years) and declines to 14.9% in older children. This pattern suggests greater instability and heterogeneity in red cell production during the period of rapid growth and frequent infection.

Importantly, haemoglobin electrophoresis findings do not indicate a substantial contribution from inherited haemoglobin disorders. Mean haemoglobin A (Hb A) accounts for 95.1% of total haemoglobin, while haemoglobin A_2 (Hb A_2) averages 2.8%, with minimal variation by age, sex, or residence. These values fall within expected ranges and argue against a major role for conditions such as beta-thalassemia trait in explaining the observed anaemia burden. Consistent with this, reticulocyte percentages, which reflect the bone marrow's compensatory response to anaemia or red cell loss, remain within normal limits, with a mean of 1.46%. This finding suggests limited evidence of haemolysis or excessive marrow stress and reinforces the interpretation that anaemia in this population is driven primarily by a combination of inflammation-mediated processes and early-life nutritional vulnerability rather than genetic blood disorders.

Many children show signs of infection or inflammation.
Inflammation makes it harder for the body to use iron.
It can also hide true iron deficiency in blood tests.
This explains why children may remain anaemic even when food support is available.
Anaemia in this setting is strongly associated with chronic biological stress, in addition to dietary factors.

5.7.3 Nutritional Versus Non-Nutritional Aetiology

The descriptive findings indicate that anaemia among children in the FDMN camps reflects a clear dual burden, with both nutritional and non-nutritional mechanisms operating simultaneously, particularly during early childhood. Nutritional iron deficiency plays an important role, especially among children 6–23 months, the age group with the highest physiological iron requirements. In this age range, nearly one in four children meets the inflammation-adjusted definition of iron-deficiency anaemia, and close to one-third have unadjusted iron deficiency based on ferritin concentrations. These patterns are consistent with rapid growth, depletion of iron stores after infancy, and limited dietary iron intake during the complementary feeding period. The sharp age gradient, characterized by substantially lower iron deficiency and anaemia prevalence among children 24–59 months, further underscores the central nutritional vulnerability of the first two years of life.

At the same time, nutritional iron deficiency alone does not account for the full anaemia burden observed. Indicators of inflammation are highly prevalent, particularly among younger children, with acute inflammation (CRP ≥5 mg/L) affecting nearly one in three infants and chronic inflammation (AGP ≥1 g/L) present in more than half of children under two years of age. This inflammatory milieu has important biological implications: inflammation suppresses erythropoiesis, limits iron absorption and mobilization, and elevates ferritin independently of true iron status. The marked increase in iron-deficiency anaemia prevalence when applying inflammation adjustments highlights the extent to which unadjusted biomarkers mask underlying nutritional deficits, while indicating inflammation as a significant biological correlate of low haemoglobin.

Red blood cell morphology further reinforces the contribution of non-nutritional and inflammation-related pathways. Very high prevalences of microcytosis and hypochromia, particularly in infancy, combined with elevated RDW in younger age groups indicate disrupted and heterogeneous red cell production, consistent with iron-restricted erythropoiesis in the setting of infection and repeated inflammatory stress. Importantly, these abnormalities decline steadily with age, alongside reductions in inflammatory markers and improvements in iron indices, suggesting that resolution of infection exposure and maturation of immune function play a role in haemoglobin recovery. In contrast, haemoglobin electrophoresis profiles and reticulocyte counts do not suggest a major contribution from hemoglobinopathies or haemolytic processes, helping to narrow the non-nutritional pathways primarily to inflammation-mediated mechanisms rather than inherited blood disorders.

Overall, the descriptive evidence points to a complex anaemia landscape in which early-life nutritional deficits and sustained exposure to infection and inflammation interact to produce a high burden of anaemia in young Rohingya children. While iron inadequacy during the complementary feeding period is clearly a necessary component of this burden, the persistence of inflammatory markers and abnormal red cell indices indicates that anaemia cannot be addressed through iron interventions alone. These findings underscore the need for integrated strategies that simultaneously improve dietary quality and iron intake while reducing infection risk and inflammatory exposure in early childhood.

Importantly, this synthesis is based on descriptive patterns and age-, sex-, and residence-specific distributions. The relative contribution of individual nutritional, inflammatory, behavioural, and environmental factors, and their independent association with anaemia, will be examined in the next chapter through bivariate and multivariate analyses designed to identify the strongest predictors of anaemia in this population.

CHAPTER 6. DETERMINANTS OF CHILDHOOD ANAEMIA

Building on the descriptive findings presented in the previous section, this chapter examines the distribution of anaemia across key demographic, household, nutritional, health, and biological factors using bivariate analysis. The objective of this stage is to explore patterns and unadjusted associations between anaemia and a broad range of potential determinants, without yet controlling for confounding or interaction effects. Anaemia is defined using age-specific haemoglobin thresholds (<10.5 g/dL for children 6–23 months and <11.0 g/dL for children 24–59 months), and all analyses account for the complex survey design.

This chapter examines factors associated with childhood anaemia using a stepwise analytical approach. Bivariate analyses are first used to explore unadjusted relationships between anaemia and demographic, environmental, nutritional, programmatic, morbidity, and biomarker-related factors. Multivariate models are then applied to identify independent predictors and to distinguish nutritional from non-nutritional aetiologies of anaemia.

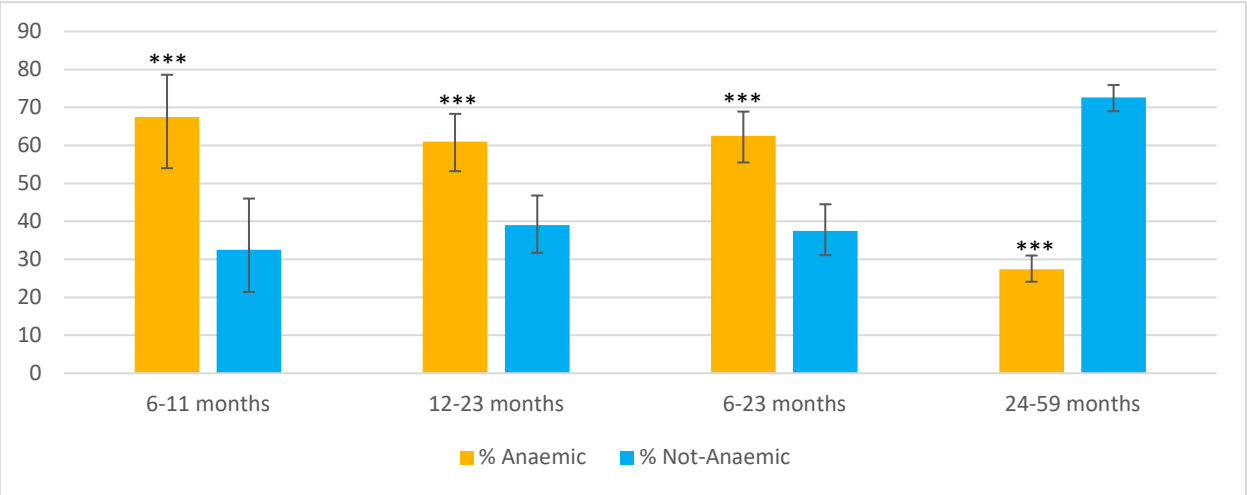
6.1 Bivariate Associations with Childhood Anaemia

Table E7 presents weighted percentages of children who are anaemic and not anaemic across key demographic, household and environmental (WASH), infant and young child feeding (IYCF), food consumption, programme exposure, morbidity, and biomarker indicators. Percentages are reported with 95% confidence intervals (CI). P-values are from survey-weighted chi-square tests assessing differences in anaemia prevalence across categories. Estimates are based on a complex survey design and weighted to represent the camp population. Cells with zero counts are marked where chi-square tests are not robust and p-values are not reported.

6.1.1 Demographic Characteristics

Anaemia shows a strong and statistically significant association with child age. Among infants aged 6–11 months, more than two-thirds of children are anaemic (67.5%), compared with 35.0% among children outside this age group ($p<0.001$). A similarly elevated burden is observed among children aged 12–23 months, where 61.0% are anaemic, compared with 30.5% among children not in this age group ($p<0.001$). Children aged 6–23 months exhibit substantially higher anaemia prevalence than older children (24–59 months), with non-overlapping confidence intervals indicating strong age-related vulnerability to anaemia. ($p<0.001$). In **Figure 23**, the error bars denote 95% confidence intervals and asterisk *** indicates $p < 0.001$. Correspondingly, among children aged 24–59 months, fewer than one-third (27.4%) are anaemic, while anaemia remains predominant among younger children. Overall, across all children aged 6–59 months, 36.9% are anaemic and 63.1% are not anaemic, underscoring the concentration of anaemia during the first two years of life.

Figure 23. Prevalence of anaemia among children by age group, 6-59 months



*** = p < 0.001

In contrast, sex is not significantly associated with anaemia status. Anaemia affects 34.9% of girls and 38.9% of boys, and this difference does not reach statistical significance (p=0.173). Similarly, regional differences between camps are modest and not statistically significant. In Ukhiya, 36.1% of children are anaemic compared with 41.3% in Teknaf (p=0.298), suggesting broadly comparable levels of anaemia across the two settings once age is not accounted for.

6.1.2 Household and Environmental Characteristics

Household and environmental characteristics show limited association with anaemia in bivariate analysis, with a few notable exceptions. Household size does not appear to differentiate anaemia risk: children living in households with fewer than five members have a similar anaemia prevalence (37.5%) to those in households with five or more members (36.7%; p=0.833). This suggests crowding, as measured by household size alone, is not a distinguishing factor for childhood anaemia in this population.

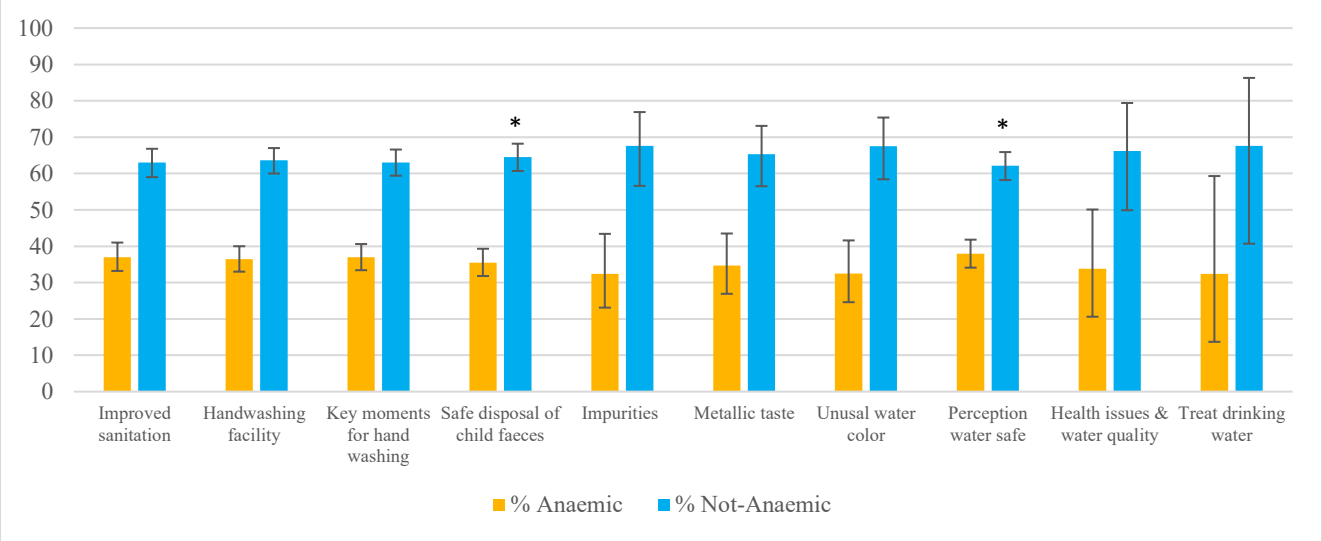
Reported use of mosquito nets also shows no significant association with anaemia status. Among children who usually sleep under a mosquito net, 37.2% are anaemic compared with 37.3% among those who slept under a net the night before the survey (p=0.184). Interpretation of the "no" category is limited by extremely small numbers (n=1–3), and no inference can be drawn for children not using mosquito nets.

Most WASH indicators similarly show no statistically significant differences in anaemia prevalence. Children from households with improved sanitation facilities have nearly identical anaemia prevalence (37.0%) to those without improved sanitation (36.4%; p=0.878). Likewise, the presence of a handwashing facility with water and soap/detergent is not associated with anaemia (36.4% vs. 56.5%; p=0.244), though the "no" category is very small (n=11) and estimates are imprecise. Maternal knowledge of at least three out of five critical handwashing moments also shows no meaningful difference in anaemia prevalence (37.0% vs. 34.5%; p=0.796).

In contrast, safe disposal of child faeces emerges as one of the few environmental factors significantly associated with anaemia. Children in households practicing safe disposal have a lower prevalence of anaemia (35.5%) compared with those where child faeces are not safely disposed (43.8%; p=0.046). This finding suggests that pathways related to environmental contamination and repeated infection may play a

role in anaemia risk, although the direction and magnitude of this association require confirmation in multivariate analysis. In **Figure 24** anaemia prevalence is compared across sanitation, hygiene, drinking water quality, and household water treatment practices. Bars show percentages with 95% confidence intervals; statistically significant differences are indicated ($p < 0.05$).

Figure 24. Anaemia prevalence by household water, sanitation, and hygiene (WASH) characteristics among children aged 6–59 months.



* = p < 0.05

Drinking water–related indicators present a mixed and somewhat counterintuitive pattern. All households report improved water sources, precluding comparison by source type. Self-reported water quality concerns—such as impurities, metallic taste, or unusual colour—are not significantly associated with anaemia, with anaemia prevalence ranging between 32–37% across categories (p>0.28 in all cases). Reported health issues due to water quality also show no significant association (33.8% vs. 37.0%; p=0.706), although numbers are small in the "yes" group (n=41).

An unexpected finding arises for perceived water safety. Children living in households that consider drinking water unsafe have a lower anaemia prevalence (25.7%) compared with those that consider water safe (37.9%; p=0.036). This pattern may reflect behavioural responses, such as increased water treatment or avoidance, rather than true exposure differences and should be interpreted cautiously given the small size of the "unsafe" group (n=78). Reported household water treatment shows no significant association with anaemia (p=0.700), but estimates among treating households are highly imprecise due to very small numbers (n=17).

6.1.3 Household Food Consumption Score

Household food consumption, as measured by the Food Consumption Score (FCS), shows relatively limited differentiation in childhood anaemia prevalence across categories in this population. Nearly all households fall within the acceptable FCS category, reflecting generally adequate dietary diversity and frequency at the household level. Among children living in households with acceptable FCS (>35), 37.0% are anaemic, compared with 34.9% among those in borderline households (FCS 21.5–35). No households are classified in the poor FCS category (FCS 0–21), precluding comparison with severely food-insecure

households. Differences across FCS categories are not statistically significant (p=0.867), indicating no clear bivariate association between household-level food consumption adequacy and childhood anaemia in this setting.

Patterns by frequency of protein-rich food consumption similarly show minimal variation. Children in households that consume protein-rich foods at least seven times per week have a slightly lower prevalence of anaemia (36.6%) compared with those consuming these foods only sometimes (41.2%), though the difference is not statistically significant (p=0.380). A small number of households report never consuming protein-rich foods, limiting meaningful comparison for this group.

Vitamin-rich food consumption also does not show a strong bivariate association with anaemia prevalence. Anaemia affects 35.7% of children in households that sometimes consume vitamin-rich foods and 37.5% in those consuming them at least seven times per week, with no statistically significant differences observed (p=0.308). Children in households that report never consuming vitamin-rich foods show a higher anaemia prevalence (49%), but this finding is based on a small sample and should be interpreted with caution.

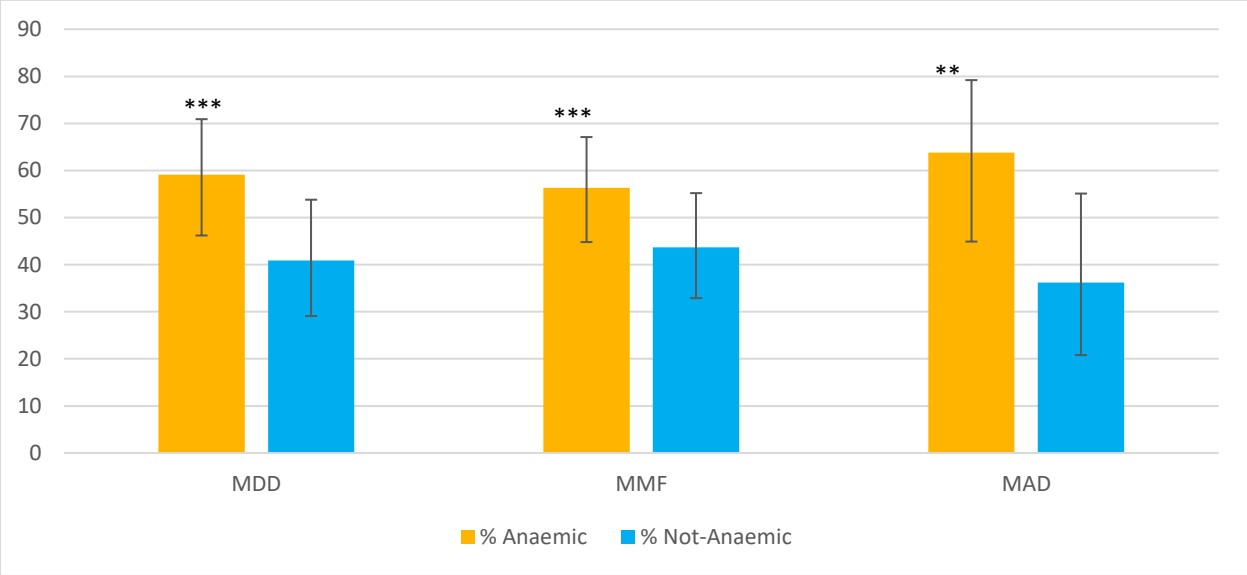
Similarly, iron-rich food consumption at the household level shows little variation in anaemia prevalence. Children in households that consume iron-rich foods at least seven times per week have an anaemia prevalence of 33.3%, compared with 37.9% among those consuming these foods sometimes (p=0.558). Very few households report never consuming iron-rich foods, limiting inference for this category.

When examining specific iron-fortified foods, anaemia prevalence is slightly lower among children in households reporting consumption (36.5%) compared to those that do not (48.0%), though this difference does not reach statistical significance (p=0.134). Consumption of eggs and/or flesh foods also shows no association with anaemia: prevalence is similar among children who consume these foods (37.3%) and those who do not (37.9%) (p=0.943).

6.1.4 Infant and Young Child Feeding (IYCF) Practices

Bivariate analysis shows strong and consistent associations between key infant and young child feeding (IYCF) practices and childhood anaemia. Dietary diversity emerges as one of the most salient factors. Children who received foods from five or more food groups during the previous day have a markedly higher prevalence of anaemia (59.1%) compared with those who did not (35.2%) ($p<0.001$). Similarly, children who achieved minimum dietary diversity (MDD ≥5) show a substantially higher anaemia prevalence (59.1%) than those who did not (35.2%) ($p<0.001$). These patterns likely reflect strong age confounding, as dietary diversity increases with age while anaemia prevalence declines. Figure 25 shows the percentage of anaemic and non-anaemic children meeting MDD, MMF, and MAD. Error bars represent 95% confidence intervals. Asterisks indicate statistically significant differences between anaemic and non-anaemic children (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$).

Figure 25. Anaemia status by Infant and Young Child Feeding (IYCF) indicators (MDD, MMF, and MAD) among children 6–23 months.

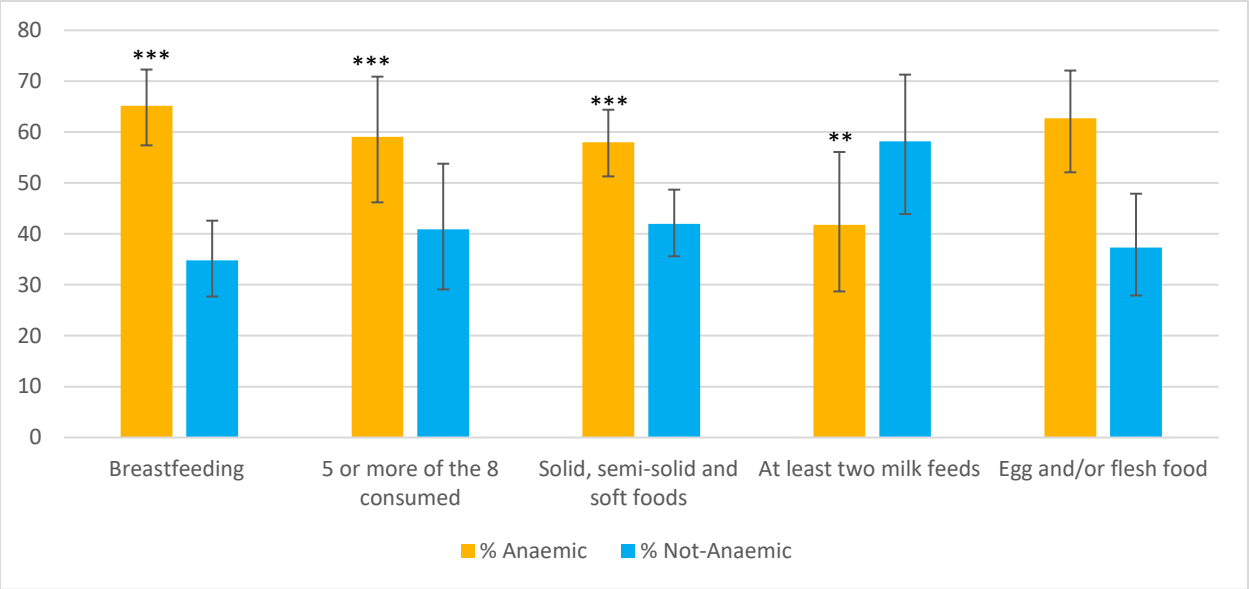


*** = p < 0.001, **= p<0.01

Consumption of solid, semi-solid, or soft foods is also significantly associated with anaemia prevalence. Among children who received any solid or semi-solid foods during the previous day, 58.0% are anaemic, compared with 28.3% among those who did not (p<0.001). The same pattern holds for consumption of at least two milk feeds, with anaemia affecting 41.8% of children who received two or more milk feeds, compared with 64.0% among those who did not (p=0.007). Among children aged 6–8 months, anaemia prevalence remains high regardless of solid food introduction, affecting 55.0% of children who received solids and 71.4% of those who did not, though this difference is not statistically significant (p=0.527) due to very small sample sizes.

Consumption of specific animal-source foods does not show a significant association with anaemia in bivariate analysis. Anaemia prevalence is similar among children who consumed eggs and/or flesh foods during the previous day (62.7%) and those who did not (62.1%) (p=0.943). Likewise, consumption of iron-fortified foods does not significantly differentiate anaemia prevalence (36.5% vs. 48.0%; p=0.134), although the non-consuming group is small. **Figure 25** show the weighted percentage of anaemic and non-anaemic children by selected IYCF indicators; error bars represent 95% confidence intervals. Asterisks indicate statistically significant differences in anaemia prevalence between Yes/No categories ($p < 0.05$ **, $p < 0.01$ ***, χ^2 test).

Figure 26. Prevalence of anaemia by infant and young child feeding (IYCF) practices among children aged 6–23 months.



*** = p < 0.001, **= p<0.01

Undesirable feeding practices, including intake of sweet beverages and unhealthy foods, do not show clear associations with anaemia. Anaemia affects 65.7% of children who consumed sweet beverages compared with 61.7% among those who did not (p=0.664). Similarly, consumption of selected sentinel unhealthy foods shows virtually identical anaemia prevalence (62.2% vs. 63.3%; p=0.915). Zero consumption of fruits and vegetables is rare and does not differentiate anaemia prevalence (61.9% vs. 62.5%; p=0.969).

Fortified supplementary foods also exhibit no clear bivariate association. Anaemia prevalence among children who consumed ready-to-use therapeutic food (RUTF) is 64.5%, compared with 62.3% among non-consumers (p=0.893). Similarly, consumption of ready-to-use supplementary food (RUSF) is not associated with lower anaemia prevalence (61.1% vs. 62.6%; p=0.918), reflecting both limited coverage and likely confounding by indication.

Indicators of feeding adequacy show strong associations. Children who met minimum acceptable diet criteria have a substantially higher anaemia prevalence (63.8%) compared with those who did not (35.9%) (p=0.003), again likely reflecting the strong influence of age on both feeding practices and anaemia. Minimum meal frequency shows a similar pattern: anaemia affects 56.3% of children who met minimum meal frequency compared with 35.2% among those who did not (p<0.001).

Breastfeeding status is strongly associated with anaemia. Anaemia affects 65.2% of children who are currently breastfed, compared with 29.2% among those who are not (p<0.001), reflecting the concentration of breastfeeding among younger children with the highest physiological vulnerability to iron deficiency.

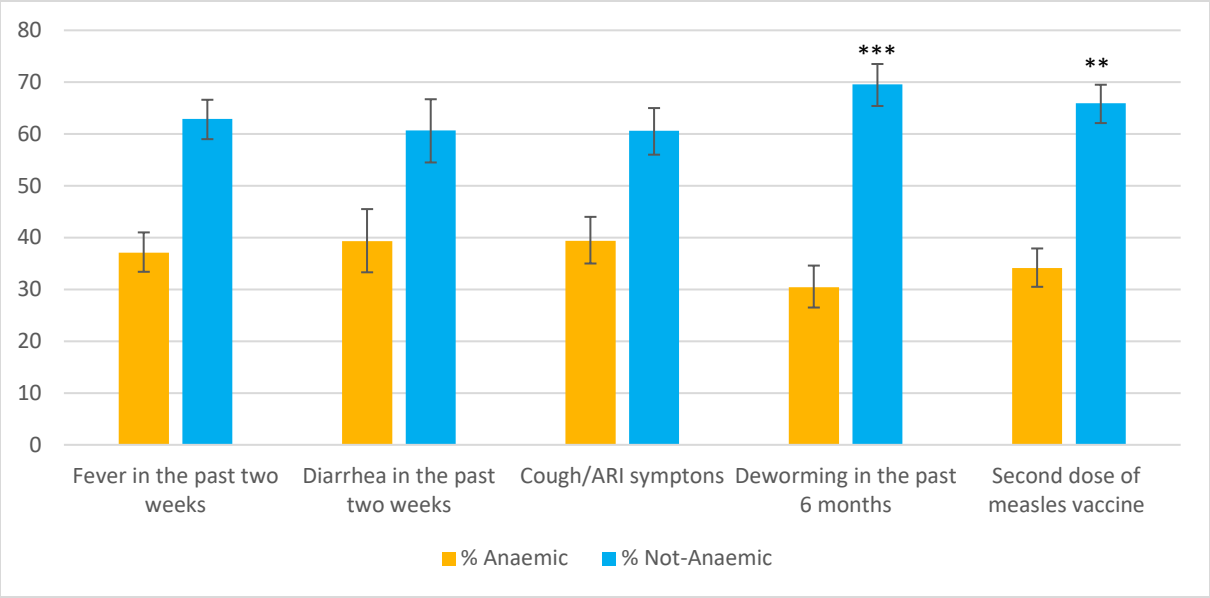
6.1.5 Morbidity and Infection

Recent morbidity is common but shows limited bivariate association with anaemia status. Among children who experienced fever in the two weeks preceding the survey, 37.1% are anaemic compared with 36.0% among those without recent fever (p=0.775). Similarly, recent diarrhoeal illness does not differentiate anaemia prevalence: 39.3% of children with diarrhoea in the past two weeks are anaemic compared with 36.1% among those without (p=0.393).

Respiratory symptoms show a borderline pattern. Anaemia affects 39.4% of children with cough or acute respiratory infection (ARI) symptoms in the past two weeks, compared with 33.7% among children without such symptoms (p=0.077), though this difference does not reach statistical significance.

In contrast, deworming status is strongly associated with anaemia prevalence. Anaemia affects 30.4% of children who received deworming medication in the past six months, compared with 49.7% among those who did not receive deworming (p<0.001). This suggests substantial differences in anaemia burden by deworming exposure at the bivariate level. **Figure 27** shows percentage of anaemic and non-anaemic children reporting recent morbidity (fever, diarrhoea, cough/ARI), receipt of deworming in the past six months, and receipt of the second dose of measles-containing vaccine.

Figure 27. Anaemia status by morbidity, deworming, and immunisation indicators among children 6–59 months



*** = p < 0.001, **= p<0.01

Vaccination status also differentiates anaemia prevalence. Among children who received the second dose of a measles-containing vaccine, 34.1% are anaemic, compared with 51.6% among children who did not receive the second dose (p=0.001), indicating higher anaemia prevalence among incompletely vaccinated children.

