

# LINK NCA IS ADAPTING TO STUNTING

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## EXECUTIVE SUMMARY

The Link NCA in Liberia, conducted across five of the country's fifteen counties from October 2019 to May 2020, was the first to investigate stunting causal pathways, based on the UNICEF Conceptual Framework for undernutrition. Causal pathways of stunting in this context were rooted in low access to water, non-optimal sanitation practices, and low access to food. The current framework of analysis for the Link NCA was appropriate for a stunting only study, but future Link NCA's focused on this form of undernutrition should continue to take into consideration new and emerging evidence on risk factors that specifically affect stunting.

## INTRODUCTION

Bordering the Atlantic coast, Grand Cape Mount, Grand Bassa, Montserrado, Rivercess, and Sinoe Counties are among the five counties of Liberia with the highest burden of stunting in the country. Continued challenges in food security, water, hygiene and sanitation, as well as gender inequalities undermine child and maternal nutrition across the eight livelihood zones of these five counties. Rates of stunting remain chronically high, exceeding 30% in the five counties<sup>1</sup>.

As part of an initiative to reduce rates of stunting, the Liberia WASH Consortium set out to conduct formative research to better understand the context-specific causes of stunting and the determinants of related behaviours. Three out of five consortium members 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. This marked the first time a Link NCA focused solely on stunting



FIGURE 1: Map of the study area [in blue]

1 2019/2020 DHS for Grand Bassa (34.7%), Grand Cape Mount (32.5%), Rivercess (40.6%), and Sinoe (30.0%) Counties; CFSNS 2018 for Rural Montserrado (35.6%), which differentiates Urban Monrovia and Rural Montserrado

## PREPARATORY PHASE & INITIAL TECHNICAL WORKSHOP

The initial stages of a Link NCA include extensive secondary data and literature reviews. This stage is followed by a technical workshop, where risk factors to be tested during qualitative inquiry and quantitative data collection are determined and ranked. Special care was taken to review risk factors that may be unique to stunting. However, stunting and wasting predominantly share underlying and basic causal factors including infectious diseases, inadequate dietary intake, and suboptimal infant feeding and caring practices<sup>2</sup>. Indeed, meta-analyses differentiated only two major risk factors for stunting and not wasting: Environmental Enteric Dysfunction (EED) and zinc inadequacy<sup>3</sup>. Upon review, the [WHO Conceptual Framework for stunting](#), developed in 2013, did not introduce causal or contextual factors that were not already represented in standard Link NCA hypotheses.

Thus, pre-selected risk factors for field testing did not vary significantly from previous Link NCA's that studied wasting. Table 1 summarizes risk factors validated for field testing based on technical experts' rankings.

Risk Factor	Weighted Ranking- Initial Technical Workshop 2019 <sup>4</sup>
A: Limited availability of quality health services	4.52
B: Limited access to health services/ traditional health providers	4.12
C: Low birth spacing/ unwanted pregnancies	4.03
D: Parental stress	3.31
E: Non-optimal breastfeeding	4.25
F: Non-optimal IYCF practices	4.48
G: Low access to food	4.28
H: Use of HH income non-beneficial to mothers/ children	3.66
I: Low diversity/ access/ availability of income sources	4.03
J: Malfunctioning market or supply system	3.24
K: Low coping capacities	2.95
L: Low access/ availability of water (quality and quantity)	4.25
M: Non-optimal water management	3.88
N: Poor sanitation practices	4.45
O: Poor hygiene practices	4.34
P: Low female autonomy/ decision-making	3.50
Q: Low social support for women	3.64
R: Early marriage and/or early pregnancies	4.03
S: Low nutritional status of women	4.14

**TABLE 1:** List of hypothesized risk factors validated for field-testing during Initial Technical Workshop, including Technical Experts Rating<sup>5</sup>

2 Angood C, Khara T, Dolan C, Berkley JA; WaSt Technical Interest Group. Research Priorities on the Relationship between Wasting and Stunting. PLoS One. 2016;11(5):e0153221. Published 2016 May 9. doi:10.1371/journal.pone.0153221

3 <https://www.enonline.net/fex/50/relationshipwastingstunting>

4 Technical Experts were afterwards invited to categorize risk factors according to their anticipated contribution to stunting in the zone of study on the scale from 1 (risk factor expected to contribute marginally to undernutrition) to 5 (risk factor expected to contribute substantially to undernutrition). Risk factors ranked to contribute substantially to undernutrition are colored in red, while those expected to contribute marginally to stunting are colored in green.

