Technical assistance to understand the evidence and research priorities for prevention of acute malnutrition

MQSUN+ retrospective case study (June 2019)

This retrospective case study is part of a brief series on Assumption maps to assess signs of impact of short-term technical assistance.

With approximately 49 million children (7.3 percent) under five years of age affected by acute malnutrition (UNICEF/WHO/World Bank Group, 2019), there is an urgent need for concerted prevention efforts. The last decade has seen significant investments to develop evidence-based prevention strategies, though a recent analysis of World Health Assembly targets highlights a lack of robust studies on effective interventions (Shekar et al., 2017).

Technical assistance implementation

Maximising the Quality of Scaling Up Nutrition Plus (MQSUN+), through its Technical Assistance for Nutrition (TAN) partner, the Emergency Nutrition Network, has been tasked to support the UK's Foreign, Commonwealth and Development Office (FCDO) and the wider nutrition community to accelerate coordinated action to develop evidence of what works to reduce the incidence and recurrence of wasting.

Phase I comprises a review of the available evidence to understand how and why wasting evolves from conception onwards and how it differs from other forms of malnutrition. This was supplemented with stakeholder consultations and an assessment of interventions to reduce wasting prevalence. These are summarized in the Aetiology of Wasting and The Current State of Evidence and Thinking on Wasting Prevention. **Phase II** is an exercise to prioritize what gaps ought to be researched. Finally, **Phase III**

PATH is a global organization that works to accelerate health equity by bringing together public institutions, businesses, social enterprises, and investors to solve the world's most pressing health challenges. With expertise in science, health, economics, technology, advocacy, and dozens of other specialties, PATH develops and scales solutions—including vaccines, drugs, devices, diagnostics, and innovative approaches to strengthening health systems worldwide.

path.org

Mailing Address
PO Box 900922
Seattle, WA 98109 USA

Street Address
2201 Westlake Avenue
Suite 200
Seattle, WA 98121 USA

Date Published
October 2021

seeks to review how actors can strengthen the humanitarian and development nexus to increase impact on the reduction of wasting and other major forms of child malnutrition.

Assumption pathway to impact

The aim of this case study is to showcase what has enabled this TA's impact, as well as the signs of impact along the pathway for scaled-up nutrition action and reduced malnutrition. It singles out one row of the assumption map to highlight how TA carrying out *research and review of the evidence* (one of the categories of support to FCDO) can lead to improved or scaled-up nutrition programs and impact malnutrition (**Figure 1**). This is part of a larger picture, the full assumption map, of how different types of TA (corresponding to each row of the map), such as TA to build capacity in nutrition, contribute to and capture the contributions to the nutrition theory of change (TOC) and the global nutrition agenda.

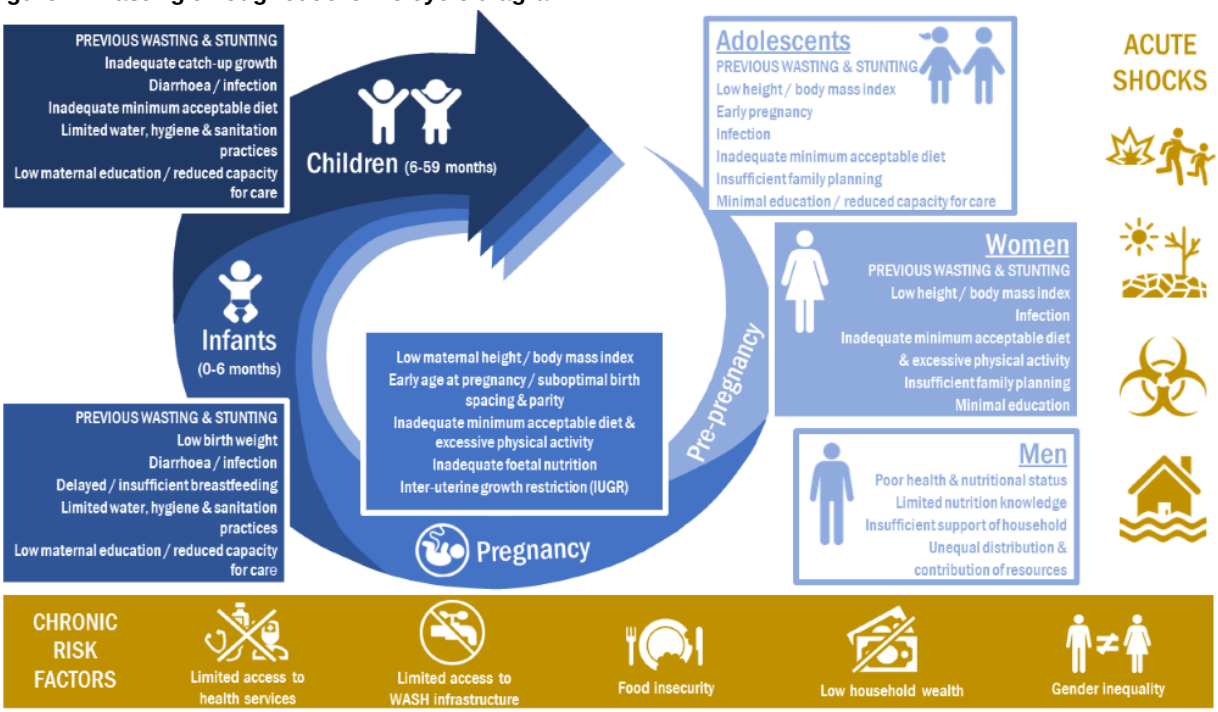
Phase I: Development of the etiology of wasting

