

Key Messages



NUTRITION CAUSAL ANALYSIS

October 2019-March 2020

Grand Bassa, Grand Cape Mount, Rural Montserrado, Rivercess, and Sinoe Counties



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I. INTRODUCTION

The Link NCA study for five counties in Liberia, namely Grand Cape Mount, Grand Bassa, Montserrado, Rivercess and Sinoe, is a part of a project funded by Irish Aid, designed through a consultative process with the Liberia WASH Consortium members as well as other key stakeholders. The specific objectives of the project are to formulate a strategy and Theory of Change (TOC) to address child stunting in a holistic, integrated and sustainable way and to conduct advocacy for the nutrition actions based on the experiences of the formative research. The aim of the project is to contribute to the improvement of nutritional security with replicable multi-sector interventions.

In order to design a high-impact, sustainable and replicable project design to reduce stunting; the programme was designed in three phases. The first phase, implemented in the period from September 2019 to May 2020, focused on formative research to better understand the context-specific causes of stunting and determinants of related behaviours. Three out of five consortium members, i.e. Action Against Hunger, Concern Worldwide and Water Aid, engaged in the delivery of assessments, namely the Link NCA Nutrition Causal Analysis, Barrier Analysis and Cost of Diet Assessment, to build a solid evidence base for future interventions adapted to an in-depth understanding of the context and community priorities.

The Link NCA study is a critical part of this approach, allowing a better understanding of the underlying causes of stunting and the linkages between nutrition, food security and livelihoods, water, sanitation and hygiene, gender and other thematic areas. The key findings drawn from the analysis will inform the design of the second and third phases of the project, supported by awareness raising and advocacy efforts, in order to develop an integrated optimal response aimed at reducing rates of stunting in the study area.

Pathways to stunting were mapped by three regions, as well the overarching study zone:

- Region 1** (North-Western):
Grand Cape Mount
- Region 2** (South Central):
Rural Montserrado + Grand Bassa
- Region 3** (South Eastern A):
Rivercess + Sinoe



Figure 1: Study area, by Region [Region 1- Green, Region 2- Blue, Region 3- Grey]

KEY FINDINGS

A. HEALTH

There are three main levels of health service delivery: primary, secondary, and tertiary.¹ The County Health Team is responsible for activities within their jurisdiction, but the allocation and transfer of funds is controlled at the national level.¹ Residents of urban and peri-urban areas can exercise some autonomy of choice when selecting formal health care (i.e. public or private provider), while residents of rural areas typically do not have a private care provider option and fall into the catchment area of one free government public health clinic or center.

Primary health care delivery is formally brought to the community level, and thus made more readily accessible, by Trained Traditional Midwives (TTM's), general Community Health Volunteers (gCHV's), and Community Health Assistants (CHA's). Other important informal health actors include 'black baggers,' who sell pharmaceuticals at community level, and traditional health providers/ herbalists. Though not associated with, or trained by, clinics, black baggers are seen by community members as extension of formal medical care, as opposed to a traditional care provider, because they carry the same medicines. Traditional herbalists and "country doctors" continue to play an influential, but evolving, role as health care providers, with large variance between and within county and cultural contexts. Most initial traditional treatment is applied by caregivers within their homes, in light of various health seeking barriers, including overwhelming financial and geographical challenges.

The barriers to access, utilization and quality of health services which impact community members' health-seeking behavior are summarized below.

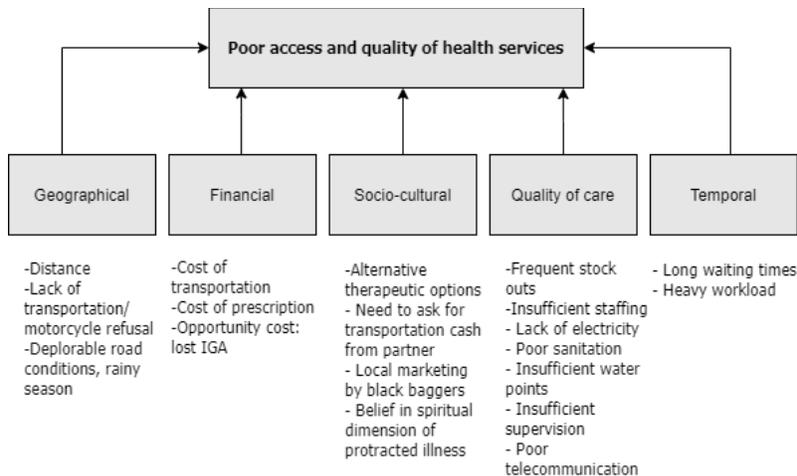


Figure 2: Summary of key barriers to health care in study zone

The percentage of children who had experienced one of the three morbidities (fever, diarrhea, and cough), per the Link NCA Risk Factor Survey, ranged from 53.4% [47.5-59.3%, 95% CI] in Region 1 to 66.2% [28.1-40.1%, 95% CI] in Region 3.² Seasonal differences in childhood illnesses mainly follow the rainy and dry seasons, with slight variation between the livelihood zones. Black baggers and

¹ Source: The Basic Package of Health Services Accreditation Final Results Report, MOHSW, 2010

² Region 2: 57.1% [50.6-63.3%, 95% CI].

pharmacies play an instrumental role in treatment of general morbidities.³ In part due to convenience, and in larger part due to being stocked with medicine, they were the most frequently sought treatment for all three major morbidities, with the exception of fever in Region 1. In Region 3, use of a black bagger or local pharmacy was significantly more likely for children living further from the nearest health facility.

The Risk Factor Survey disaggregated measles vaccination by card and caregiver recall; the percentage of children 9-59 months vaccinated for measles by either confirmation source ranged from 66.8% in Region 2 [61.0-72.6%] to 88.8% in Region 1 [85.1-92.5%, 95% CI].⁴ When only a card was considered, percentage of children vaccinated was much lower, ranging from 28.5% in Region 2 [22.9-34.1%, 95% CI] to 67.8% in Region 1 [62.4-73.3%, 95% CI].⁵ Analyses of variance suggest significant differences in confirmed measles vaccination by Region and county, with significantly higher coverage in Region 1 (Grand Cape Mount) and significantly lowest coverage in Grand Bassa and Sinoe Counties.⁶

The percentage of children 12-59 months who had a confirmed measles vaccination, had received Vitamin A in the past 6 months, and had received deworming medication in the past 6 months, ranged from 13.6% in Region 3 [8.8-18.4%, 95% CI] to 36.9% in Region 1 [30.9-42.9%, 95% CI].⁷ Subsequent analyses taking into account anthropometric measurements of children in the household revealed an association between these indicators; a child who met all three criteria was potentially less likely to be stunted in Region 2.

Despite a desire to space births two years, and a stigma attached to low birth spacing, women did not feel in control of the time between births, saying that their male partners '*love sex too much*' and/or wanted more children. Findings of the Risk Factor Survey indicated a mean birth interval over 2 years, with mean birth-spacing intervals for children under 5 years old ranging from 25.8 months in Region 1 [23.4-28.1, 95% CI] to 44.3 months in Region 3 [39.9-48.6, 95% CI].⁸ In Region 2, first-born children were significantly less likely to be stunted. In Region 3, children born less than 24 months after their next oldest sibling had potentially higher odds of being stunted.

Older women and men acknowledge suspicions toward family planning are shifting. This shift was credited to regular sensitization at the clinic and community level on the health benefits of birth spacing for both mother and child. Any form of contraceptive was used by 37.4% of women in Region 2 [31.2-43.6%, 95% CI] to 51.2% in Region 3 [44.4-57.9%, 95% CI].⁹ Over 10% of women reported using the Lactation Amenorrhea Method to prevent pregnancy. While some women retain stigmas for contraceptives passed by older generations of women, the main barriers to contraceptive use are male preference and/or fear of a changed sexual experience. Modern contraceptive use ranged from 31.9% in Region 2 [26.0-37.9%, 95% CI] to 47.9% in Region 3 [41.2-54.6%, 95% CI].¹⁰ Preference for the

³ Pharmacies are generally unregulated, offer similar health advice to black baggers, and have similar quality of care constraints- thus, coded with black baggers in Risk Factor Survey analyses.

⁴ Region 3: 75.7% [70.0-81.4%, 95% CI]

⁵ Region 3: 28.8% [22.8-34.8%, 95% CI]. If a printed Child Health Passport was not available at the child's birth or vaccination, some caregivers carried cardboard paper with vaccination and other health updates by the clinic/ vaccinators. This was considered by the study team as a confirmed card if signed by the health facility or vaccinator.

⁶ 18.5% of surveyed children in Grand Bassa measles vaccination confirmed by card; 20.6% in Sinoe County

⁷ Region 2: 20.2% [14.9-25.4%, 95% CI]

⁸ Months since the child's next oldest sibling was born. Region 2, 28.2[25.8-30.6, 95% CI].

⁹ Region 1: [43.0%, 37.1-48.9% 95% CI]

¹⁰ Not significantly lower or higher in female headed households: 40.0% [32.4-47.6%], study zone

injection instead of IUCD was based on the duration of action- an IUCD lasts for years, while the injection is taken on a quarterly basis.

Over 94% of children's mothers had attended the clinic for at least one antenatal care visit in all three regions.¹¹ The percentage of mothers who met the recommended minimum four visits ranged from 77.2% in Region 2 [70.6-83.8%, 95% CI] to 81.2% in Region 3 [75.2-87.2%, 95% CI]. Children in Region 2 and the entire study zone whose mothers had attended four or more antenatal care visits were less likely to be stunted.¹² Mothers whose previous pregnancy was desired were more likely to complete 4 or more ANC visits in Regions 1 and 2, while mothers who were more involved with decision making in Region 1 were more likely to complete 4 or more ANC visits.

Non-attendance or antenatal care visits and childbirth at a young age were considered high risk to mother and child, while giving birth at an older age was considered lower risk. While the mean age of first pregnancy ranged from 17.4 in Region 1 to 17.6 years in Region 3,¹³ the percentages of children whose mothers first became at or before the age of 18 ranged from 45.4% in Region 2 [37.5-53.5, 95% CI] to 60.0% in Region 3 [33.1-47.4%, 95% CI].¹⁴ Subsequent analyses taking into account anthropometric measurements of children in the household revealed a statistical association between these indicators; in Region 2, a child whose mother first became pregnant as a teenager was more likely to be stunted. Women whose first pregnancy occurred as a teenager were significantly more likely to report undesired pregnancies. Many unmarried adolescent girls fall in a detrimental family planning services gap. Health service centers indicated adolescent girls were unlikely to attend the clinic for contraceptives alone, unless married. They are often not included in the target audience of general sensitization sessions, i.e. already pregnant women, lactating mothers, and other female caregivers of young children.

Childbirth at a health facility is preferred but reaching the clinic or health center is often too risky or impossible due to the sudden onset of labor pains and distance. According to the Risk Factor Survey, percentage of children whose mothers had clinic deliveries ranged from 59.4% in Region 2 [53.3-65.4%] to 79.9% in Region 3 [74.8-85.0%].¹⁵ Subsequent analyses taking into account anthropometric measurements of children in the household revealed a potential association between these indicators; in Region 2 and the entire study zone, children born in a health facility are potentially less likely to be stunted. Childbirth in a health facility may serve as a proxy indicator for health facility access, with implications later in the child's life- in Regions 3 and the full study zone, children who were not born in a health facility and who lived more than one hour from the clinic were significantly more likely to be stunted than children born in a health facility and/or who lived closer to the nearest clinic.