Among children who experienced diarrhoea, receipt of oral rehydration salts (ORS) with or without zinc does not show a statistically significant association with anaemia prevalence. Anaemia affects 40.6% of children who received ORS alone, 41.3% of those who received ORS with zinc, and 20.6% of those who did not receive ORS or zinc (p=0.324), though the latter group is small (n=21), limiting robust comparison.

Skin disease in the past two weeks does not differentiate anaemia prevalence, with 36.5% of affected children anaemic compared with 37.3% among those without recent skin disease (p=0.824).

6.1.6 Malaria Prevention and Care-Seeking

Use of malaria prevention tools shows limited association with anaemia. Anaemia affects 37.3% of children who slept under an insecticide-treated net (ITN) the night before the survey, compared with 0% among those who did not sleep under an ITN, though the comparison group is extremely small (n=3), and the association is not statistically significant (p=0.184).

Receipt of antimalarial treatment in the past two weeks does not differentiate anaemia prevalence. Anaemia affects 29.6% of children who received antimalarial treatment compared with 37.2% among those who did not (p=0.608), though very few children report recent treatment (n=9).

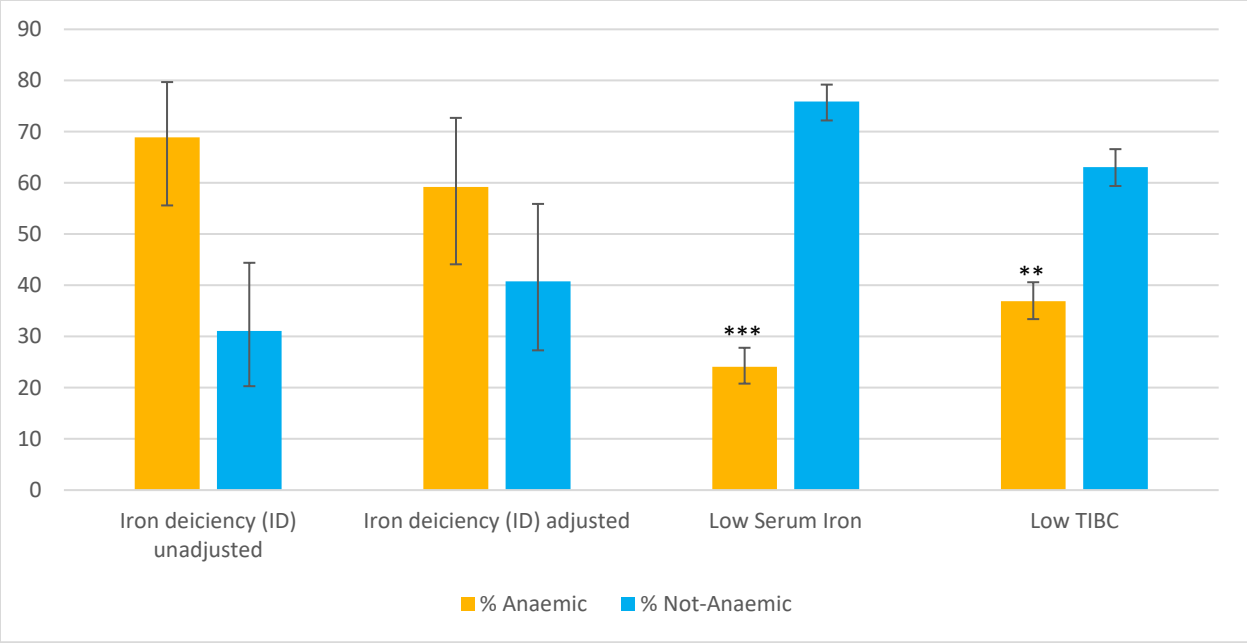
Similarly, receipt of artemisinin-based combination therapy (ACT) or other first-line antimalarial treatment does not show a statistically significant association with anaemia. Anaemia affects 23.2% of children who received ACT or first-line treatment compared with 37.2% among those who did not (p=0.406), again with very small numbers in the treated group (n=5).

6.1.7 Biomarkers: Nutritional Indicators

Biochemical indicators of iron status show strong bivariate associations with anaemia. Based on unadjusted iron deficiency (ferritin <12 µg/L), 68.9% of iron-deficient children are anaemic compared with 34.7% of children without iron deficiency (p<0.001). When iron deficiency is adjusted for inflammation using CRP and AGP, anaemia remains substantially more prevalent among iron-deficient children (59.2%) than among those without adjusted deficiency (26.2%; p<0.001).

Low circulating iron is also strongly associated with anaemia. Among children with low serum iron, 75.9% are anaemic compared with 50.6% among children with normal serum iron levels (p<0.001). Similarly, children with low total iron-binding capacity (TIBC) show higher anaemia prevalence (36.9%) compared with children with normal TIBC (36.5%), though the number of children with low TIBC is small.

Figure 28. Anaemia status by iron deficiency and iron-related biomarkers among children 6–59 months



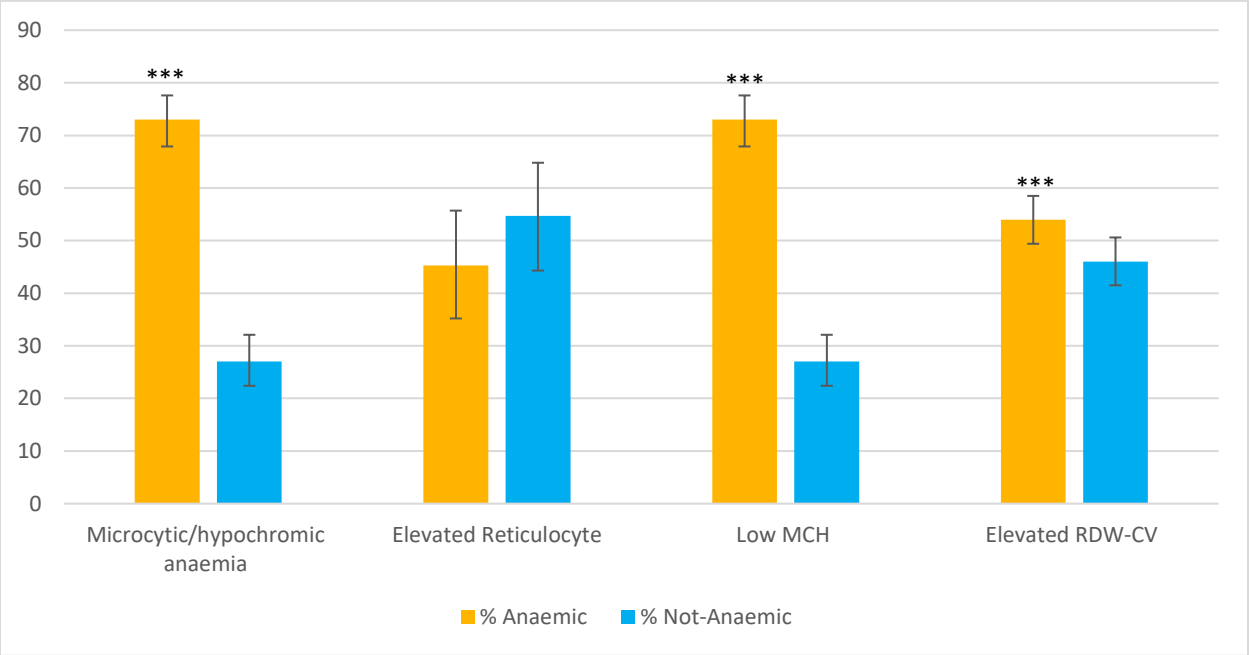
NOTE: Both IDA (adjusted and unadjusted) resulted in "zero" cell indicative of lack of robustness of chi-square test. Hence, p-value cannot be reported.

Iron-deficiency anaemia (IDA), defined by the joint presence of low haemoglobin and iron deficiency, shows the strongest association with anaemia status by definition. Under the unadjusted IDA definition, 100% of children classified with IDA are anaemic. Among children without unadjusted IDA, anaemia prevalence is 25.6%. The same pattern is observed for BRINDA-adjusted IDA, where all children meeting the adjusted IDA definition are anaemic, compared with 17.0% among those without adjusted IDA.

6.1.8 Biomarkers: Non-Nutritional Hematologic Indicators

Red blood cell indices show pronounced bivariate differences by anaemia status. Microcytic or hypochromic anaemia, defined by low mean corpuscular volume (MCV) or low mean corpuscular haemoglobin (MCH), is strongly associated with anaemia: 73.0% of children with microcytosis or hypochromia are anaemic, compared with 20.1% among children with normal indices ($p<0.001$). Low MCH alone shows an identical pattern, with 73.0% anaemia prevalence among affected children versus 20.1% among those without low MCH ($p<0.001$).

Figure 29. Anaemia status by red cell indices and markers of erythropoiesis among children 6–59 months



*** = p < 0.001, **= p<0.01

Elevated red cell distribution width (RDW-CV) is also strongly associated with anaemia. Among children with high RDW-CV, 54.0% are anaemic compared with 14.2% among children with normal RDW-CV (p<0.001), indicating marked red cell size variability among anaemic children.

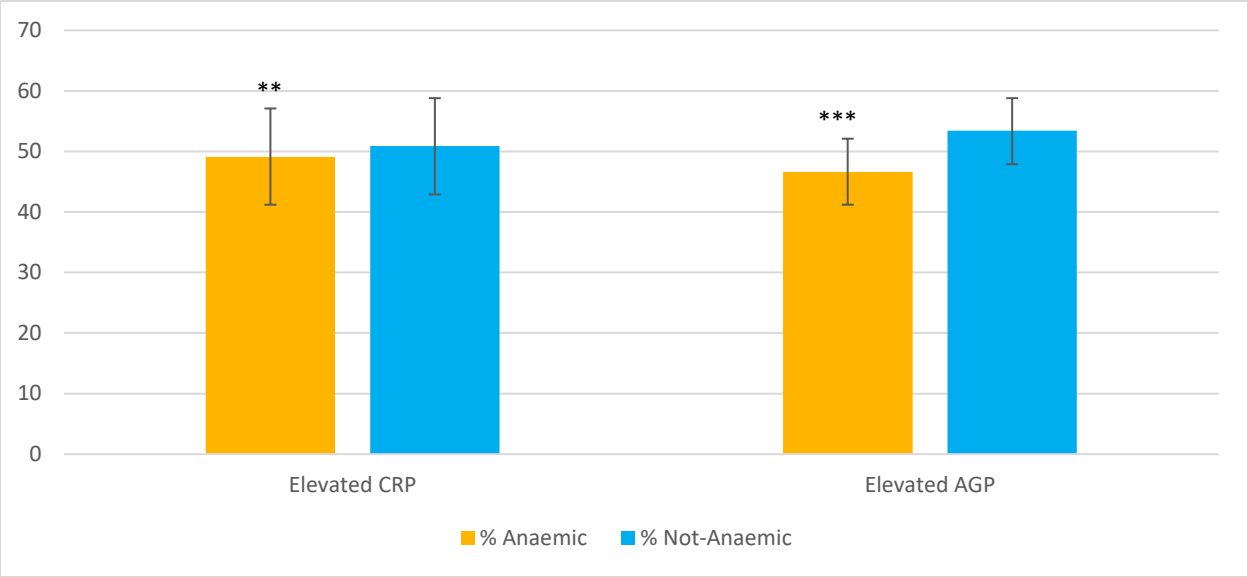
Markers of erythropoietic response show weaker associations. Elevated reticulocyte counts are associated with higher anaemia prevalence (45.3%) compared with normal reticulocyte levels (35.7%), though this difference does not reach statistical significance (p=0.077). Abnormal red blood cell counts are uncommon but associated with markedly high anaemia prevalence (87.8% among those with abnormal RBC counts versus 36.2% among those with normal counts; p=0.004), reflecting a small but high-risk subgroup.

Macrocytic anaemia, defined by elevated MCV, is not observed in the sample and therefore does not contribute to overall anaemia patterns at the bivariate level.

6.1.9 Biomarkers: Inflammation Markers

Inflammation markers are strongly associated with anaemia status. Among children with elevated CRP (≥5 mg/L), 49.1% are anaemic, compared with 34.0% among children without elevated CRP (p=0.001). Chronic inflammation, measured by elevated AGP (≥1 g/L), shows an even stronger association: 46.6% of children with elevated AGP are anaemic compared with 29.4% among those with normal AGP levels (p<0.001). Figure 30 shows the percentage of anaemic and non-anaemic children with elevated CRP and elevated AGP.

Figure 30. Anaemia status by markers of inflammation among children 6–59 months



*** = p < 0.001, **= p<0.01

6.1.10 Synthesis of Bivariate Findings

The bivariate analyses reveal a complex and highly patterned distribution of anaemia across demographic, environmental, behavioural, and biological domains. Across nearly all domains examined, child age emerges as the dominant differentiating factor, with substantially higher anaemia prevalence consistently observed among infants and young children, particularly those under 24 months. This age gradient is evident across demographic characteristics, diet and infant feeding indicators, micronutrient status, markers of inflammation, and red blood cell indices, underscoring the vulnerability of children during the complementary feeding period.

At the demographic level, anaemia prevalence differs sharply by age group but shows no statistically significant differences by sex or camp of residence. These findings suggest that while anaemia is widespread across settings and affects boys and girls similarly, its burden is disproportionately concentrated in younger age cohorts. Household size and most environmental characteristics also show limited bivariate association with anaemia, though selected WASH-related indicators—most notably unsafe disposal of child faeces—are associated with significantly higher anaemia prevalence, pointing to potential infection-mediated pathways.

Dietary and food security indicators present a more nuanced picture. Household-level food consumption patterns, including FCS and frequency of protein-, vitamin-, and iron-rich food intake, show little to no bivariate association with anaemia, suggesting that household food access alone may not adequately capture individual nutritional risk. In contrast, child-level IYCF practices, including minimum dietary diversity, minimum meal frequency, minimum acceptable diet, breastfeeding status, and consumption of complementary foods, show strong and statistically significant associations with anaemia. Children who do not meet recommended IYCF practices are consistently more likely to be anaemic, reinforcing the central role of early feeding practices in shaping haemoglobin status.

Programmatic and supplementation-related variables show mixed associations at the bivariate level. Enrolment in child supplementary feeding programmes is significantly associated with anaemia, reflecting the fact that nutritionally vulnerable children are more likely to be targeted or enrolled. Maternal receipt or consumption of iron-related supplements and fortified rations shows limited direct association with child anaemia, while vitamin A supplementation among children is strongly associated with higher anaemia prevalence, likely indicating reverse causality or targeted delivery to high-risk children.

Morbidity and infection indicators further highlight the multifactorial nature of anaemia. Recent fever, diarrhoea, and respiratory symptoms show limited bivariate association with anaemia, while deworming and completion of measles vaccination are strongly associated with lower anaemia prevalence, suggesting protective effects of preventive health interventions. Malaria-related prevention and care-seeking indicators do not show significant associations, consistent with the low malaria transmission context.

Biochemical analyses provide critical insight into the underlying aetiology of anaemia. Nutritional biomarkers demonstrate strong bivariate associations: children with iron deficiency—whether assessed using unadjusted ferritin, inflammation-adjusted ferritin, low serum iron, or iron-deficiency anaemia definitions—are substantially more likely to be anaemic. At the same time, markers of inflammation (CRP and AGP) and abnormal red blood cell indices (microcytosis, hypochromia, elevated RDW) are also strongly associated with anaemia, indicating an important contribution of non-nutritional and inflammation-related mechanisms. In contrast, indices suggestive of hemoglobinopathies and haemolysis show limited or no contribution at the bivariate level.

Overall, the bivariate findings indicate that anaemia in this population is shaped by overlapping nutritional and non-nutritional pathways, with strong age-dependence, clear links to suboptimal infant feeding, substantial influence of inflammation, and limited explanatory power of household-level food security alone. However, many of these factors are interrelated: age is closely linked to feeding practices and infection risk; inflammation modifies iron biomarkers; and program enrolment reflects underlying vulnerability.

For these reasons, the bivariate analyses, while informative, are insufficient to disentangle independent predictors of anaemia. The following chapter therefore applies multivariate regression models to quantify the relative contribution of demographic, environmental, dietary, programmatic, morbidity-related, and biomarker-based predictors while adjusting for confounding and mediation.

6.2 Multivariate Analysis of Childhood Anaemia

Multivariate logistic regression models were fitted to identify factors independently associated with anaemia among children aged 6–59 months, while controlling for potential confounding and the complex survey design. Anaemia was defined using age-specific haemoglobin cut-offs (<10.5 g/dL for children 6–23 months and <11.0 g/dL for children 24–59 months). Results are presented as adjusted odds ratios (ORs) with associated p-values.

Variable selection for the multivariate analysis followed a staged and conceptually driven approach designed to examine multiple pathways potentially associated with childhood anaemia. The process moved systematically from distal, non-modifiable determinants to increasingly proximate biological

mechanisms, allowing each set of factors to be evaluated without obscuring effects operating at other levels.

In the first stage, demographic characteristics, including child age group, sex, and camp of residence, were retained *a priori* in all models. These variables represent fixed upstream determinants that consistently showed strong associations with anaemia in descriptive and bivariate analyses and are known to structure exposure to nutritional risk, infection, and care access across early childhood.

In the second stage, household, environmental, and morbidity-related variables were examined as potential distal contributors to anaemia through exposure pathways, including sanitation. Variables related to household size, water and sanitation conditions, deworming, and measles vaccination were included in Model 1 to assess whether these contextual factors contributed to anaemia risk after accounting for demographic characteristics. Although several of these indicators did not retain statistical significance in the multivariate model, their inclusion was justified based on biological plausibility and relevance to programme design.

In the third stage, dietary, IYCF, fortification, and supplementation variables were evaluated as intermediate nutritional exposures. These indicators were not retained in the final multivariate models for several reasons. First, most did not demonstrate independent associations with anaemia in multivariate analyses once age was taken into account. Second, many variables were restricted to specific age groups (6-8 months, 12-23 months, or 6-23 months), resulting in reduced sample sizes and limited statistical power. Finally, for certain micronutrients, including vitamin B12 and folate, very low/negligible prevalence of deficiency precluded meaningful multivariate analysis. As a result, inclusion of these variables would have increased model complexity without improving explanatory value.

In the final stage, Model 2 & 3 replaced distal behavioural and environmental factors with biological markers in order to examine proximate nutritional and non-nutritional mechanisms underlying anaemia. Biomarkers of inflammation were prioritised followed by iron status, red blood cell morphology, bone marrow response, and due to their direct physiological relevance to haemoglobin concentration. Demographic variables were retained for adjustment, but distal exposures were excluded to avoid overadjustment along the causal pathway. This staged modelling strategy allowed clearer differentiation between upstream risk factors and downstream biological processes contributing to anaemia in this population.

6.2.1 Model 1: Demographic and Environmental Factors

After adjustment for demographic, environmental, and programmatic factors, child age remains the strongest independent predictor of anaemia (Table 12b). Compared with children aged 24–59 months, infants aged 6–11 months have nearly five times higher odds of anaemia (AOR = 4.98, 95% CI: 2.64–9.39, $p < 0.001$), while children aged 12–23 months have four times higher odds (AOR = 4.04, 95% CI: 2.72–5.99, $p < 0.001$). These findings confirm that the burden of anaemia is overwhelmingly concentrated during the first two years of life, independent of household size, sanitation practices, deworming, vaccination status, or camp of residence. The magnitude and consistency of these age effects underscore the biological vulnerability of infancy and early toddlerhood, periods characterized by rapid growth velocity, elevated iron requirements, and heightened exposure to infection.

Sex is not independently associated with anaemia in this model. Female children show slightly lower odds relative to males (AOR = 0.80, 95% CI: 0.62–1.04, p = 0.095), but this difference does not reach statistical significance, indicating no meaningful gender disparity in haemoglobin status after adjustment.

Camp of residence shows a borderline association. Children residing in Ukhiya have lower odds of anaemia compared with Teknaf (AOR = 0.66, 95% CI: 0.41–1.06, p = 0.082), though this does not achieve conventional statistical significance. Household size (≥5 members) is not independently associated with anaemia (AOR = 1.12, p = 0.496), suggesting that crowding alone does not explain haemoglobin deficits once age and camp are considered.

Among environmental variables, only household perception of drinking water safety retains statistical significance. Children in households reporting their water as safe to drink have nearly twice the odds of anaemia (AOR = 1.96, 95% CI: 1.03–3.73, p = 0.039). While counterintuitive, this association may reflect residual confounding, reporting bias, or unmeasured environmental exposures not captured by perception alone. Safe disposal of child faeces and recent deworming do not retain independent associations in the adjusted model (**Table 14**).

Model 1 is intentionally structured to assess structural and programmatically actionable factors that influence anaemia risk indirectly. The persistence of strong age effects, coupled with the limited independent contribution of household and programmatic indicators, suggests that environmental exposures likely operate through biological mechanisms that are not directly captured in this model.

The absence of statistically significant associations for several programme and environmental indicators does not imply lack of importance; rather, it suggests that their influence on anaemia may be mediated through proximal biological pathways, particularly iron availability, inflammation, and red blood cell dysfunction, which are examined more directly in Models 2 & 3.

6.2.2 Model 2: Inflammation and Infection Pathways

Model 2 introduces inflammatory biomarkers (CRP and AGP). This expansion increases statistical power and allows direct examination of inflammation-mediated pathways.

Age remains a dominant predictor. Compared with children aged 24–59 months, infants aged 6–11 months have more than five times higher odds of anaemia (AOR = 5.18, 95% CI: 2.84–9.42, p < 0.001), while children aged 12–23 months have nearly four times higher odds (AOR = 3.83, 95% CI: 2.70–5.43, p < 0.001). The persistence of these large effect sizes confirms that early-life vulnerability is not fully explained by environmental or inflammatory exposures alone.

Elevated AGP (≥1 g/L), reflecting chronic inflammation, is independently associated with anaemia (AOR = 1.57, 95% CI: 1.13–2.18, p = 0.007). In contrast, elevated CRP (≥5 mg/L), an indicator of acute inflammation, does not retain statistical significance (AOR = 1.30, p = 0.179). This pattern suggests that sustained inflammatory processes, rather than transient acute infections, are more relevant to anaemia risk in this population. Chronic inflammation is biologically linked to hepcidin upregulation, impaired iron recycling, and suppression of erythropoiesis, providing a plausible mechanistic explanation.

Table 14. Multivariable logistic regression models of factors associated with anaemia among children aged 6–59 months

Variables	Category	Model 1 Adjusted OR	95% CI	*p-value*	Model 2 Adjusted OR	95% CI	*p-value*	Model 3 Adjusted OR	95% CI	*p-value*
Age group (ref: 24–59 months)	6–11 months	**4.98**	[2.64 - 9.39]	0.000	**5.18**	[2.84 - 9.42]	0.000	**2.56**	[1.28 - 5.12]	0.009
	12–23 months	**4.04**	[2.72 - 5.99]	0.000	**3.83**	[2.70 - 5.43]	0.000	**2.02**	[1.36 - 3.02]	0.001
Sex (ref: male)	Female	0.80*	[0.62 - 1.04]	0.095	0.81	[0.62 - 1.05]	0.114	0.96	[0.71 - 1.30]	0.790
Camp (ref: Teknaf)	Ukhiya	0.66*	[0.41 - 1.06]	0.082	0.72	[0.47 - 1.12]	0.141	0.85	[0.55 - 1.32]	0.465
Household size (ref: <5 members)	≥5 members	1.12	[0.81 - 1.54]	0.496	1.08	[0.79 - 1.49]	0.627	1.08	[0.77 - 1.51]	0.664
Morbidity and Environmental										
Safe disposal of child faeces (ref: no)		0.77	[0.53 - 1.11]	0.160	–	–	–	–	–	–
Water considered safe to drink (ref: no)		**1.96**	[1.03 - 3.73]	0.039	–	–	–	–	–	–
Child dewormed in past 6 months (ref: no)		0.90	[0.64 - 1.28]	0.556	–	–	–	–	–	–
Inflammation and Infection										
Elevated CRP (≥5 mg/L) (ref: <5 mg/L)		–	–	–	1.30	[0.88 - 1.92]	0.179	–	–	–
Elevated AGP (≥1 g/L) (ref: <1 g/L)		–	–	–	**1.57**	[1.13 - 2.18]	0.007	–	–	–
Haemataology										
Low serum iron (ref: ≥50 µg/dL)		–	–	–	–	–	–	**2.45**	[1.81 - 3.31]	0.000
Low MCH (<23 pg) (ref: normal)		–	–	–	–	–	–	**8.34**	[6.03 - 11.54]	0.000
Elevated reticulocyte (>2%) (ref: normal)		–	–	–	–	–	–	**2.15**	[1.29 - 3.58]	0.004
Constant		**0.4**	[0.18 - 0.86]	0.020	**0.41**	[0.25 - 0.66]	0.000	**0.14**	[0.08 - 0.24]	0.000

The introduction of inflammation markers does not materially alter the associations for sex, camp, or household size, which remain non-significant. However, the identification of AGP as an independent predictor indicates that non-nutritional, inflammation-related pathways contribute meaningfully to haemoglobin suppression.

6.2.3 Model 3: Full Biological Model Including Haematological Indicators

Model 3 introduces direct haematological markers of iron availability and red blood cell physiology. This model represents the most biologically proximal explanation of anaemia.

After inclusion of serum iron and red cell indices, the magnitude of the age effect attenuates substantially. Infants aged 6–11 months have 2.56 times higher odds of anaemia (95% CI: 1.28–5.12, p = 0.009), and children aged 12–23 months have 2.02 times higher odds (95% CI: 1.36–3.02, p = 0.001) compared with children aged 24–59 months. The reduction in odds ratios relative to Models 1 and 2 indicates that a substantial portion of the age gradient is mediated through underlying biological mechanisms captured in this model.

Among nutritional biomarkers, low serum iron (<50 µg/dL) is strongly associated with anaemia (AOR = 2.45, 95% CI: 1.81–3.31, p < 0.001), confirming that impaired circulating iron availability contributes significantly to haemoglobin deficits.

Red blood cell indices provide even stronger evidence. Low mean corpuscular haemoglobin (MCH <23 pg) is the most powerful predictor in the model (AOR = 8.34, 95% CI: 6.03–11.54, p < 0.001). This large effect size indicates that impaired haemoglobinization at the cellular level is central to anaemia in this population. Low MCH reflects reduced haemoglobin content per erythrocyte and is consistent with iron-restricted erythropoiesis.

Elevated reticulocyte counts (>2%) are also independently associated with anaemia (AOR = 2.15, 95% CI: 1.29–3.58, p = 0.004), suggesting increased bone marrow response to red cell loss or recovery from prior insult.

Notably, inflammatory markers no longer retain independent significance in Model 3. The attenuation of AGP suggests that the influence of chronic inflammation on haemoglobin operates primarily through downstream effects on iron metabolism and red blood cell production rather than exerting a direct independent effect once haematological dysfunction is accounted for.

6.2.4 Integrated Interpretation Across Models

Across the three models, a clear pattern emerges. First, age consistently remains the most important independent predictor of anaemia. Even after accounting for environmental exposures, inflammation, and direct biological markers, children under two years of age remain significantly more vulnerable. This indicates that early-life physiology—characterized by rapid growth, high iron demand, and immature immune response—creates an inherently high-risk window.

Second, environmental and programmatic variables show limited independent effects once biological factors are included. Their influence appears indirect, likely mediated through infection burden and inflammatory pathways.

Third, proximal biological markers—particularly low MCH and low serum iron—are strongly associated of anaemia. These findings highlight iron-restricted erythropoiesis as the central mechanism driving haemoglobin deficits.

Finally, the transition from the household-linked sample (n = 838) to the full venous subsample (n = 933) strengthens the biological inference by incorporating objective haematological data. The attenuation of demographic and contextual effects in the final model confirms that observed disparities in earlier models are largely explained by underlying biological dysfunction rather than structural differences alone.

Taken together, the multivariate findings demonstrate that anaemia in this population is primarily driven by impaired iron metabolism and disordered erythropoiesis during early childhood, with chronic inflammation contributing indirectly. Environmental and programmatic exposures shape the context of risk but do not independently predict haemoglobin status once biological mechanisms are considered.

> **Age is the strongest risk factor.**
> **Biological markers explain anaemia better than household conditions.**
> **Sanitation and services matter, but their effects operate indirectly.**
> **The immediate drivers are iron availability, red blood cell health, and inflammation.**

CHAPTER 7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

This study confirms that anaemia among children aged 6–59 months in the FDMN camps of Cox's Bazar remains a persistent and multifaceted public health challenge. Using a layered analytical approach, combining descriptive statistics, bivariate associations, and conceptually staged multivariate models, the analysis provides a nuanced understanding of both the scale of the problem and the mechanisms through which anaemia is sustained in this protracted humanitarian context.

Overall, 36.9% of children aged 6–59 months are anaemic, meeting age-specific haemoglobin thresholds (Hb <10.5 g/dL for 6–23 months; <11.0 g/dL for 24–59 months).

Risk is disproportionately concentrated in the first two years of life.