The comprehensive review of peer-reviewed journal articles and key pieces of grey literature, led by a team of experts, resulted in a clearer understanding of the pathways through which children become wasted. It highlighted a growing evidence base on the association between wasting and stunting, the overlap of risk factors, and the multiplicative effect of dual deficits on child mortality. This led to the idea that prevention strategies may need to include a joint approach to capture, understand, and address this vulnerability. The evidence review, which resulted in a depiction of the cycle of wasting, collaboratively prepared with the FCDO advisor who requested the assignment (**Figure 2** and **Table 1**), highlights the need to act on early determinants to support optimal fetal development and infant feeding. This has consequences not only for the type of literature search on interventions but also on the type of research questions that arise, such as how and to what extent does in utero experience amplify the risk of wasting in response to external factors during infancy and childhood?

Figure 11. One slice of the assumption map for the wasting research.

Key activities *and their pre-conditions*	Key outputs *and potential formats*	Selection of assumptions	Key outcomes	Selection of assumptions	Signs of uptake *(sign of impact itself)*	Selection of assumptions	Impact
Research and review of evidence • *Right under-standing and/or experts conducting the work* • *Availability and access to information* • *Scientific method to systematically review the evidence*	Summary of available evidence to adequately understand the condition(s), and of the breadth and depth of the evidence base • *Causal diagrams or similar (e.g., Figure 2)* • *Table of literature on risk factors, potential confounders, or effect modifiers (e.g., Table 1)* • *Report on literature review* • *Research article*	**IF** 1) Quality of summary is appropriate 2) Evidence found is pertinent to nutrition global agenda 3) Sufficient buy-in and funding to use the evidence 4) Feasibility to roll out or scale up effective interventions 5) Enabling environment for use of evidence, **THEN**	Use of evidence gaps to inform research questions to further the nutrition agenda Key experts convene to prioritize research appropriately	**IF** 6) There is investment to address the research gaps and use the prioritized research questions 7) The evidence is used to roll out or scale up effective programs based on scientific evidence, **THEN**	Using research of the evidence base to inform future research activities and program design or scale-up Using the prioritized research to inform funding for scaling up nutrition action	**IF** 8) The research prioritized translates into decreased burden of disease or its risk factors 9) Funding is available for rolling out research and interventions 10) There is good coverage of evidence-based program, **THEN**	Enhanced quality, scale, and effectiveness of nutrition-related programs and policies Reduced burden of disease

Figure 2. Wasting throughout the life cycle diagram.



Abbreviation: WASH, water, sanitation, and hygiene.

Table 1. Data sources for child wasting factors and examples.