The median days rested after delivery ranged from 14 in Region 2 to 30 in Region 3.¹⁶ The amount of time a woman rests after delivery depends on the helpers she has at home, usually sisters, sisters-in-law, a mother, and/or older female children (eight to ten years and older). Women typically take at least 3 months before having sex with their husbands after birth. In addition to their own desire for

¹¹ Region 1 : 94.9% [91.6-98.2%, 95% CI], Region 2 : 95.6% [92.4-98.8%, 95% CI], Region 3 : 98.2% [96.1-100%, 95% CI].

¹² Question posed regarding the mother's last pregnancy, not necessarily the child assessed for stunting.

¹³ Region 1: 17.4[17.0-17.7 CI], Region 2: 17.6[17.2-18.0 CI], Region 3: 17.5[17.1-18.0 CI].

¹⁴ Region 1: 55.6% [48.0-63.0%, 95% CI].

¹⁵ Region 1: 78.5% [73.6-83.4%]. Analysis of variance suggests significant variation between regions (p-val 0.000).

¹⁶ Region 2, median days rested: 30

intimacy, motivators for resuming sexual activity are also rooted in jealousy and a fear that a man might find a different partner.

B. NUTRITION AND CARE PRACTICES

"Rice is the food considered for our health. Rice is the food our grandparents were eating and we also eat. It is our staple food that we cannot live without."

Focus group participant, Grand Cape Mount

Liberians in the study zone oscillate between rice and cassava-based diets, depending on the time of the year. Rice is heavily preferred, referencing a common attitude that *"one has not eaten at all if one has not eaten rice"*.

*'When food is plenty'*¹⁷; Liberians in the study zone prefer to eat three times per day- across regions, this is most often realized in the dry season, post-harvest, though with less disruption in peri-urban areas. If food is cooked for the family, it is typically eaten by all family members- though not necessarily at the same time. It is important to note that meal frequency also increases the workload of the woman. As sauces and starch base (cassava/rice) do not preferably repeat in the day, women need to prepare fresh meals at different times of the day. While a woman often sets aside a portion of any leftover meal for later in the day or the next day, daily preparation of food represents a significant portion of her daily workload.

Good nutrition during pregnancy is seen as an important part of the development of the baby, but generally less achievable than antenatal care visit attendance, because of the daily implied costs and/or lifestyle changes. Women who did attend antenatal care visits indicated that they heard what foods to eat while pregnant but cited financial barriers. Foods listed as 'good' for the pregnant woman ranged from more starches,¹⁸ to vegetables,¹⁹ and fruits.²⁰

According to the Risk Factor Survey, 62.0% [48.0-74.2%, 95% CI] of currently pregnant and/or lactating women increased their intake during pregnancy, while 32.4% [21.5-45.6%, 95% CI] of women did not have the appetite to.²¹ This corroborates reports from both men and women, who indicated that many women actually *reduce* their intake during pregnancy, because of frequent nausea. A woman's appetite generally increases during breastfeeding; 89.5% [85.3-92.6%, 95% CI] of children's lactating mothers increased their intake during breastfeeding, while only 3.4% [1.8-6.5%, 95% CI] did not have the appetite to.²² Taboos play an important and interesting restriction on pregnant and lactating women's intake, though, like personal taboos, no major food groups were listed as taboo. Because a child and woman's nutritional needs are intertwined during pregnancy and lactation, according to some town's traditions, women are not allowed to consume the husband's taboo food (as well as her own) during this period.

According to the last DHS Survey, nationally, a little more than half [55%] of children under 6 months are exclusively breastfed; the 2018 CFSNS reported a slightly lower percentage- 51%. Both were a celebrated increase over the 29% exclusive breastfeeding found in the 2007 DHS. While the Risk Factor

¹⁷ Meaning, when the household is not food insecure and has access to the quantity and diversity of meals desired.

¹⁸ Eddoes, plantains, bulgur wheat.

¹⁹ Especially leafy greens.

²⁰ Oranges, pineapple- but not good for lactation, due to 'sour in the stomach' in the breastfeeding child.

²¹ 5.6% indicated they had the appetite to eat more, but food/ resources were unavailable.

²² 7.1% said they had the appetite to eat more, but the food was not available.

Survey sample size was not powered to estimate prevalence of exclusive breastfeeding, 56.4% [46.9-65.8% CI] of children 0-6 months surveyed were exclusively breastfed, ranging from 46.3% [30.4-62.3%, 95% CI] in Region 2, 57.9% [41.4-74.3%, 95% CI] in Region 3, to 67.7% [50.3-85.2%, 95% CI] in Region 1.²³

Discussions during the Link NCA reflected protracted challenges in exclusive breastfeeding, despite targeted sensitization at health facility level, beginning with breastfeeding initiation. While clinic staff say they encourage women to breastfeed upon delivery, initiation is delayed for mothers who give birth on their way to the facility or at home. Early introduction of water remains a widespread but non-universal practice, as exclusive breastfeeding is sometimes understood as abstinence from food and/or juices but not water- in the Risk Factor Survey, 39.3% [30.3-49.1%, 95% CI] of children 0-6 months had received clear water in the day prior. While behavior change communication, strategies have targeted early introduction of water, other important breaches in exclusive breastfeeding include a woman's illness and pregnancy.

Three-quarters [75%, 95% CI [60.1-89.9%, 95% CI] of children surveyed were still breastfed after one year; this was not significantly associated with stunting. In the study zone, sufficient nutrition during the complementary feeding window (6-24 months), including meal frequency, dietary diversity, and food safety, is well documented as lacking. Challenges perpetuating inadequate IYCF are much more nuanced than knowledge barriers, especially in the new generation of mothers who give birth in a health facility. The two most common inappropriate complementary feeding practices are binarily problematic: discontinued breastfeeding at six months (meaning, food with no complementary breastmilk) and extended exclusive breastfeeding past 6 months, delaying introduction of soft/semi-solid foods. The Risk Factor Survey indicated delayed introduction of complementary foods; more than one in five children [21.8%, full study zone] 6-18 months in all three regions, were fed zero meals in the twenty four hour recall period;²⁴ compared to 1.7% of children age 18-36 months fed zero meals.²⁵ Even the youngest children in the complementary feeding window (6-18 months) were fed a median two meals per day in all three regions.²⁶ A child in the complementary feeding window who was breastfed only (thus, meal frequency of zero) was significantly more likely to be concurrently wasted and stunted (WaST).²⁷

Dietary diversity in Liberia can be generally labelled as inadequate for children and households. As noted above, the diet of young children mirrors that of the other family members and is typically not more (or less) diverse. The mean Infant Dietary Diversity Score, expanded to include children 6-36 months, ranged from 2.1 [1.9-2.7, 95% CI] in Region 1 to 2.7 [2.5-2.9, 95% CI] in Region 3,²⁸ falling short of the maximum score of 7 food groups, as well as the recommended minimum score of 4 food groups. Only 10.3% [7.6-13.1%, 95% CI] of children across the study zone met the recommended 4 food groups.²⁹

²³ Region 1: 67.7% [50.3-85.2%], Region 2: 46.3% [30.4-62.3%], Region 3: 57.9% [41.4-74.3%]. Due to a relatively small sample size, this finding should be taken with precaution and not used in project proposals.

²⁴ Region 1: 21.4% [10.3-32.5%]; Region 2: 22.4% [11.4-33.5%]; Region 3: 21.5% [11.3-31.8%]; Full study zone: 21.8% [15.7-27.9%]

²⁵ Full study zone: [0.2%-3.1% 95% CI].

²⁶ Full study zone: [0.2%-3.1% 95% CI].

²⁷ In Region 3, these children were also significantly more likely to be wasted.

²⁸ Region 1: 2.1[1.9-2.3 95% CI], Region 2: 2.4[2.2-2.5 95% CI], and Region 3: 2.7[2.5-2.9 95% CI].

²⁹ Full study zone: 10.3% [7.6-13.1], Region 1: 8.8[4.4-13.3], Region 2: 11.8[6.8-16.8], Region 3: 10.4[5.4-15.5]. No significant variation between livelihood zones, according to ANOVA.

Density and texture of the meal might be altered for the children, particularly tougher forms of cassava. Understanding portions appropriate for a child's age also appears to be a challenge. According to secondary literature review and observation,³⁰ young children are often assisted by older siblings, 8-10 years old and above, who might not participate in active feeding like a mother would. Inadequate consumption might also be linked to several gastrointestinal symptoms in young children from cassava, strengthening preferences for rice.

When a child reaches the stage of 'no longer taking titty water',³¹ s/he increasingly feeds for himself with assistance from older siblings, an aunt, and/or the grandmother. In larger families, girls age 10 and above play an assistant role, shadowing the mother in all her tasks and implementing other basic tasks, such as bathing the children and sweeping. Only 7.1% of children were primarily kept by the father, in the mother's absence [5.2-9.7%, 95% CI], and 14.6% of women said they must carry the child everywhere they go [11.8-17.8%, 95% CI]. In Region 3, children who are primarily watched by their fathers were potentially less likely to be stunted, while in the same region, children watched by their grandmother were potentially more likely to be stunted. Children watched by an auntie in Region 3 were significantly more likely to be WaST.

C. FOOD SECURITY AND LIVELIHOODS

The seven livelihood zones of the study area, while characterized by certain special features/income opportunities, rest on a base economy of cassava-dominated-with-supplemental-rice and rice-dominated-with-supplemental-cassava.³² Rubber and charcoal production, with supplementary small scale agriculture, characterize LR08 in Region 2, Rural Montserrado. The Coastal Fishing and Cassava livelihood zone (LR05) represents the strip along the Atlantic coast in all 5 of the study counties and it is characterized by fishing activities, with increasing resemblance to the peripheral Coastal Plain Cassava with Rice & Inland Fishing livelihood zone (LR04) 5 km inland.³²

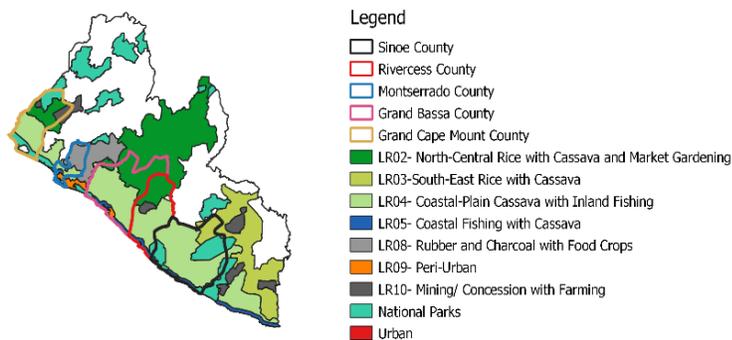


Figure 3: Livelihood zones [2017] and study counties

Artisanal/ makeshift mining (LR10 activity) is growing in north and central Region 1, which sits on a rice-with-cassava (LR02) economy.³³ The primary motivator for an individual's or community's shift to mining activities is the perception of mining as lucrative. Secondary motivators include dissatisfaction with agriculture, which is tedious and sometimes dangerous. In Region 2, the peri-urban livelihood zone (LR09)

is defined by a proximity to Buchanan (Grand Bassa), Monrovia, and Kakata (Margibi). Despite some access to land, income generating activities in this zone are mostly defined by the needs of

³⁰ Source: Yovsi, R.; Samba, K.; Bahr, B. et al. 2010. A Qualitative Study of Infant and Young Child Feeding Practices in Liberia. UNICEF.