Anaemia is overwhelmingly concentrated in infancy and early toddlerhood. Over half of infants aged 6–11 months are anaemic, and children under 24 months face more than four times higher odds of anaemia compared with children aged 24–59 months, independent of household or environmental conditions. This consistent age gradient across descriptive, bivariate, and multivariate analyses identifies the first two years of life as the critical window for intervention.

The burden is far from evenly distributed across childhood. More than half of infants aged 6–11 months (55%) are anaemic, compared with 42% of children aged 12–23 months and 27% of children aged 24–59 months. This steep age gradient is evident across all analyses and persists after multivariate adjustment.

Severity patterns further contextualise this burden. Mild anaemia affects 22% of children, while moderate anaemia affects approximately 10%. Severe anaemia (Hb <7.0 g/dL) is rare, affecting only 0.1% of children. Although severe cases are uncommon, the predominance of mild and moderate anaemia remains epidemiologically significant, given well-established links with impaired neurodevelopment, reduced immunity, and growth faltering, particularly when experienced during the first two years of life.

Mean haematocrit levels mirror haemoglobin trends, with the lowest values observed among infants (mean Hct 34.9% in 6–11 months) and gradual increases through early childhood (37.2% among 24–59 months), reinforcing the physiological vulnerability of the youngest age groups.

Across all logistics regression models, the first two years of life emerge as the critical window for intervention.

- In Model 1 (n=838), which includes demographic, household, environmental, and programmatic variables, infants aged 6–11 months have nearly five times higher odds of anaemia compared with children aged 24–59 months (AOR 4.98), while children aged 12–23 months have approximately four times higher odds (AOR 4.04).
- In Model 2 (n=933), which introduces inflammatory biomarkers, the age gradient persists (AOR 5.18 for 6–11 months; 3.83 for 12–23 months).
- In Model 3 (n=933), which incorporates direct haematological indicators, age effects attenuate but remain significant (AOR 2.56 for 6–11 months; 2.02 for 12–23 months), indicating that a

substantial portion of early-life vulnerability operates through biological pathways captured in the full model.

Iron deficiency matters but explains only part of the anaemia burden.

Iron deficiency contributes meaningfully to anaemia, particularly among young children. Nearly one-quarter of children aged 6–23 months meet inflammation-adjusted criteria for iron-deficiency anaemia, confirming iron depletion as a major concern during the complementary feeding period. However, because 14.8% of all children have adjusted IDA compared with 32% who are anaemic overall, iron deficiency alone does not account for the majority of cases.

Iron deficiency contributes meaningfully to childhood anaemia in the camps, but it does not fully explain its prevalence. Based on unadjusted ferritin <12 µg/L, 9% of children are iron-deficient overall. Iron deficiency peaks sharply during early life: 14% among infants aged 6–11 months and 29% among children aged 12–23 months, before declining to 5% among children aged 24–59 months. When low ferritin is combined with anaemia, unadjusted iron-deficiency anaemia (IDA) affects 6.6% of children overall, rising to 15.2% among children aged 6–23 months and falling to 2.5% among older children.

After adjusting ferritin for inflammation, the estimated contribution of IDA increases substantially. Adjusted IDA affects 14.8% of children aged 6–59 months, including 24.8% of children aged 6–23 months. This increase after adjustment reflects the masking effect of inflammation on ferritin concentrations and indicates that iron deficiency is partially obscured in high-inflammation settings.

Mean iron biomarkers reinforce this interpretation. Mean serum iron is lowest in infancy (43.8 µg/dL) and increases steadily with age to 60.9 µg/dL among children aged 24–59 months. Total iron-binding capacity is highest in children under two years, reflecting heightened physiological iron demand during rapid growth. These patterns are consistent with biological vulnerability during the complementary feeding period, when breastmilk alone is insufficient to meet iron requirements and dietary diversification is often constrained in humanitarian settings.

Inflammation and altered erythropoiesis play a central biological role.

Markers of infection and inflammation are highly prevalent, affecting nearly half of all children and more than 60% of those under two years of age. Elevated inflammatory markers, widespread microcytosis and hypochromia, increased red cell heterogeneity, and elevated reticulocyte responses indicate that inflammation-related suppression of erythropoiesis and impaired iron utilisation are important contributors to anaemia. These processes also mask underlying iron deficiency by elevating ferritin levels, complicating diagnosis and programme response.

This study reveals a substantial inflammatory burden that both interacts with iron metabolism and complicates nutritional interpretation of anaemia. Elevated CRP is observed in 19% of children overall, rising to 29% among infants, while elevated AGP affects 44% of all children and exceeds 58–61% among those under two years of age. These levels point to widespread acute and chronic inflammatory exposure during early childhood. While inflammatory markers are not independently associated with anaemia in the fully adjusted multivariate model, their high prevalence and biological interaction with iron regulation underscore their central relevance to anaemia aetiology in this setting.

Red blood cell indices provide further insight into non-nutritional mechanisms. Microcytic or hypochromic anaemia affects 23% of children overall, but more than half of infants aged 6–11 months (55%) and 41% of children aged 12–23 months. Mean MCV and MCH increase progressively with age, while RDW-CV is highest among younger children (17.7–18.0%), indicating heterogeneous red cell populations and physiological stress. Reticulocyte counts are modestly elevated in a subset of children, suggesting compensatory marrow responses rather than isolated nutritional deficiency.

Importantly, haemoglobin electrophoresis does not suggest a major contribution from haemoglobinopathies: mean HbA (95.1%) and HbA_2 (2.8%) remain within expected ranges with minimal variation by age or camp. This directs attention away from inherited disorders and toward infection-, inflammation-, and nutrition-related pathways as the dominant mechanisms sustaining anaemia in this population.

Biological markers explain anaemia better than household factors.

Once age is controlled for, anaemia is much more strongly associated with iron indices and red cell abnormalities than with sanitation, water, or programmatic indicators.

Multivariate modelling clarifies the relative importance of these pathways. In Model 1, which examines demographic, household, environmental, and programmatic factors, child age emerges as the most powerful independent predictor of anaemia. Compared with children aged 24–59 months, infants aged 6–11 months have nearly five times higher odds of anaemia (AOR 4.98), and children aged 12–23 months have approximately four times higher odds (AOR 4.04) after adjustment. Household size, sanitation, drinking water perception, deworming, and measles vaccination do not retain independent associations once age is accounted for.

In Model 2, which introduces inflammatory biomarkers, the age gradient persists (AOR 5.18 for 6–11 months; 3.83 for 12–23 months), and elevated AGP is independently associated with higher odds of anaemia. This finding highlights the contribution of chronic inflammation to anaemia risk during early childhood.

Model 3, which incorporates direct haematological indicators, further underscores that proximal physiological processes drive anaemia risk. After adjustment for biomarkers, age effects attenuate but remain statistically significant (AOR 2.56 for 6–11 months; 2.02 for 12–23 months), indicating that part of the early-life vulnerability operates through biological pathways captured in the full model. Low serum iron, low mean corpuscular haemoglobin (MCH), and elevated reticulocytes are all strongly and independently associated with anaemia. In contrast, inflammatory markers (CRP and AGP) no longer retain statistical significance in the fully adjusted model, suggesting that their influence is mediated through iron availability and red blood cell dysfunction rather than acting as independent predictors.

Taken together, these models demonstrate that while upstream environmental and programmatic factors shape exposure risk, anaemia in this population is most directly explained by biological disruption of iron metabolism and erythropoiesis.

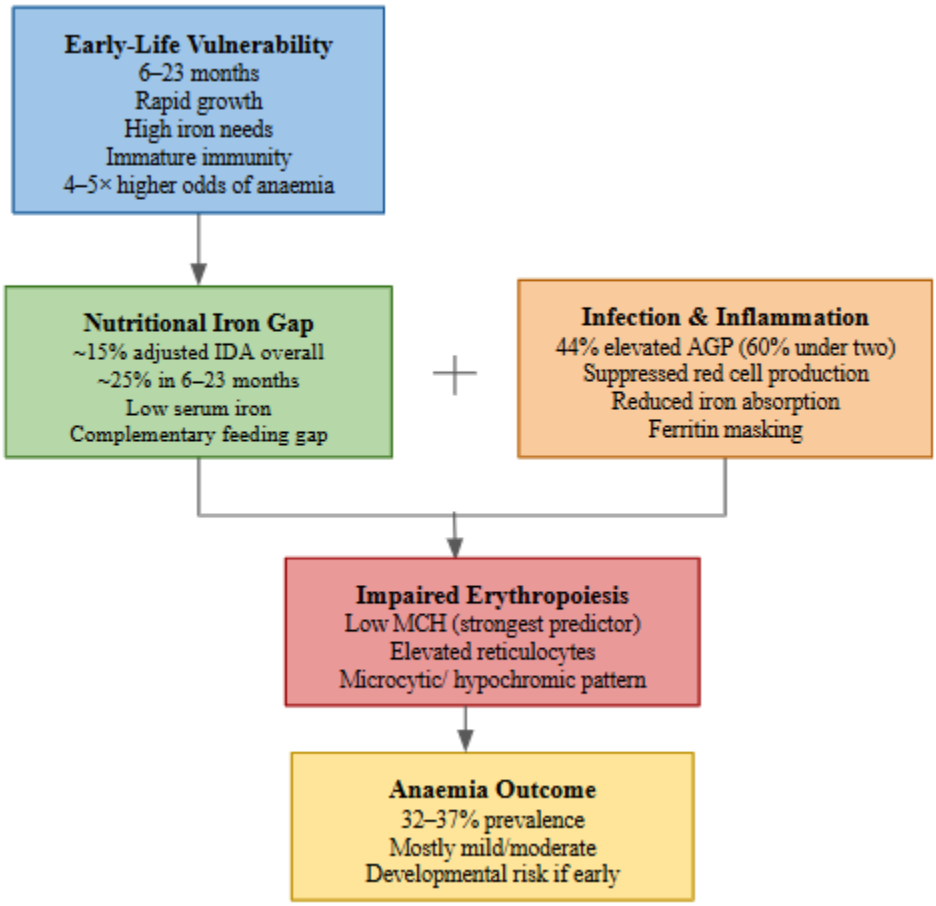
Anaemia reflects cumulative early-life stress rather than a single exposure.

These findings suggest that childhood anaemia in the FDMN camps is best understood as the biological imprint of overlapping early-life stressors, including rapid growth, suboptimal micronutrient intake,

repeated infection, and sustained inflammation. Multivariate analyses demonstrate that once age is controlled for, proximal biological markers—particularly iron availability and red blood cell abnormalities—are more strongly associated with anaemia than household or programmatic variables. The attenuation of age effects after inclusion of biomarker variables further supports the role of underlying physiological pathways in explaining early-life vulnerability. Anaemia declines as children grow older and inflammatory exposure diminishes, consistent with gradual biological recovery over time.

Figure 31 illustrates anaemia in the camps is not caused by iron deficiency alone—it results from the combined effects of early-life vulnerability, limited iron availability, and high levels of infection and inflammation that disrupt healthy blood production, especially in children under two years

Figure 31. Conceptual Pathways to Childhood Anaemia in FDMN Camps, Cox's Bazar (2025)



In conclusion, childhood anaemia in the camps clearly reflects a dual burden. Nutritional iron deficiency, particularly during the first 1,000 days of life, is an important contributor, but a large share of anaemia appears to be driven or sustained by inflammation-related mechanisms linked to infection, environmental exposure, and chronic physiological stress. Although inflammatory markers are not independently predictive in the fully adjusted model, their high prevalence and their modifying effect on iron interpretation underscore their biological relevance. The progressive decline in anaemia prevalence and

inflammatory markers with age suggests gradual recovery as children mature, but this recovery often follows a period of heightened vulnerability during which developmental consequences may already have occurred.

These findings underscore that anaemia in protracted humanitarian settings cannot be fully understood, or effectively addressed, through single-sector lenses. It is simultaneously a nutritional condition, an infection-related condition, and a marker of structural vulnerability in early life.

7.2 Recommendation

Based on the descriptive, bivariate, and multivariate analyses, anaemia among children 6–59 months in the camps emerges as a multi-factorial condition driven by early-life vulnerability, partial iron deficiency, and pervasive inflammation. Effective response therefore requires a layered, integrated strategy that prioritises the first two years of life while addressing both nutritional and non-nutritional pathways. The recommendations below are organised by intervention domain.

1. Prioritise the first 1,000 days as the core anaemia intervention window.

Infants and young children under 24 months exhibit the highest burden of anaemia and the strongest independent risk after adjustment. In structural models (Model 1 and Model 2), children under two have approximately four- to five-fold higher odds of anaemia compared with children aged 24–59 months. Even after incorporating direct biological markers in Model 3, children 6–11 months and 12–23 months retain approximately two-fold higher odds of anaemia, indicating persistent early-life vulnerability mediated through physiological pathways.

Over 50% of infants 6–11 months are anaemic, and nearly two-thirds of children 6–23 months meet age-specific haemoglobin deficiency criteria.

Recommendations:

- Reorient anaemia prevention and treatment strategies to explicitly prioritise children 6–23 months, rather than broadly targeting all children under five.
- Align programming with the first 1,000 days framework, recognising that biological vulnerability peaks before age two and declines thereafter.
- Strengthen routine early-life screening for anaemia at 6, 9, and 12 months through child health services.

2. Maintain iron interventions but target them precisely.

Iron deficiency is a significant contributor to anaemia, particularly in children 6–23 months, where ~25% have inflammation-adjusted IDA. However, because iron deficiency explains less than half of anaemia overall, indiscriminate iron-only strategies are insufficient and may be inefficient.

Recommendations:

- Continue age-appropriate iron supplementation or fortification for infants and young children, especially during the complementary feeding period.

- Prioritise preventive approaches (e.g., fortified complementary foods, micronutrient powders) rather than treatment-only models.
- Avoid exclusive reliance on ferritin alone for screening; where feasible, interpret iron status alongside inflammatory markers to reduce misclassification.

3. Integrate Infection and Inflammation Reduction into Anaemia Programming.

Chronic inflammation affects nearly 44% of all children and over 60% of those under two years. Although inflammatory markers are not independently predictive in the fully adjusted haematological model, their high prevalence and biological interaction with iron metabolism underscore their importance in shaping anaemia risk.

Biological models demonstrate that disruptions in erythropoiesis and iron utilisation are central to anaemia, and these processes are strongly influenced by infection and inflammatory exposure during early childhood.

Recommendations:

- Strengthen infection prevention measures as a core anaemia control strategy, not a parallel intervention.
- Ensure consistent access to: routine childhood immunization, timely treatment of acute infections, and deworming aligned with age and epidemiological guidelines.
- Reinforce WASH interventions specifically as mechanisms to reduce repeated enteric infections and inflammation, even where their independent associations appear muted in multivariate models.

4. Combine Nutrition-Specific and Nutrition-Sensitive Interventions.

Anaemia in this setting reflects cumulative early-life stress, not a single exposure. Biological evidence indicates impaired erythropoiesis, iron sequestration, and red cell abnormalities driven by overlapping nutritional and inflammatory pathways.

Recommendations:

- Design integrated anaemia packages that combine: IYCF support, micronutrient provision, infection prevention, and caregiver education on hygiene and illness management.
- Recognise that nutrition-sensitive interventions may not show large independent effects in multivariate models yet remain essential for addressing upstream drivers of inflammation and nutrient loss.

5. Use Biomarkers Strategically to Refine Programme Targeting.

Biomarker-inclusive models explain anaemia risk more clearly than household or programmatic variables. Indicators of iron availability and red blood cell morphology, particularly low MCH and low serum iron, are the strongest independent predictors of anaemia.

Recommendations:

- Where resources permit, incorporate basic haematological indicators (e.g., MCH, RDW, reticulocyte indices) into periodic surveys to improve understanding of anaemia aetiology.
- Use biomarker data primarily for programme design and evaluation, rather than individual diagnosis in routine settings.
- Avoid overinterpreting ferritin without inflammatory context in high-burden infection settings.

6. Reframe Anaemia as a Developmental Risk, Not Only a Nutritional Deficiency.

Although severe anaemia is rare, mild and moderate anaemia affect a large proportion of children and occur during critical windows of neurodevelopment. The concentration of anaemia in infancy and early toddlerhood places children at risk during a period of rapid brain growth and immune maturation.

Recommendations:

- Position anaemia prevention as part of early child development and human capital protection, not solely as a micronutrient issue.
- Advocate for anaemia reduction within broader strategies for child survival, development, and long-term resilience in humanitarian settings.

7. Strengthen Monitoring, Evaluation, and Adaptive Programming.

The decline in anaemia prevalence with age suggests that biological recovery is possible but delayed. Programmes must therefore capture timing, not just prevalence.

Recommendations:

- Monitor anaemia outcomes stratified by narrow age bands, particularly within the first two years of life.
- Use routine data to assess whether interventions are reaching children before peak vulnerability, rather than after anaemia is established.
- Adapt programming iteratively based on emerging biological and epidemiological evidence.

Overall Recommendation Framework: Addressing Anaemia Through Dual, Interacting Pathways

Anaemia in this population is best understood and addressed through a dual-pathway framework that recognises the interplay between nutritional deficiency and sustained biological stress in early life. The evidence indicates that no single intervention—nutritional or environmental alone—is sufficient to substantially reduce anaemia prevalence.

First, interventions must prevent and treat iron deficiency during early childhood, particularly throughout the complementary feeding period (6–23 months), when iron requirements are high and dietary adequacy is most difficult to achieve. Iron deficiency, especially after accounting for inflammation, affects a significant share of young children and contributes meaningfully to anaemia risk. Ensuring timely access to iron-rich complementary foods, fortified products, and age-appropriate supplementation during this

critical window is therefore essential to support adequate erythropoiesis and prevent early depletion of iron stores.

Second, and equally important, interventions must reduce the burden of sustained inflammation and infection that constrains haemoglobin recovery, even in the presence of adequate iron. High levels of chronic inflammatory exposure during infancy impair iron absorption and recycling and contribute to red cell abnormalities. This inflammatory environment limits the effectiveness of iron-focused strategies alone and helps explain why the majority of anaemia cannot be attributed to iron deficiency in isolation. Addressing recurrent infections, enteric disease exposure, and underlying inflammatory stress through improved WASH, infection prevention, immunisation coverage, and timely case management is therefore a fundamental component of anaemia control.

Crucially, these two pathways are biologically interdependent. Iron interventions delivered in the context of unresolved inflammation are less effective, while infection control without addressing nutritional deficits fails to meet the physiological demands of rapid growth. The convergence of immature immune systems, elevated iron requirements, and high pathogen exposure during the first two years of life makes early, integrated action imperative.

BIBLIOGRAPHY

Chaparro, C. M., & Suchdev, P. S. (2019). Anemia epidemiology, pathophysiology, and etiology in low- and middle-income countries. *Ann N Y Acad Sci.*, *1450*(1), 15–31. https://doi.org/doi: 10.1111/nyas.14092

ENA SMART. (2018). *Emergency Nutrition Assessment (ENA/SMART) Survey of Rohingya Refugees, Cox's Bazar, Bangladesh – Round 2018.* [Nutrition Sector].

Gardner, W. M. (2023). Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990–2021: Findings from the Global Burden of Disease Study 2021. *The Lancet Haematology*, *10*(9), e713–e734. https://doi.org/10.1016/ S2352-3026(23)00160-6

Hess, S. Y., Owais, A., Jefferds, M. E. D., Young, M. F., Cahill, A., & Rogers, L. M. (2023). *Accelerating action to reduce anemia: Review of causes and risk factors and related data needs*. *1523*(1), 11–23. https://doi.org/doi: 10.1111/nyas.14985.

Leidman, E., Miah, M. L., Humphreys, A., Totoitich-van Mil, L., Wilkinson, C., Chelan'at Koech, M., Sbuliba, H., Siddique, M. A. B., & Bilukha, O. (2020). Malnutrition trends in Rohingya children aged 6–59 months residing in informal settlements in Cox's Bazar District, Bangladesh: An analysis of cross-sectional, population-representative surveys. *PLoS Medicine*, *17*(3), e1003060. https://doi.org/10.1371/journal.pmed.1003060

Ministry of Health and Sports (MoHS), & ICF. (2017). *Myanmar Demographic and Health Survey 2015-16*. Ministry of Health and Sports and ICF. http://dhsprogram.com/pubs/pdf/FR324/FR324.pdf

Naheed, A. (2022, October 30). *National Micronutrient Survey, Bangladesh 2019-2020*. National dissemination program, Hotel Lakeshore, Gulshan, Dhaka. https://www.nnsop.gov.bd/storage/files/file-2023-08-08-64d1dbdd5fb30.pdf

National Institute of Population Research and Training (NIPORT), & ICF. (2017). *Bangladesh Demographic and Health Survey 2017-18*. NIPORT, Ministry of Health and Family Welfare, and ICF. https://www.dhsprogram.com/pubs/pdf/FR344/FR344.pdf

National Institute of Population Research and Training (NIPORT), & ICF. (2013). *Bangladesh Demographic and Health Survey 2011*. NIPORT/Bangladesh, Mitra and Associates/Bangladesh, and ICF International. http://dhsprogram.com/pubs/pdf/FR265/FR265.pdf.

National Institute of Population Research and Training (NIPORT), & ICF. (2016). *Bangladesh Demographic and Health Survey 2014*. NIPORT/Bangladesh, Mitra and Associates, and ICF International. http://dhsprogram.com/pubs/pdf/FR311/FR311.pdf

National Institute of Population Research and Training (NIPORT), & ICF. (2024). *Bangladesh Demographic and Health Survey 2022: Final Report*. NIPORT and ICF.

Salma, P. (2019). Measles Outbreak among Rohingya Refugees—Cox's Bazar, Bangladesh, 2017–2018. *CDC MMWR*.

SENS. (2024). *Standardised Expanded Nutrition Survey (SENS) 2023: Nutrition and Health Status of Rohingya Refugees in Cox's Bazar.* UNHCR, WFP, UNICEF, and ACF.

Sunuwar, D. R., Singh, D. R., Pradhan, P. M. S., Shrestha, V., Rai, P., Shah, S. K., & Adhikari, B. (2023). Factors associated with anemia among children in South and Southeast Asia: A multilevel analysis. *BMC Public Health*, *23*(1), 343. https://doi.org/10.1186/s12889-023-15265-y

Teketelew, B. B., Chane, E., Angelo, A. A., Tamir, M., Cherie, N., Nigus, M., Mulatie, Z., & Berta, D. M. (2024). Global prevalence of anemia in displaced and refugee children: A comprehensive systematic review and meta-analysis. *PLoS ONE*, *19*(11: e0312905). https://doi.org/10.1371/journal.pone.0312905

UNHCR. (2024a). *Joint GoB-UNHCR Population Factsheet. Rohingya Refugee Response/Bangladesh*.

UNHCR. (2024b). *UNHCR Bangladesh 2023 Standardized Expanded Nutrition Survey (SENS). Final Executive Summary*. 2023_BAN_CXB-SENS-FINAL-EXEC-SUMMARY_4-JAN-2024.pdf

UNHCR. (2024c). *UNHCR Population Factsheet Block Level Data*. https://data.unhcr.org/en/country/bgd

Weiss, G., Ganz, T., & Goodnough, L. T. (2019). Anemia of inflammation. *Iron Metabolism and Its Disorders*, *133*(1), 40–50. https://doi.org/10.1182/blood-2018-06-856500

WHO. (2018). *WHO Bangladesh: Rohingya Refugee Crisis – Health Sector Bulletin*. World Health Organization.

WHO. (2021). *Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity*. WHO. https://www.who.int/publications/i/item/WHO-NMH-NHD-MNM-11.1

WHO. (2024). *Guideline on haemoglobin cutoffs to define anaemia in individuals and populations* (No. Licence: CC BY-NC-SA 3.0 IGO). Geneva: World Health Organization.

Yujuan, L., Weifang, R., Shuying, W., Minmin, X., Shunxian, Z., & Feng, Z. (2024). Global burden of anemia and cause among children under five years 1990–2019: Findings from the global burden of disease study 2019. *Original Research*, *11*. https://doi.org/10.3389/fnut.2024.1474664

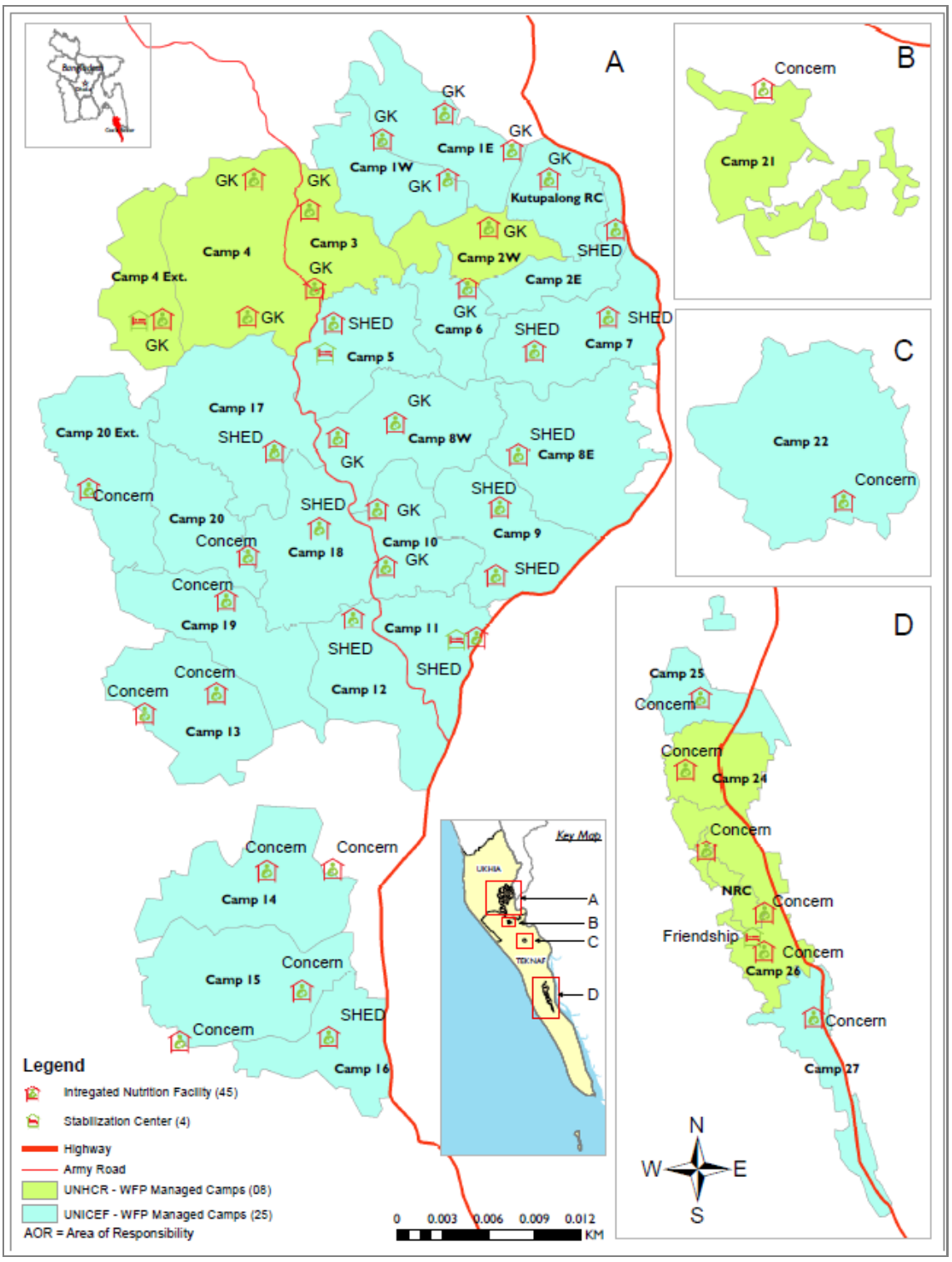
GLOSSARY

Anaemia	A condition where the blood has lower-than-normal haemoglobin levels, reducing its ability to carry oxygen.
Haemoglobin (Hb)	A protein in red blood cells that carries oxygen throughout the body.
Iron Deficiency (ID)	Low body iron stores, typically measured using ferritin or serum iron.
Iron-Deficiency Anaemia (IDA)	Anaemia caused specifically by insufficient iron for haemoglobin production.
Ferritin	A blood marker used to measure iron stores. Ferritin increases during infection, which can mask true iron deficiency.
Inflammation	The body's response to infection or illness. Chronic inflammation can interfere with iron use and red blood cell production.
CRP (C-reactive protein)	A marker of recent or acute infection.
AGP (Alpha-1-Acid Glycoprotein)	A marker of chronic or ongoing inflammation.
Adjusted Iron Deficiency	Iron deficiency estimate corrected for inflammation using CRP and/or AGP levels.
Erythropoiesis	The process by which the body produces red blood cells.
Reticulocytes	Immature red blood cells. Elevated levels suggest the body is responding to anaemia or red blood cell loss.
MCH (Mean Corpuscular Haemoglobin)	The amount of haemoglobin inside each red blood cell. Low MCH indicates reduced haemoglobin content.
MCV (Mean Corpuscular Volume)	The size of red blood cells. Low values suggest microcytic anaemia (often iron-related).
RDW (Red Cell Distribution Width)	A measure of variation in red blood cell size. High RDW indicates stress in red blood cell production.
Inflammation-Adjusted Ferritin (BRINDA approach)	A WHO-recommended method to correct ferritin values in high-infection settings.
Multivariate Analysis	Statistical method that adjusts for multiple factors simultaneously to identify independent associations.
Cross-Sectional Study	A study that collects data at one point in time. It shows associations but cannot prove causality.