Factor	Example
Association with child wasting outcomes	
Maternal status (short) and body mass index (BMI) (thin)	(Ali et al., 2017; Ozaltin et al., 2010; Subramanian et al., 2009; Tigga & Sen, 2016)
Maternal age (young)	(Fall et al., 2015; Pravana et al., 2017)
Family planning	(Aheto et al., 2015; Asfaw et al., 2015; Betebo et al., 2017; Fink et al., 2014; Tette et al., 2015)
Intra-uterine growth restriction, preterm and/or low birth weight	(Christian et al., 2013; Rahman et al., 2016; Sania et al., 2015)
Child stunting	(McDonald et al., 2013; Victora, 1992)
Inflammation and enteric enteropathy	(Genton et al., 2015; Harper et al., 2018; Patwari, 1999; Relman, 2013)
Diarrhea	(Ahmed et al., 1993; Patwari, 1999; Relman, 2013)
Dietary diversity	(Arimond & Ruel, 2018; Frempong & Annim, 2017)
Food insecurity	(Abdurahman et al., 2016; Betebo et al., 2017)
Water, sanitation, and hygiene (WASH)	(Humphrey, 2009; Raihan et al., 2017)
Household wealth (low)	(Bhutta et al., 2013; Frongillo et al., 1997; Martorell & Young, 2012)
Mother's education/literacy	(Aheto et al., 2015; Frozanfar et al., 2016; Ickes et al., 2015; Mishra et al., 2014)
Women's empowerment	(Alaofè et al., 2017; Shroff et al., 2011)
Male involvement	(Kansiime et al., 2017)

Factor	Example
Multiple risk factors in the life cycle	(Akombi et al., 2017)
Emergency contexts	(Altare et al., 2016)
Impact of child wasting	
Multiple impacts	(Black et al., 2008, 2013)
Cognitive development	(Kar et al., 2008)
Morbidity	(Black et al., 2013)

Phase I: Summarizing the state of evidence on wasting prevention

The team used the findings of the evidence summary to frame the literature search on nutrition-related interventions and develop a semi-structured questionnaire for expert stakeholders to share their opinion on what approaches work, the challenges, and the knowledge gaps. The systematic summary of the state of evidence by intervention area, quality of available studies, potential effect on wasting prevention, and the expert opinion on its significance helped depict where the evidence is mixed or inconclusive. This in itself has the potential to demonstrate impact, if the nutrition community uses the gaps identified to bolster action and research in the coming months or years. In terms of this piece of TA contracted by FCDO, the findings were used in Phase II.

Phase II: Establishing research questions relevant to the prevention of wasting

Drawing from the review of the literature on the etiology of and the findings of the state of the evidence on what works to prevent wasting, the team was able to meet a sign of impact: using the findings to develop tangible research questions for an expert group to review. The investment in this exercise is itself a testament to the uptake and progression towards the global nutrition agenda.

Phase II: Prioritizing research questions

Useful research questions must meet some key assumptions. That is, they must be answerable (feasible given context and time?), efficient (likely to produce the outcome hypothesized?), deliverable (cost-effective?), and gap-filling (pertinent to the knowledge gaps?). Whether these assumptions will be met for the top-ranked/prioritized questions is yet to be seen (i.e., whether there will be sufficient buy-in from the global nutrition-related communities). The questions would serve as a preliminary point to conduct supplementary research to strengthen the evidence base and/or test new or scale up existing interventions for impact. It provides an opportunity for scaling up action beyond wasting prevention, such as strengthening health systems to achieve the World Health Assembly targets and deliver on the Sustainable Development Goal to end malnutrition in all forms by 2030.

Discussion on signs of impact

The findings of this TA should facilitate uptake related to wasting prevention, though incorporation of the relevant findings into FCDO investment decision-making is yet to be seen. It also has the potential to inform FCDO of key networks, groups, and initiatives involved in this research area (Phase III). Having prioritized study questions as a result of technical consensus has the potential to support decision-making on funding and harmonization of efforts to avoid duplication. In addition, it is essential to consider where existing data can be used and where evidence can be improved to identify opportunities to prevent wasting and other forms of child malnutrition. The dissemination of the results and uptake of the information by appropriate stakeholders can strengthen global-, regional-, and country-level understanding of nutrition status and help in making targeted and informed decisions, which in turn will help prevent death in children due to wasting.

References

Abdurahman, A. A., Mirzaei, K., Dorosty, A. R., Rahimiforoushani, A., & Kedir, H. (2016). Household food insecurity may predict underweight and wasting among children Aged 24–59 months. *Ecology of Food and Nutrition*, *55*(5), 456–472. https://doi.org/10.1080/03670244.2016.1207069.

Aheto, J. M. K., Keegan, T. J., Taylor, B. M., & Diggle, P. J. (2015). Childhood malnutrition and Its determinants among under-five children in Ghana. *Paediatric and Perinatal Epidemiology*, *29*(6), 552–561. https://doi.org/10.1111/ppe.12222.

Ahmed, N. U., Zeitlin, M. F., Beiser, A. S., Super, C. M., & Gershoff, S. N. (1993). A longitudinal study of the impact of behavioural change intervention on cleanliness, diarrhoeal morbidity and growth of children in rural Bangladesh. *Social Science & Medicine (1982)*, *37*(2), 159–171.