³¹ Breastmilk.

³² Source: FEWSNET. 2017. Livelihood zoning activity in Liberia - Update

³³ Golakonneh, Porkpa, and Tewor Districts.

the city for residents along the main road and a blend of activities (agricultural and non-agricultural) for residents further away from the main road. While the agricultural livelihood zones of Region 3 share common income generating activities as Regions 1 and 2, LR10 in Region 3 is increasingly defined by larger scale gold and diamond prospecting/mining activities, organized both at an individual (artisanal) and a corporate level. However, both income streams are sporadic, based on production. Women's income generating activities generally supplement those of men, though are less defined by the livelihood zone.

Aside from formal employment in peri-urban livelihood areas, few activities in the three study regions generate income year-round; the rainy season consistently disrupts most households' main sources of income, especially in agricultural zones. In the Link NCA Risk Factor Survey, 56.1% [48.6-63.3%, 95% CI] of heads of households in Region 1 were primarily engaged in farming, followed by 15.9% [11.5-21.6%] engaged in mining. In the same region, the predominant income source for women was petty trade or business [39.4%, 29.6-50.2% 95% CI], followed by farming [37.7%, 28.3-48.1% 95% CI] and allowance/support from a partner [20%, 12.9-29.7% 95% CI]. A child whose mother was engaged in petty trade was less likely to be stunted in Region 1.

In Region 2, 45.1% [37.7-52.7% 95% CI] of children's heads of households were primarily engaged in farming, followed by 13.4% [8.6-20.3% 95% CI] engaged in daily labor. Women's primary income generating activity in Region 2 was petty trade [44.2%, 36.4-52.3% 95% CI], whether or not they live in an agricultural livelihood zone. The secondary source of income for women in agricultural livelihood zones in LR02 was farming [31.0%, 23.2-40.1% 95% CI], followed by allowance from a partner [11.7%, 6.2-21.2% 95% CI]. In a non-agricultural livelihood zones, the secondary source of income was a partner's allowance [33.9%, 23.4-46.4% 95% CI], followed by daily hire [5.2%, 2.2-12.1% 95% CI]. A child whose head of households was engaged in business and/or petty trade was less likely to be stunted in Region 2.

In Region 3, 51.5% [44.6-58.3% 95% CI] of children's heads of households were primarily engaged in farming, followed by 10.9% [7.1-16.3% 95% CI] engaged in mining activities, and 10.0% [6.2-16.0% 95% CI] formally employed. Women's primary income generating activity was petty trade [36.7%, 30.3-43.5% 95% CI], followed by agriculture [33.8%, 27.9-40.2% 95% CI]. However, in agricultural livelihood zones of Region 3, the inverse relationship exists: the primary income source for women is agriculture [39.7%, 31.9-48.2% 95% CI], followed by petty trade/ business [32.1%, 24.5-40.7% 95% CI]. A child whose head of household was engaged in business and/or petty trade was less likely to be stunted, while a child whose head of household was engaged in agriculture was more likely to be stunted. A child whose mother depended on allowance from a partner was less likely to be stunted. While perhaps counterintuitive, only 16.7% [10.0-26.5% 95% CI] of women in Region 3 depend on allowance from their husbands. From qualitative inquiry, these were typically partners who were making sufficient income from mining or farming that the woman did not need to work.

Communities in the overarching study zone were not making major investments in livestock due to multiple deterrents to maintenance. Firstly, for poor families, the cost of keeping the animal healthy is prolonged and high. In addition, goats and larger livestock are believed to be an invitation for easy theft. As the war depleted livestock, the current generation of farmers did not say animals were part of their upbringing or that they learned livestock management practices in

traditional schooling. Average number of owned chickens ranged from 8.7 in Region 2 to 10.4 in Region 3. Average number of sheep/ goats owned exceeded one only in Region 3. Subsequent analyses taking into account anthropometric measurements of children in the household revealed a significant statistical association between these indicators in Region 2, such that ownership of livestock presented a significant risk factor to stunting. However, this is likely confounded by the role of livestock in increasing exposure to fecal contamination.

Food is the pre-dominant expense across the Link NCA study's livelihood zones. According to the 2018 CFSNS, 53% of the population in Grand Cape Mount, Region 1; 48% of the population in Rural Montserrado and 54% of the population in Grand Bassa, Region 2; and 53% of the population in Rivercess and 44% of the population in Sinoe, Region 3 spend over 65% of their expenditures on food. In addition to food, school also presents a significant cost, as families who can afford to send their children to Buchanan or Monrovia for schooling, do so and thus incur a significant cost.

According to the Risk Factor Survey, the percentage of children under 5 years old who live in households financially supporting older children attending an urban school ranged from 45.5% in Region 2 [40.1-50.9%, 95% CI] to 60.6% in Region 3 [54.9-66.2%, 95% CI].³⁴ Subsequent analyses taking into account anthropometric measurements of children in the household revealed a significant statistical association between these indicators; a child whose household was supporting an older child in an urban school was less likely to be stunted. This perhaps suggests that households that can support urban school tuition fees also have money to provide food and other needs in the home.

As is true for income generating activities, household expenses generally follow the rainy and dry seasons, with a tendency to increase in the Christmas season, as families are expected to celebrate the holidays and women are typically given a small allowance for purchasing items for the women.

Poor road conditions further limit opportunities for rural citizens, primarily in market integration with urban areas. Within rural road networks, poor infrastructure limits access to markets, especially during rainy season. Bridge crossings are frequent, due to the country's web of inland creeks and rivers. In the absence of a bridge, canoes and/or rafts ferry people and/or motorbikes back and forth, for a fee. In addition to inconsistent maintenance, heavy trafficking by mining and logging companies exacerbate poor road conditions for parts of all three regions. In addition to difficult road conditions to access markets, national inflation rates exacerbate an already poor purchasing power from insufficient income and thus represent a significant financial barrier to access the commodities.

The median distance (time) to the market ranged from 30 minutes in Region 2 to 97.5 minutes in Region 3, although the median time in the agricultural livelihood zones of Region 2 rose to 45 minutes. In central and northern Sinoe County of Region 3, distance to the market reaches extremes as the mean distance walked to the market reached 122.1 minutes [93.3-150.9 95% CI]; while some communities reported relying on Greenville market, which could require up to 8 hours of transit. Two communities sampled for the Risk Factor Survey described their market access as

³⁴ Region 1: 54.2% [49.0-59.4%, 95% CI]

4 hours of walking to the nearest town and subsequent 3 hours on motorcycle to reach Greenville. Children who live more than one hour from the market were more likely to be stunted in Regions 2, 3, and the pooled study zone.³⁵ Children whose households have market access at least 10 months in the year were less likely to be stunted in Region 3.

Community members in the three regions described the rainy season as a challenging time to maintain the health and well-being of their families. According to the Risk Factor Survey, adequate months of household food provisioning (MAHFP) ranged from 10.1 months [9.9-10.3, 95% CI] in Region 3 to 10.4 months [10.2-10.5, 95% CI] in Region 2. Due to challenging market access and reduced farming activities, the most challenging months coincide with the rainy season (April to August, peaking in June/July), i.e. several months after the Risk Factor Survey.

During the Risk Factor Survey, which took place at the tail-end of the dry season, children living in households, which were engaging in medium coping strategies³⁶ ranged from 11.2% in Region 3 [7.5-14.9%, 95% CI] to 30.9% in Region 1 [26.0-35.7% 95% CI].³⁷ The majority of children lived in households engaged in low coping strategies, ranging from 68.3% in Region 1 [60.7-75.0%, 95% CI], to 85.2% in Region 2 [78.7-90.0%, 95% CI], and 88.8% in Region 3 [83.1-92.7%, 95% CI]. The most commonly deployed coping strategy during the quantitative data collection period in Regions 2 and 3 was a consumption of less preferred or expensive foods, i.e. cassava instead of rice.

In Region 3, a child in a household with medium or high rCSI was significantly more likely to be concurrently wasted and stunted (WaST). In the same region, consumption of less expensive foods and reducing meal portions were associated with stunting, meaning a child whose household engaged in those strategies might be more likely to be stunted. Restricting consumption by adults to prioritize small children's food intake was associated with stunting in Region 3, and significantly associated with stunting in the entire study zone, meaning that children whose households engaged in those strategies might be more likely to be stunted in Region 3, and were more likely to be stunted in the entire study zone.

Formal and informal crediting schemes are common across the study zone as citizens struggle to navigate market instability and price fluctuations. The most common club reported in the Risk Factor Survey was a VSLA or *susu*; ranging from 39.4% [33.6-45.2% 95% CI] in Region 1, to 39.0% [33.0-45.0%] in Region 2, to 42.5% [36.2-48.8%, 95% CI] in Region 3. In Region 1 and the entire study zone, a child whose mother participated in at least one or more external support club/group, including a VSLA, *susu*, mother's group, or agricultural *koo*, were potentially less likely to be stunted.

³⁵ OR Region 2: 2.00[1.19-3.35], OR Region: 2.11[1.18-3.80; Full study zone 1.70[1.26-2.29].

³⁶ Reduced Coping Strategies Index

³⁷ Region 2: 14.5% [10.7-18.3%, 95% CI]

D. WATER, SANITATION AND HYGIENE

Fresh water courses through mainland Liberia in a vast network of inland streams and rivers facilitate physical access of Liberians in the study zone to one or multiple sources of water. However, many are still water insecure as access to protected water points is much less ubiquitous.

According to the Risk Factor Survey, the most common protected source of water in a household was a hand pump, ranging from 48.5% [43.3-53.7%, 95% CI] of total children's households in Region 2 to 78.8% [72.72-82.7%, 95% CI] in Region 1.³⁸ The next most common source of water for households was unprotected; the percentage of households that relied on the creek for water reached 42.6% [37.8-47.4%, 95% CI] in Region 3.³⁹ Rainwater, which requires no distance walked, is frequently collected with buckets outside of the household, but is a supplementary source of water for washing clothes and cooking.⁴⁰ A child whose household's main source of water was an improved water point was less likely to be stunted in Region 3

In towns with multiple water points, the decision-making tree guiding which water point to use factors in availability, distance, quality, and preference. The selection of a water source is primarily conditioned by its proximity. After proximity, the community members typically prioritized quality of a water point, preferring a hand pump first, then a well and a creek in the third place, usually reserved for cooking and bathing only, with the exception of elderly households, which would use it for drinking as well. Distance to the used waterpoint (therefore, not necessarily an improved source) ranged from an average of 5 minutes in Region 1 [4.2-5.8 mins, 95% CI] to 8.3 minutes in Region 3 [6.7-9.9, 95% CI].⁴¹ When factoring in waiting time at the water point,⁴² average fetching time (one-way) increased to 13.3 minutes in Region 1 [11.1-15.5, 95% CI] to 14.9 minutes in Region 3 [12.4-17.4, 95% CI]. Children who live more than 20 minutes from the water point were significantly more likely to have experienced diarrhea in the two-week recall period.