5 Rankings weighted from 1-5; red indicates highest ranked contribution to stunting, while green indicates lower contribution to stunting.

Zinc deficiency, one identified risk factor for stunting, as it relates to **DIARRHEAL REOCCURRENCE AND TREATMENT**, was explored through Hypotheses **A & B** [zinc/ ORS availability and acceptability], as well as Hypotheses **L, M, and N** [recurrent diarrhea]. Zinc deficiency as it relates to **INADEQUATE DIETARY INTAKE** was investigated through Hypotheses **F, H, G, and J**- namely through typical consumption of the household, mother/child dyad. It is currently outside of the scope of the Link NCA to assess EED biomarkers<sup>6</sup>. Thus, investigation of EED during the Link NCA centered on known fecal-oral transmission routes, namely during investigation of Hypotheses **N and O**, as well as Hypothesis **F**.

## QUALITATIVE INQUIRY

As the risk factors did not significantly vary from previous Link NCA's, qualitative inquiry guides for stunting only were similar to those used in the recent [Madagascan](#), [Haitian](#), and [Ethiopian](#) contexts<sup>7</sup>. During qualitative inquiry, various risk factors are assessed by means of detailed focus group discussions, Key Informant Interviews, guided observations, and community immersion<sup>8</sup>. Community members are specifically probed about their perceptions of malnutrition - including risk factors, vulnerability, and health-seeking routes. Members of visited communities tended to fixate on wasting when presented with photos and drawings of different forms of undernutrition. The majority of community members did not perceive stunting as a medical condition; thus, concentrating causal pathways around stunting during focus group discussions was challenging, as a critical sensitization component was missing, and it is not the role of researchers to also provide health education. The team thus centered conversations on stunting as referred to colloquially or in local dialects, with heavily supplemented discussions including probes about underlying factors- namely, recurrent infections and inadequate dietary intake.

Despite a noted discrepancy in perceived severity of this form of malnutrition, there was consensus on stunting's differentiation from natural and normal shortness. With a 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.

**"IF THE CHILD IS 6 YEARS OLD AND LOOKS LIKE THREE YEARS, THEN THAT'S HOW WE KNOW THAT THE CHILD IS TIGHT NOT SHORT."**

**Focus group participant, Grand Bassa**

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 s/he was not well taken care of in the home- this referred to both nutrition and household hygiene. However, this was grouped into beliefs about general health of the child, and not stunting specifically. The stigma of mild stunting, thus, was generally associated with the poorest households' inability to keep children clean or healthy. 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 for general health of the child. 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.

**"SOME PEOPLE ARE TIGHT & SOME PEOPLE GROW FAST BECAUSE THAT'S HOW GOD CREATED THEM- GOD TAKES SOME PEOPLE FROM TALL FAT LAND AND GOD TAKES OTHER PEOPLE FROM TIGHT LAND."**

**Focus group participant, Rivercess**

6 Tickell, K.D., Atlas, H.E. and Watson, J.L., 2019. Environmental enteric dysfunction: a review of potential mechanisms, consequences and management strategies. BMC medicine, 17(1), p.181.

7 Qualitative inquiry guide included as Annex C in the [Final Report](#).

8 Across three regions of the study, 1324 community participants were consulted during series of focus group discussions and Key Informant Interviews. 60% of these participants were women. The full summary of community consultations can be found in Table 3 of the [Final Report](#).

The overwhelming consensus was that boys were more vulnerable to stunting than girls. Boys were said to be greedy when breastfeeding<sup>9</sup>. If they were not satisfied from infancy, they were believed to be frustrated and unable to grow. Therapeutic paths for stunting are much simpler than for marasmus, as they are essentially non-existent. A suggested treatment plan for stunting by one caregiver was for the child to eventually marry a tall person, to break the cycle of stunting for his/her children.