APPENDICES

Appendix A. Nutrition Sector in Cox's Bazar

Figure A1. Nutrition Sector Partners Presence, 2025



Appendix B. Sampling Design and Sample Size Calculation

The section provides the sample design characteristics for this survey, including defining the sampling frame that covers the target population, the sample size determination steps, the proposed stratification, sample allocation, sampling stages, and sample selection methodology for this survey. These proposed methodologies were guided by the sample requirements as defined by in the technical section of the RFP and discussions with UNICEF.

A. Sampling Frame

A stratified two-stage cluster sample design will be used to select a representative household sample for this cross-sectional survey of the 33 FDMN camps in CXB, based on the sampling requirements outlined in the RFP.

In general, the stages of sample selection will include a sample of primary sampling units (PSUs) at the first stage, with households selected in the second stage to form the household sample. Within each selected household, there will be further sampling of eligible children under five for collecting information on non-nutritional indicators and indicators of infection and inflammation, including children aged 6-59 months for collecting information on nutritional indicators and anaemia testing.

To select a probability sample that is representative of the population, a valid frame of the sampling units at each stage of sample selection is required. This section discusses the sampling frames that will be used at each stage of sampling for this survey. A high-quality sampling frame is critical to the successful implementation of any population-based survey. It comprises a complete list of all sampling units that cover the target population (i.e., blocks, households, or individuals) from which a representative sample can be randomly selected at each stage of the survey. Without such frames, it is difficult to ensure a representative sample for the survey. The sampling frame that will be used at the first stage is the block-level UNHCR population estimates as of November 30, 2024, covering the population residing within each block across the 33 FDMN camps (UNHCR, 2024c).

Within the selected clusters, a complete and comprehensive list of all households will be created through a household listing process that occurs before the fieldwork for the survey. This list of households in each cluster will constitute the sampling frame for selecting a representative random sample of households for the survey.

NOTE. There may be an additional stage of selection that will be implemented depending on the availability of the sub-block level data once the first stage sample of camp blocks has been selected. It is expected that the sub-block level population information will be provided for all camp sub-blocks within each of the sampled camp blocks selected at the first stage.

At the final stage of sampling, the frame consists of eligible individuals found within the sampled households from the previous stage. This frame is established through a household roster, which is a listing of all household members, along with associated information such as demographics and relationship to other members within the household. Interviewers generate the household roster during the main data collection, after sampled households have been located and contact has been established with a responsible adult within these households.

Table B1 shows the population distribution across the two registered camps, Kutupalong and Nayapara, along with the other camps that form the Mega Camps.

Table B1. Distribution of blocks by camp type

Camp Type	Camps	Blocks	Population
Mega Camps	31	167	927,766
Kutupalong Registered Camp	1	7	17,633
Nyapara Registered Camp	1	7	24,895
Total	**33**	**181**	**970,294**

Source: UNHCR Population Factsheet Block Level Data - November 2024. Accessed at https://data.unhcr.org/en/country/bgd on 01/04/2025.

B. Sample Size Determination

Determining an appropriate sample size for a population-based survey (PBS) is a crucial step in the survey design process. The primary aim of this survey is to gather information on the various causes of anaemia among children aged 6-59 months in the FDMN Camps in CXB, Bangladesh. A cross-sectional survey will be conducted among household's representatives of the 33 FDMN camps, which include the 31 MCs and the registered camps of Kutupalong and Nayapara. This approach treats the 33 FDMN camps as a single sampling domain, ensuring that the sample size determined below will provide reliable estimates for the overall 33 FDMN camps in CXB.

Table B2 presents the calculation to determine the required number of children 6-59 months to be sampled in order to achieve the desired level of precision for the survey (i.e., a relative margin of error (RME) of 10%). These calculations are based on the input parameter values as presented in **Table 3**, using the sample size determination formula (see equation (1) below) and parameter assumptions as described below.

Table B2. Calculation of the required sample size of children 6-59 months

r	*deff*	*RME*	*z*	n_{C6_59}
44.3%	2	10%	2	1,006

The following formulae was used to estimate the required sample size for the survey:

$$n = \frac{[4(r)(1-r)(deff)]}{[(RME \times r)^2 (pb)(AveSize)(RR)]} \qquad (1)$$

Where;

n_{C6_59} = the required sample size in terms of the number of children 6-59 months needed in the survey.

r = the predicted or anticipated value of the indicator, expressed in the form of a proportion. This value was set at 0.443 (or 44.3%), based on the estimated upper 95% confidence

interval threshold for the overall prevalence of anaemia for children 6-59 months (Hb<11g/dl) observed for the Kutupalaong Mega camps from the 2023 Standardized Expanded Nutrition Survey (SENS).

deff = the estimated design effect for the indicator. This value was set at 2, which is at the upper end of the recommended value to be used for cluster sampling, to provide a more robust sample size estimate for the survey.

RME = the relative margin of error of *r* to be tolerated at the 95 per cent level of confidence i.e. a 5% level of significance. However, to reduce costs and time, a RME of 0.1 (or 10%) was desired for the survey.

z = the critical value for the probability distribution at a 5% significance level, which is rounded to a value of 2.

Therefore, from the results of the calculation in **Table B2,** a sample of 1,006 children 6-59 months is required for this survey. **Table B3** presents the calculations to convert this sample size to the required number of households needed to be selected in the survey after adjusting for anticipated non-response. These calculations are based on the input parameter values as presented in **Table B3**, using the formula (see equation (2) below) and parameter assumptions as described below.

Table B3. Calculation of the required sample size of households

n_{C6_59}	*pb*	*AveSize*	*RR*	n_{HH}
1,006	14.7%	5.0	90%	1,523

$$n_{HH} = n_{C6\_59} \times \frac{1}{(pb)(AveSize)} \times \frac{1}{(RR)} \qquad (2)$$

Where;

n_{C6_59} = the required sample size in terms of the number of children 6-59 months needed in the survey as determined from **Table B3** above.

pb = the estimated proportion of the total population upon which the indicator, *r*, is based. A value of 0.147 (or 14.7%) was used. This value was based on the per centage of 16.3% of children under 5 years in the Kutupalaong Mega camps from the November 2024 block-level UNHCR population estimates, multiplied by a factor of 0.9 to estimate the proportion of children 6-59 months in the population (i.e., 16.3% x 0.9 = 14.7%).

AveSize = the average household size (mean number of persons per household). A value of 5.0 was used based on the average household size estimated from the November 2024 block-level UNHCR population estimates for the Kutupalaong Mega camps.

RR = the estimated household response rate. This was based on an expected 90% household response rate for the survey.

n_{HH} = the required sample size in terms of the number of households needed to be selected for the survey.

Therefore, from the results of the calculation in **Table B3**, and accounting for the expected household response rate (90%) from 1,523 households, a sample of 1,371 children 6-59 months is required for this survey.

Table B4. Expected precision and number of interviews from the sample

Required Sample Size		Expected Precision (for r ≅ 0.443)			
		Standard error (se)	RME	Lower 95% CI	Upper 95% CI
Number of households to be selected (Sample size)	1,523 households	0.022	0.1	0.399	0.487
Expected number of completed households, i.e., 90% of 1,523 households			1,371 households		
Expected number of interviewed children 6-59 months			1,006 children 6-59 months		

Based on the sample size formula and parameter assumptions listed above, a sample size of 1,523 households is required to achieve an expected relative margin of error of around 10% to meet the objectives of the survey. The number of clusters to be selected for the survey is determined by the number of households a team could complete during data collection per day as shown in **Table B5.**

Table B5. Determination of cluster size based on fieldwork requirements

Activity	Dedicated Time	Total time remaining
Time per day for Fieldwork	6:30am until 4:30pm = 600 mins	600 minutes
Average expected round trip travel time	60 mins x 2 trips = 120 mins	600 – 120 = 480 minutes
One break of 15 mins + 30 min lunch break	10 min + 30 min = 45 mins	480 – 45 = 435 minutes
Average expected time to walk to the camp/block, discussion with the block leader, and identify first selected household.	15 mins	435 – 15 = 420 minutes
Average expected time allocated for interview per household	30 mins*	
Total number of households to be covered by a team per day	420/30 = 14	

* *Two interviewers administered Individual and household questionnaires in parallel*

Based on the average expected time for fieldwork activities, a team is expected to complete about 14 households per day, rounding up this translates to a total of 109 clusters (i.e., 1523/14) to be selected for the survey at the first stage of sampling. This results in a final sample size of 1,526 households for the survey after rounding up to maintain the sample takeof 14 households per cluster.

C. Stratification, Sample Allocation, and Sample Selection

The section describes the proposed sample design in more detail specifically with respect to the stratification, sample allocation and sample selection.

C1. Stratification

Stratification is the process of dividing a target population into subgroups (called strata) that share similar characteristics. This step is crucial in designing probability sample surveys because it reduces overall variability across the sample, thereby increasing the precision of survey estimates. For this survey, the

stratification of the sampling frame will first involve explicit stratification. Within each explicit stratum, implicit stratification will be used to achieve further gains in precision.

C1.1 Explicit Stratification

For this survey, the 33 FDMN camps are geographically clustered within specific areas of the Ukhiya and Teknaf sub-districts of Cox's Bazar district. Due to this geographical clustering, it is expected that the characteristics of the population in camps clustered in a certain area or sub-district will be more similar than those in camps clustered in another area or sub-district. To take advantage of this clustering, it is proposed that the sampling frame covering the 33 FDMN camps be explicitly stratified by sub-district, forming two explicit strata: the Ukhiya stratum and the Teknaf stratum. This stratification by sub-district is expected to result in gains in precision for the overall estimates across the 33 FDMN camps being surveyed.

C1.2 Implicit Stratification

Implicit stratification is an additional measure that can be implemented to improve the efficiency of the sample design prior to sampling, without creating explicit strata. By logically ordering the frame within each explicit stratum and then sampling, gains in precision can be achieved because the ordering has a similar effect as stratification without explicitly creating separate strata. For the current survey design, within each of the explicit strata (as listed in Table B6), the clusters will be sorted by camp number and block number before the selection of clusters during the first stage of sampling to increase the efficiency of the sample design.

Table B6. Distribution of the camps and blocks per stratum

Stratum	Number of Camps	List of Camps	Blocks
Ukhiya	26	(Kutupalong RC, 1E, 1W, 2E, 2W, 3, 4, 4 Ext, 5, 6, 7, 8E, 8W, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 20 Ext)	144
Teknaf	7	(21, 22, 24, 25, 26, 27, Nayapara RC)	37
Total		**33**	**181**

C2. Sample Allocation

The main aim of the survey is to produce indicator estimates at the overall level for the 33 FDMN camps in the study. As shown in Table 5, a sample of 1,526 households will be selected across the camps in the Ukhiya and Teknaf strata. The appropriate allocation method to produce optimal estimates at the overall level is proportional allocation within each of the design strata. This method allocates the sample to each stratum proportional to the stratum population size. The formula for allocating the final sample size to the strata using proportional allocation is given by:

$$n_h = n \times \frac{N_h}{\sum_h N_h} \qquad (3)$$

Where;

n = the final required household sample size

n_h = the portion of the final sample size (n) to be allocated to stratum h.

N_h = population size in stratum h.

$\sum_h N_h$= total population size across all strata making up the 33 FDMN camps.

Table B7 presents the proportional allocation of the final sample size of 1,526 households to each stratum.

Table B7. Proportional Allocation of Final Household Sample Size across Strata

Stratum	Population Size in Stratum (N_h)[a]	Proportional Allocation of the Sample (n_{final_h})[b]
Ukhiya	805,668	1,267
Teknaf	164,626	259
Total	**970,294**	**1,526**

[a] *Based on the UNHCR Population Factsheet Block Level Data - November 2024.*
[b] *Allocated sample sizes per stratum, rounded to the nearest whole number.*

C3. Sample Selection

The sampling process will involve multiple stages of selection to arrive at the final sample to be implemented during fieldwork. This section describes each stage of sampling and how it will be implemented. Section C3.1 outlines the proposed methodology for selecting the first-stage sample of camp blocks. The household listing operation within these sampled camp blocks will determine the basis for subsequent stages of selection, as described in Sections C3.2 and C3.3. After the listing operations are completed, the sampling of households will be conducted (see Section C3.4), followed by the sampling of eligible individuals within the sampled households (see Section C3.5).

C3.1 First-stage sampling of Camp Blocks

After the stratification of the sample frame and sample allocation has been completed, each stratum, denoted by h, has its own sample size, n_h, according to the proportional allocation scheme used. The next step in the survey design process is to randomly select the sample of camp blocks from the sampling frame, independently within each stratum.

Systematic probability proportional to size (PPS) sampling will be used to randomly select a sample of camp blocks during the first stage of sampling, referred to as the PSUs. PPS sampling ensures a probability-based sampling approach and representativeness of all camps in the study population. This approach takes into account the relative sizes of camps across the survey area during sample selection, improving sample efficiency and survey precision.

Another advantage of PPS sampling in a multistage design is that it leads to an overall self-weighting scheme (when combined with subsequent stages), resulting in a more efficient sample design for increased precision in estimating population indicators. Generally, PPS sampling selects the PSUs according to a measure of size (MOS) related to the key indicators of interest. In this survey, the MOS is the total population size per camp block, as provided in the November 2024 UNHCR Population Factsheet Block Level Data file. Additionally, a fixed household sample size of 14 households per PSU will maintain the approximate self-weighting design. This fixed household sample size was determined

based on a logistically feasible number of households per PSU that can be completed in a day (see Table 6).

Table B8 presents the expected distribution of the systematic PPS sample of camp blocks across the strata based on the allocated stratum sample size, n_h and the sample take of 14 households per camp block.

Table B8. Distribution of the sample camp blocks per stratum

Stratum	Number of sampled Camp Blocks per Stratum
Ukhiya	90
Teknaf	19
Total	**109**

C3.2 Preparation of the second- and third-stage sampling frames: Household Listing[2]

Before conducting the second and subsequent stages of sampling, a field-based household listing operation must take place within each sampled camp block. The listing operation is critical because it provides an update of the current situation on the ground in these areas in terms of the sampling units and target population. This information is needed to create an up-to-date and accurate sampling frame for subsequent stages of sampling.

The 109 camp blocks selected during the first stage of sampling will be undergoing the household listing process. During this process, some of the camp blocks might be identified to undergo segmentation (which involves an additional stage of selection) based on the given criteria (see Section C3.3). For camp blocks that do not require segmentation, a listing of all households will be undertaken following the household listing methodology for the survey.

C3.3 Potential second-stage sampling of segmented camp blocks

In case, the sampled camp blocks may be very large, making it a time-consuming and resource-intensive process to list all the households in the sample block. Additionally, due to the large size of the camp block, it would take substantially longer than feasible to traverse the area and complete interviews with each sampled household. In this scenario, segmentation can be used to reduce the area covered by the survey teams, allowing for a more cost-effective and efficient fieldwork implementation process.

The segmentation procedure involves dividing the sampled camp block into smaller areas called segments and randomly choosing one segment to include as a sampled cluster. For this survey, any camp blocks estimated to have more than 300 households will be segmented. This division will be based on existing administrative units (sub-blocks, etc.), ach segment, with its boundaries, will be clearly annotated on the sketch map during listing. Once these segments are defined with an approximate population size, one

[2] There may be an additional stage of selection that will be implemented depending on the availability of the sub-block level data once the first stage sample of camp blocks has been selected. It is expected that the sub-block level population information will be provided for all camp sub-blocks within each of the sampled camp blocks selected at the first stage. If this sub-block level data is provided and available to be used for sampling sub-blocks then there will be an additional stage of selection implemented after the first stage selection of camp blocks to randomly select a sub-block within the sampled camp block. This will become the second stage of sampling, and a household listing and subsequent stages of sampling will be implemented within the sampled sub-block. A PPS sampling method will be used to randomly select a sub-block for the survey.

segment will be selected randomly using PPS sampling, and a complete household listing will be undertaken within the sampled segment.

After the listing operation is complete, an up-to-date list frame of the households within each sampled cluster which can either be a sampled camp block or a sampled segment of a camp block will be available to be used to select the households for the next stage of sampling.

C3.4 Third-stage sampling of households within sampled camp blocks or segments

The third stage of sampling involves randomly selecting the households in which to conduct interviews for the survey within each sampled cluster. The listing exercise provides an ordered list of households for each sampled cluster, serving as a household sampling frame.

The process of randomly selecting households will be carried out using an equal probability variant of systematic sampling called fractional interval systematic sampling. Systematic sampling is the preferred method because it spreads the sample of selected households throughout the cluster, thereby capturing more within-cluster variation compared to methods like simple random sampling.

C3.5 Third-stage sampling of households within sampled camp blocks or segments

During the fieldwork, and as part of the household interview, a roster of household members will be established for each sampled household by obtaining information from the household head. This roster serves as a fourth-stage sampling frame of individuals for all sampled households. Demographic information, including the name, relationship to the household head, age, sex, and any other information needed to establish eligibility for one or more subsequent questionnaire modules, will be collected for all individuals included in the roster.

All eligible individuals (for all target populations) found within the sampled households should be selected for interview (i.e., eligible household members are sampled with certainty). This “take-all” approach is beneficial because it simplifies the sample design and the fieldwork process. By including all eligible individuals with certainty, there is no need for separate individual-level weights to be derived at this stage, which would increase the variability in survey weights and result in decreased precision of survey estimates for these target populations. Furthermore, selecting all eligible household members simplifies fieldwork because a procedure for selecting individuals within sampled households (such as the implementation of a Kish grid) does not need to be administered in the field. Additionally, for rare target populations, such as children under five years old, this approach has the advantage of requiring the sampling of fewer households to achieve the desired number of sampled children. Finally, the approach reduces the design effect due to unequal weighting because all eligible members of the household are sampled with certainty.

D. Reserve Sample

In some cases, survey teams may experience challenges in accessing some sampled clusters after fieldwork has begun for the survey. These sampled clusters may become impossible to survey during the fieldwork period because of insecurity, accessibility, refusal of the community or leaders, etc. Examples can be a conflict that starts in an area that contains a sampled cluster, or a flood might occur, and a cluster becomes inaccessible.

To mitigate against the potential for inaccessibility of any of the originally sampled clusters, a reserve sample of camp blocks will be selected for this survey. A total reserve sample of 10 clusters will be selected proportionally across the two design strata using a two-phase sampling approach during the first stage sample selection.

Appendix C. Sampling Weights

This section provides details on the steps undertaken to produce the sampling weights used during data analysis for this survey. The survey employed a complex sample design that included stratification, clustering, unequal probabilities of selection, and multiple stages of sampling. These features must be accounted for during analysis through the use of sampling weights, which ensure design-based point estimates, appropriate measures of precision, and correct statistical inference for the target population. After data collection, processing, and editing, the final data must be weighted to reflect the sample design and any adjustments required due to non-response before analysis can take place. The sampling weights required for this survey correspond to the analytical domains:

- Household weight: for household-level analysis
- Child weight: for analysis of children aged 6–59 months (modules 4 and 5)
- Anaemia weight: for analysis of venous blood draw data (module 6)

Calculating Probabilities of Selection and Base Weights

The sampling design forms the basis for constructing sampling weights. Accordingly, the probabilities of selection at each sampling stage must be determined. The inverse of these probabilities constitutes the base weights. This section outlines how the base weights were derived based on the sample design. For further detail, please refer to the survey's sample design document.

First Stage Selection

The survey used a stratified, multi-stage cluster sample design. The first-stage sampling frame was constructed using block-level UNHCR population estimates (March 31, 2025) for all 33 FDMN camps. These were considered the most up-to-date and comprehensive population data available at the time of survey design. Blocks were randomly selected as primary sampling units (PSUs). In addition to the main sample of 102 blocks, 10 reserve blocks were selected through a two-phase sampling approach in case any main-sample blocks proved inaccessible. During phase one, blocks were selected using systematic probability proportional to size (SPPS) sampling. In phase two, reserve blocks were selected using fractional interval systematic sampling. The measure of size (MOS) was the number of families per block.

Thus, the first-stage probability of selection is:

$$f_{1hi} = \frac{m_h \times N_{hi}}{N_h} \times \frac{m_h^*}{m_h} = \frac{m_h^* \times N_{hi}}{N_h}$$

Where:

- f_{1hi}: probability of selecting block i in stratum h
- m_h: number of blocks selected in phase one
- m_h^*: number of blocks released for interviewing
- N_{hi}: number of families in block i

- $N_h = \sum_g \quad N_{hg}$: total number of families in stratum h

No reserve clusters were ultimately used; weights were updated accordingly.

Second Stage Selection

Within sampled blocks, one sub-block was selected using PPS based on updated local administrative records. For the registered camps of Kutupalong and Nayapara, no sub-block data were available. In these camps, field teams implemented segmentation protocols, dividing blocks into roughly equal segments and then selecting one segment at random.

Thus, the second-stage probability of selection is:

$$f_{2hij} \in \begin{cases} \frac{N^s_{hij}}{N^s_{hi}}, & \text{if camp} \neq \{\text{Kutupalong RC, Nayapara RC}\} \\ \frac{1}{g_{hi}}, & \text{if camp} = \{\text{Kutupalong RC, Nayapara RC}\} \end{cases}$$

Where:

- f_{2hij}: probability of selecting sub-block or segment j
- N^s_{hij}: updated families in sub-block j
- N^s_{hi}: updated families in block i
- g_{hi}: number of segments created

Third Stage Selection

A listing of households was conducted in each selected cluster, and 10 households were selected via fractional interval systematic sampling. The probability of selecting a household is:

$$f_{3hijk} = \frac{n_{hij}}{N^{sl}_{hij}} = \frac{10}{N^{sl}_{hij}}$$

Where:

- N^{sl}_{hij}: number of listed households
- $n_{hij} = 10$: households selected per cluster

Fourth Stage Selection

All eligible children aged 6–59 months in selected households were included (take-all). Thus: $f_{4hijkl} = 1$

The overall probability of selecting a household is: $f_{hijk} = f_{1hi} \times f_{2hij} \times f_{3hijk}$

The overall probability of selecting a child is identical: $f_{hijkl} = f_{hijk} \times 1 = f_{hijk}$

Thus:

$$w_{hijk} = \frac{1}{f_{hijk}}, w_{hijkl} = \frac{1}{f_{hijkl}} = w_{hijk}$$

Adjustments to the Base Weights

Missing Block-Level Information. Because a small proportion of families (0.8%–4.2%) were missing block information, a stratum-level adjustment factor was applied:

$$w_h^{miss} = \frac{N_h^*}{N_h}$$

Where N_h^*includes families with missing block information.

Household Non-Response Adjustment

Household weights were adjusted as:

$$w_{hHH\_NR} = \frac{\sum_{t \in s} \quad w_{hijkt}}{\sum_{t \in s_r} \quad w_{hijkt}}$$

Where:

- s: all sampled households
- s_r: responding households

Individual-Level Non-Response Adjustment

Children could be non-respondents for:

- health/nutrition modules (modules 4–5)
- venous blood draw (module 6)

There was no non-response for modules 4–5: $w_{hC\_NR}^{health} = 1$

Blood-draw non-response adjustment: $w_{hC\_NR}^{blood} = \frac{\sum_{t \in s} \quad w_{hijklt}}{\sum_{t \in s_r} \quad w_{hijklt}}$

Adjusted Sampling Weights

Household: $w_{HH}^{adj} = w_{hijk} \times w_h^{miss} \times w_{hHH\_NR}$

Child: $w_{Child}^{adj} = w_{HH}^{adj}$

Blood Draw: $w_{blood}^{adj} = w_{Child}^{adj} \times w_{hC\_NR}^{blood}$

Trimming of Sampling Weights

Because weights were positively skewed, sampling weights were trimmed at the **95th percentile** per stratum. This reduced extreme values and improved the precision and stability of estimates.

Final Sampling Weights

Final weights are the product of adjusted weights and the stratum-specific trimming factor.

Household: $w_{HH} = w_{HH}^{adj} \times w_{hHH}^{trim}$

Child: $w_{child} = w_{HH}$

Blood Draw: $w_{blood} = w_{blood}^{adj} \times w_{hblood}^{trim}$

Appendix D. Laboratory Testing in Central Facilities

Table D1. Equipment specifications and laboratory procedures for blood sample testing

Diagnostic Centre	Test	Instrument/Analyzer	Assay Kits/Reagents	Laboratory Method & Procedure Summary
Popular Diagnostic Centre	Complete Blood Count (CBC)	Sysmex XN-2000 (Sysmex, Japan)	Sysmex reagents	Fluorescence flow cytometry and optical methods generate complete blood count profiles.
	Reticulocyte Count	Sysmex XN-2000 (Sysmex, Japan)	Sysmex reagents	Reticulocytes stained with RNA-binding fluorescent dye; analysed via flow cytometry.
	Serum Iron	Cobas 501 (Cobas, Germany)	Cobas kits (Germany/USA)	Ferrozine colorimetric method; absorbance at 560 nm is proportional to serum iron concentration.
	Total Iron-Binding Capacity (TIBC)	Cobas 501, Beckman AU680	Cobas kits	Colorimetric assay: serum iron removed via ferrozine binding; unbound iron measured to calculate TIBC.
	Vitamin B12	Alinity I (Abbott, USA)	Abbott CMIA reagents	Chemiluminescent microparticle immunoassay (CMIA); competitive binding with intrinsic-factor labelled analogue.
	Folate	Alinity I (Abbott, USA)	Abbott CMIA reagents	CMIA method: folate competes with labelled antilog; emitted light is inversely proportional to folate level.
	Serum Ferritin	Alinity I (Abbott, USA)	Abbott CMIA reagents	CMIA ferritin assay: ferritin binds to anti-ferritin microparticles; light emitted is proportional to ferritin concentration.
	C-Reactive Protein (CRP)	Cobas 501 (Beckman, USA) or AU680 (Japan)	Beckman CRP reagents	Immunoturbidimetric assay; antigen-antibody complexes with latex particles increase turbidity measured photometrically.

Diagnostic Centre	Test	Instrument/Analyzer	Assay Kits/Reagents	Laboratory Method & Procedure Summary
	Haemoglobin Electrophoresis	Capillary's Octa 3 (Sebia, France)	Sebia electrophoresis reagents	High-voltage capillary electrophoresis separates haemoglobin variants by charge and mobility.
	Peripheral Blood Smears (PBS)	—	—	Blood drop air-dried, fixed, stained, and examined microscopically for cell morphology.
icddr,b	Alpha-1-Acid Glycoprotein (AGP)	Cobas Pro integrated chemistry system + Cobas e801 immunochemistry module (Roche Diagnostics GmbH, Germany)	Tina-quant α1-AGP Gen.2 (Roche)	Immunoturbidimetric assay: latex reagent reacts with AGP to form antigen-antibody complexes; optical turbidity is proportional to AGP concentration. Standardized to IRMM BCR470/CRM470. Serum stored at −70°C; samples thawed, mixed, centrifuged, calibrated with controls, and analysed per SOP.