Akombi, B., Agho, K., Hall, J., Wali, N., Renzaho, A., & Merom, D. (2017). Stunting, wasting and underweight in sub-Saharan Africa: A systematic review. *International Journal of Environmental Research and Public Health*, *14*(8), 863. https://doi.org/10.3390/ijerph14080863.

Alaofè, H., Zhu, M., Burney, J., Naylor, R., & Douglas, T. (2017). Association between women's empowerment and maternal and child nutrition in Kalalé district of Northern Benin. *Food and Nutrition Bulletin*, *38*(3), 302–318. https://doi.org/10.1177/0379572117704318.

Ali, Z., Saaka, M., Adams, A.-G., Kamwininaang, S. K., & Abizari, A.-R. (2017). The effect of maternal and child factors on stunting, wasting and underweight among preschool children in Northern Ghana. *BMC Nutrition*, *3*(1), 31. https://doi.org/10.1186/s40795-017-0154-2.

Altare, C., Delbiso, T. D., & Guha-Sapir, D. (2016). Child wasting in emergency pockets: A meta-analysis of small-scale surveys from Ethiopia. *International Journal of Environmental Research and Public Health*, *13*(2), 178. https://doi.org/10.3390/ijerph13020178.

Arimond, M., & Ruel, M. T. (2018). Dietary diversity Is associated with child nutritional status: Evidence from 11 Demographic and Health Surveys. *The Journal of Nutrition*, *134*(10). https://doi.org/10.1093/jn/134.10.2579.

Asfaw, M., Wondaferash, M., Taha, M., & Dube, L. (2015). Prevalence of undernutrition and associated factors among children aged between six to fifty nine months in Bule Hora district, South Ethiopia. *BMC Public Health*, *15*, 41. https://doi.org/10.1186/s12889-015-1370-9.

Betebo, B., Ejajo, T., Alemseged, F., & Massa, D. (2017). Household food insecurity and its association with nutritional status of children 6-59 months of age in East Badawacho District, South Ethiopia. *Journal of Environmental and Public Health*, *2017*, 6373595. https://doi.org/10.1155/2017/6373595.

Bhutta, Z. A., Das, J. K., Rizvi, A., Gaffey, M. F., Walker, N., Horton, S., Webb, P., Lartey, A., & Black, R. E. (2013). Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *The Lancet*, *382*(9890), 452–477. https://doi.org/10.1016/S0140-6736(13)60996-4.

Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., de Onis, M., Ezzati, M., Mathers, C., & Rivera, J. (2008). Maternal and child undernutrition: global and regional exposures and health consequences. *The Lancet*, *371*(9608), 243–260. https://doi.org/10.1016/S0140-6736(07)61690-0.

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., & Uauy, R. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, *382*(9890), 427–451. https://doi.org/10.1016/S0140-6736(13)60937-X.

Christian, P., Lee, S. E., Donahue Angel, M., Adair, L. S., Arifeen, S. E., Ashorn, P., Barros, F. C., Fall, C. H. D., Fawzi, W. W., Hao, W., Hu, G., Humphrey, J. H., Huybregts, L., Joglekar, C. V., Kariuki, S. K., Kolsteren, P., Krishnaveni, G. V., Liu, E., Martorell, R., … Black, R. E. (2013). Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. *International Journal of Epidemiology*, *42*(5), 1340–1355. https://doi.org/10.1093/ije/dyt109.

Fall, C. H. D., Sachdev, H. S., Osmond, C., Restrepo-Mendez, M. C., Victora, C., Martorell, R., Stein, A. D., Sinha, S., Tandon, N., Adair, L., Bas, I., Norris, S., & Richter, L. M. (2015). Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). *The Lancet Global Health*, *3*(7), e366–e377. https://doi.org/10.1016/S2214-109X(15)00038-8.

Fink, G., Sudfeld, C. R., Danaei, G., Ezzati, M., & Fawzi, W. W. (2014). Scaling-up access to family planning may improve linear growth and child development in low and middle income countries. *PloS One*, *9*(7), e102391. https://doi.org/10.1371/journal.pone.0102391.

Frempong, R. B., & Annim, S. K. (2017). Dietary diversity and child malnutrition in Ghana. *Heliyon*, *3*(5), e00298. https://doi.org/10.1016/j.heliyon.2017.e00298.

Frongillo, E. A., de Onis, M., & Hanson, K. M. (1997). Socioeconomic and demographic factors are associated with worldwide patterns of stunting and wasting of children. *The Journal of Nutrition*, *127*(12), 2302–2309.