As nearly all Liberians in the study zone rely on fetching water outside of their household, drinking water is carried to and stored in the household in buckets and/or plastic gallons. The buckets are typically not cleaned as it is believed that the water carried in a bucket washes it. Households typically store water in covered gallons, with a narrow mouth, but it is brought out of the house into large tubs for prolonged use. The Risk Factor Survey assessed household water transportation and management using a composite index with 0 indicating the lowest risk and 7 indicating the highest risk of contamination. The findings demonstrate a mean score ranging from 2.8 in Region 1 to 3.3 in Region 2, indicating most households fell into the 'mild risk' of water transportation and management.⁴³ Subsequent analyses taking into account anthropometric measurements of children in the household revealed a significant statistical association between these indicators;

³⁸ Region 3: 54.3%[49.6-59.0%, 95% CI]

³⁹ Region 1 : 13.3% [9.6-18.1%, 95% CI], Region 2 : 28.2% [24.7-32.0%, 95% CI]

⁴⁰ Risk Factor Survey took place in the dry season; percentage of households that rely primarily or solely on rainwater increases in peak rainy season months.

⁴¹ Region 2: [5.4, 4.6-6.2] 95% CI.

⁴²Source: Liberia Ministry of Public Works. 2017. Liberia Water Point Survey. Basic water service defined as 30 minutes round trip to the improved water source.

⁴³ Household Water Transportation and Management Checklist, Link NCA Indicator Guide.

as household water transportation and management scale risk increased, a child's HAZ decreased- meaning they were more likely to be stunted.

Point of use water treatment (POUWT) is low. In the Risk Factor Survey, percentage of households that treated water before drinking ranged from 6.9% [4.0-9.9%, 95% CI] in Region 3 to 12.4% [8.8-16.0%, 95% CI] in Region 2.⁴⁴ However, when safe methods are considered as separate from unsafe methods, the percentage of water treatment is quite lower: less than 1% [0.5%, 0-1.0%, 95% CI] of households boil their water, which is only safe if done for recommended duration.⁴⁵ Just over 6% [6.3%, 4.8-7.8%, 95% CI] in the pooled study zone chlorinate water at home, which is efficient only if the water is not turbid.⁴⁵ Comparatively, 7.0% of rural households⁴⁶ utilized this method in 2013, according to the DHS data.

The GOL has endorsed the community-led total sanitation (CLTS) model with a heavy emphasis on "triggering" community disgust toward open defecation. The highest percentage of households without improved sanitation live in Grand Bassa and Rivercess counties of Regions 2 and 3, respectively.⁴⁷ However, outside of recent NGO-interventions, it was uncommon to see a used latrine in the community. A major barrier cited was the anticipated cost of latrine construction, which community members estimated at \$175-400 USD. Unlike in case of water points, which benefit from the community-level management, there are fewer systems in place for the management of sanitation facilities, including their cleaning or maintenance. A consistent discrepancy was noted with perceived risk and practice of cleaning a latrine. Most communities that ranked this as a low risk activity did not have experience cleaning a latrine and deferred this responsibility to community leaders if a public latrine was made available.

Use of public latrines by children was nil. In the rare occasion one was available, it was deemed too unclean for children. Because children were feared to be at risk of falling into the latrine, communities with private latrines maintained a bucket ("child potty") instead, and from which child feces then immediately thrown in the latrine. According to the Risk Factor Survey, the most common place of defecation for children less than 36 months was a washable diaper, ranging from 42.8% [36.4-49.5%, 95% CI] in Region 2 to 50.3% [43.2-57.3%, 95% CI] in Region 1.⁴⁸ If a child does not utilize a child potty or washable diaper, s/he defecates openly.

Washable diapers are handmade, composited of layers of cloth and plastic, meaning a strip of cloth is laid against the child's body, and then the baby is wrapped in plastic, sealed with more cloth or plastic at the top. An important role of the mother is to check and change the baby every time s/he defecates. By observation, a child is often left in his diaper for several hours at a time, and the diaper is cleaned during the time of other clothes' cleaning- once two twice a day. Mothers said this was a tedious task due to their already high workload. While they understood its importance, they said it was challenging to set aside more time for this activity apart from the regular times when a child is changed into clean clothes. In Region 2, a child who defecated in a washable diaper, as opposed to a latrine or disposable diaper, was more likely to be stunted.

⁴⁴ Region 1: 11.1% [7.8-14.4%, 95% CI]

⁴⁵ Link NCA Indicator Guide.

⁴⁶ Nationwide.

⁴⁷ Source: 2018 CFSNS.

⁴⁸ Region 3: 48.4% [41.3-55.6%, 95% CI]

Children over the age of 18 months, who were still kept in washable diapers, were also more likely to be stunted in Region 2 as well as the entire study zone.⁴⁹

Cleanliness is an important tenant of an 'ideal' man, woman, and baby, but handwashing is believed to be the responsibility of adults and not necessarily small children. The most frequently identified key handwashing times was before eating, followed by after defecation. Washing hands before cooking was perceived as less important, because the food is cooked so the heat will kill the germs. In the Risk Factor Survey, a presence of hand/bathing soap was confirmed in 63.7% of child's homes in Region 3 [58.1-69.2%, 95% CI] to 84.6% in Region 2 [80.3-89.0%, 95% CI].⁵⁰ Confirmed presence of laundry soap was lower, ranging from 42.4% in Region 3 [36.6-48.1%, 95% CI] to 53.1% in Region 2 [47.3-58.9%, 95% CI].⁵¹

A child whose household had either, or both, handwashing and laundry soap was potentially less likely to be stunted in Region 1. In the entire study zone, a child whose household had either, or both, handwashing and laundry soap was significantly less likely to experience diarrhea. Presence of soap significantly negatively correlated with distance to the market, meaning soap was less likely to be found in households further from the market.

Despite frequent bathing, caregivers conceded that keeping the child clean is next to impossible, as the play area is a shared household yard, which is nearly always dirty. Mats are infrequently prioritized for the child. A child who was observed playing in the dust or mud was significantly more likely to be stunted in Region 2, and, in the entire study zone, potentially more likely to be stunted. Children who last defecated openly, and not in a latrine or disposable diaper, were more likely to be unclean. Children in agricultural livelihood zones were also more likely to be observed as unclean during the Risk Factor survey, compared to children in peri-urban livelihood zones who were less likely to be unclean. Children who lived more than one hour from the market, as well as children who lived more than one hour from the health facility, were more likely to be unclean. Food preservation is another hygienic concern at household level. Leftover rice, soup, and/or cassava are typically kept aside in a covered pot and then reheated for all family members, including young children. In Region 2; a child whose household preserved food and was classified as very poorly hygienic⁵² was more likely to be stunted.

E. GENDER

"Tradition makes laws in our community, tradition trains people how to become a good wife or husband, tradition makes peace in the community."

Focus group participant, Sinoe

Traditional knowledge systems play a major role in defining gendered expectations, especially in rural areas. In addition to teaching young people local customs, marital roles, and livelihood skills, cultural traditions set rules and regulations enforced by town chiefs and/or elders. Youth themselves felt that, while traditional values of respect and marriage still largely defined their

⁴⁹ Children who were kept in washable diapers were more likely to be wasted in Regions 1 and 2.

⁵⁰ Region 1: 67.1% [61.6-72.7%, 95% CI]

⁵¹ Region 1: 52.5% [46.8-58.2%, 95% CI]

⁵² Score of 4 or more on the HH hygiene checklist.

identities, the role of societies was shifting, largely because they would prefer to invest their time in formal education, if given the choice

Daily workload of both men and women is reported as high. In agricultural livelihood zones, women's workload is especially high during the weeding season when they must tend to their household and field duties simultaneously. When a woman is pregnant, her daily workload tends to decrease but she still needs to tend to certain tasks, such as fetching water, nevertheless. The total number of children a woman negatively correlated with a woman's workload, meaning that the more children a woman had, the more likely she was to identify with a heavier workload. Widows and single mothers assume both caretaker and head of household roles.

While some older women blamed family planning access for early coupling, coupling transitioned to marriage early most often because of pregnancy, i.e. a young couple was not taking family planning and the woman became pregnant, thus the couple deciding to start a household together. Other reasons for early coupling and/or marriage were dissatisfaction with the care received at home, peer pressure, interest in sex, and/or a desire to start one's own family. While only a proxy measure of marriage, in the Risk Factor Survey, the percentage of mothers who first became pregnant at 14 or earlier ranged from 10.8% in Region 2 [6.9-16.5%, 95% CI] to 16.1% in Region 1 [10.6-23.6%, 95% CI].⁵³

The percentage of children who lived in polygynous households, by either female or male report,⁵⁴ per the Risk Factor Survey, ranged from 10.6% in Region 2 [7.2-14.1%, 95% CI] to 21.1% in Region 1 [16.7-25.6%, 95% CI]. Multiple co-wives were reported only in Region 1, in 4.6% of children's households [2.1-7.2%, 95% CI]. Subsequent analyses taking into account anthropometric measurements of children in the household did not reveal any statistical association between these indicators, which means that polygyny did not seem to be a risk factor for stunting in the study population.⁵⁵

"The man is the hustler for the money so he is the one to decide in the home, but if the woman has some money, she can make the decision too."

Focus group participant, Grand Bassa, LR04

The way decisions are made in the home varies widely within and between study areas. The percentage of children whose mothers made or jointly made three or more of the studied decisions⁵⁶ ranged from 17.6% in Region 1 [13.0-22.1%, 95% CI] to 32.9% in Region 3 [26.7-39.1%, 95% CI].⁵⁷ The percentage of mothers who were involved in no household decisions ranged from 19.2% [14.3-24.1%, 95% CI] in Region 2 to 35.5% [29.8-41.2%, 95% CI] in Region 1.⁵⁸ While a woman's decision-making did not significantly associate with stunting, it did significantly associate with antenatal care attendance in Region 1 and perception of external support in the overarching study zone.

⁵³ Region 3: 11.3% [7.0-17.7%, 95% CI].

⁵⁴ Question was posed to both the head of household and the female caregiver; indicated as yes if either or both said yes.

⁵⁵ Analyses of variance indicate significant variance by Region; highest rates of polygyny in Region 1.

⁵⁶ Family planning, contraceptives, sending a child to school, taking child to the clinic, use of household money

⁵⁷ Region 2: 30.4%, [24.7-36.1%] 95% CI

⁵⁸ Region 3: 22.1% [16.6-27.6%, 95% CI]

A woman's social support network plays a major role in offsetting her workload, either by helping with childcare or assuming chores. In times of insurmountable stress, many women indicated that they had someone in their life to listen to and comfort them, but not necessarily to alleviate them from their situation. A concerning number of women, however, felt that in times of stress, they had no one to speak to or be comforted by- ranging from 18.9% in Region 1 to 25.0% in Region 3. In Region 2, a child whose mother had the lowest perceived external support was possibly more likely to be stunted. In the same region, a child whose mother had the lowest external support was more likely to be WaST. Women who migrate to mining/ concession areas were noticeably at higher risk of lacking social support networks.