Appendix E. Study Tables

Table E1. Haemoglobin status, anaemia severity, iron deficiency, iron-deficiency anaemia, and iron biomarkers among children aged 6–59 months, by upazila, Cox's Bazar, 2025

	Ukhiya		Teknaf		Total (6-59 months)		
Characteristics	%	95% CI	%	95% CI	%	95% CI	n
Children 6-59 months with haemoglobin deficiency (any anaemia)	31.0	[28.0 - 35.0]	39.0	[30.0 - 49.0]	32.0	[20.0, 36.0]	933
Children 6-23 months with haemoglobin deficiency <10.5 g/dl	43.0	[35.0 - 51.0]	59.0	[37.0 - 78.0]	45.0	[38.0 - 53.0]	249
Children 24-59 months with haemoglobin deficiency <11 g/dl	26.0	[23.0 - 30.0]	33.0	[25.0 - 42.0]	27.0	[24.0 - 31.0]	684
Children 6-59 months with mild anaemia	21.6	[18.7 - 24.7]	25.8	[20 - 32.7]	22.2	[19.6 - 25.1]	933
Children 6-23 months with mild anaemia, 9.5 to 10.4 g/dl	27.0	[21.0 - 34.0]	39.0	[30.0 - 49.0]	29.0	[23.0 - 35.0]	249
Children 24-59 months with mild anaemia, 10 to 10.9 g/dl	19.0	[16.0 - 23.0]	22.0	[16.0 - 31.0]	20.0	[17.0 - 23.0]	684
Children 6-59 months with moderate anaemia	9.2	[7.1 - 12]	13.3	[8.8 - 19.7]	9.9	[7.8 - 12.4]	933
Children 6-23 months with moderate anaemia, 7 to 9.4 g/dl	16.0	[11.0 - 23.0]	22.0	[10.0 - 42.0]	17.0	[12.0 - 23.0]	249
Children 24-59 months with moderate anaemia, 7 to 9.9 g/dl	7.0	[5.0 - 10.0]	11.0	[6.0- 18.0]	7.0	[5.0 - 10.0]	684
Children with severe anaemia <7 g/dl	0.1	[.02 - 0.9]	0.0	0.0	0.1	[0.01 - 0.8]	933
Haematocrit (HCT)%	36.8	[36.47 - 37.18]	36.1	[35.28 - 36.9]	36.71	[36.4 - 37.0]	933
Children with iron deficiency (ID), unadjusted	9.0	[0.06 - 0.12]	11.0	[6.0 - 21.0]	9.0	[7.0 - 12.0]	502
Children with iron deficiency (ID), adjusted (BRINDA)	43.19	[38.92 - 47.46]	38.7	[32.01 - 45.3]	42.49	[38.8 - 46.2]	502
Children (6-59 months) with IDA, unadjusted	6.44	[4.77 - 8.64]	7.6	[4.78 - 11.9]	6.62	[5.10 - 8.5]	502
Children (6-23 months) with IDA, unadjusted	15.1	[8.07 - 26.44]	16.3	[4.37 - 45.6]	15.2	[8.63 - 25.5]	95
Children (24-59 months) with IDA, unadjusted	2.3	[1.11 - 4.75]	3.3	[0.71 - 13.8]	2.5	[1.28 - 4.72]	407
Children (6-59 months) with IDA, adjusted	15.04	[11.45 - 19.5]	13.18	[8.09 - 20.8]	14.75	[11.56 - 18.6]	502
Children (6-23 months) with IDA, adjusted	23.6	[14.34 - 36.34]	33.9	[15.9 - 58.1]	24.8	[16.13 - 36.2]	95
Children (24-59 months) with IDA, adjusted	12.9	[9.31 - 17.64]	9.7	[4.93 - 18.1]	12.4	[9.19 - 16.5]	407
Serum Iron (µg/dL), mean	57.21	[54.95 - 59.46]	56.18	[51.4 - 60.9]	57.05	[55.1 - 59.1]	933
Total Iron Binding Capacity (TIBC, µg/dL), mean	343.01	[338.91 - 347.11]	337.1	[327.3 - 346.9]	342.1	[338.3 - 345.9]	933
Ferritin (ng/mL), mean	61.24	[56.22 - 66.27]	50.6	[44.2 - 57.0]	59.61	[55.3 - 63.9]	933
Low levels of adjusted serum ferritin and adjusted low Hb	5.0	[3.0 - 8.0]	5.0	[2.0 - 13.0]	5.0	[3.0 - 7.0]	502
Children with serum folate deficiency	-	-	-	-	-	-	922
Children with vitamin B12 deficiency	-	-	-	-	-	-	922

Characteristics	Ukhiya		Teknaf		Total (6-59 months)		
	%	95% CI	%	95% CI	%	95% CI	n
Children with macrocytic anaemia	-	-	-	-	-	-	

Table E2. Anaemia morphology, inflammation markers, haemoglobin fractions, and haematological indices among children aged 6–59 months, by upazila, Cox's Bazar, 2025

Characteristics	Ukhiya		Teknaf		Total (6-59 months)		
	%	95% CI	%	95% CI	%	95% CI	n
Microcytic or hypochromic anaemia	22.0	[19.0 - 25.0]	29.0	[21.0 - 40.0]	23.0	[20.0 - 26.0]	933
Elevated c-reactive protein (CRP), ≥ 5 mg/L	19.0	[16.0 - 23.0]	19.0	[13.0 - 27.0]	19.0	[16.0 - 22.0]	933
Elevated α-1-acid glycoprotein (AGP), ≥ 1 g/L	44.0	[4.0 - 49.0]	42.0	[33.0 - 52.0]	44.0	[40.0 - 48.0]	933
Mean Hb A (%)	95.15	[94.6 - 95.71]	94.92	[93.56 - 96.28]	95.12	[94.6 - 95.63]	928
Mean Hb A2 (%)	2.81	[2.71 - 2.92]	2.73	[2.61 - 2.86]	2.8	[2.71 - 2.89]	933
Other Haematological Indices (Mean)							
White Blood Cells (K/µL)	12.52	[12.14 - 12.9]	11.87	[11.31 - 12.43]	12.42	[12.09 - 12.75]	933
Neutrophils (K/µL)	5.39	[5.17 - 5.6]	5.01	[4.59 - 5.43]	5.33	[5.14 - 5.52]	933
Lymphocytes (K/µl	5.59	[5.41 - 5.78]	5.39	[5.07 - 5.71]	5.56	[5.4 - 5.73]	933
Monocytes (K/µL)	0.47	[0.46 - 0.49]	0.44	[0.41 - 0.46]	0.47	[0.45 - 0.48]	933
Eosinophils (K/µL)	1.08	[0.99 - 1.17]	1.03	[0.9 - 1.16]	1.08	[1 - 1.15]	933
Neutrophil %	43.26	[42.22 - 44.29]	42.07	[39.47 - 44.66]	43.07	[42.11 - 44.04]	933
Lymphocyte %	44.84	[43.9 - 45.77]	45.48	[43.44 - 47.53]	44.94	[44.08 - 45.79]	933
Monocyte %	3.84	[3.73 - 3.96]	3.76	[3.52 - 4]	3.83	[3.73 - 3.93]	933
Eosinophil %	8.07	[7.54 - 8.59]	8.69	[7.77 - 9.62]	8.16	[7.7 - 8.63]	933
Red Blood Cells (million/µL)	4.72	[4.69 - 4.75]	4.68	[4.61 - 4.76]	4.72	[4.69 - 4.75]	933
MCV (fL)	78.38	[77.67 - 79.09]	77.49	[76.37 - 78.62]	78.24	[77.62 - 78.87]	933
MCH (pg)	23.94	[23.72 - 24.15]	23.7	[23.32 - 24.08]	23.9	[23.71 - 24.09]	933
MCHC (g/dL)	30.49	[30.27 - 30.72]	30.52	[30.11 - 30.94]	30.5	[30.3 - 30.7]	933
RDW-CV (%)	15.76	[15.53 - 16]	15.32	[14.87 - 15.77]	15.7	[15.48 - 15.91]	933
Platelets (K/µL)	417.66	[406.46 - 428.86]	404.96	[382.35 - 427.57]	415.7	[405.61 - 425.8]	933
MPV (fL)	10.67	[10.57 - 10.77]	10.75	[10.58 - 10.92]	10.68	[10.6 - 10.77]	933
PCT (%)	0.44	[0.43 - 0.46]	0.43	[0.41 - 0.46]	0.44	[0.43 - 0.45]	855
PDW (fL)	12.59	[12.36 - 12.82]	12.61	[12.15 - 13.07]	12.59	[12.39 - 12.8]	855
Reticulocyte %	1.48	[1.42 - 1.53]	1.36	[1.24 - 1.47]	1.46	[1.41 - 1.51]	933

Table E3. Haemoglobin status, anaemia severity, iron deficiency, iron-deficiency anaemia, and iron biomarkers among children aged 6–59 months, by sex, Cox's Bazar, 2025

	Female		Male		Overall		
Characteristics	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**n**
Children 6-59 months with haemoglobin deficiency (any anaemia)	30.0	[27.0, 35.0]	34.0	[29.0, 39.0]	32.0	[20.0, 36.0]	933
Children 6-23 months with haemoglobin deficiency <10.5 g/dl	43.0	[33.0 - 54.0]	47.0	[36.0 - 59.0]	45.0	[38.0 - 53.0]	249
Children 24-59 months with haemoglobin deficiency <11 g/dl	26.0	[21.0 - 3.0]	29.0	[25.0 - 34.0]	27.0	[24.0 - 31.0]	684
Children 6-59 months with mild anaemia	22.8	[19.3 - 26.6]	21.7	[18.1 - 25.8]	22.2	[19.6 - 25.1]	933
Children 6-23 months with mild anaemia, 9.5 to 10.4 g/dl	30.0	[21.0 - 4.0]	27.0	[2.0 - 36.0]	29.0	[23.0 - 35.0]	249
Children 24-59 months with mild anaemia, 10 to 10.9 g/dl	20.0	[17.0 - 24.0]	20.0	[15.0 - 25.0]	20.0	[17.0 - 23.0]	684
Children 6-59 months with moderate anaemia	7.6	[5.2 - 11]	12.1	[7.6 - 11]	9.9	[7.8 - 12.4]	933
Children 6-23 months with moderate anaemia, 7 to 9.4 g/dl	13.0	[7.0 - 23.0]	18.0	[8.0 - 34.0]	17.0	[12.0 - 23.0]	249
Children 24-59 months with moderate anaemia, 7 to 9.9 g/dl	5.0	[3.0 - 9.0]	9.0	[6.0 - 13.0]	7.0	[5.0 - 10.0]	684
Children with severe anaemia <7 g/dl	0.0	0.0	0.0	[0.03 - 1.5]	0.1	[0.01 - 0.8]	933
Haematocrit (HCT)%	37.0	[36.61 - 37.4]	36.4	[36.0 – 36.8]	36.71	[36.4 - 37.0]	933
Children with iron deficiency (ID), unadjusted	9.0	[6.0 - 13.0]	9.0	[6.0 - 14.0]	9.0	[7.0 - 12.0]	502
Children with iron deficiency (ID), adjusted (BRINDA)	43.29	[37.41 - 49.2]	41.67	[37.66 - 45.7]	42.49	[38.76 - 46.2]	502
Children (6-59 months) with IDA, unadjusted	5.9	[3.99 - 8.8]	7.34	[5.18 - 10.3]	6.62	[5.10 - 8.5]	502
Children (6-23 months) with IDA, unadjusted	14.4	[6.51 - 28.9]	16.4	[6.64 - 35.1]	15.2	[8.63 - 25.5]	95
Children (24-59 months) with IDA, unadjusted	2.9	[1.2 - 6.9]	2.1	[0.77 - 5.6]	2.5	[1.28 - 4.7]	407
Children (6-59 months) with IDA, adjusted	12.64	[8.6 - 18.3]	16.9	[12.48 - 22.5]	14.75	[11.56 - 18.64]	502
Children (6-23 months) with IDA, adjusted	21.3	[10.8 - 37.6]	29.7	[15.94 - 48.4]	24.8	[16.13 - 36.2]	95
Children (24-59 months) with IDA, adjusted	10.2	[6.3 - 16.3]	14.4	[10.1 - 20.2]	12.4	[9.19 - 16.5]	407
Serum Iron (µg/dL), mean	59.21	[56.5 - 61.9]	54.88	[52.3 - 57.5]	57.05	[55.01 - 59.09]	933
Total Iron Binding Capacity (TIBC, µg/dL), mean	340.73	[335.5 - 345.9]	343.49	[338.9 - 348.1]	342.11	[338.3 - 345.9]	933
Ferritin (ng/mL), mean	61.96	[55.3 - 68.6]	57.24	[51.9 - 62.6]	59.61	[55.27 - 63.9]	933
Low levels of adjusted serum ferritin and adjusted low Hb	5.0	[3.0 - 9.0]	4.0	[2.0 - 8.0]	5.0	[3.0 - 7.0]	502
Children with serum folate deficiency	-	-	-	-	-	-	922
Children with vitamin B12 deficiency	-	-	-	-	-	-	922
Children with macrocytic anaemia	-	-	-	-	-	-	

Table E4. Anaemia morphology, inflammation markers, haemoglobin fractions, and haematological indices among children aged 6–59 months, by sex, Cox's Bazar, 2025

	Female		Male		Overall		
Characteristics	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**n**
Microcytic or hypochromic anaemia	21.0	[18.0 - 26.0]	25.0	[21.0 - 3.0]	23.0	[20.0 - 26.0]	933
Elevated c-reactive protein (CRP), ≥ 5 mg/L	18.0	[15.0 - 22.0]	2.0	[16.0 - 25.0]	19.0	[16.0 - 22.0]	933
Elevated α-1-acid glycoprotein (AGP), ≥ 1 g/L	44.0	[37.0 - 5.0]	44.0	[39.0 - 49.0]	44.0	[40.0 - 48.0]	933
Mean Hb A (%)	94.8	[94.0 - 95.6]	95.44	[94.8 - 96.1]	95.12	[94.6 - 95.63]	928
Mean Hb A2 (%)	2.77	[2.65 - 2.9]	2.83	[2.68 - 2.9]	2.8	[2.71 - 2.89]	933
Other Haematological Indices (Mean)							
White Blood Cells (K/µL)	12.55	[12.2 - 12.9]	12.29	[11.81 - 12.8]	12.42	[12.09 - 12.75]	933
Neutrophils (K/µL)	5.36	[5.2 - 5.6]	5.3	[5.02 - 5.6]	5.33	[5.14 - 5.52]	933
Lymphocytes (K/µl	5.64	[5.4 - 5.9]	5.49	[5.26 - 5.71]	5.56	[5.4 - 5.73]	933
Monocytes (K/µL)	0.45	[0.4 - 0.5]	0.48	[0.46 - 0.5]	0.47	[0.45 - 0.48]	933
Eosinophils (K/µL)	1.1	[1.0 - 1.2]	1.05	[0.94 - 1.16]	1.08	[1 - 1.15]	933
Neutrophil %	43.01	[41.8 - 44.2]	43.13	[41.81 - 44.46]	43.07	[42.11 - 44.04]	933
Lymphocyte %	44.9	[43.9 - 45.9]	44.97	[43.77 - 46.17]	44.94	[44.08 - 45.79]	933
Monocyte %	3.68	[3.6 - 3.8]	3.98	[3.82 - 4.14]	3.83	[3.73 - 3.93]	933
Eosinophil %	8.41	[7.8 - 9]	7.91	[7.3 - 8.53]	8.16	[7.7 - 8.63]	933
Red Blood Cells (million/µL)	4.69	[4.7 - 4.7]	4.75	[4.7 - 4.79]	4.72	[4.69 - 4.75]	933
MCV (fL)	79.35	[78.6 - 80.1]	77.13	[76.34 - 77.9]	78.24	[77.62 - 78.87]	933
MCH (pg)	24.22	[23.9 - 24.5]	23.58	[23.31 - 23.84]	23.9	[23.71 - 24.09]	933
MCHC (g/dL)	30.48	[30.3 - 30.7]	30.51	[30.3 - 30.73]	30.5	[30.3 - 30.7]	933
RDW-CV (%)	15.39	[15.1 - 15.6]	16	[15.7 - 16.3]	15.7	[15.48 - 15.91]	933
Platelets (K/µL)	420.3	[407.6 - 433.0]	411	[397.9 - 424.16]	415.7	[405.61 - 425.8]	933
MPV (fL)	10.71	[10.6 - 10.8]	10.65	[10.6 - 10.76]	10.68	[10.6 - 10.77]	933
PCT (%)	0.44	[0.4 - 0.5]	0.44	[0.43 - 0.45]	0.44	[0.43 - 0.45]	855
PDW (fL)	12.6	[12.3 - 12.9]	12.59	[12.4 - 12.84]	12.59	[12.39 - 12.8]	855
Reticulocyte %	1.53	[1.4 - 1.7]	1.38	[1.32 - 1.44]	1.46	[1.41 - 1.51]	933

Table E5. Haemoglobin status, anaemia severity, iron deficiency, iron-deficiency anaemia, and iron biomarkers among children aged 6–59 months, by age groups, Cox's Bazar, 2025

	6-11 months		12-23 months		6-23 months		24-59 months	
Characteristics	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**
Children 6-59 months with haemoglobin deficiency (any anaemia)	55.0	[42.0, 68.0]	42.0	[34.0, 50.0]	45.0	[39.0, 45.0]	27.0	[24.0, 31.0]
Children 6-23 months with haemoglobin deficiency <10.5 g/dl	55.0	[41.0 - 69.0]	42.0	[34.0 - 51.0]	45.0	[38.0 - 53.0]	n/a	n/a
Children 24-59 months with haemoglobin deficiency <11 g/dl	n/a	n/a	n/a	n/a	n/a	n/a	27.0	[24.0 - 31.0]
Children 6-59 months with mild anaemia	37.6	[26.5 - 50.1]	25.9	[20.1 - 32.7]	28.5	[23.6 - 34.0]	19.9	[16.8 - 23.4]
Children 6-23 months with mild anaemia, 9.5 to 10.4 g/dl	38.0	[25.0 - 52.0]	26.0	[19.0 - 34.0]	29.0	[23.0 - 35.0]	n/a	n/a
Children 24-59 months with mild anaemia, 10 to 10.9 g/dl	n/a	n/a	n/a	n/a	n/a	n/a	20.0	[17.0 - 23.0]
Children 6-59 months with moderate anaemia	17.7	[9.3 - 31.1]	16.2	[11.8 - 21.8]	16.5	[12.1 - 22.1]	7.4	[5.4 - 10.1]
Children 6-23 months with moderate anaemia, 7 to 9.4 g/dl	16.0	[11.0 - 23.0]	17.0	[12.0 - 23.0]	7.0	[5.0 - 1.0]	n/a	n/a
Children 24-59 months with moderate anaemia, 7 to 9.9 g/dl	n/a	n/a	n/a	n/a	n/a	n/a	7	[5.0 - 10.0]
Children with severe anaemia <7 g/dl							0.1	[0.02 - 1.0]
Haematocrit (HCT)%	34.9	[33.9 - 35.9]	35.6	[35.11 - 36.6]	35.5	[34.96 - 36]	37.2	[36.9 - 37.5]
Children with iron deficiency (ID), unadjusted	14.0	[4.0 - 36.0]	29.0	[20.0 - 40.0]	26.0	[18.0 - 35.0]	5.0	[3.0 - 8.0]
Children with iron deficiency (ID), adjusted (BRINDA)	35.18	[23.4 - 46.9]	24.9	[20.3 - 29.6]	27.1	[22.6 - 31.7]	46.11	[41.7 - 50.5]
Children (6-59 months) with IDA, unadjusted	8.72	[3.62 - 19.5]	16.31	[11.9 - 21.8]	14.6	[10.8 - 19.9]	3.64	[2.39 - 5.5]
Children (6-23 months) with IDA, unadjusted	13.8	[3.59 - 40.6]	15.6	[8.36 - 27.3]	15.2	[8.63 - 25.4]	n/a	n/a
Children (24-59 months) with IDA, unadjusted	n/a	n/a	n/a	n/a	n/a	n/a	2.5	[1.28 - 4.7]
Children (6-59 months) with IDA, adjusted	27.88	[12.2 - 51.9]	23.9	[15.7 - 34.8]	24.82	[17.1 - 34.6]	12.38	[9.2 - 16.5]
Children (6-23 months) with IDA, adjusted	27.9	[10.5 - 55.9]	24.0	[14.72- 36.6]	24.8	[16.3 - 36.1]	n/a	n/a
Children (24-59 months) with IDA, adjusted	n/a	n/a	n/a	n/a	n/a	n/a	12.4	[9.2 - 16.5]
Serum Iron (µg/dL), mean	43.8	[39.5 - 48.0]	47.6	[44.9 - 50.3]	46.7	[44.4 - 49.2]	60.87	[58.4 - 63.3]
Total Iron Binding Capacity (TIBC, µg/dL), mean	349.5	[332.0 - 366.9]	358.4	[349.7 - 367.2]	356.5	[348.1 - 364.8]	336.8	[332.9 - 340.7]
Ferritin (ng/mL), mean	50.67	[40.4 - 60.9]	51.9	[40.9 - 62.8]	51.7	[42.9 - 60.4]	62.6	[58.2 - 66.9]
Low levels of adjusted serum ferritin and adjusted low Hb	14.0	[4.0 - 36.0]	16.0	[9.0 - 25.0]	15.0	[9.0 - 24.0]	2.0	[1.0 - 5.0]
Children with serum folate deficiency	-	-	-	-	-	-	-	-
Children with vitamin B12 deficiency	-	-	-	-	-	-	-	-

	6-11 months		12-23 months		6-23 months		24-59 months	
Children with macrocytic anaemia	-	-	-	-	-	-	-	-

Table E6 Anaemia morphology, inflammation markers, haemoglobin fractions, and haematological indices among children aged 6–59 months, by age group, Cox's Bazar, 2025

	6-11 months		12-23 months		6-23 months		24-59 months	
Characteristics	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**	**%**	**95% CI**
Microcytic or hypochromic anaemia	55.0	[42.0 - 68.0]	41.0	[34.0 - 48.0]	44.0	[38.0 - 51.0]	16.0	[13.0 - 19.0]
Elevated c-reactive protein (CRP), ≥ 5 mg/L	29.0	[17.0 - 44.0]	26.0	[2.0 - 33.0]	27.0	[21.0 - 33.0]	17.0	[13.0 - 20.0]
Elevated α-1-acid glycoprotein (AGP), ≥ 1 g/L	58.0	[43.0 - 71.0]	61.0	[53.0 - 68.0]	60.0	[54.0 - 67.0]	38.0	[33.0 - 42.0]
Mean Hb A (%)	93.7	[91.2 - 96.1]	94.9	[93.8 - 96.1]	94.7	[93.6 - 95.8]	95.28	[94.7 - 95.9]
Mean Hb A2 (%)	2.8	[2.59 - 2.9]	2.7	[2.6 - 2.9]	2.7	[2.6 - 2.8]	2.84	[2.7 - 2.9]
Other Haematological Indices (Mean)								
White Blood Cells (K/µL)	14.8	[13.61 - 15.9]	13.7	[13.0 - 14.3]	13.9	[13.3 - 14.5]	11.87	[11.5 - 12.2]
Neutrophils (K/µL)	5.1	[4.6 - 5.64]	5.3	[4.9 - 5.7]	5.3	[4.9 - 5.6]	5.35	[5.6 - 5.6]
Lymphocytes (K/µl	7.9	[7.23 - 8.67]	6.6	[6.3 - 6.9]	6.9	[6.6 - 7.3]	5.05	[4.9 - 5.2]
Monocytes (K/µL)	0.7	[0.56 - 0.7]	0.5	[0.5 - 0.6]	0.6	[0.5 - 0.6]	0.44	[0.4 - 0.5]
Eosinophils (K/µL)	1.1	[0.79 - 1.3]	1.2	[1.01 - 1.3]	1.1	[1.0 - 1.3]	1.05	[0.9 - 1.1]
Neutrophil %	35.4	[32.88 - 37.9]	39.2	[37.5 - 40.8]	38.3	[36.8 - 39.9]	44.83	[43.8 - 45.8]
Lymphocyte %	53.5	[51.1 - 55.9]	48.9	[47.4 - 50.6]	49.9	[48.5 - 51.5]	43.06	[42.2 - 43.9]
Monocyte %	4.4	[3.9 - 4.9]	3.9	[3.7 - 4.1]	4.0	[3.8 - 4.3]	3.76	[3.7 - 3.9]
Eosinophil %	6.7	[5.4 - 7.9]	7.9	[7.1 - 8.8]	7.7	[6.9 - 8.4]	8.35	[7.8 - 8.9]
Red Blood Cells (million/µL)	4.9	[4.7 - 5.0]	4.8	[4.8 - 4.9]	4.8	[4.8 - 4.9]	4.67	[4.6 - 4.7]
MCV (fL)	72.2	[70.2 - 74.3]	74.2	[73.2 - 75.2]	73.8	[72.8 - 74.7]	79.91	[79.3 - 80.6]
MCH (pg)	21.4	[20.6 - 22.1]	22.1	[21.7 - 22.5]	21.9	[21.6 - 22.3]	24.63	[24.4 - 24.8]
MCHC (g/dL)	29.5	[29.2 - 29.9]	29.7	[29.4 - 30.0]	29.7	[29.9 - 29.9]	30.81	[30.6 - 31.0]
RDW-CV (%)	17.7	[16.9 - 18.4]	17.9	[17.4 - 18.5]	17.9	[17.4 - 18.3]	14.88	[14.7 - 15.1]
Platelets (K/µL)	438.2	[394.5 - 481.9]	460.5	[434.1 - 487.1]	455.6	[432.1 - 479.2]	400.8	[390.1 - 411.6]
MPV (fL)	10.6	[10.3 - 10.9]	10.6	[10.4 - 10.7]	10.6	[10.4 - 10.7]	10.72	[10.6 - 10.8]
PCT (%)	0.48	[0.4 - 0.6]	0.5	[0.5 - 0.5]	0.5	[0.5 - 0.5]	0.43	[0.4 - 0.4]
PDW (fL)	12.8	[11.9 - 13.6]	12.7	[12.3 - 13.1]	12.7	[12.3 - 13.1]	12.6	[12.4 - 12.9]

	6-11 months		12-23 months		6-23 months		24-59 months	
Reticulocyte %	1.49	[1.4 - 1.6]	1.5	[1.4 - 1.6]	1.4	[1.4 - 1.5]	1.44	[1.39 - 1.50]

Table E7. Bivariate associations between child, household, dietary, morbidity, programme, and biomarker characteristics and anaemia among children aged 6–59 months.