Due to existing and emerging evidence on the role of environmental pathogens, particular care was taken during the qualitative inquiry to assess household environments, particularly the child's play spaces, as well as teething and mouthing behaviors. This was done during household observations, key informant interviews in or near caregiver's homes, and community immersion. The bulk of this time was dedicated to observing household pathogens for children in the first 1,000 days of life, considering the evidence regarding stunting's progression from the womb. Exposure to dirt through play and sleep environments was found to be nearly ubiquitous in the study zone. Child cleanliness appeared to interact with the incidence of frequent child morbidities, such as The study yielded interesting links between the potential role of diaper management in stunting.

## QUANTITATIVE RISK FACTOR SURVEY

The quantitative risk factor survey consisted of anthropometric measurements and 45 indicators, covering all risk factors identified and validated in preceding stages. The quantitative indicators reflected the 19 validated hypotheses of the study. Special care was taken to incorporate components of EED assessments that were within the feasibility of the study, namely through structured kitchen observations and child cleanliness checklists. The questionnaires were deployed on mobile devices and the collected data was uploaded and compiled in KoboToolBox, an approach optimized in the 2016 [Belle-Anse Link NCA](#)<sup>10</sup>. Assessment of stunting did not require new anthropometric measurements, and wasting anthropometric indicators (MUAC, weight, and edema) were retained for purposes of historical comparison.

The Risk Factor Survey revealed a prevalence of global chronic malnutrition (GCM) on the basis of height-for-age z-score <-2 above 30% in all three regions of the study, which was similar to the stunting prevalence estimated by the national CFSNS<sup>11</sup> conducted two years prior and the 2019/2020 DHS<sup>12,13</sup>. The prevalence of stunting in all three regions was 'very high' according to the 2018 WHO thresholds<sup>14</sup>. Prevalence of global acute malnutrition (GAM) on the basis of weight-for-height z-score <-2 ranged from 5.4% to 8.7%, which is 'medium' per the WHO thresholds for wasting<sup>14</sup>.

## PATHWAYS AND VULNERABILITY TO STUNTING

Age alone was not a significant risk factor for stunting across the study zone; however, gender and livelihood zone played a role- pooled analyses of the three regions revealed males were indeed at higher odds of stunting than girls. The group most vulnerable to chronic malnutrition was male children living in mining/concession areas and/or agricultural livelihood zones. Their vulnerability to stunting increases as a mother's age decreases.

Upon triangulation of all evidence, two major risk factors 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.

A dominant overarching pathway to stunting took its roots in limited access to markets, which then exacerbates a variety of household factors, including environmental hygiene, personal hygiene, and consumption of diverse, nutritious foods. 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.

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9 Breastfeeding practices are detailed in Section B 'Nutrition and Care Practices' of the [Final Report](#).

10 Free tool for data collection in harsh environments, [www.kobotoolbox.org](http://www.kobotoolbox.org).

11 Comprehensive Food Security and Nutrition Survey.

12 [Demographic and Health Survey](#).

13 For construction of causal pathways, the 5 counties were grouped into 3 regions, based on the 2016 Malaria Indicator Survey precedent.

14 de Onis M, Borghi E, Arimond M, Webb P, Croft T, Saha K, De-Regil LM, Thuita F, Heidkamp R, Krasevec J, Hayashi C, Flores-Ayala R. Prevalence thresholds for wasting, overweight and stunting in children under 5 years. *Public Health Nutr*. 2019 Jan;22(1):175-179.

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 lower scores on the child-caregiver interaction scale 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 feces, was marginally 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). 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.

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 marginally 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.

On a health-seeking side, a child living in a household more than 1 hour away from the nearest health facility was marginally more likely to be stunted. 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 marginal risk factor across all livelihoods zones. In mining/concession areas, an undesired pregnancy revealed a significant statistical association with stunting.

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. 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 at a marginally greater risk of chronic malnutrition. It is interesting to note that a perception of external support decreased as women's decision-making powers declined.