F. UNDER-NUTRITION

ANTHROPOMETRIC DATA COLLECTION RESULTS

The anthropometric data collection findings revealed a prevalence of global chronic malnutrition (GCM) on the basis of height-for-age z-score at 33.8% [29.2-38.7%, 95% CI] in Region 1, 34.1% [27.0-42.0%, 95% CI] in Region 2, and 36.4% [29.6-43.7%, 95% CI] in Region 3. Prevalence of global acute malnutrition (GAM) on the basis of weight-for-height z-score is estimated at 5.4% [2.8-10.2%, 95% CI] in Region 1, 7.1% [4.6-10.9%, 95% CI] in Region 2, and 8.7% [5.5-13.5, 95% CI] in Region 3. The prevalence of severe acute malnutrition (SAM), according to the same criterion, was estimated at 1.4% [0.5-3.7%, 95% CI] in Region 1, 2.6% [1.2-5.8%, 95% CI] in Region 2, and 3.1% [1.4-6.4%, 95% CI] in Region 3.

References	Indicators	Region 1		Region 2		Region 3	
WHZ	Global Acute Malnutrition W/H <-2 z-score and/or edema	Z-scores and/or edema (N =294)	5.4 % (2.8 - 10.2 95% CI)	Z-scores and/or edema (N =267)	7.1 % (4.6 - 10.9 95% CI)	Z-scores and/or edema (N =229)	8.7% (5.5-13.5 95% CI)
	Severe Acute Malnutrition W/H <-3 z-score and/or edema		1.4 % (0.5 - 3.7 95% CI)		2.6 % (1.2 - 5.8 95% CI)		3.1 % (1.4 - 6.4 95% CI)
Edema	Bilateral pitting edema	Age= 0-59 months (N =322)	0.0 %	Age= 0-59 months (N =310)	0.03% (0.0-2.3 95% CI)	Age= 0-59 months (N =269)	0.4% (0.0-2.6 95% CI)
HAZ	Global Chronic Malnutrition H/A <-2 z-score	Z-scores (N =293)	33.8 % (29.2 - 38.7 95% CI)	Z-scores (N =270)	34.1 % (27.0 - 42.0 95% CI)	Z-scores (N =231)	36.4 % (29.6 - 43.7 95% CI)
	Severe Chronic Malnutrition H/A <-3z		12.6 % (8.6 - 18.2 95% CI)		11.9 % (7.6 - 18.1 95% CI)		16.0 % (10.5 - 23.7 95% CI)
WaST	Wasting & Stunting H/A <-2 z-score and W/H <-2 z-score	Composite (N= 293)	3.4% (1.9-6.2 95% CI)	Composite (N= 267)	4.1% (2.3-7.3 95% CI)	Composite (N= 231)	4.0% (2.1-7.4 95% CI)
WAZ	Global Underweight W/A <-2z	Z-scores (N =294)	17.7 % (12.4 - 24.6 95% CI)	Z-scores (N =267)	21.0 % (14.9 - 28.7 95% CI)	Z-scores (N = 231)	18.2 % (13.8 - 23.6 95% CI)

	Severe Underweight W/A < -3z		3.4 % (1.8 - 6.5 95% CI)		7.1 % (3.6 - 13.5 95% CI)		7.4 % (4.2 - 12.6 95% CI)
MUAC	Global Acute Malnutrition (MUAC <125mm) and/or edema	Age = 6-59 months (N =295)	2.7 % (1.2 - 6.0 95% CI)	Age = 6-59 months (N =271)	5.2 % (2.6 - 9.9 95% CI)	Age = 6-59 months (N =232)	4.3 % (2.3 - 8.0 95% CI)

Table 1: Summary of anthropometric results, Risk Factor Survey

In addition to risks posed by respective classifications of undernutrition, secondary literature suggests increased mortality in children with multiple anthropometric deficits.⁵⁹ The prevalence of children who were both wasted and stunted ranged from 3.4% [1.9-6.2%, 95% CI] in Region 1 to 4.1% [2.3-7.3%, 95% CI] in Region 2.

Concurrence of anthropometric deficits was common in wasted children and less common in stunted children. All children who were wasted and stunted were also underweight. In Region 3, all underweight children were also wasted, stunted, or both.

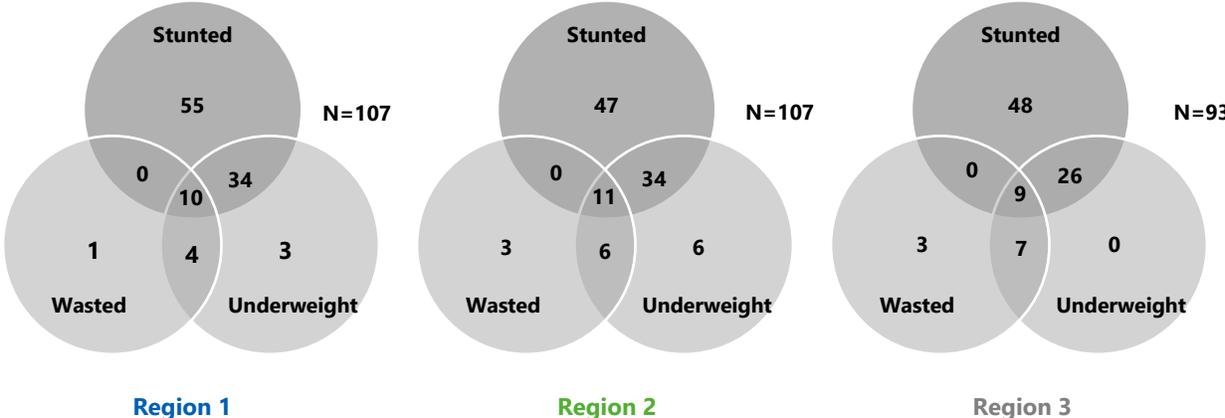


Table 2: Number of cases by anthropometric deficiency, Risk Factor Survey⁶⁰

G. COMMUNITY PERCEPTIONS OF UNDERNUTRITION AND THERAPEUTIC ROUTES

The population in the sampled communities referred to undernutrition using 45 terms, 20 of which referred to chronic malnutrition, 18 of which were used to identify the marasmic form of acute malnutrition, and 8 of which described kwashiorkor.

Most community members did not often indicate wasting in their own community but associated it with their lived experiences in civil war. If a community did have a marasmic child, this child was readily identified as 'dry'- the Liberian English phrase for wasting used ubiquitously across the study zone, though interpretations in local dialects were interchangeably used. When asked what causes a child to be dry, responses directly or indirectly blame mother's negligence. A child is at risk of becoming dry if he 'does not get food on time,' is not washed frequently enough, and/or has frequent diarrhea. Fathers were seldom directly blamed, though general socioeconomic

⁵⁹ Source: Myatt et al. 2018. Children who are both wasted and stunted are also underweight and have a high risk of death: a descriptive epidemiology of multiple anthropometric deficits using data from 51 countries. *Arch Public Health*. 2018; 76: 28.

⁶⁰ N represents total children wasted, stunted, and/or underweight.

distress in the home was. Unlike general morbidities, a dry child is more likely to have been a victim of witchcraft. Dryness is perceived as a chronic condition, and it is challenging to overcome the conditions that made a child to be dry.

At the view of a child with kwashiorkor, focus group participants again associated the image with extended periods of civil war and conflict. During the qualitative inquiry, communities said they had not seen children with that condition in at least a decade. The parents of a few children diagnosed with bilateral pitting edema in the Risk Factor Survey indicated they had already received pressure from community members to attend the clinic but had delayed due to heavy workload or financial barriers.⁶¹

At the view of a stunted child next to a healthy child, community members tended to identify the stunted child as younger. When guided by the study team to consider that the shorter child was actually slightly older than the taller child, community members were quick to recognize this child as one who is '*tight*' in the body- meaning a child who cannot grow into his or her full height for his age. Tightness is differentiated from shortness if the child progressively falls further behind his peer's growth. As children age, it is easier to differentiate shortness from tightness, so community members say they can tell easily if a child is *tight*, but that they don't know when the condition starts.

Community etiology of stunting roughly fell into three categories: hereditary, environmental, and spiritual. The dominant belief is that a '*tight*' child is short because his/her parents are short. When asked to differentiate what made a child tight, instead of short, community members said it was the combination of having two short parents that made the child stunted, or the parents were *tight* themselves.

A child could become stunted if he was not well taken care of in the home- this referred to both nutrition and household hygiene. A few community members identified pregnancy and lactation as influential times that a child could or could not become stunted, but this was typically in sensitized areas that espoused the general health benefits of breastmilk. As was true for any other protracted undesirable situation (health, economic, etc.), a 'very very tight' child could have been vexed by witchcraft. However, the more common spiritual belief was associated with genetics- that God willed the child to be stunted, because he gave the child to short or stunted parents.

Therapeutic paths for stunting are much simpler than for marasmus, as they are essentially non-existent. A suggested treatment plan for stunting by one community member was for the child to eventually marry a tall person, to break the cycle of stunting for his/her children.

The overwhelming consensus was that boys were more vulnerable to stunting than girls. Community members said they could visualize this difference; they saw more tight boys than girls. Boys are said to be greedy when breastfeeding. If they were not satisfied from infancy, they were believed to be frustrated and unable to grow. Others believed that boys were more stubborn and therefore more disciplined, or carrying heavier loads, which could make them to be stunted- especially if a boy was disciplined or had a heavy workload from a young age. While girls, and women, are said to grow on a daily basis, because they are involved in household chores and not

⁶¹ Transportation not cost of treatment [treatment is free at public clinics].

"heavy labor," men and boys are said to only grow on Sundays. This was interpreted quite literally as physical growth only one day per week, for males, making boys more susceptible to stunting than girls.

H. SUMMARY OF RESULTS AND CATEGORIZATION OF RISK FACTORS

After the completion of both quantitative and qualitative data collection, Link NCA Analyst triangulated all available data sets, compared correlations for each risk factor and determined the strength of its association with undernutrition. The ratings for each hypothesized risk factor are summarized in the table below.