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Demographic Characteristics						
Age group						
6-11 months						
Yes	32.5	[21.4,46.0]	67.5	[54.0,78.6]	0.000	58
No	65	[61.4,68.4]	35	[31.6,38.6]	0.000	875
12-23 months						
Yes	39	[31.7,46.8]	61	[53.2,68.3]	0.000	191
No	69.5	[65.8,73.0]	30.5	[27.0,34.2]	0.000	742
6-23 months						
Yes	37.5	[31.1,44.5]	62.5	[55.5,68.9]	0.000	249
No	72.6	[69.0,75.9]	27.4	[24.1,31.0]	0.000	684
24-59 months						
Yes	72.6	[69.0,75.9]	27.4	[24.1,31.0]	0.000	684
No	37.5	[31.1,44.5]	62.5	[55.5,68.9]	0.000	249
6-59 months						
Yes	63.1	[59.4, 66.6]	36.9	[33.4, 40.6]	-	933
No	-	-	-	-	-	-
Sex						
Female	65.1	[60.7,69.2]	34.9	[30.8,39.3]	0.173	464
Male	61.1	[56.1,65.8]	38.9	[34.2,43.9]	0.173	469
Region						

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Ukhiya	63.9	[59.9,67.6]	36.1	[32.4,40.1]	0.298	756
Teknaf	58.7	[49.3,67.5]	41.3	[32.5,50.7]	0.298	177
Household and Environmental Characteristics						
Household size						
<5	62.5	[56.2,68.4]	37.5	[31.6,43.8]	0.833	237
≥5	63.3	[59.1,67.2]	36.7	[32.8,40.9]	0.833	696
Use of mosquito net						
Usually sleep under mosquito net						
Yes	62.8	[59.2,66.3]	37.2	[33.7,40.8]	0.184	927
No	100	-	-	-	-	1
Slept under mosquito net						
Yes	62.7	[59.1,66.2]	37.3	[33.8,40.9]	0.184	924
No	100	-	-	-	0.4	3
WASH						
Household has improved sanitation facilities						
Yes	63	[59.0,66.8]	37	[33.2,41.0]	0.878	772
No	63.6	[55.8,70.8]	36.4	[29.2,44.2]	0.878	161
Household has handwashing facility at home where water and soap/detergent						
Yes	63.6	[60.0,67.0]	36.4	[33.0,40.0]	0.244	901
No	43.5	[15.4,76.5]	56.5	[23.5,84.6]	0.244	11
Mother knows at least 3 out of 5 key moments for hand washing						
Yes	63	[59.4,66.6]	37	[33.4,40.6]	0.796	919
No	65.5	[45.3,81.3]	34.5	[18.7,54.7]	0.796	14
Safe disposal of child faeces						
Yes	64.5	[60.7,68.2]	35.5	[31.8,39.3]	0.046	763
No	56.2	[48.1,64.0]	43.8	[36.0,51.9]	0.046	170
Drinking Water						
Household source of drinking water						
Improved	100	-	-	-	-	933
Unimproved	-	-	-	-	-	-
Household reported impurities						
Yes	67.6	[56.6,76.9]	32.4	[23.1,43.4]	0.391	93
No	62.6	[58.7,66.4]	37.4	[33.6,41.3]	0.391	840
Household reported metallic taste						
Yes	65.3	[56.5,73.1]	34.7	[26.9,43.5]	0.581	112

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
No	62.8	[59.0,66.5]	37.2	[33.5,41.0]	0.581	821
Household reported unusual water colour						
Yes	67.5	[58.4,75.4]	32.5	[24.6,41.6]	0.282	124
No	62.5	[58.6,66.1]	37.5	[33.9,41.4]	0.282	809
Household considered water safe for drinking						
Yes	62.1	[58.2,65.9]	37.9	[34.1,41.8]	0.036	855
No	74.3	[63.7,82.7]	25.7	[17.3,36.3]	0.036	78
Household reported health issues due to water quality						
Yes	66.2	[49.9,79.4]	33.8	[20.6,50.1]	0.706	41
No	63	[59.1,66.8]	37	[33.2,40.9]	0.706	840
Household treat drinking water						
Yes	67.6	[40.7,86.3]	32.4	[13.7,59.3]	0.7	17.0
No	63	[59.3,66.5]	37	[33.5,40.7]	-	916.0
FCS						
FCS status of household						
Percent of households with FCS 0–21 (Poor)	-	-	-	-	-	0
Percent of households with FCS 21.5–35 (Borderline)	65.1	[39.8,84.0]	34.9	[16.0,60.2]	0.867	15
Percent of households with FCS over 35 (Acceptable)	63.0	[59.4,66.5]	37.0	[33.5,40.6]	0.867	918
FCS-N status of household						
Protein-rich foods						
Never	-	-	-	-	-	0
Consumed sometimes	58.8	[48.6,68.3]	41.2	[31.7,51.4]	0.380	76
Consumed at least 7 times	63.4	[59.6,67.1]	36.6	[32.9,40.4]	0.380	857
Vitamin-rich foods						
Never	51	[31.6,70.0]	49	[30.0,68.4]	0.308	28
Consumed sometimes	64.3	[59.7,68.6]	35.7	[31.4,40.3]	0.308	508
Consumed at least 7 times	62.5	[57.9,66.8]	37.5	[33.2,42.1]	0.308	397
Heme iron-rich foods						
Never	64.2	[13.4,95.4]	35.8	[4.6,86.6]	0.558	3
Consumed sometimes	62.1	[58.2,65.8]	37.9	[34.2,41.8]	0.558	736
Consumed at least 7 times	66.7	[57.9,74.4]	33.3	[25.6,42.1]	0.558	194
Consumption of iron rich foods						
Iron-fortified foods						
Yes	63.5	[59.8,67.1]	36.5	[32.9,40.2]	0.134	895
No	52	[37.0,66.6]	48	[33.4,63.0]	0.134	38
Eggs and/or flesh						

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Yes	37.3	[27.9,47.9]	62.7	[52.1,72.1]	0.943	160
No	37.9	[26.7,50.5]	62.1	[49.5,73.3]	0.943	89
IYCF						
Received foods from 5 or more of the 8 defined food groups during the previous day						
Yes	40.9	[29.1,53.8]	59.1	[46.2,70.9]	0.000	65
No	64.8	[61.0,68.4]	35.2	[31.6,39.0]	0.000	868
Received solid, semi-solid and soft foods						
Yes	42	[35.6,48.7]	58	[51.3,64.4]	0.000	269
No	71.7	[67.9,75.2]	28.3	[24.8,32.1]	0.000	664
Consumed at least two milk feeds during the previous day						
Yes	58.2	[43.9,71.3]	41.8	[28.7,56.1]	0.007	53
No	36	[29.2,43.5]	64	[56.5,70.8]	0.007	233
Consumed solid, semisolid or soft foods during the previous day (6-8 months)						
Yes	28.6	[9.5,60.3]	71.4	[39.7,90.5]	0.527	21
No	45	[7.5,89.2]	55	[10.8,92.5]	0.527	4
Consumed egg and/or flesh food during the previous day						
Yes	37.3	[27.9,47.9]	62.7	[52.1,72.1]	0.943	160
No	37.9	[26.7,50.5]	62.1	[49.5,73.3]	0.943	89
Consumed a sweet beverage during the previous day						
Yes	34.3	[20.7,51.1]	65.7	[48.9,79.3]	0.664	49
No	38.3	[29.9,47.5]	61.7	[52.5,70.1]	0.664	200
Consumed selected sentinel unhealthy foods during the previous day						
Yes	37.8	[29.1,47.3]	62.2	[52.7,70.9]	0.915	195
No	36.7	[22.2,54.0]	63.3	[46.0,77.8]	0.915	54
Did not consume any vegetables or fruits during the previous day						
Yes	38.1	[14.8,68.6]	61.9	[31.4,85.2]	0.969	17
No	37.5	[29.8,45.9]	62.5	[54.1,70.2]	0.969	232
Consumed RUTF during the previous day						
Yes	35.5	[12.8,67.5]	64.5	[32.5,87.2]	0.893	13
No	37.7	[30.1,45.9]	62.3	[54.1,69.9]	0.893	236
Consumed RUSF during the previous day						
Yes	38.9	[15.6,68.8]	61.1	[31.2,84.4]	0.918	15
No	37.4	[30.1,45.4]	62.6	[54.6,69.9]	0.918	234
Minimum dietary diversity achieved during the previous day						
MDD≥5	40.9	[29.1,53.8]	59.1	[46.2,70.9]	0.000	65
MDD <5	64.8	[61.0,68.4]	35.2	[31.6,39.0]	0.000	868

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Minimum acceptable diet met during the previous day						
Yes	36.2	[20.8,55.1]	63.8	[44.9,79.2]	0.003	33
No	64.1	[60.3,67.6]	35.9	[32.4,39.7]	0.003	900
Minimum meal frequency achieved during the previous day						
Yes	43.7	[32.9,55.2]	56.3	[44.8,67.1]	0.000	75
No	64.8	[61.1,68.4]	35.2	[31.6,38.9]	0.000	858
Breastfeeding status						
Yes	34.8	[27.7,42.6]	65.2	[57.4,72.3]	0.000	199
No	70.8	[66.8,74.4]	29.2	[25.6,33.2]	0.000	734
Undesirable food consumption						
Sweet beverages						
Yes	34.3	[20.7,51.1]	65.7	[48.9,79.3]	0.664	49
No	38.3	[29.9,47.5]	61.7	[52.5,70.1]	0.664	200
Unhealthy foods						
Yes	37.8	[29.1,47.3]	62.2	[52.7,70.9]	0.915	195
No	36.7	[22.2,54.0]	63.3	[46.0,77.8]	0.915	54
Zero consumption of fruits and vegetables						
Yes	38.1	[14.8,68.6]	61.9	[31.4,85.2]	0.969	17
No	37.5	[29.8,45.9]	62.5	[54.1,70.2]	0.969	232
Fortified and Supplementary Ration						
Supplementary feeding programmes						
Mother's Enrolment in BSFP						
Yes	64.3	[55.6,72.2]	35.7	[27.8,44.4]	0.558	218
No	41.4	[2.6,94.9]	58.6	[5.1,97.4]	0.558	3
Mother's Enrolment in TSFP						
Yes	41.4	[2.6,94.9]	58.6	[5.1,97.4]	0.558	3
No	64.3	[55.6,72.2]	35.7	[27.8,44.4]	0.558	218
Mother received rations from semolina or nutrition program						
Yes	65	[55.2,73.7]	35	[26.3,44.8]	0.655	173
No	60.7	[42.6,76.2]	39.3	[23.8,57.4]	0.655	48
Child enrolled in BSFP						
Yes	43.5	[37.6,49.6]	56.5	[50.4,62.4]	0.029	298
No	57.7	[45.7,68.8]	42.3	[31.2,54.3]	0.029	74
Child enrolled in TSFP						
Yes	58.5	[47.2,68.9]	41.5	[31.1,52.8]	0.011	74
No	43.1	[37.4,49.1]	56.9	[50.9,62.6]	0.011	295

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Child enrolled in OTP						
Yes	46.1	[21.2,73.1]	53.9	[26.9,78.8]	0.985	17
No	46.4	[40.5,52.4]	53.6	[47.6,59.5]	0.985	355
BSFP Consumption						
Consumed only by the child	50.4	[36.2,64.6]	49.6	[35.4,63.8]	0.743	53
Shared with Other Household Member	41.3	[33.5,49.6]	58.7	[50.4,66.5]	0.743	201
Child was not fed	31.3	[5.7,77.3]	68.7	[22.7,94.3]	0.743	7
No ration at home.	46.8	[4.9,93.8]	53.2	[6.2,95.1]	0.743	4
TSFP Consumption						
Consumed only by the child	59	[41.4,74.6]	41	[25.4,58.6]	0.196	33
Shared with Other Household Member	39.6	[25.7,55.4]	60.4	[44.6,74.3]	0.196	25
Child was not fed	0	-	100	-	0.196	1
No ration at home.	31.2	[8.6,68.8]	68.8	[31.2,91.4]	0.196	3
Mother's nutrition factors						
Supplementation and use of therapeutic foods						
Given iron tablets or syrups in the last 12 months						
Yes	63.3	[49.9,74.9]	36.7	[25.1,50.1]	0.972	52
No	63.1	[59.4,66.5]	36.9	[33.5,40.6]	0.972	881
Received vitamin A supplementation in the last 6 months						
Yes	40.8	[31.2,51.1]	59.2	[48.9,68.8]	0.000	136
No	67	[63.3,70.5]	33	[29.5,36.7]	0.000	797
Mothers received iron-fortified ration (Pusti rice)						
Yes	62.7	[58.7,66.5]	37.3	[33.5,41.3]	0.085	737
No	64	[55.3,71.8]	36	[28.2,44.7]	0.085	193
Mothers received iron and folic acid (IFA) tablets						
Yes	62.7	[58.6,66.5]	37.3	[33.5,41.4]	0.21	175
No	64	[55.3,71.8]	36	[28.2,44.7]	0.21	758
Mothers consumed iron and folic acid (IFA) tablets						
Yes	65.3	[53.4,75.5]	34.7	[24.5,46.6]	0.742	111
No	55.8	[34.5,75.2]	44.2	[24.8,65.5]	-	32
Morbidity and Infection						
Fever in the past two weeks						
Yes	62.9	[59.0,66.6]	37.1	[33.4,41.0]	0.775	761
No	64	[56.4,70.9]	36	[29.1,43.6]	0.775	172
Diarrhoea in the past two weeks						
Yes	60.7	[54.5,66.7]	39.3	[33.3,45.5]	0.393	240

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
No	63.9	[59.5,68.0]	36.1	[32.0,40.5]	0.393	693
Cough/ARI symptoms						
Yes	60.6	[56.0,65.0]	39.4	[35.0,44.0]	0.077	520
No	66.3	[61.1,71.1]	33.7	[28.9,38.9]	0.077	413
Deworming in the past 6 months						
Yes	69.6	[65.4,73.5]	30.4	[26.5,34.6]	0.000	612
No	50.3	[44.4,56.2]	49.7	[43.8,55.6]	0.000	319
Received the second dose of measles containing vaccine						
Yes, received second dose	65.9	[62.1,69.5]	34.1	[30.5,37.9]	0.001	748
No, not received second dose	48.4	[38.2,58.7]	51.6	[41.3,61.8]	0.001	92
Children with diarrhoea who received ORS/ORS with Zinc						
Yes, ORS	59.4	[50.0,68.2]	40.6	[31.8,50.0]	0.324	117
Yes, ORS and zinc	58.7	[50.0,66.8]	41.3	[33.2,50.0]	0.324	100
No	79.4	[56.2,92.0]	20.6	[8.0,43.8]	0.324	21
Don't Know	53	[6.3,95.0]	47	[5.0,93.7]	0.324	2
Skin disease in the past two weeks						
Yes	63.5	[58.4,68.3]	36.5	[31.7,41.6]	0.824	414
No	62.7	[57.6,67.6]	37.3	[32.4,42.4]	0.824	519
Non-nutritional Indicators: Prevention & Care-seeking for children: malaria						
Slept under an ITN the night before the survey						
Yes	62.7	[59.1,66.2]	37.3	[33.8,40.9]	0.184	924
No	100	-	0	-	0.184	3
Received any antimalarial treatment in the past 2 weeks						
Yes	70.4	[38.0,90.2]	29.6	[9.8,62.0]	0.608	9
No	62.8	[58.9,66.5]	37.2	[33.5,41.1]	0.608	752
Received ACT or other first line antimalarial treatment						
Yes	76.8	[39.2,94.4]	23.2	[5.6,60.8]	0.406	5
No	62.8	[59.0,66.5]	37.2	[33.5,41.0]	0.406	757
Biomarkers - Nutritional Indicators						
Iron deficiency (ID) unadjusted						
Yes	31.1	[20.3,44.4]	68.9	[55.6,79.7]	0.000	65
No	65.3	[61.5,68.9]	34.7	[31.1,38.5]	-	868
Iron deficiency (ID) adjusted						
Yes	40.8	[27.3,55.9]	59.2	[44.1,72.7]	0.000	49
No	73.8	[69.1,77.9]	26.2	[22.1,30.9]	-	453
Low Serum Iron						

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Yes	75.9	[72.2,79.2]	24.1	[20.8,27.8]	0.000	478
No	49.4	[44.4,54.4]	50.6	[45.6,55.6]	-	455
Low TIBC						
Yes	63.1	[59.4,66.6]	36.9	[33.4,40.6]	0.007	12
No	63.5	[59.8,67.1]	36.5	[32.9,40.2]	-	921
Iron deficiency Anaemia (IDA) unadjusted						
Yes	0.0†	-	100		†	476
No	74.4	[69.9,78.4]	25.6	[21.6,30.1]	-	26
Iron deficiency Anaemia (IDA) BRINDA adjusted						
Yes	0.0†	-	100	-	†	75
No	83	[78.9,86.4]	17	[13.6,21.1]	-	427
Biomarkers - Non- Nutritional Indicators						
Microcytic/hypochromic anaemia (Low MCH or low MCV)						
Yes	27.0	[22.4,32.1]	73.0	[67.9,77.6]	0.000	300
No	79.9	[76.0,83.4]	20.1	[16.6,24.0]	-	633
Macrocytic Anaemia (MCV)						
Yes	0.0†	-	0	-	†	0
No	63.1	[59.4,66.6]	36.9	[33.4,40.6]	-	933
RBC						
Yes	12.2	[1.6,53.7]	87.8	[46.3,98.4]	0.004	12
No	63.8	[60.1,67.3]	36.2	[32.7,39.9]		921
Low MCH						
Yes	27	[22.4,32.1]	73	[67.9,77.6]	0.000	300
No	79.9	[76.0,83.4]	20.1	[16.6,24.0]	-	633
Elevated RDW-CV						
Yes	46	[41.5,50.6]	54	[49.4,58.5]	0.000	526
No	85.8	[81.4,89.2]	14.2	[10.8,18.6]	-	407
Elevated Reticulocyte						
Yes	54.7	[44.3,64.8]	45.3	[35.2,55.7]	0.077	111
No	64.3	[60.4,67.9]	35.7	[32.1,39.6]	-	822
Biomarkers - Inflammation Markers						
Presence of Inflammation						
Children with elevated c-reactive protein (CRP), ≥ 5 mg/L						
Yes	50.9	[42.9,58.8]	49.1	[41.2,57.1]	0.001	179
No	66	[62.0,69.7]	34	[30.3,38.0]	-	754
Children with elevated α-1-acid glycoprotein (AGP), ≥ 1 g/L						

Characteristic	% not anaemic	95% CI	% anaemic children	95% CI	*p-value*	Number
Yes	53.4	[47.9,58.8]	46.6	[41.2,52.1]	0.000	406
No	70.6	[66.2,74.7]	29.4	[25.3,33.8]	-	527
† Zero cell = Chi square is not robust, p-value cannot be reported						

Appendix F. Qualitative Tools

F1. Key Informant Interview

Interviewer Guide

This document presents the guidance to conduct the key informant interviews of mothers/caregivers in Cox's Bazaar.

INSTRUCTIONS: ENTER THE BACKGROUND INFORMATION.

Respondent Background	
Name	
Country	
Organization	

Introduction

Read the following to the respondent: "Hello, my name is [NAME], and I'm part of a team that is trying to understand anaemia in children in Cox's Bazaar. Thank you for speaking with us today. This discussion should take about 60 minutes. Your participation in this interview is completely voluntary, so we can stop the interview at any time and/or skip any questions that you don't feel comfortable answering. Do you have any questions before we get started?"

INSTRUCTIONS: After a brief introduction, obtain permission from each participant to conduct the interview.

Informed Consent Statement

Hello [PREFERRED SALUTATIONS], my name is [NAME]. I am part of a research team from [Mitra's and Associates and RISE International Consulting LLC]. In collaboration with UNICEF and the Nutrition Sector, we are conducting a study to understand children are cared for to prevent and treat anaemia in this community of Cox's Bazaar.

As part of this study, we are interviewing mothers. You are asked to participate in this effort because you have valuable perspectives on your child's health. I will ask you some questions which will take an hour of your time. Your answers will help improve how anaemia is managed in children in this community.

This study poses no risk to you. The information collected will be confidential and will not be used for any purpose other than this study. Your responses will be anonymous—that is, we will remove your name from the information you provide, and we will not cite your name anywhere within the study.

The interview will be recorded, so I do not miss any of the information that you have provided. I will also take written notes during the interview. Any information you provide will be stored safely on password protected computers. Further, all notes and the recordings will be destroyed after the analysis is complete.

Participation in this study is strictly voluntary. You may stop at any time. You may also refuse to answer any question that you do not wish to answer. Please let me know and we will skip it. If you choose not to participate, you can withdraw and are not obliged to give any reason.

If you have any questions, you can ask questions at any time during your participation.

May I have your consent to participate in the study? And may I have your consent to record the interview?

PLEASE CHECK THE OPTION.

Yes, participant accepted to the interview and recording ¨
Yes, participant accepted to the interview but no recording ¨
No, participant did not accept to the interview ¨

Signature of the interviewer _____
Name of the interviewer _____
Date _____

Do you have any questions for me before we start?

※※※

SECTION I

I. Background Information

First, we would like to know more about you.

1. How old are you? And tell me about your family such as how many children you have and their ages.
2. How long have you been living in this community?
3. Do you a husband or partner living with you?

Now we will transition into more specific questions related to anaemia, iron rich foods and its consumption.

SECTION II

II. Knowledge of anaemia

1. Have you heard of anaemia or low iron levels in the blood? Can you explain what causes it and what happens when someone has anaemia??

   How do you assess if your child has anaemia?

III. Nutritional and dietary practices–Current dietary practices

1. Can you share with me which foods you know are rich in iron?
2. What kinds of foods do your children usually eat?
3. Which foods should your children eat more of/less of?

IV. Nutritional and dietary practices–Prevention & Treatment

1. Is there anything you can do to prevent anaemia?
2. Which foods do you believe are important for preventing anaemia?
3. To what extent does your household have access to these preventative foods?
4. When your child is sick, do you feed him/her differently?
   a. Probe: And if he/she has anaemia, how would you feed him/her?

V. Nutritional and dietary practices–Barriers to prevent and treat anaemia, and negative coping strategies

Iron from meat, fish, poultry is easily absorbed. Additionally, foods rich in vitamin C, such as citrus, tomatoes, and bell peppers, can increase iron absorption.

1. Tell me how often and how much your children eat these foods?
2. Do you cook food in cast iron pan or pots?
3. When your household does not have sufficient preventative foods for anaemia, how do you cope with feeding at mealtime?
   a. Probe: Do children get more/less?
4. Some foods, such as tea and coffee, can reduce iron absorption when consumed with meals. Do you give tea or coffee along with food to your children?

VI. Programme enrolment and experience–Programme sufficiency

1. What services are there in this community to prevent anaemia?
2. To what extent are you able to access these services?
   a. Probe: How often do you use these services?
3. Are there problems to access these services?

VII. Programme enrolment and experience–Adherence to treatment

1. When iron is given out in the community, to what extent are you able to give your children the recommended doses?
   a. Probe: Why are you unable to give the recommended doses?

VIII. Programme enrolment and experience–Experience of care

1. When accessing the prevention programmes for anaemia, do you feel that the services meet your needs?
    a. Probe: Tell me why/why not.

SECTION III

IX. Water, Sanitation and Handwashing

1. In your household, do you think that you have clean, reliable water for everyone in your family?
    a. Probe: What major issues do you have with this?
2. In your household, do you think that you have adequate sanitation facilities for your family members?
    a. Probe: What major issues do you have with this?
3. In your household, do you think that you have adequate hand-washing facilities?
    a. Probe: What major issues do you have with this?

X. Malaria and other childhood diseases

1. When your child has an illness such as fever or a cold, malaria diarrhoea or dengue, what services are available to you in this community?
    a. Probe: What problems do you have to access these services?

SECTION IV

Wrap-up Question(s)

1. Is there anything you would like to add or share that we haven't covered?
2. What advice would you give to other parents about preventing anaemia in children?

Conclusion

INSTRUCTION: Thank the participants for their time.

Thank you again for taking the time to speak with us today. The information you shared will be invaluable as we move forward with our efforts.

※ ※※

F2. Key Stakeholder Interview

Interviewer Guide

This document presents the guidance to conduct the key stakeholders in Cox's Bazaar. These include donors, providers of supplementation/iron-fortified products and ANC/health workers in health centres.

INSTRUCTIONS: ENTER THE BACKGROUND INFORMATION.

Respondent Background	
Name	
Organization	

Introduction

> **INSTRUCTIONS:** After a brief introduction, obtain permission from each participant to conduct the interview.

Read the following to the stakeholder: "Hello, my name is [NAME], and I'm part of a team that is trying to understand anaemia in children in Cox's Bazaar. Thank you for speaking with us today. This discussion should take about 60 minutes. Your participation in this interview is completely voluntary, so we can stop the interview at any time and/or skip any questions that you don't feel comfortable answering. Do you have any questions before we get started?"

Informed Consent Statement

Hello [PREFERRED SALUTATIONS], my name is [NAME]. I am part of a research team from [Mitra's and Associates and RISE International Consulting LLC]. In collaboration with UNICEF and the Nutrition Sector, we are conducting a study to understand children are cared for to prevent and treat anaemia in this community of Cox's Bazaar.

As part of this study, we are interviewing stakeholders which have a role in improving the situation of anaemia in children in Cox's Bazaar. You are asked to participate in this effort because you have valuable perspectives on this. I will ask you some questions which will take an hour of your time. Your answers will help improve how anaemia is managed in children in this community.

This study poses no risk to you. The information collected will be confidential and will not be used for any purpose other than this study. Your responses will be anonymous—that is, we will remove your name from the information you provide, and we will not cite your name anywhere within the study.

The interview will be recorded, so I do not miss any of the information that you have provided. I will also take written notes during the interview. Any information you provide will be stored safely on password protected computers. Further, all notes and the recordings will be destroyed after the analysis is complete.

Participation in this study is strictly voluntary. You may stop at any time. You may also refuse to answer any question that you do not wish to answer. Please let me know and we will skip it. If you choose not to participate, you can withdraw and are not obliged to give any reason.

If you have any questions, you can ask questions at any time during your participation.

May I have your consent to participate in the study? And may I have your consent to record the interview?

PLEASE CHECK THE OPTION.

Yes, participant accepted to the interview and recording ..
Yes, participant accepted to the interview but no recording ..

No, participant did not accept to the interview ..

Signature of the interviewer _____
Name of the interviewer _____
Date _____

Do you have any questions for me before we start?

※ ※※

SECTION I

I. Background information

First, we would like to know more about you.

1. How long have you worked with you organization?
2. Describe your roles and responsibilities in your organization.
3. How long have you worked in Cox's Bazaar?

Now we will transition into more specific questions related to anaemia in this community and how organizations work on this topic.

SECTION II

II. Funding for programming [only for donors]

1. Can you describe the scope of your funding for anaemia prevention and treatment programs in the FDMN camps?
2. What criteria do you use to allocate funds to different health and nutrition programs?

III. Programme impact

1. Can you share any success stories or significant achievements from the programs you support?

IV. Challenges and barriers to funding

1. What challenges do you face in funding and supporting anaemia-related programs?
2. How do you address issues related to resource allocation and program sustainability?

V. Anaemia screening and treatment

1. How is screening for anaemia done at the community level?
    a. Probe: what are the issues related to implementation?
    b. Probe: Are there problems to access these services?
2. In terms of treating anaemia, to what extent are services meet the needs of the community?
    a. Probe: What issues need adjusting so that services are better fit for purposes?
3. What treatments do you provide for anaemia, and how do you ensure adherence to treatment protocols?
4. What are the challenges to providing treatments?
5. And what are the challenges for monitoring the progress of patients?

VI. Collaboration and coordination

1. How do you collaborate with other donors and stakeholders to maximize the impact of your funding?
2. What improvements do you think are needed in the coordination of efforts to combat anaemia?
3. How would you use the study results?

VII. Future plans/strategies

1. What are your future plans or strategies for supporting anaemia prevention and treatment?

SECTION III

WRAP-UP QUESTION(S)

1. Is there anything you would like to add or share that we haven't covered?
2. What advice would you give to other organizations in preventing anaemia in children?

Conclusion

INSTRUCTION: Thank the participants for their time.

Thank you again for taking the time to speak with us today. The information you shared will be invaluable as we move forward with our efforts.

※ ※ ※

Appendix G. Survey Questionnaire

PREVALENCE OF ANAEMIA UNDER FIVE ROHINGYA CHILDREN IN FDMN CAMPS, COX'S BAZAR -2025

HOUSEHOLD IDENTIFICATION

01. HOUSEHOLD NUMBER _____ ☐☐☐
02. CLUSTER NUMBER/BLOCK NUMBER _____ ☐☐☐
03. SUB BLOCK NUMBER AND CODE _____ ☐☐☐
04. CAMP (MC OR RC) _____ ☐☐☐
05. DISTRICT/UPAZILA _____ ☐☐☐

06. INTERVIEWER VISITS

	FIRST VISIT	SECOND VISIT	THIRD VISIT	FINAL VISIT
DATE				DAY ☐☐ MONTH ☐☐ YEAR 2025
INTERVIEWER'S NAME				INT. CODE ☐☐☐
RESULT* USE CODES BELOW				RESULT* ☐
NEXT VISIT: DATE	_____	_____		TOTAL NO. OF VISITS ☐
TIME	_____	_____		

*RESULT CODES:

01 COMPLETED
02 NO HOUSEHOLD MEMBER AT HOME
03 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME
04 POSTPONED/UNAVAILABLE
05 REFUSED
06 HOUSEHOLD MEMBER TOO ILL TO RESPOND/ COGNITIVELY IMPAIRED
07 PARTIAL COMPLETE
96 OTHER _____ (SPECIFY)

07. TOTAL PERSONS IN HOUSEHOLD ☐☐

08. TOTAL ELIGIBLE CHILDREN AGE UNDER 6-59 MONTHS ☐☐

09. INTERVIEWER NAME _____ ☐☐☐☐ NUMBER

10. SUPERVISOR NAME _____ ☐☐☐☐ NUMBER

LANGUAGE OF QUESTIOINNAIRE 01 LANGUAGE OF INTERVIEWER ☐☐ NATIVE

LANGUAGE OF RESPONDENT ☐☐ TRANSLATOR USED ☐ (YES=1, NO=2)

LANGUAGE OF QUESTIOINNAIRE _____

LANGUAGE OF CODES: 01= ENGLISH, 02= BANGLA 03= ROHINGYA, 04= CHITTAGONIAN, 05= OTHER

INFORMED CONSENT

INTRODUCE THE HOUSEHOLD TO THE SURVEY. ASK TO SPEAK WITH THE MOTHER OR CAREGIVER FOR CHILDREN LESS THAN 5 YEARS. OBTAIN THE INFORMED CONSENT AND PROCEED TO THE HOUSEHOLD ROSTER, DWELLING CHARACTERISTICS AND OTHER MODULES

Introduction

Hello. My name is _____. I am working with Mitra's and Associates under the project named "Prevalence of anaemia among children under five in FDMN camps, Cox's Bazar", which is led by RISE International and funded by UNICEF. We are conducting a survey to understand anaemia levels in Rohingya children age 6-59 months living in FDMN camps. We aim to gather crucial information about the health and nutritional status of children in the FDMN camps. The data collected will help us identify the types of anaemia affecting these children.

I will ask you questions about your child's nutrition, use of mosquito nets, and water, sanitation, and hygiene (WASH) practices. In addition, the health technician will insert a needle into the vein of your [CHILD'S] arm to draw blood into two collection tubes. After the blood draw, needle will be removed, and a bandage will be applied to stop any bleeding.

The survey and venous blood draw will take 40 minutes of your time.

The blood draw(s) may cause slight pain, bruising, or infection at the site of the needle insertion. In the event that any issues arise during the blood draw, the procedure will be halted immediately. Necessary first aid will be administered, and additional medical assistance will be sought if required.

All information collected in this study will be kept confidential. Your child's identity will not be revealed in any reports or publications resulting from this study.

Your participation is important as it will help us understand the health and nutritional needs of children in the FDMN camps. Your participation in this study is entirely voluntary. You may choose not to participate or withdraw from the study at any time without any consequences.

If you have any questions or concerns about this study, please contact and your rights as a participant in this study please you may contact Dr. Jasbir Kaur, PhD, MHS, Executive Director, RISE International, Mobile: +12404478250, email: jasbir.kaur@riseintllc.com. If you want to know more may contact S Fuad Pasha, Director (Operation), Mitra and Associates, Mobile: 01711-278664, e-mail: fuadpasha@mitraaaasociates.com . In addition it you have further question you can contact with Mr. Shahidul Islam, executive Director, Mitra and Associates, Mobile: 01715-208929, email: shahidulislam@mitraassociates.com and or we welcome you to contact with (Mitra and Associates, Senpara porbota, Mirpur, Section-10). Dhaka Bangladesh.

Do you have any questions?