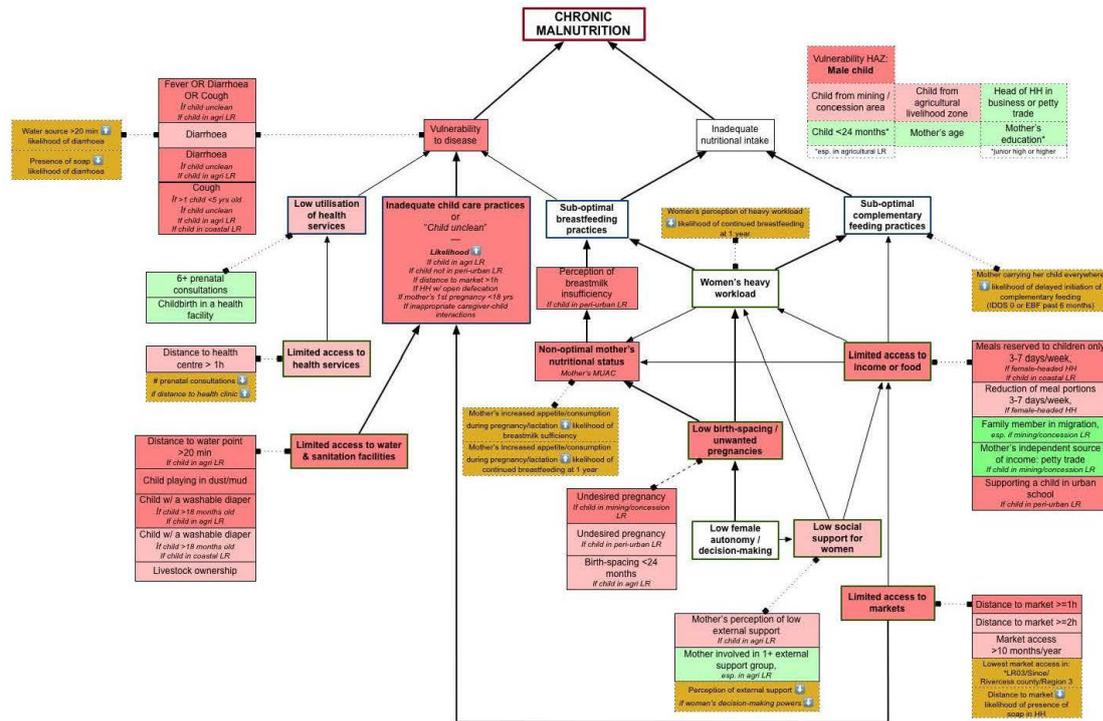


FIGURE 2: Simplified causal pathway for the entire study area (based on pooled data)<sup>15</sup>

## LIMITATIONS

- **COMMUNITY PERCEPTIONS OF STUNTING:** Link NCA is a participatory methodology, engaging stakeholders residing in and outside of the implicated communities. Community recommendations are based on their perceived susceptibility and causes of an issue. Despite best efforts, it is possible that community rankings reflect general undernutrition and not chronic malnutrition, specifically, if no ill effect or consequence was associated with stunting.
- **RISK FACTORS FOR STUNTING:** While the UNICEF Conceptual Framework was used to guide the study, it was outside of the scope of the study to assess zinc deficiency and EED biomarkers.
- **SEASONALITY:** Qualitative inquiry took place at the tail end of the rainy season, while the Risk Factor Survey started before the next rainy season. While stunting is less influenced by seasonality than wasting, cross-sectional data is, again, limited and does not substantiate potential seasonal stresses that influence growth faltering.

## RECOMMENDATIONS

As various forms of undernutrition share causal pathways, Link NCA's should continue to consider and weight stakeholders' perspectives on the most critical forms of malnutrition to investigate. For example, in this context, a deep investigation of GAM would not have yielded actionable information if acute malnutrition was not identified as an issue of public health concern. The current framework of analysis for the Link NCA was appropriate for a stunting only study, but future Link NCA's focused only on stunting should take into consideration new and emerging evidence on risk factors that specifically affect stunting. **ULTIMATELY, THIS LINK NCA WAS USED TO INFORM A 4-YEAR PROPOSAL TO ADDRESS CAUSAL PATHWAYS OF STUNTING. WE RECOMMEND FUTURE LINK NCA'S BE DESIGNED TO ASSESS CAUSAL PATHWAYS THAT CAN INFORM MEANINGFUL, FUNDED PROGRAMMING,** which means first considering the public health significance of the form of undernutrition to be assessed.

15 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.