	Risk factor	Strength of the association of the risk factor with under-nutrition in the scientific literature	Prevalence of risk factor according to secondary data (literature review)	Statistical associations from the quantitative survey				Classification of the risk factor according to the results of the qualitative study				Classification of the risk factor by the communities				Interpretation / Impact of the risk factor			
				R1	R2	R3	Pooled data	R1	R2	R3	Overall	R1	R2	R3	Overall	R1	R2	R3	Overall
A	Limited availability of quality health services	++	+	N/A	N/A	N/A	N/A	+	++	++	++	+	+++	+	++	M-	M-	M-	M-
B	Limited access to health services/ use of traditional health providers	++	++	-	-	+++	+	+++	+++	++	++	+++	++	+	++	I	I	I	I
C	Low birth spacing/ unwanted pregnancies	++	++	-	-	++	+++	+	++	+++	++	+	+	+++	++	M-	M-	I	I
D	Parental stress	++	++	N/A	N/A	N/A	N/A	++	++	++	++	+	++	++	++	M-	M-	M-	M-
E	Non-optimal breastfeeding practices	+++	+++	-	-	-	+	++	+++	+++	+++	+	+	+++	++	M-	M-	I	I
F	Non-optimal IYCF practices	+++	+++	-	-	-	-	++	++	++	++	+	+	++	+	M-	M-	I	M-
G	Low access to food	++	++	-	-	++	+++	+++	+++	+++	+++	+++	+++	++	+++	I	I	M+	M+

H	Use of HH income non-beneficial to mothers/ children	++	+	N/A	N/A	N/A	N/A	++	+	++	++	+	+	++	+	M-	M-	I	M-
I	Low diversity/ access/ availability of income sources	++	++	+	+	+++	++	+++	+++	+++	+++	+++	++	++	++	I	I	M+	I
J	Malfunctioning market or supply system	+	+++	-	+++	+++	+++	+++	++	+++	+++	+++	+	+++	+++	I	I	I	I
K	Low coping capacities	+++	++	-	-	++	-	++	+++	++	++	+	+	+	+	M-	M-	I	M-
L	Low access/ availability of water (quality & quantity)	+++	++	-	-	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	I	I	M+	M+
M	Non-optimal water management	+++	++	-	+++	-	-	+	+	++	+	+	+	+	+	M-	I	M-	M-
N	Poor sanitation practices	++	+++	+	++	-	+++	+++	+++	+++	+++	+++	++	+++	+++	I	I	I	M+
O	Poor hygiene practices	++	+++	+	+++	+	+++	++	++	++	++	+	+	+	+	I	I	I	I
P	Low female autonomy/ decision-making	+	++	-	-	-	-	+	++	+	+	+	+	+	+	M-	M-	M-	M-
Q	Low social support for women	+	+	+	-	+	++	++	++	++	++	++	+	+	+	M-	M-	M-	I
R	Early marriage and/or early pregnancies	+	++	-	+++	-	-	++	+++	+++	+++	++	++	++	++	M-	I	M-	M-
S	Low nutritional status of women	+++	++	+++	+	-	++	++	++	++	++	+	++	+	+	I	M-	M-	I

Table 3: Summary of categorization of risk factors

At the same time, the Link NCA Analyst revisited causal pathways of undernutrition, as developed with communities during the qualitative inquiry, and developed four simplified outlines, likely to explain a majority of cases of stunting in Grand Bassa, Grand Cape Mount, Rural Montserrado, Rivercess, and Sinoe Counties. Most importantly, this exercise allowed to highlight differences between causal mechanisms across regions, which will enable the adaptation of response strategies to respective counties and/or livelihood zones.

Figure 4 below depicts a **causal mechanism for Region 1**, represented by Grand Cape Mount County, highlighting the risk factors with a significant statistical association with stunting and/or a concurrent wasting and stunting. The most vulnerable group to chronic malnutrition were children of mothers of younger age as their vulnerability to stunting significantly decreased as mother's age increased. Children under 24 months of age appear to be most vulnerable to a concurrent wasting and stunting.

The key risk factor significantly associated with stunting in Region 1 is a nutritional status of women, which means that children of mothers with a lower mid-upper arm circumference (MUAC) have higher chances of being stunted. While, the rest of available data did not demonstrate significant statistical relationships with stunting in the area, it is possible to infer that a mother's nutritional status is linked with her access to food as children of mothers with petty trade as an independent income were potentially less likely to be stunted. In addition, children of mothers belonging to at least one external support group were also potentially less likely to be stunted. This suggests that a combination of women's income-generating activities in the form of petty trade and their membership in community-based organisations increases their access to food with a positive effect on their nutritional status and eventually their breastfeeding practices, thus ensuring a proper development of their child. Mothers with an increased appetite or consumption during pregnancy or lactation were more likely to report sufficient quantity of breastmilk to satisfy their child, thus refraining from premature weaning or early initiation to complementary feeding.

However, a dominant pathway to stunting in Region 1 more likely takes its roots in a limited access to markets, which translates into a limited access to soap and/or, more generally speaking, non-optimal environmental hygiene and sanitation. In other words, the presence of soap in a household is potentially a protective factor against chronic malnutrition while the presence of kitchen waste has potentially a reverse effect. The non-optimal environmental hygiene and sanitation then increase the likelihood of child being unclean, which increases his/her vulnerability to disease and to a growth retardation, as a consequence. The likelihood of a child not being clean in Region 1 increased in cases when inappropriate child-caregiver interactions were observed during the data collection.

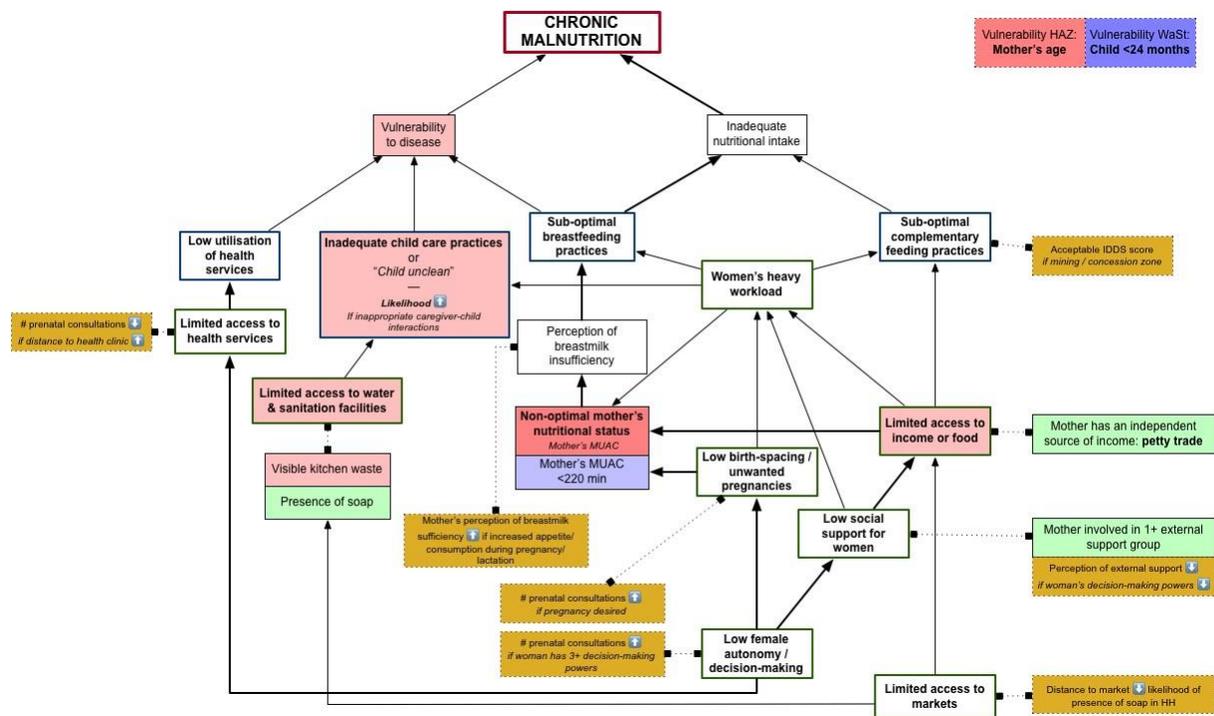


Figure 4: Simplified causal pathway for Region 1 (Grand Cape Mount County)⁶²

Figure 5 below depicts a **causal mechanism for Region 2**, represented by Grand Bassa and Montserrat Counties, highlighting the risk factors with a significant statistical association with stunting and/or a concurrent wasting and stunting. The most vulnerable group to chronic malnutrition were children who were not first born. Children of heads of households involved in business or petty trade appear to be less vulnerable to stunting than children of heads of households involved in other income-generating activities. Children under 24 months of age living in agricultural livelihood zones while having a mother under 19 years of age appear to be most vulnerable to a concurrent wasting and stunting.

Similarly to Region 1, a dominant pathway to stunting in Region 2 takes its roots in a limited access to markets. Children living in households within at least one hour from the nearest market were more likely to be stunted than children living in a closer proximity. Among other things, distance to market decreased the likelihood of a presence of soap in household while it also contributed to a likelihood of child being unclean. The likelihood of a child being unclean increased in agricultural livelihood zones (while it decreased for children living in peri-urban areas), in households living more than 20 minutes from the nearest water point and households practicing open defecation. In addition, children of mothers who did not complete their elementary education or higher and who had their first pregnancy before 18 years of age were

⁶² Dark red cells represent risk factors presenting a significant statistical association with chronic malnutrition while dark purple cells represent risk factors presenting a significant statistical association with a concurrent wasting and stunting ($p < 0.05$) (See Appendix B). Cells highlighted in light red and light purple signify risk factors with a potential link to chronic malnutrition and a concurrent wasting and stunting, respectively ($p < 0.1$). Cells in dark/light green represent protective factors with a significant and/or potential statistical association with chronic malnutrition.

more likely to be observed unclean as well as children, in cases of which inappropriate child-caregiver interactions were observed during the data collection.

The likelihood of child being unclean increases his/her vulnerability to disease and to a growth retardation, as a consequence. This seems to be backed up the available data on the incidence of key childhood diseases as a child suffering from diarrhoea was potentially more likely to be stunted if observed unclean while a child suffering from cough was significantly more likely to be stunted if observed unclean. Children suffering from cough were also significantly more likely to be stunted if living in a household with more than one child under 5 years of age. Children from these households were eventually more likely to be stunted if they were suffering from any of surveyed morbidities, i.e. fever or cough or diarrhoea.

This suggests a link with non-optimal birth-spacing (<24 months), potentially an early pregnancy, and women's decision-making powers. The available data suggests that a child born to a mother who had her first pregnancy before 18 years of age had higher odds of being stunted. In addition, low female autonomy leads to a low utilisation of health services, which does not reflect only on the use of contraceptive means but also on mother's health-seeking behaviour during the pregnancy. Mothers who desired to be pregnant were more likely to attend antenatal care, while children of mothers who completed at least four visits were significantly less likely to be stunted. In addition, children who were born in a health facility were potentially less likely to be stunted. It is possible to infer that the attendance of prenatal consultations plays an important role in mother's sensitisation on optimal care practices, planting a seed for proper child development once he/she is born. As such, children vaccinated against measles, dewormed and having received a Vitamin A supplementation were potentially less likely to be stunted.

The protection against pathogens is particularly important in non-optimal hygiene and sanitation environments, which are directly linked with child cleanliness, as discussed above. A child observed playing in dust or mud was significantly more likely to be stunted. The risk was comparably equally as high for children living in a household owning a livestock, thus exposed to a contamination through the proximity to animals and/or their faeces. This may also translate into a contamination of food as children living in households with poor hygiene practices where cooked food was stored for eating later in the day and/or the next day were potentially more likely to be stunted. The significant risk of chronic malnutrition was also confirmed for children living in household, where non-optimal water transportation and storage practices were observed during the data collection.

An interesting statistical association was detected among children wearing a washable diaper, especially children older than 18 months, who are significantly more likely to be stunted than children using a disposable diaper or a latrine.