May I begin the interview now

	Yes	No
Did respondent agree for interview?	☐	☐
Did respondent agree to the venous blood draw?	☐	☐

Interviewers Name and Code…… ☐☐

Signature and Date:…….. Day ☐☐ Month ☐☐ Year ☐☐☐☐

INTERVIEWER: PLEASE GIVE A DUPLICATE COPY TO THE PARENT/CARE-GIVER

21	Recoed the Time	Hours..... ☐☐ Minutes..... ☐☐

MPDULE 1: HOUSEHOLD ROSTER AND DEMOGRAPHICS

		DEMOGRAPHICS					RESICENCE			
Line No.	**101**	**102**	**103**	**104**	**104a**	**104 b**	**105**	**106**	**107**	**108**
	Please give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of the household. Record the first name of the head of the household After listing the names and recording the relationship, sex, residence, and age for each person, ask questions 108a to be sure that the listing is complete.	What is [Name's] sex? M = 1 F = 2	What is the relationship of [Name] to the head of the household? (See codes below)	_____ (Name) What is the date of birth? Write in days, Month, year	What is [Name's] age? In years (If the age is less than 1 year, write 00. If it is 95 or more, write 95.)	If the age is less than 5, then write in month	Is [Name] a usual household member? Yes = 1 No = 2	Did [Name] stay here last night Yes =1 No =2	How long has it been since [Name] has spent the night in this household? (See codes below)	Are there any other persons living in this household? Yes = 1 No = 2 ← Go to next line 2 Go to 108A

LINE NO.	101	102	103	104	105	106	107	108
01		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
02		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
03		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
04		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
05		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
06		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
07		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 → 107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A
08		F ..... 1 M..... 2	☐☐	☐☐	Yes No 1 2 →107	Yes .....1 No 2	1 2 3 ☐☐	Yes No 1 2 Go to next line Go to 108A

MARITAL STATUS AND ELIGIBILITY		DISPLACEMENT AND ARRIVAL			EDUCATION				BIRTH CERTIFICATION
109	110	111	112	113	114	115	116	117	118
What is (Name)'s current marital status? 1 = Married or living together 2 = Divorced/ separated 3 = Widowed 4 = Never-married and never lived together	Select line number of all women age 15-49	Select the line number of all children aged 6–59 months.	Did (Name) arrive at the Bangladesh from Myanmar after 2024?	What was the month (Name) arrived at the Bangladesh? Enter month arrived at the Bangladesh	What year did (NAME) arrive at the Bangladesh? Enter years arrived at the Bangladesh	Has (Name) ever attended school or any early childhood education program? Yes, School…1 Yes, Madrasah……2 No…….3 Go to 118 This question should only be asked if the child is 3 years of age or older. (Suggestion from UNICEF) Note: Questions related to education should only be asked to the household head and the mother/ caregiver.	What is the highest level of school (Name) has attended? See codes below	What is the highest grade (Name) completed at that level? See codes below	Does (NAME) have a birth certificate? IF NO, PROBE: Has (NAME)'s birth certificate ever been registered with the civil authority? Has Birth certificate…1 Has Registered Birth Certificate…2 Neither…3 Don't Know..8
☐	01	01	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8
☐	02	02	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8
☐	03	03	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8

MARITAL STATUS AND ELIGIBILITY			DISPLACEMENT AND ARRIVAL		EDUCATION				BIRTH CERTIFICATION
109	110	111	112	113	114	115	116	117	118
☐	04	04	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8
☐	05	05	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8
☐	06	06	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8
☐	07	07	1 2 Go to115 ←	Month ☐☐	Year ☐☐☐☐	1 2 3 Go to 118 ←	Level ☐	Grade ☐☐	1 2 3 8

RESULT CODES FOR Q103:

01= Household head, 02= spouse/partner, 03= Son/Daughter, 04= Son/Daughter-in-law, 05= Grandson/Granddaughter; 06= Mother/father, 07= Brother/sister, 08= Nephew/Niece, 09= Nephew/Niece of spouse, 10= Cousin, 11= Brother/Sister-in-law, 12= Mother/Father-in-law, 13= Other Relative, 14= Servant/Maid, 15= Labour, 16=No decision maker age 18 or, Older in household 96= Other relationship

RESULT CODES FOR Q107: TIME SINCE SPENT THE NIGHT

Select 1 If Days; Enter Number of In Box (1-6)
Select 2 If Weeks; Enter Number of Weeks In Box (1-4)
Select 3 If Months; Enter Number of Months in Box (1-12)

RESULT CODES FOR Q113 & Q114: ARRIVAL DATE

113. ARRIVAL MONTH	114. ARRIVAL YEAR
Enter 01 for January; Enter 02 for February Enter 03 for March Enter 03 for March Enter 05 for May Enter 06 for June Enter 07 for July Enter 08 for August Enter 09 for September Enter 10 for October Enter 11 for November Enter 12 for December	Enter the full year example: 2025 2024 2023 2022 2021 2020 2019 2018 2017

RESULT CODES FOR Q116 & Q117: EDUCATION

LEVEL:

00= Early childhood education program, 01 = Primary, 02 = Secondary,03= Higher, 04= Informal Education, 08 = Don't know

GRADE:

00 = Less than 1 year completed, Class One =1, Class Two =2, Class Three =3, Class Four =4, Class Five =5, Class Six =6, Class Seven = 7, Class eight = 8, Class Nine = 9, S.S.C/O Level = 10, H.S.C/Alim (1st year) = 11, H.S.C/ A Level/Paramedic/Diploma eng.=12, Honours/degree (1st year) = 13, Honours/degree (2nd year) = 14, Honours/degree (3rd year)/ BA/Bcom (BSC Pass = 15, Honours pass/MA/MSC/Mcom (1st part Preliminary) = 16, MA/MSC/Mcom = 17, MBBS/BSC Eng./Advocated/Phd =18, Don't know = 98

108A	Just to make sure that I have a complete listing: are there any other people such as small children or infants that we have not listed?	Yes ☐ → Add to table No ☐

MODULE 2: DWELLING CHARACTERISTICS

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
201	Observe main material of the Roof of the Dwelling. Record Observation	**NATURAL ROOFING:** No roof ..... 11 Thatch (Palm Leaf, Straw, Reed)..... 12 Sod..... 13 Bamboo ..... 14 **RUDIMENTARY ROOFING** Wood Planks ..... 21 Cardboard ..... 22 Plastic tarpaulin/polythene……..23 **FINISHED ROOFING** Metal..... 31 Wood..... 32 Calamine/Cement Fiber ..... 33 Ceramic Tiles ..... 34 Cement..... 35 Roofing Shingles..... 36 Other..... 96 (Specify)	
202	Observe main material of the Floor of the Dwelling? (Record Observation)	**NATURAL FLOOR:** Earth/Sand.....11 Dung .....12 Palm Leaves.....13 Bamboo……...14 Bamboo and Mud…….....15 Bamboo and Stone…….....16 **RUDIMENTARY FLOOR:** Wood Planks .....21 Bamboo Slats .....22 **FINISHED FLOOR:** Vinyl or Asphalt Strips .....31 Wall-to-Wall Carpet .....32 Cement .....33 Parquet or Polished Wood .....34 Ceramic Tiles .....35 Other _____ 96 (Specify)	
203	Observe Main Material of the Exterior Walls of the Dwelling. (Record Observation)	**NATURAL WALLS:** No Walls.....11 Dirt .....12 Cane/Palm/Tree Trunks .....13 Bamboo fence.....14 Bamboo with Mud.....15 Stone with Mud …….16 **RUDIMENTARY WALLS:** Cardboard .....21 Reused Wood.....22 Plywood.....23 Unbaked Bricks .....24 **FINISHED WALLS:** Wood Planks/Shingles 31	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
		Unbaked Bricks Covered With Plaster .....32 Brick .....33 Cement Blocks.....34 Cement.....35 Stone with Lime/Cement .....36 Plastic tarpaulin/polythene……37 Other _____ 96 (Specify)	
204	Now I would like to ask you a few questions about your home. How many rooms in this household are used for sleeping?	Rooms..... ☐☐	
HANDWASHING			
205	Please show me where members of your household most often wash their hands?	Observed.....1 Not Observed, not In Dwelling/ yard/ Plot.....2 Not Observed, No Permission to See.....3 Not Observed, Other Reason 4	→ 207a
206	Observe Presence of Water at the place for handwashing. (Record Observation)	Water is available .....1 Water is not available 2	
207	Observe Presence of Soap, Detergent, or Other Cleansing Agent At the place for handwashing. (Record Observation)	Soap Or Detergent (Bar, Liquid, Powder, Paste) .....1 Ash, Mud, Sand.....2 None 3	
207a	There are times when people should wash their hands. Can you please tell me all the important occasions when people should wash their hands?	After Going to the Toilet ..... 1 After Attending to a child who has Defecated ..... 2 Before preparing food ..... 3 Before feeding a child ..... 4 Before eating ..... 5 Any other ..... 96 (Specify) Don't Know 98	
SANITATION			
208	What is the main type of toilet your household uses? If not possible to determine, ask permission to observe the facility.	**FLUSH OR POUR FLUSH TOILET** Flush to piped sewer system ..... 11 Flush to septic tank ..... 12 Flush to pit latrine ..... 13 Flush to somewhere else ..... 14 Flush, don't know where ..... 15 **PIT LATRINE**: Ventilated improved pit latrine .....21 Pit latrine with slab.....22 Pit latrine without slab/open pit .....23 Composting toilet .....31 Bucket toilet .....41 Hanging toilet/hanging latrine .....51 No facility/bush/field.....61 Other _____ 96 (specify)	→210a

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
209	Do you share this toilet with other households?	Yes ..... 1 No ..... 2 →	210a
210	Including your own household, how many households use this toilet facility?	Number of households (If less than 10) ..... 0 ☐ 10 or more households..... 95 Don't Know 98	
210a	Can you please show me the place where you usually dispose of your children's faeces? Select '1' if the respondent states an improved sanitation facility: Pit latrine with slab, ventilated improved pit latrine, flush/pour toilet connected to a sewer system or a septic tank or composting toilet.	Put them into any of Improved sanitation facility ..... 1 Throw them in the field/bush/river ..... 2 bury them in the soil..... 3 Leave them with other Trash/Rubbish ..... 4 Any other ..... 96 (Specify) Don't know 98	
DRINKING WATER			
211	What is the main source of drinking water for your household?	**PIPED WATER**: Piped into dwelling ..... 11 Piped to yard/plot ..... 12 → 214 Piped to neighbour ..... 13 Public tap/standpipe ..... 14 Tube well or borehole ..... 21 **DUG WELL**: Protected well ..... 31 Unprotected well ..... 32 **WATER FROM SPRING**: Protected spring ..... 41 Unprotected spring..... 42 Rainwater ..... 51 Tanker truck..... 61 Cart with small tank..... 71 Surface water (river/dam/ Lake/pond/stream/canal/irrigation Channel) ..... 81 Bottled water ..... 91 Permanent tap of NGO..... 92 Water supply through pipe by host community ..... 93 Other _____ 96 (specify)	
212	Where is that water source located?	In own dwelling ..... 1 In own yard/plot ..... 2 → Elsewhere 3	214
213	How long does it take to go there, get water, and come back?	Minutes ..... ☐☐☐ Don't know 98	
214	Is water available from this source all year round?	Yes ..... 1 No ..... 2 Don't know..... 8	
215	In the past two weeks, was water available every day from this source?	Yes ..... 1 No ..... 2 Don't know..... 8	
215a	Have you noticed any visible impurities such as dirt, sand, or floating particles in your drinking water?	Yes ..... 1 No ..... 2 Don't know..... 8	
215b	Sometimes water has a distinct metallic taste because of arsenic. Does your drinking water have a metallic taste?	Yes ..... 1 No ..... 2 Don't know..... 8	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
215c	Sometimes water has an unusual colour due to iron or other contaminants. Have you observed any unusual colour such as yellow, brown or reddish colour in your drinking water?	Yes ..... 1 No ..... 2 Don't know 8	
215d	Do you consider your drinking water safe for consumption?	Yes ..... 1 No ..... 2 Don't know 8	
215e	Have you or your family members experienced any health issues such as stomach problems, skin irritation, etc that you believe might be related to the drinking water quality?	Yes ..... 1 No ..... 2 Don't know 8	
216	Do you do anything to the water to make it safer to drink?	Yes ..... 1 No ..... 2 Don't know 8	→ 219
217	What do you usually do to make the water safer to drink? Anything else? (Select all that apply)	Boil ..... 1 Add bleach/chlorine ..... 2 Strain through a cloth ..... 3 Use water filter (ceramic/ sand/ composite/etc) ..... 4 Solar disinfection ..... 5 Let it stand and settle ..... 6 With Fitkari stone/Alum ..... 7 Other ..... 96 (Specify) Don't know 98	
ELECTRICITY AND COOKING FUEL			
219	What is the main source of cooking fuel for your household?	Electricity ..... 01 Liquid propane Gas ..... 02 Natural Gas ..... 03 Biogas ..... 04 Kerosene ..... 05 Coal, Lignite ..... 06 Charcoal ..... 07 Wood ..... 08 Straw/Shrubs/Grass ..... 09 Agricultural crop residue ..... 10 Animal dung ..... 11 No food cooked in the household ..... 95 Other _____ 96 (Specify)	→ 222
220	Is the cooking usually done in the house, in a separate building, or outdoors?	In the house ..... 1 In a separate building ..... 2 Outdoors ..... 3 Other _____ 6 (Specify)	→ 222
221	Do you have a separate room which is used as a kitchen?	Yes ..... 1 No 2	
OTHER HOUSEHOLD CHARACTERISTICS			
222	Does your household have: a) Electricity? b) A radio? c) A Television?	YES NO a) Electricity ..... 1 2 b) Radio ..... 1 2 c) Television ..... 1 2 d) Solar fan 1 2	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
	d) Solar Fan e) Charger fan f) A computer/laptop? g) A refrigerator? h) Solar electricity? i) A mobile phone? j) An almirah/wardrobe? k) An electric fan? l) A DVD/VCD player? m) A water pump? n) An IPS/generator o) Air Conditioner [Add additional items. see footnote 2.]	e) Charger fan……1 2 f) Computer/Laptop ..... 1 2 g) Refrigerator ..... 1 2 h) Solar Electricity..... 1 2 i) Mobile Phone ..... 1 2 j) Almirah/Wardrobe..... 1 2 k) Electric Fan ..... 1 2 l) Dvd/Vcd Player..... 1 2 m) Water Pump..... 1 2 n) Ips/Generator..... 1 2 o) Air Conditioner.....1 2	
OTHER HOUSEHOLD CHARACTERISTICS			
223	Does any member of this household own: a) A watch? b) A mobile phone? c) A bicycle? d) A motorcycle or motor scooter? e) Auto rickshaw? f) CNG g) A car or truck? h) A boat with a motor?	Yes No a) Watch 1 2 b) Mobile phone 1 2 c) Bicycle 1 2 d) Motorcycle/Scooter 1 2 e) Auto rickshaw f) CNG 1 2 g) Car or truck 1 2 h) Boat with motor 1 2	
224	Does any member of this household have a bank account?	Yes.....1 No.....2	
USE OF MOSQUITO NET			
225	Does your household have any mosquito nets?	Yes..... 1 No..... 2 Don't know.....8	→ 300
226	How many mosquito nets does your household have?	Number of Nets ..... ☐☐	
227	What is the brand of the mosquito net?	**Long-Lasting Insecticide-Treated Net (LLIN)** PermaNet.....1 Dawa Plus .....2 Interceptor G2 .....3 Other/Don't Know Brand LLIN .....9 Other type (Not LLIN)..... 96 Don't know type..... 98	
228	Did you have your house sprayed with insecticide spray in the past month?	Yes ..... 1 No..... 2 Don't Know.....8	

MODULE 3: FOOD CONSUMPTION (FCS & FCS_N)

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES		SKIP
300	Now I would like to ask you some questions about your food consumption in the past 12 months. How many days over the last 7 days, did most members of your household (50% +) eat the following food items, inside or outside the home? And what was their source? Use Codes below, write 0 if not Consumed in the last 7 days.			
	Food Categories for Fcs and Fcs-N	300 A Number of days eaten in the past **7 days** ENTER: 1 = 1 day 2 = 2 days 3 = 3 days 4 = 4 days 5 = 5 days 6 = 6 days 7 = 7 days 0 = Not consumed	300 B What was the primary source from which [READ FOOD GROUPS] was obtained? ENTER: 100 = Own production (crops, animals) 200 = Fishing/Hunting 300 = Gathering 400 = Loan 500 = Market (purchase with cash) 600 = Market (purchase on credit) 700 = Begging for food 800 = Exchange labour or items for food 900 = Gift (food) from family relatives or friends 901 = Food aid from civil society, NGOs, government, WFP, etc. 999 = Other	
301	Cereals, grains, roots and tubers, such as: Rice, pasta, bread, sorghum, millet, maize, potato, yam, cassava, white sweet potato, plantain.	☐	☐☐☐	
302	Pulses/legumes, nuts and seeds, such as: beans, cowpeas, lentils, soy, pigeon pea, peanuts, and/or other nuts	☐	☐☐☐	
303	Milk and other dairy products, such as: milk, yoghurt, cheese, and other dairy products [Exclude margarine or butter or small amounts of milk for tea or coffee]	☐	☐☐☐	
304	Meat, fish and eggs, such as: goat, beef, chicken, pork, fish, including canned tuna, insects, escargot, and/or other seafood, eggs (meat and fish consumed in large quantities and not as a condiment).	☐	☐☐☐	
304a	Flesh meat, such as: beef, pork, lamb, goat, rabbit, chicken, duck, other birds, insects	☐	☐☐☐	
304b	Organ meat, such as: liver, kidney, heart and/or other organ meats	☐	☐☐☐	

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES		SKIP
304c	Fish/shellfish, such as: fish, including canned tuna, escargot, and/or other seafood (fish in large quantities and not as a condiment)	☐	☐☐☐	
304d	Eggs?	☐	☐☐☐	
305	Vegetables and leaves, such as: spinach, onion, tomatoes, carrots, peppers, green beans, lettuce, etc	☐	☐☐☐	
305a	Orange vegetables (vegetables rich in Vitamin A), such as: carrot, red pepper, pumpkin, orange sweet potatoes	☐	☐☐☐	
305b	Green leafy vegetables, such as: spinach, broccoli, amaranth and/or other dark green leaves, cassava leaves	☐	☐☐☐	
306	Different types of fruits, such as: banana, apple, lemon, mango, papaya, apricot, or reddish-coloured summer citrus fruits rich in minerals and vitamins, orange-coloured sweet apricot, peach, etc.	☐	☐☐☐	
306a	Red/orange-coloured fruits (Vitamin A-rich fruits), such as: ripe mango, ripe papaya, ripe jackfruit, apricot or summer Vitamin A-rich red-coloured sweet apricot, and peach.	☐	☐☐☐	
307	Oil/fat/butter, such as: vegetable oil, palm oil, shea butter, margarine, and other fats/oil	☐	☐☐☐	
308	Sugar, or sweet, such as: sugar, honey, jam, candy, cookies, pastries, cakes and other sweet (sugary drinks)	☐	☐☐☐	
309	Condiments/spices, such as: tea, coffee, cocoa powder, salt, garlic, spices, yeast, baking powder, tomato paste or sauce, and small amounts of meat, fish, milk or other food items consumed as a condiment.	☐	☐☐☐	

Note for Interviewer: Not all types of foods are commonly available in Bangladesh; names of many foreign foods have also been included. Try to familiarize yourself with different region-specific Bangladeshi foods. Use Google search if needed.

MODULE 4: CHILDREN'S HEALTH AND USE OF MOSQUITO NET

NO.	QUESTION	CHILD 1	CHILD 2	CHILD 3	CHILD 4	CHILD 5
400	**Identify the primary caregiver of each child age 6-59 months in the household. Ask these questions of the primary caregiver of each child. Check the informed consent register and ensure that the respondent(s) to this module have previously provided informed consent; If not, administer informed consent for this module.**					
401	**"Now we will ask you some questions about your child's health"**					
402	Child's Line Number and first Name from the Household Roster	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________
403	Caregiver's Line Number and Name from the Household Roster	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________	Line No .... ☐☐ Name______________
404	Obtain Consent. does [Name] agree to Participate in the Survey?	Yes .... 1 No .... 2 End of interview ←	Yes .... 1 No .... 2 End of interview ←	Yes .... 1 No .... 2 End of interview ←	Yes .... 1 No .... 2 End of interview ←	Yes .... 1 No .... 2 End of interview ←
404a	Did (child's name)'s parents come to Bangladesh from Myanmar in 2024 or later? (for new arrival identification)	Yes......................1 No 2	Yes......................1 No........................2	Yes......................1 No........................2	Yes......................1 No........................2	Yes......................1 No........................2
405	(What is [Child's Name]'s sex?	Male.......................... 1 Female 2	Male.......................... 1 Female...................... 2	Male.......................... 1 Female 2	Male.......................... 1 Female 2	Male.......................... 1 Female 2
406	I Would Like to ask you some Questions about [Child's Name]. What Is [His/Her] Birthday?	Day...................... ☐☐ Don't Know Day.........98 Month................. ☐☐ Don't Know Month.....98 Year .... ☐☐☐☐ Don't Know Year.......................9998	Day...................... ☐☐ Don't Know Day.........98 Month................. ☐☐ Don't Know Month.....98 Year .... ☐☐☐☐ Don't Know Year 9998	Day...................... ☐☐ Don't Know Day.........98 Month................. ☐☐ Don't Know Month.....98 Year .... ☐☐☐☐ Don't Know Year 9998	Day...................... ☐☐ Don't Know Day.........98 Month................. ☐☐ Don't Know Month.....98 Year .... ☐☐☐☐ Don't Know Year 9998	Day...................... ☐☐ Don't Know Day.........98 Month................. ☐☐ Don't Know Month.....98 Year .... ☐☐☐☐ Don't Know Year 9998
407	Check 406: If the information on the Child's Day, Month, and Year of Birth complete.	Yes .... 1 Skip to 417 ← No 2	Yes .... 1 Skip to 417 ← No 2	Yes .... 1 Skip to 417 ← No 2	Yes .... 1 Skip to 417 ← No 2	Yes .... 1 Skip to 417 ← No 2
408	Does [Child's Name] have a health or vaccination card with the Birth Date Recorded?	Yes .... 1 No .... 2 Don't know .... 8 Skip to 417 ←	Yes .... 1 No .... 2 Don't know.............. 8 Skip to 417 ←	Yes .... 1 No .... 2 Don't know.............. 8 Skip to 417 ←	Yes .... 1 No .... 2 Don't know .... 8 Skip to 417 ←	Yes .... 1 No .... 2 Don't know .... 8 Skip to 417 ←

409	May I please see the Card?	Yes..... 1 No..... 2 Card not Available... 8 Skip to 417 ←	Yes..... 1 No..... 2 Card not Available... 8 Skip to 417 ←	Yes..... 1 No..... 2 Card not Available... 8 Skip to 417 ←	Yes ..... 1 No ..... 2 Card not Available ... 8 Skip to 417 ←	Yes ..... 1 No ..... 2 Card not Available ... 8 Skip to 417 ←
410	Confirm with the respondent that the information on the Card Is correct. If the health/ vaccination Card is shown and the respondent confirms the information is correct, Record the Date of Birth as documented on the Card.	Day..... ☐☐ Don't know Day..... 98 Month..... ☐☐ Don't Know Month..... 98 Year..... ☐☐☐☐ Don't Know Year 9998	Day..... ☐☐ Don't know Day..... 98 Month..... ☐☐ Don't Know Month..... 98 Year..... ☐☐☐☐ Don't Know Year 9998	Day..... ☐☐ Don't know Day..... 98 Month..... ☐☐ Don't Know Month..... 98 Year..... ☐☐☐☐ Don't Know Year 9998	Day ..... ☐☐ Don't know Day ..... 98 Month ..... ☐☐ Don't Know Month .... 98 Year ..... ☐☐☐☐ Don't Know Year 9998	Day ..... ☐☐ Don't know Day ..... 98 Month ..... ☐☐ Don't Know Month .... 98 Year ..... ☐☐☐☐ Don't Know Year 9998
USE OF MOSQUITO NET						
417	Check 225: Does the household have a Net?	Yes..... 1 No..... 2 Skip to 420 ←	Yes..... 1 No..... 2 Skip to 420 ←	Yes..... 1 No..... 2 Skip to 420 ←	Yes..... 1 No ..... 2 Skip to 420 ←	Yes..... 1 No ..... 2 Skip to 420 ←
418	Did (Child) usually sleep under the Net?	Yes..... 1 No..... 2 Don't know..... 8 Skip to 420 ←	Yes..... 1 No..... 2 Don't know..... 8 Skip to 420 ←	Yes..... 1 No..... 2 Don't know..... 8 Skip to 420 ←	Yes..... 1 No ..... 2 Don't know ..... 8 Skip to 420 ←	Yes..... 1 No ..... 2 Don't know ..... 8 Skip to 420 ←
419	Did (Child) sleep under the Mosquito Net last Night?	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No ..... 2 Don't know 8
420	Did (Child) have fever in the last 2 weeks?	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No ..... 2 Don't know 8
421	Did (Child) receive any anti-malarial treatment in the past 2 weeks?	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No ..... 2 Don't know 8
422	Did (Child) receive anti-malarial Drugs and also received artemisinin-based combination Therapy (act) or (other first-line treatment according to national policy) in the past 2 weeks?	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know..... 8	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No ..... 2 Don't know 8

	Note: The treatment in which two or more medicines are combined for malaria treatment is called ACT Therapy.					
ARI, DIARRHEA AND USE OF ORS						
422a	Has (CHILD) had any skin diseases at any time in the last 2 weeks?	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8
422b	Has (CHILD) had an illness with a cough at any time in the last 2 weeks?	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8
422c	Has (CHILD) had fast, short, rapid breaths or difficulty breathing in the last 2 weeks?	Yes....1 No....2 Don't know....8 Go to 423 question	Yes....1 No....2 Don't know....8 Go to 423 question	Yes....1 No....2 Don't know....8 Go to 423 question	Yes....1 No....2 Don't know....8 Go to 423 question	Yes....1 No....2 Don't know....8 Go to 423 question
422d	Was the fast or difficult breathing due to a problem in the chest or to a blocked or runny nose?	Chest only....1 Nose only....2 Both....3 Other....6 (Specify) Don't know....8	Chest only....1 Nose only....2 Both....3 Other....6 (Specify) Don't know....8	Chest only....1 Nose only....2 Both....3 Other....6 (Specify) Don't know....8	Chest only....1 Nose only....2 Both....3 Other....6 (Specify) Don't know....8	Chest only....1 Nose only....2 Both....3 Other....6 (Specify) Don't know....8
423	Did (Name) have Diarrhoea in the past 2 weeks?	Yes....1 No....2 Don't know....8 Skip to 425	Yes....1 No....2 Don't know....8 Skip to 425	Yes....1 No....2 Don't know....8 Skip to 425	Yes....1 No....2 Don't know....8 Skip to 425	Yes....1 No....2 Don't know....8 Skip to 425
424	Did (Name) Received Ors or Ors with zinc in the past 2 weeks?	Yes Ors....1 Yes, Ors and Zinc ....2 Yes, Homemade ORS..3 No....4 Don't know....8	Yes Ors....1 Yes, Ors and Zinc ....2 Yes, Homemade ORS..3 No....4 Don't know....8	Yes Ors....1 Yes, Ors and Zinc ....2 Yes, Homemade ORS..3 No....4 Don't know....8	Yes Ors....1 Yes, Ors and Zinc ....2 Yes, Homemade ORS..3 No....4 Don't know....8	Yes Ors....1 Yes, Ors and Zinc ....2 Yes, Homemade ORS..3 No....4 Don't know....8
DEWORMING, MEASLES VACCINATION & SUPPLEMENTATION						
425	Did (Child) Receive Deworming Medication in the past 6 Months?	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8
426	(Did (Child) Receive Measles Vaccination, that is, an injection in the arm to prevent Measles?	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8	Yes....1 No....2 Don't know....8

427	(How Many times did (Name) Receive the Measles Vaccine?	Number of Times..... ☐	Number of Times ..... ☐	Number of Times .....☐	Number of Times ..... ☐	Number of Times ..... ☐
428	Check 402: Are there more children 6-59 months in the household	Check 402: for other children age 6-59 months in the household; If None, Go to Module 5	Check 402: for other children age 6-59 months in the household; If None, Go to Module 5	Check 402: for other children age 6-59 months in the household; If None, Go to Module 5	Check 402: for other children age 6-59 months in the household; If None, Go to Module 5	Check 402: for other children age 6-59 months in the household; If None, Go to Module 5

MODULE 5: CHILDREN'S NUTRITION AND ENROLMENT IN SUPLEMENTARY FOOD PROGRAM (6-59)