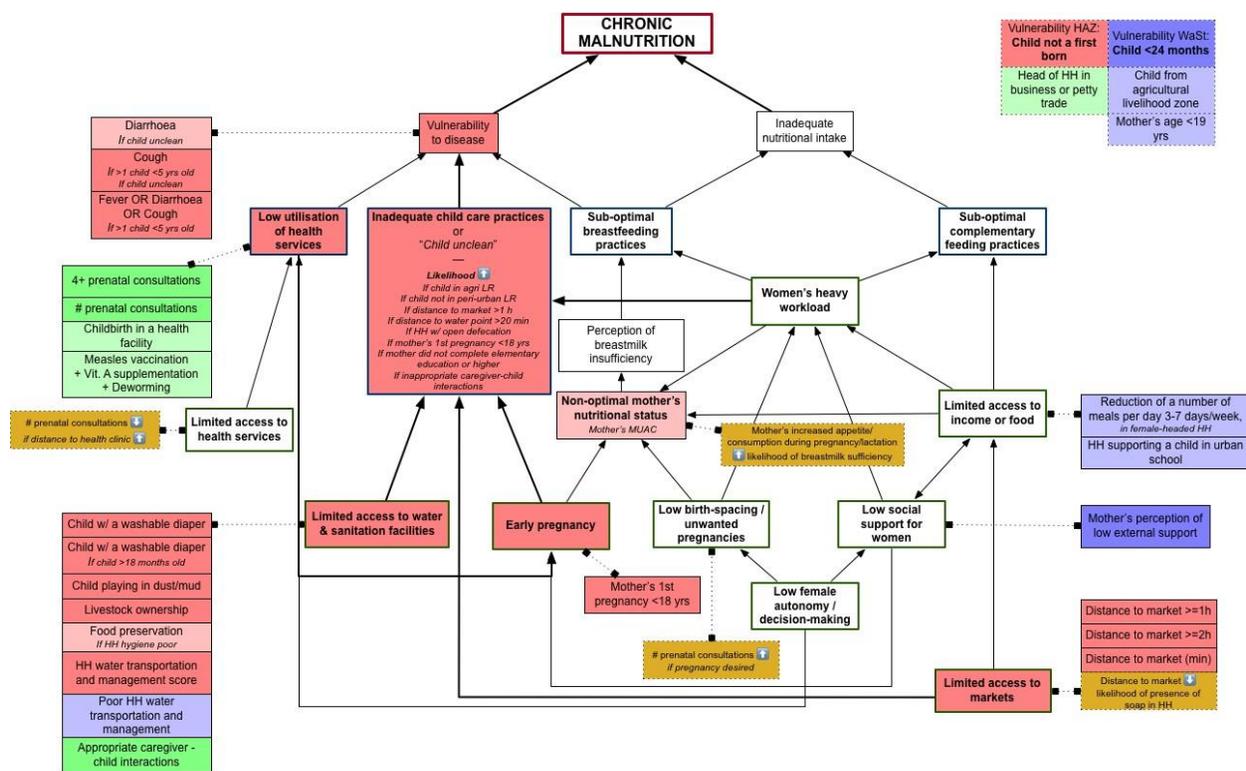


Figure 5: Simplified causal pathway for Region 2 (Grand Bassa and Montserrado Counties)

Figure 6 below depicts a **causal mechanism for Region 3**, represented by Sinoe and Rivercess Counties, highlighting the risk factors with a significant statistical association with stunting and/or a concurrent wasting and stunting. The most vulnerable group to chronic malnutrition were male children living in mining/concession areas and/or households where a head of household is engaged in agriculture. Children under 24 months of age, living in households where heads of households were involved in business or petty trade appear to be less vulnerable to stunting. The same applies to children, whose mother completed education at a junior high or higher level. Male children under 24 months of age living in mining/concession areas appear to be most vulnerable to a concurrent wasting and stunting. This condition also seems to be triggered by a recent death in the family, potentially implying financial and emotional burden caused by this event.

Similarly to Region 1 and 2, a dominant pathway to stunting in Region 3 takes its roots in a limited access to markets. Children living in households within at least one hour from the nearest market were more likely to be stunted than children living in a closer proximity. From among all surveyed areas, LR03 in Sinoe County came out as the livelihood zone with the lowest market access, while Rivercess County and Region 3 demonstrated the lowest market access at a county and regional level, respectively. Among other things, distance to market decreased the likelihood of a presence of soap in household and increased a likelihood of child being unclean. The likelihood of child being unclean also increased in agricultural livelihood zones (while it decreased for children living in peri-urban areas), in households practicing open defecation and where inappropriate child-caregiver interactions were observed during the data collection.

The likelihood of child being unclean increases his/her vulnerability to disease and to a growth retardation, as a consequence. This seems to be backed up the available data on the incidence of key childhood diseases as a child suffering from diarrhoea was potentially more likely to be stunted if living in a household with more than one child under 5 years of age. This suggests a link with non-optimal birth-spacing (<24 months) and women's heavy workload, which then reflects negatively on child care practices. The available data implies that a child cared for by a grandmother is more likely to be stunted while a child cared for by an aunt has significantly higher odds of being concurrently wasted and stunted.

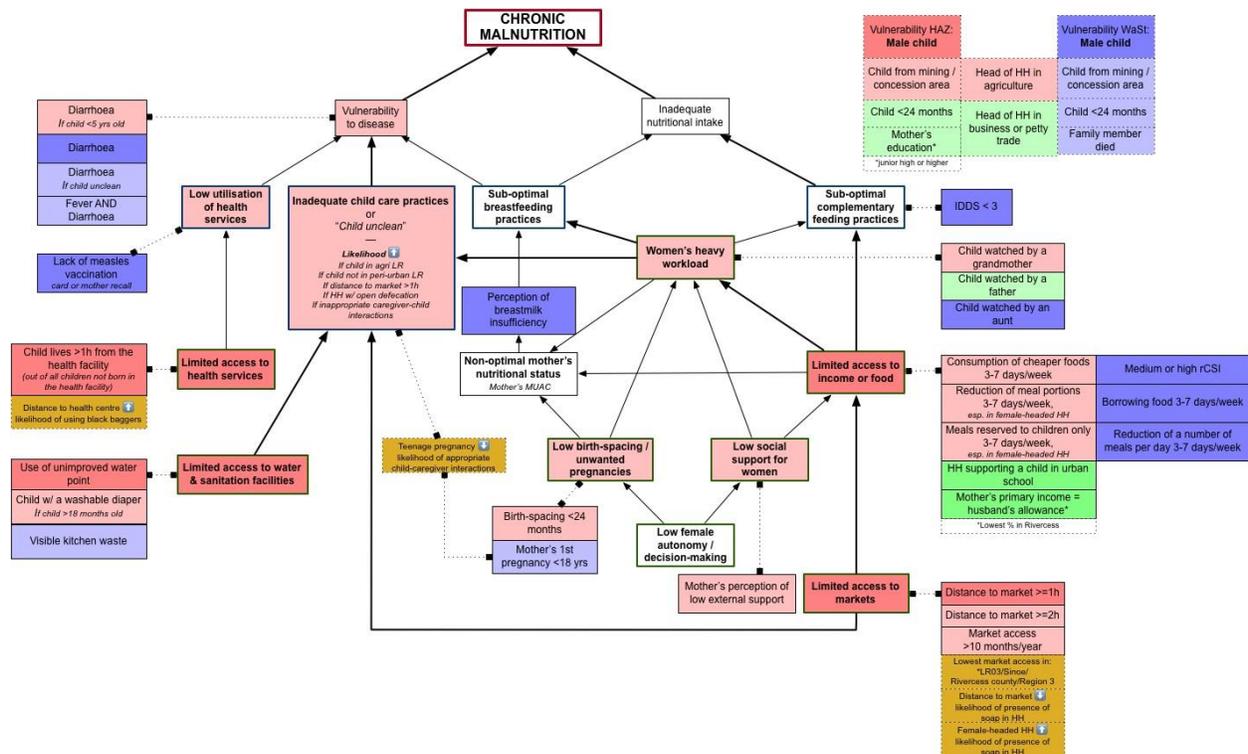


Figure 6: Simplified causal pathway for Region 3 (Sinoe and Rivercess Counties)

Women's heavy workload is particularly applicable in case of women with insufficient support and/or limited access to income. Children of mothers perceiving a low external support were potentially more likely to be stunted while children of mothers benefiting from husband's allowance as a primary source of income were less susceptible to be chronically malnourished. Children living in female-headed households were potentially more vulnerable to stunting if a mother deployed coping strategies, e.g. reducing meal portions or reserving meals for children only, for 3- 7 days a week, thus highlighting a high level of food insecurity in the household. The deployment of coping strategies demonstrated a significant statistical association with a concurrent wasting and stunting, as children living in households with a medium or high rCSI score had higher odds of suffering from multiple nutritional deficiencies.

On a health-seeking side, from among children who were not born in a health facility, children living in a household more than 1 hour away from the nearest health facility were significantly more likely to be stunted. Longer distance to a health facility also seems to suggest a higher use

of black baggers. The lack of measles vaccination among surveyed children increased their odds of being concurrently wasted and stunted.

Considering the role of non-optimal hygiene and sanitation environments on child cleanliness, children living in households using an unimproved water point were significantly more likely to be stunted while children wearing a washable diaper older than 18 months of age were potentially more likely to be stunted.

The analysis of pooled data from all three regions, representing five counties covered by this Link NCA study, allowed for a design of an **overarching causal pathway** (Figure 7 below) detailing generally applicable causal mechanism based on the risk factors with a significant statistical association with stunting across the study zone. The most vulnerable group to chronic malnutrition were male children living in mining/concession areas and/or agricultural livelihood zones. Their vulnerability to stunting increases as a mother's age decreases. Children under 24 months of age living in households where heads of households are involved in business or petty trade and mothers completed education at junior high and higher level appear to be less vulnerable to stunting.

Similarly to all three regions analysed separately, a dominant overarching pathway to stunting takes its roots in a limited access to markets. Children living in households within at least one hour from the nearest market were more likely to be stunted than children living in a closer proximity. Among other things, distance to market decreased the likelihood of a presence of soap in household and increased a likelihood of child being unclean. The likelihood of child being unclean also increased in agricultural livelihood zones (while it decreased for children living in peri-urban areas) and in households practicing open defecation. In addition, children of mothers who had their first pregnancy before 18 years of age were more likely to be observed unclean as well as children, in cases of which inappropriate child-caregiver interactions were observed during the data collection.

As child cleanliness can be heavily dependent on environmental hygiene and sanitation, a child observed playing in dust or mud was significantly more likely to be stunted while a child living in a household owning a livestock, thus exposed to a contamination through the proximity to animals and/or their faeces, was potentially more likely to be stunted. In addition, a child living in a household more than 20 minutes away from the closest water point, was significantly more likely to be stunted, especially if living in one of agricultural livelihoods zones (potentially via increased odds of diarrhoea, as explained below). An interesting statistical association was also detected among children wearing a washable diaper, particularly among children older than 18 months, living in agricultural livelihoods zones, who were significantly more likely to be stunted than children using a disposable diaper or a latrine. A potential risk was detected for children wearing a washable diaper if older than 18 months and living in coastal livelihoods zones.

The likelihood of child being unclean increases his/her vulnerability to disease and to a growth retardation, as a consequence. This seems to be backed up the available data on the incidence of key childhood diseases as a child suffering from diarrhoea was potentially more likely to be stunted. A child suffering from diarrhoea was significantly more likely to be stunted if living in one of agricultural livelihoods zones or observed unclean. Water source at more than 20 minute

distance from a household increased odds of child suffering from diarrhoea while the presence of soap decreased them. A child suffering from cough was significantly more likely to be stunted if living in one of agricultural or coastal livelihoods zones, if living in a household with more than one child under 5 years of age and if observed unclean. A child suffering from any of surveyed morbidities, i.e. fever of cough or diarrhoea, was more likely to be stunted if living in one of agricultural livelihoods zones or observed unclean.