NO.	QUESTION	CHILD 1	CHILD 2	CHILD 3	CHILD 4	CHILD 5
500	**"Now I will ask you about your and your child's participation in supplementary food programs."**					
501	Child's Line Number and first Name from the household Roster	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____
502	Caregiver's Line Number and Name from the household Roster	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____	Line Number ..... ☐☐ Name _____
SUPPLEMENTARY FOOD PROGRAM						
503	Did (Child's Mother) Receive Iron-Fortified Ration (Pusti-rice)?	Yes, ... 1 No ..... 2 Don't know 8	Yes, ... 1 No ..... 2 Don't know 8	Yes, ... 1 No ..... 2 Don't know 8	Yes, ... 1 No ..... 2 Don't know 8	Yes, ... 1 No ..... 2 Don't know 8
503a	Did (Child's Mother) Consume Iron-fortified Rations or Iron-fortified? Such as: Pusti-rice, meat, sea fish/food, vegetables, deep green colour vegetables, Green leafy vegetables, spinach, fruits, seeds etc. Observe Ration and Verify	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8
503b	Did (Child) Consume Iron-fortified Rations or Iron-fortified? Such as: Pusti-rice, meat, sea fish/food, vegetables, deep green colour vegetables, Green leafy vegetables, spinach, fruits, seeds etc.	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8
503c	Did (Child's Mother) Receive Iron and Folic Acid tablet from any Programme in the past 30 Days?	Yes, ... 1 No ..... 2 Don't know ..... 8 Skip to 503g ←	Yes, ... 1 No ..... 2 Don't know ..... 8 Skip to 503g ←	Yes, ... 1 No ..... 2 Don't know ..... 8 Skip to 503g ←	Yes, ... 1 No ..... 2 Don't know ..... 8 Skip to 503g ←	Yes, ... 1 No ..... 2 Don't know ..... 8 Skip to 503g ←
503d	Ask the respondent to show the Tablets Enter the Date Tablets Received and The Quantity of Tablets (One/Day) Received (In Numbers)	Date Tablets Received Day ☐☐ Month ☐☐ Number of Tablets Received ☐☐	Date Tablets Received Day ☐☐ Month ☐☐ Number of Tablets Received ☐☐	Date Tablets Received Day ☐☐ Month ☐☐ Number of Tablets Received ☐☐	Date Tablets Received Day ☐☐ Month ☐☐ Number of Tablets Received ☐☐	Date Tablets Received Day ☐☐ Month ☐☐ Number of Tablets Received ☐☐
503e	Did (Child's Mother) consume iron folic acid tablet yesterday?	Yes, ... 1 No ..... 2 Don't know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8	Yes, ... 1 No ..... 2 Don't Know 8

503f	What Is the Quantity of Iron Folic Acid Available at the household? Observe the Quantity	Number of tablets available at the HH .... ☐☐	Number of tablets available at the HH....................... ☐☐	Number of tablets available at the HH...................... ☐☐	Number of tablets available at the HH....................... ☐☐	Number of tablets available at the HH....................... ☐☐
503g	Did (Child's Mother) Receive Iron and Folic Acid Tablet from Local Pharmacy?	Yes, ...1 No ....2 Don't Know.................8	Yes, ...1 No...............................2 Don't Know.................8	Yes,............................. 1 No .... 2 Don't Know 8	Yes,.............................1 No...............................2 Don't Know 8	Yes,.............................1 No...............................2 Don't Know 8
504	Did (Child's Mother) Enrolled And/or Received Ration from Targeted/Blanket Supplementary Feeding Programme (BSFP/TSFP) in the Past 3 Months?	Yes ....1 No ....2 Don't Know.................8 Go to the question 505	Yes..............................1 No...............................2 Don't Know.................8 Go to the question 505	Yes.............................. 1 No .... 2 Don't Know .... 8 Go to the question 505	Yes..............................1 No...............................2 Don't Know ....8 Go to the question 505	Yes..............................1 No...............................2 Don't Know ....8 Go to the question 505
504a	If the answer is yes, see the cards and identify in which program child's mother was enrolled? (Multiple)	BSFP……………….A TSFP……………….B Other specify….….…C Not admitted in any program……………D (If the response is C, then specify the reason) Go to question number 505.	BSFP……………….A TSFP……………….B Other specify….….…C Not admitted in any program……………D (If the response is C, then specify the reason) Go to question number 505.	BSFP……………….A TSFP……………….B Other specify….….…C Not admitted in any program……………D (If the response is C, then specify the reason) Go to question number 505.	BSFP……………….A TSFP……………….B Other specify….….…C Not admitted in any program……………D (If the response is C, then specify the reason) Go to question number 505.	BSFP……………….A TSFP……………….B Other specify….….…C Not admitted in any program……………D (If the response is C, then specify the reason) Go to question number 505.
504b	CHECK 504a: IF THE RESPONDENT WAS NOT ENROLLED IN ANY PROGRAM (CODE D). ASK: Could you please share the reason why you are not enrolled in any programs? PLEASE SPECIFY					
504c	Does (the child's mother) currently receive rations from any semolina/nutrition program?	Yes, ...1 No ....2 Don't know..................8 Skip to 505	Yes, ...1 No...............................2 Don't know ....8 Skip to 505	Yes,.............................1 No ....2 Don't know..................8 Skip to 505	Yes,.............................1 No...............................2 Don't know ....8 Skip to 505	Yes,.............................1 No...............................2 Don't know ....8 Skip to 505
504d	Ask The Respondent to Show the Beneficiary Card. Enter The Quantity of Ration Received and Amount of Ration Available for Child's Mother at Household Note: TSFP Ration Size Is 250 Gm/Day (7.5 Kg/Month)	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐

	BSFP Ration Size Is 200 Gm/Day (6 Kg/Month)	Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997
505	Was the (child) given Iron Tablets or Syrups in the last 12 Months?	Yes ....1 No ....2 Don't Know.................8	Yes..............................1 No..............................2 Don't Know 8	Yes ....1 No ....2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8
506	Did the (child) Consume Iron Tablets or Syrups Given to him/her in the last 12 Months?	Yes ....1 No ....2 Don't Know.................8	Yes..............................1 No..............................2 Don't Know 8	Yes ....1 No ....2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8
507	Did The (Child) Receive Vitamin A Capsule after December 2024?	Yes ....1 No ....2 Don't Know.................8	Yes..............................1 No..............................2 Don't Know 8	Yes ....1 No ....2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8	Yes..............................1 No..............................2 Don't Know 8
508	Did (Child) Receive Blanket Supplementary Feeding Ration (Super cereal Plus) From BSFP/TSFP/OTP) In the Last 3 Months?	Yes ....1 No ....2 Don't Know.................8 Skip To 512	Yes..............................1 No..............................2 Don't Know ....8 Skip To 512	Yes ....1 No ....2 Don't Know ....8 Skip To 512	Yes..............................1 No..............................2 Don't Know ....8 Skip To 512	Yes............................ 1 No..............................2 Don't Know ....8 Skip to 512
508a	If the answer is yes, see the cards and identify in which program child's was enrolled? (Multiple) (Multiple)	BSFP……………….1 TSFP……………..2 OTP………………...3 Not admitted in any program…………… ….4				
508b.	CHECK 508a: IF THE RESPONDENT WAS NOT ENROLLED IN ANY PROGRAM (CODE D). ASK: Could you please share the reason why you are not enrolled in any programs? PLEASE SPECIFY					

508c.	Is the child currently receiving rations from any Suji/Pushti program?	BSFP…………1→508a TSFP…………2→510a OTP…………3→511b Not admitted in any program……..4 →512	BSFP…………1→508a TSFP…………2→510a OTP…………3→511b Not admitted in any program……..4 →512	BSFP…………1→508a TSFP…………2→510a OTP…………3→511b Not admitted in any program……..4 →512	BSFP…………1→508a TSFP…………2→510a OTP…………3→511b Not admitted in any program……..4 →512	BSFP…………1→508a TSFP…………2→510a OTP…………3→511b Not admitted in any program……..4 →512
508d	CHECK 508c: IF THE RESPONDENT IS NOT CURRENTLY ENROLLED IN ANY PROGRAM (CODE D). ASK: Could you please share the reason why you are not currently enrolled in any programs? PLEASE SPECIFY					
508e	Ask the respondent to show the beneficiary card. Record the amount of food/ration received by the household and the amount of ration available at home.	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of BSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of BSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997
509	Was This Supplementary Food (BSFP) Consumed by the Child, or shared with another child or family member?	Yes, Consumed only by the child .... 1 Yes, Shared with Other Household Member .... 2 No, No, the child was not fed…………………..3 No ration at home. ...... 4 Don't Know................ 8	Yes, Consumed only by the child .... 1 Yes, Shared with Other Household Member ..... 2 No, No, the child was not fed…………………..3 No ration in home. ...... 4 Don't Know 8	Yes, Consumed only by the child .... 1 Yes, Shared with Other Household Member...... 2 No, No, the child was not fed…………………..3 No ration in home. .... 4 Don't Know 8	Yes, Consumed only by the child.................. 1 Yes, Shared with Other Household Member...... 2 No, No, the child was not fed…………………..3 No ration in home. .... 4 Don't Know 8	Yes, Consumed only by the child..................1 Yes, Shared with Other Household Member......2 No, No, the child was not fed…………………..3 No ration in home.........4 Don't Know 8

510a	Ask the respondent to show the beneficiary card. Record the amount of ration received for the child in the household and the amount of ration currently available at home	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of TSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of TSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of TSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of TSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of TSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of TSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of TSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of TSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997	Packet received date Date☐☐☐ Month ☐☐☐ Quantity of TSFP Ration Received ☐☐☐ Enter Amount in Gram Amount of TSFP Ration Available ☐☐☐ Enter Amount in Gram Did not go or receive on the specified date for Suji/Ration…………… 997
511	Was This Supplementary Food (TSFP) Consumed by the Child, or shared with Another Child or Family Member? F506	Yes, Consumed only by the child ....1 Yes, Shared with Other Household Member .....2 No, No, the child was not fed…………………...3 No ration in home. ....4 Don't Know 8	Yes, Consumed only by the child..................1 Yes, Shared with Other Household Member......2 No, No, the child was not fed…………………..3 No ration in home.........4 Don't Know..................8	Yes, Consumed only by the child ....1 Yes, Shared with Other Household Member......2 No, No, the child was not fed…………………..3 No ration in home. ....4 Don't Know 8	Yes, Consumed only by the child..................1 Yes, Shared with Other Household Member......2 No, No, the child was not fed…………………...3 No ration in home. ....4 Don't Know 8	Yes, Consumed only by the child..................1 Yes, Shared with Other Household Member......2 No, No, the child was not fed…………………..3 No ration in home.........4 Don't Know 8
511b	Ask The Respondent to show the Beneficiary Card Enter Date & Month Received and the Quantity Received	Date Tablets Received Day ☐☐ Month ☐☐ Quantity Received from OTP Enter No. of Sachets ☐☐ Available ration in home received from OTP Enter No. of Sachets ☐☐ Did not go or receive on the specified date for Suji/Ration…………… 997	Date Tablets Received Day ☐☐ Month ☐☐ Quantity Received from OTP Enter No. of Sachets ☐☐ Available ration in home received from OTP Enter No. of Sachets ☐☐ Did not go or receive on the specified date for Suji/Ration…………… 997	Date Tablets Received Day ☐☐ Month ☐☐ Quantity Received from OTP Enter No. of Sachets ☐☐ Available ration in home received from OTP Enter No. of Sachets ☐☐ Did not go or receive on the specified date for Suji/Ration…………… 997	Date Tablets Received Day ☐☐ Month ☐☐ Quantity Received from OTP Enter No. of Sachets ☐☐ Available ration in home received from OTP Enter No. of Sachets ☐☐ Did not go or receive on the specified date for Suji/Ration…………… 997	Date Tablets Received Day ☐☐ Month ☐☐ Quantity Received from OTP Enter No. of Sachets ☐☐ Available ration in home received from OTP Enter No. of Sachets ☐☐ Did not go or receive on the specified date for Suji/Ration…………… 997

511c	Was This Therapeutic Food (OTP) Consumed by the Child, or shared with Another Child or Family Member?	Yes, Consumed only by the child .....1 Yes, Shared with Other Household Member .....2 No, No, the child was no fed……...3 No ration in home. .....4 Don't Know 8	Yes, Consumed only by the child.....1 Yes, Shared with Other Household Member.....2 No, No, the child was no fed……...3 No ration in home.....4 Don't Know 8	Yes, Consumed only by the child .....1 Yes, Shared with Other Household Member.....2 No, No, the child was no fed……...3 No ration in home. .....4 Don't Know 8	Yes, Consumed only by the child.....1 Yes, Shared with Other Household Member.....2 No, No, the child was no fed……...3 No ration in home. .....4 Don't Know 8	Yes, Consumed only by the child.....1 Yes, Shared with Other Household Member.....2 No, No, the child was no fed……...3 No ration in home.....4 Don't Know 8
BREASTFEEDING AND MINIMUM ACCEPTABLE DIET (6-23 months)						
512	(Has [Child's Name] Ever Been Breastfed? **(6-23 months)**	Yes ..... 1 No ..... 2 Skip to 514	Yes.....1 No.....2 Skip To 514	Yes..... 1 No ..... 2 Skip To 514	Yes..... 1 No..... 2 Skip To 514	Yes.....1 No.....2 Skip To 514
513	Was [Child's Name] Breastfed Yesterday During the Day or at Night? **(6-23 months)**	Yes.....1 No .....2 Don't know.....8 Skip to 514	Yes.....1 No.....2 Don't know .....8 Skip to 514	Yes .....1 No .....2 Don't know.....8 Skip to 514	Yes .....1 No.....2 Don't know .....8 Skip to 514	Yes .....1 No.....2 Don't know .....8 Skip to 514
514	Sometimes Babies Are Fed Breast Milk in Different Ways, For Example by Spoon, Cup, or Bottle. This can happen when the mother cannot always be with her Baby. Sometimes babies are breastfed by another woman or given breast milk from another woman by Spoon, Cup, Bottle, or some other way. This Can Happen If a Mother Cannot Breastfeed Her Own Baby. Did (Child's name) Consume breast milk in any of these was yesterday during the day or at night? **(6-23 months)**	Yes.....1 No .....2 Don't know.....8	Yes.....1 No.....2 Don't know 8	Yes .....1 No .....2 Don't know.....8	Yes .....1 No.....2 Don't know 8	Yes .....1 No.....2 Don't know 8
517	**READ THE QUESTIONS BELOW. READ THE LIST OF LIQUIDS ONE BY ONE AND MARK YES OR NO, ACCORDINGLY**. (6-59 months) **"Next I would like to ask you about some Liquids that [Child's Name] may have had yesterday during the day or at Night.** **Did [Child's Name] Have any [Item from List]?"**					
518	Plain Water?	Yes.....1 No .....2 Don't know.....8	Yes.....1 No.....2 Don't know 8	Yes .....1 No .....2 Don't know.....8	Yes .....1 No.....2 Don't know 8	Yes .....1 No.....2 Don't know 8

519	Infant Formula Such As [Insert Local Examples]?	Yes ..... 1 No ..... 2 Don't know..... 8 Skip to 521	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip to 521	Yes..... 1 No ..... 2 Don't know..... 8 Skip to 521	Yes..... 1 No..... 2 Don't know ..... 8 Skip to 521	Yes..... 1 No..... 2 Don't know ..... 8 Skip to 521
520	How many times yesterday during the Day or at Night did [Child's Name] Consume any Formula?	Times..... ☐☐ Don't know..... 98	Times ..... ☐☐ Don't know 98	Times..... ☐☐ Don't know..... 98	Times ..... ☐☐ Don't know 98	Times ..... ☐☐ Don't know 98
521	Did [Child's Name] Have any Milk such as Tinned, Powdered, or fresh animal Milk?	Yes ..... 1 No ..... 2 Don't know..... 8 Skip to 523	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip to 523	Yes..... 1 No ..... 2 Don't know..... 8 Skip to 523	Yes..... 1 No..... 2 Don't know ..... 8 Skip to 523	Yes..... 1 No..... 2 Don't know ..... 8 Skip to 523
522	How many times yesterday During the Day or at Night Did [Child's Name] Consume any Milk?	Times..... ☐☐ Don't know..... 98	Times ..... ☐☐ Don't know 98	Times..... ☐☐ Don't know..... 98	Times ..... ☐☐ Don't know 98	Times ..... ☐☐ Don't know 98
523	Did [Child's Name] have any Juice or Juice Drinks?	Yes..... 1 No ..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know 8	Yes ..... 1 No..... 2 Don't know 8
523a	Did [CHILD'S NAME] have any chocolate-flavoured drinks including those made from syrups or powders?	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8
523b	.Did [CHILD'S NAME] have any soda, malt drinks, sports drinks or energy drinks?	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8
523c	Did [CHILD'S NAME] have any tea, coffee or herbal drinks?	Yes ..... 1 No ..... 2 Don't know..... 8 Skip To 524	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 524	Yes..... 1 No ..... 2 Don't know..... 8 Skip To 524	Yes..... 1 No..... 2 Don't know ..... 8 Skip To 524	Yes..... 1 No..... 2 Don't know ..... 8 Skip To 524
523d	Was the drink/were any of these drinks sweetened?	Yes..... 1 No ..... 2 Don't know 8	Yes..... 1 No..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8
524	Did [Child's Name] have any Clear Broth?	Yes..... 1 No ..... 2 Don't know..... 8	Yes..... 1 No..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know..... 8	Yes ..... 1 No..... 2 Don't know 8
525	Did [Child's Name] have any Yogurt?	Yes ..... 1 No ..... 2 Don't know..... 8 Skip To 527	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 527	Yes..... 1 No ..... 2 Don't know..... 8 Skip To 527	Yes..... 1 No..... 2 Don't know ..... 8 Skip To 527	Yes..... 1 No..... 2 Don't know ..... 8 Skip To 527

526	How many times yesterday during the day or at Night Did [Child's Name] Consume any Yogurt?	Times ..... ☐☐ Don't Know 98	Times ..... ☐☐ Don't Know 98	Times ..... ☐☐ Don't Know 98	Times ..... ☐☐ Don't Know 98	Times ..... ☐☐ Don't Know 98
526a	Was the [YOGURT DRINK] a sweet or flavoured type of yogurt drink?	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8
526b	Did [CHILD'S NAME] have any thin porridge?	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8
526c	Any other liquids such as lemon juice, coconut water, rice water, etc?	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8	Yes ..... 1 No ..... 2 Don't know 8
527	Did [Child's Name] Have any other Liquids in last day and night?	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 528	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 528	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 528	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 528	Yes ..... 1 No ..... 2 Don't know ..... 8 Skip To 528
527a	RECORD ALL OTHER LIQUIDS MENTIONED					
527b	Was this/these beverage(s) sweet?	Yes ..... 1 No ..... 2 Don't Know 8	Yes ..... 1 No ..... 2 Don't Know 8	Yes ..... 1 No ..... 2 Don't Know 8	Yes ..... 1 No ..... 2 Don't Know 8	Yes ..... 1 No ..... 2 Don't Know 8

CHILDREN'S DIETARY DIVERSITY (6-23 months)

528 **STEP I: ASK THE CAREGIVER TO RECALL FOODS AND DRINKS [CHILD'S NAME] CONSUMED YESTERDAY DURING THE DAY OR NIGHT**.

Now I would like to ask you to tell me about the foods and drinks that [CHILD'S NAME] consumed yesterday during the day or night, whether [Child's Name] ate it at home or anywhere else. Please include all foods and drinks, any snacks or small meals, as well as any main meals.

Think about when [Child's Name] first woke up yesterday. Did [Child's Name] eat or drink anything at that time?
If Yes: Please tell me everything [Child's Name] ate at that time. Anything else?
Continue Probing Until Caregiver Says "Nothing Else."

Did [Child's Name] eat or drink anything later in the morning?
If Yes: Please tell me everything [CHILD'S NAME] ate at that time. Anything else?
Continue Probing Until Caregiver Says "Nothing Else."

Did [Child's Name] eat or drink anything at mid-day?
If Yes: Please tell me everything [Child's Name] ate at that time. Anything else?

	Continue Probing Until Caregiver Says “Nothing Else." Did [Child’s Name] eat or drink anything during the afternoon? **If Yes:** Please tell me everything [CHILD’S NAME] ate at that time. Anything else? Continue Probing Until Caregiver Says “Nothing Else." Did [Child’s Name] eat or drink anything in the evening? **If Yes**: Please tell me everything [CHILD’S NAME] ate at that time. Anything else? Continue Probing Until Caregiver Says “Nothing Else." Did [Child’s Name] eat or drink anything in the evening before going to bed or during the night? **If Yes:** Please tell me everything [CHILD’S NAME] ate at that time. Anything else? Continue Probing Until Caregiver Says “Nothing Else." **Note:** • If The Caregiver Mentions Mixed Dishes Like a Porridge, Sauce, or Stew, Probe: What Ingredients were in That [Mixed Dish]? Probe: Anything Else? Continue Probing Until Caregiver Says “Nothing Else.” • If Foods Are Used in Small Amounts for Seasoning or as a Condiment, Include Them Under the Condiments Food Group. As The Respondent Recalls Foods, Enter ‘1’ In the Column Next to the Food Group. **STEP II**: For Each Food Group Where ‘1’ Was Not Entered, Ask: Yesterday During the Day or Night, did [Child’s Name] Eat or Drink Any [Name of Food Group]? Enter ‘1’ If Respondent Says Yes, ‘2’ If no, and ‘8’ If Don’t Know. **Step III:** Ask The Respondent About Any Other Food or Drinks [Child's Name] May Have Consumed. Write The Food(S) Or Drink(S) In Item 560 ‘Any Other Foods.’					
529	Food Made from Grains, Such As Bread, Rice, Noodles, Porridge, or [Other Local Grain Food]?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
530	Pumpkin, Carrots, Squash, or Sweet Potatoes That Are Yellow or Orange Inside or [Other Local Yellow/Orange Foods]?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
531	White Potatoes, White Yams, Manioc, Cassava, [Other Local Root Crops] Or Any Other Foods Made from Roots?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
532	Any Plantains or Green Bananas?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
533	Any dark green leafy vegetables such as [vegetables, deep green	Yes.....1 No.....2	Yes.....1 No.....2	Yes.....1 No.....2	Yes.....1 No.....2	Yes.....1 No.....2

	colour vegetables, Green leafy vegetables, spinach, ripe mango ripe jackfruits and ripe papaya, seeds etc]?	Don't Know.....8	Don't Know.....8	Don't Know 8	Don't Know 8	Don't Know 8
534	Any Other Vegetables and fruits?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
535	Red/orange-coloured fruits (Vitamin A-rich fruits), such as: ripe mango, ripe papaya, ripe jackfruit, apricot, or summer Vitamin A-rich red/orange-coloured sweet apricot, peach, etc.	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
536	Any other fruits?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
537	Did (he/she) eat liver, kidney, heart, or other organ meat from wild animals, such as [names of wild animals commonly eaten locally]?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
537a	Sausages, hot dogs, ham, bacon, salami, canned meat or processed organ meats such as kebab (minced meat), meatballs, processed chicken or turkey?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
538	Any Meat from Domesticated Animals, Such As Cow, Lamb, Goat, Chicken, or Duck?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
541	Eggs?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
542	Fresh Or Dried Fish, Shellfish, or Seafood?	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8
543	Any type of bean, pea, or lentil-based food, such as: masoor dal, moong dal, black gram, urad dal, chickpeas, local chickpeas, kidney beans, lentils, broad beans, or soybean, including any other bean, pea, or lentil-based food	Yes.....1 No .....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes .....1 No .....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8	Yes .....1 No.....2 Don't Know 8

544	Any Foods Made from Nuts or Seeds Such As [Add Any Local Nut/Seed and simer bichi/bean seed]?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
545	Cheese, Yogurt, Or Other Milk Products?	Yes.....1 No.....2 Don't know.....8 Skip To 546	Yes.....1 No.....2 Don't know.....8 Skip To 546	Yes.....1 No.....2 Don't know.....8 Skip To 546	Yes.....1 No.....2 Don't know.....8 Skip To 546	Yes.....1 No.....2 Don't know.....8 Skip To 546
545a	How many times did [NAME] eat yogurt?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
545b	Hard or soft cheese? ADD COMMONLY CONSUMED TYPES OF CHEESE	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
546	Any Oil, Fats, Or Butter, Or Foods Made with any of These?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
547	Any Sugary Foods Such as Chocolates, Sweets, Candies, Pastries, Cakes, Or Biscuits?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
547a	Any Fried Foods Such as Chips, Crisps, Puffs, French Fries, Fried Dough, Instant Noodles, etc.?	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
550a	Any ready-to-use therapeutic food (RUTF), such as: Plumpy'Nut, eeZeePaste [add locally available products]? Show the sachet.	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
550b	Any ready-to-use supplementary food (RUSF), such as: Plumpy'Sup, eeZeePaste [add locally available products]? Show the sachet.	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8	Yes.....1 No.....2 Don't Know.....8
551	Any Other Foods: Please Write Down Any Other Foods That Respondent Mentioned, But Are Not Listed Above. This Will Allow for Classification of Food Later by	Write the name of any other food consumed here:	Write the name of any other food consumed here:	Write the name of any other food consumed here:	Write the name of any other food consumed here:	Write the name of any other food consumed here:

	the Supervisor or Other Relevant Personnel.	______ ______ ______	______ ______ ______	______	______	______
552	Check Categories 529 - 551: If All 'No' Or No Food Listed In 551, Go To 553. If At Least One 'Yes', Or Any Food Listed In 551, Or All 'Don't Know,' Go To 553					
553	Did [Child's Name] Eat Any Solid, Semi-Solid, Or Soft Foods Yesterday During the Day or At Night? If 'Yes' Probe: What Kind of Solid, Semi-Solid, Or Soft Foods Did [Child's Name] Eat?	Yes .... 1 Go Back To 529-551 and Record Foods Eaten Then Continue With 554 No .... 2 Don't Know .... 8 Skip To 555	Yes........................... 1 Go Back To 529-551 And Record Foods Eaten Then Continue With 554 No .... 2 Don't Know............... 8 Skip To 555	Yes .... 1 Go Back To 529-551 And Record Foods Eaten Then Continue With 554 No .... 2 Don't Know .... 8 Skip To 555	Yes........................... 1 Go Back To 529-551 And Record Foods Eaten Then Continue With 554 No........................... 2 Don't Know .... 8 Skip To 555	Yes........................... 1 Go Back To 529-551 And Record Foods Eaten Then Continue With 554 No........................... 2 Don't Know .... 8 Skip To 555
554	How Many Times Did [Child's Name] Eat Solid, Semi-Solid, Or Soft Foods Other Than Liquids Yesterday During the Day or at Night?	Times.................. ☐☐ Don't Know...............98	Times .... ☐☐ Don't Know...............98	Times.................. ☐☐ Don't Know 98	Times.................. ☐☐ Don't Know 98	Times.................. ☐☐ Don't Know 98
555	Check 501, Are There More Children 6-59 Months in the Household?	Verify question 501 for other children aged 6–23 months: If there are no other children, go to Module–6.	Verify question 501 for other children aged 6–23 months: If there are no other children, go to Module–6.	Verify question 501 for other children aged 6–23 months: If there are no other children, go to Module–6.	Verify question 501 for other children aged 6–23 months: If there are no other children, go to Module–6.	Verify question 501 for other children aged 6–23 months: If there are no other children, go to Module–6.

MODULE 6: VENOUS BLOOD SAMPLE COLLECTION

NO.	QUESTION	CHILD 1	CHILD 2	CHILD 3	CHILD 4	CHILD 5
600	Child's Line Number and First Name from The Household Roster	Line Number ... ☐☐ Name_ _____	Line Number ..... ☐☐ Name_ _____	Line Number ..... ☐☐ Name_ _____	Line Number ... ☐☐ Name_ _____	Line Number.... ☐☐ Name_ _____
601	Check Consent: Did The Parent/Responsible Adult Provided Consent for Blood Draw?	Granted..... 1 Refused ..... 2 Not Present.... 3	Granted.....1 Refused.....2 Not Present 3	Granted ..... 1 Refused ..... 2 Not Present.... 3	Granted.....1 Refused.....2 Not Present 3	Granted .....1 Refused.....2 Not Present 3
602	Result of Blood Draw Select all that Apply	Red-Top Collected ..... 1 Purple-Top Collected. ..... 2 Not Collected 6 (Specify)	Red-Top Collected.....1 Purple-Top Collected.....2 Not Collected.6 (Specify)	Red-Top Collected ..... 1 Purple-Top Collected. ..... 2 Not Collected 6 (Specify)	Red-Top Collected ..... 1 Purple-Top Collected. ..... 2 Not Collected 6 (Specify)	Red-Top Collected.....1 Purple-Top Collected.....2 Not Collected.6 (Specify)
603	Check 600 Are there more Children 6-59 Months in the Household	Check 600 Are there more Children 6-59 Months in the Household	Check 600 Are there more Children 6-59 Months in the Household	Check 600 Are there more Children 6-59 Months in the Household	Check 600 Are there more Children 6-59 Months in the Household	Check 600 Are there more Children 6-59 Months in the Household

HEALTH TECHNICIAN (PRINT NAME)

_____TECH. CODE_____

ASSISTANT/INTERVIEWER (PRINT NAME)

_____INT. CODE_____

SUPERVISOR (PRINT NAME)

_____SIGNATURE_____