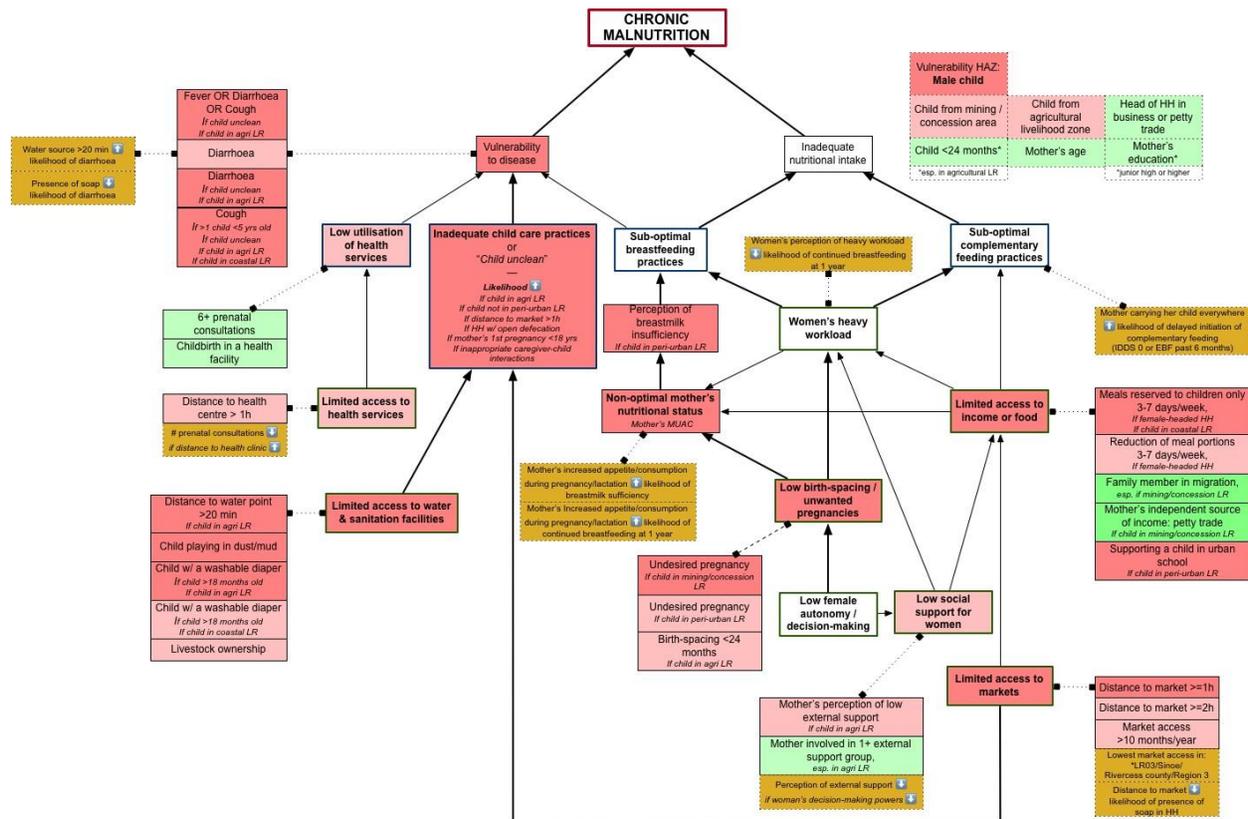


Figure 7: Simplified causal pathway for the entire study area (based on pooled data)

On a health-seeking side, a child living in a household more than 1 hour away from the nearest health facility was potentially more likely to be stunted. Similarly to Region 2, children born in a health facility and children, whose mothers attended more than 6 prenatal consultations during their pregnancy were potentially at a lesser risk of stunting. It is possible to infer that such mothers had a better access to health facilities while the attendance of prenatal consultations played an important role in mother's sensitisation on optimal care practices, planting a seed for proper child development once he/she was born.

Possibly linked with a health services' utilisation, a mother's use of contraceptive means and/or her capacity to birth-space surfaced as a significant or potential risk factor across all livelihoods zones. In mining/concession areas, an undesired pregnancy revealed a significant statistical association with stunting while a slightly statistically weaker association was observed in peri-urban areas too. Children in agricultural livelihoods zones, on the other hand, were potentially more likely to be stunted if born within 24 months' time from the birth of their older sibling.

Biologically, low birth-spacing can lead to a non-optimal nutritional status of women as their bodies cannot sufficiently recuperate from one pregnancy to another. This translates into a sub-normal development of a child during both a gestation and a lactation period. The nutritional status of women, assessed using a mid-upper arm circumference (MUAC), significantly links with the impaired growth, potentially via non-optimal breastfeeding practices caused by mother's perception of breastmilk insufficiency, triggering a premature weaning or early initiation of complementary feeding. According to the available data, mothers with an increased appetite or consumption during pregnancy or lactation were more likely to report sufficient quantity of breastmilk to satisfy their child and more likely to continue breastfeeding at 1 year.

The optimal nutritional status of women is naturally linked with their access to income or food, which may be particularly limited in food insecure households. Children in mining/concession areas, whose mothers benefited from a husband's allowance as a primary source of income, were less susceptible to be chronically malnourished. However, children of women who did not benefit from such support, especially children in female-headed households and children living in coastal livelihoods zone, were more likely to be stunted when a parent admitted to reserving meals for children only 3 to 7 days a week, thus implying the extreme vulnerability of the household. In addition, children in peri-urban areas living in households supporting another child in urban school, which translates into a preferential use of resources for education (at the expense of balanced meals), were also more likely to be stunted. In agricultural livelihoods zones, access to resources being intrinsically linked with the availability of external support, children of mothers who perceived low levels of such support and/or were not part of external support groups, were potentially at a greater risk of chronic malnutrition. It is interesting to note that a perception of external support decreased as women's decision-making powers declined.

II. CONCLUSION AND RECOMMENDATIONS

The analyses undertaken during this Link NCA study allowed to identify 19 risk factors, believed to have an impact on the incidence of undernutrition in the study zone. Following a triangulation of data from diverse sources, three (3) risk factors were identified as having a major impact, eight (8) risk factors were classified as having an important impact and eight (8) risk factors were judged to have a minor impact on the incidence of undernutrition in the zone of study.

Among the major risk factors, two were identified in the sector of water, sanitation and hygiene, namely **low access to water** and **non-optimal sanitation practices**, while the last major risk factor, **low access to food**, was identified in the sector of food security and livelihoods.

The calculation of statistical associations between individual risk factors and nutritional status of children in surveyed households allowed to differentiate between the so-called "regional" causal mechanisms of stunting specifically designed for each set of respective counties and an overarching causal pathway based on all collected data. While the overarching causal pathway details generally applicable mechanisms across the study zone, regional pathways highlight the identified nuances between different counties and therefore allow for a more suitable adaptations for future interventions.

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

GLOBAL RECOMMENDATIONS

- Improve access to water through construction of new and/or maintenance of existing water points using existing structures and mechanisms to ensure their proper long-term utilization (e.g. water committees, town legislature, etc.);
- Improve water treatment management at water point and household levels, including the use of appropriate water treatment options and effective water transportation and storage practices to ensure water safety before use;
- Encourage the construction of family latrines using methodological approaches, which proved previously successful in the Liberian context, including trainings and sensitization activities adapted to context, typical income, lifestyle and concerns;
- Encourage the creation of baby-friendly play spaces, including mats and/or laying cement in areas where children play frequently, and their appropriate maintenance to decrease a potential contamination with the surroundings;
- Strengthen the sensitization of mothers as well as other family members (grandmothers, aunts, fathers and older siblings) on appropriate care practices, especially in households of young mothers in agricultural livelihood zones and mining/concession areas with more than 1h distance from the closest market;
- Launch a SBCC campaign on the appropriate use of washable diapers, highlighting the importance of their frequent cleaning and timely transition to other safe forms of defecation, especially for children older than 18 months;
- Improve access to markets by improving existing road network (among other by lobbying local authorities to ensure that road maintenance is done in line with signed concession agreements) and/or construction of new markets in closer proximity to the population, especially in areas with a general or seasonal access difficulties;
- Support diversification of income opportunities through livelihood zone appropriate revenue streams, including agricultural production schemes and/or community/ household gardens, adapting assistance modalities to target hardship during lean periods;
- Support the creation and/or capacity building of external support groups (*koo's*, VSLA, *susu* clubs, mothers' groups, community gardens) for both men and women, especially in agricultural livelihood zones, in order to strengthen existing social support mechanisms in communities and households, putting a particular emphasis on emotional support and stress relief. This may include an incentivization of loans to women, especially in female-headed households.
- Promote appropriate birth-spacing and family planning practices, especially among adolescents, by facilitating access to relevant health, education and/or youth services responsible for relevant information sharing, support and provision of suitable means of contraception to target groups. This may include nation-wide sensitization campaigns aiming to destigmatize the sexuality in parent-child conversations and/or adolescents desiring to use family planning methods.

REGION 1: GRAND CAPE MOUNT

- Strengthen the sensitization of households on appropriate waste management practices, especially the disposal of organic kitchen waste and the importance of soap for handwashing, bathing and dish/clothes washing;
- Promote optimal nutritional status of women via existing sensitization campaign via health facilities, community health worker networks or mothers' groups, highlighting the importance of balanced nutrition during pregnancy and/or lactation to ensure mother's perception of breastmilk sufficiency to maintain breastfeeding, as advised;

REGION 2: GRAND BASSA/ RURAL MONTSERRADO

- Improve access to health facilities by improving quality of provided services, especially via a continuous capacity building of health facility personnel and a constant availability of medicinal products as well as through innovative, low resource community approaches addressing geographical and financial barriers of access in order to ensure an increase in health facility utilization by pregnant and lactating women and children under 5 years of age, especially for antenatal care, assisted childbirth, vaccination, Vitamin A supplementation and deworming;

REGION 3: RIVERCESS/ SINOE

- Strengthen the sensitization of households on appropriate infant and young child feeding practices, especially in relation to the initiation, frequency and diversity of feeding. This may include a promotion of fruit snacks and a production of infant cereals⁶³ at scale for petty traders to decrease a potential higher workload of women;
- Research and design appropriate support strategies for households in mining/concession areas to assist them in child care.

HEALTH SYSTEMS STRENGTHENING

- Build on the momentum of successful antenatal mortality schemes and exclusive breastfeeding promotion by also establishing stunting as a public health nutrition issue;
- Improve quality of care by increasing the number trained and dedicated personnel in health establishments, fitting out their workspaces for adequate care in a healthy environment with the permanent availability of the quality equipment / drugs necessary for this care;
- Improve the quality of growth monitoring and promotion by emphasizing the importance of linear growth monitoring by clinician and caregiver, equipping every health facility with anthropometric equipment;
- Review current TSFP procedures for passive and active screening, considering a significant percentage of malnourished children are not detected as malnourished by MUAC; incentivize compliance of updating the Child Health Passport with growth progress on every visit;
- Leverage traditional healers and TTM's as important participants in sensitized health messages for children and women.

⁶³ Benny dust, plantain dust, rice dust, etc.