Frozanfar, M. K., Yoshida, Y., Yamamoto, E., Reyer, J. A., Dalil, S., Rahimzad, A. D., & Hamajima, N. (2016). Acute malnutrition among under-five children in Faryab, Afghanistan: prevalence and causes. *Nagoya Journal of Medical Science*, *78*(1), 41–53.

Genton, L., Cani, P. D., & Schrenzel, J. (2015). Alterations of gut barrier and gut microbiota in food restriction, food deprivation and protein-energy wasting. *Clinical Nutrition*, *34*(3), 341–349. https://doi.org/10.1016/j.clnu.2014.10.003.

Harper, K. M., Mutasa, M., Prendergast, A. J., Humphrey, J., & Manges, A. R. (2018). Environmental enteric dysfunction pathways and child stunting: A systematic review. *PLOS Neglected Tropical Diseases*, *12*(1), e0006205. https://doi.org/10.1371/journal.pntd.0006205.

Humphrey, J. H. (2009). Child undernutrition, tropical enteropathy, toilets, and handwashing. *Lancet (London, England)*, *374*(9694), 1032–1035. https://doi.org/10.1016/S0140-6736(09)60950-8.

Ickes, S. B., Hurst, T. E., & Flax, V. L. (2015). Maternal literacy, facility birth, and education are positively associated with better infant and young child feeding Practices and nutritional status among Ugandan children. *The Journal of Nutrition*, *145*(11), 2578–2586. https://doi.org/10.3945/jn.115.214346.

Kansiime, N., Atwine, D., Nuwamanya, S., & Bagenda, F. (2017). Effect of male involvement on the nutritional status of children less than 5 years: A cross sectional study in a rural Southwestern District of Uganda. *Journal of Nutrition and Metabolism*, *2017*, 3427087. https://doi.org/10.1155/2017/3427087.

Kar, B. R., Rao, S. L., & Chandramouli, B. A. (2008). Cognitive development in children with chronic protein energy malnutrition. *Behavioral and Brain Functions*, *4*(1), 31. https://doi.org/10.1186/1744-9081-4-31.

Martorell, R., & Young, M. F. (2012). Patterns of stunting and wasting: Potential explanatory factors. *Advances in Nutrition*, *3*(2), 227–233. https://doi.org/10.3945/an.111.001107.

McDonald, C. M., Olofin, I., Flaxman, S., Fawzi, W. W., Spiegelman, D., Caulfield, L. E., Black, R. E., Ezzati, M., Danaei, G., & Nutrition Impact Model Study. (2013). The effect of multiple anthropometric deficits on child mortality: meta-analysis of individual data in 10 prospective studies from developing countries. *The American Journal of Clinical Nutrition*, *97*(4), 896–901. https://doi.org/10.3945/ajcn.112.047639.

Mishra, K., Kumar, P., Basu, S., Rai, K., & Aneja, S. (2014). Risk factors for severe acute malnutrition in children below 5 years of age in India: A case-control study. *The Indian Journal of Pediatrics*, *81*(8), 762–765. https://doi.org/10.1007/s12098-013-1127-3.

Ozaltin, E., Hill, K., & Subramanian, S. V. (2010). Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. *JAMA*, *303*(15), 1507–1516. https://doi.org/10.1001/jama.2010.450.

Patwari, A. K. (1999). Diarrhoea and malnutrition interaction. *Indian Journal of Pediatrics*, *66*(1 Suppl), S124-134.

Pravana, N. K., Piryani, S., Chaurasiya, S. P., Kawan, R., Thapa, R. K., & Shrestha, S. (2017). Determinants of severe acute malnutrition among children under 5 years of age in Nepal: a community-based case-control study. *BMJ Open*, *7*(8), e017084. https://doi.org/10.1136/bmjopen-2017-017084.

Rahman, M. S., Howlader, T., Masud, M. S., & Rahman, M. L. (2016). Association of low-birth weight with malnutrition in children under five years in Bangladesh: Do mother's education, socio-economic status, and birth interval matter? *PloS One*, *11*(6), e0157814. https://doi.org/10.1371/journal.pone.0157814.

Raihan, M. J., Farzana, F. D., Sultana, S., Haque, M. A., Rahman, A. S., Waid, J. L., McCormick, B., Choudhury, N., & Ahmed, T. (2017). Examining the relationship between socio-economic status, WASH practices and wasting. *PLOS ONE*, *12*(3), e0172134. https://doi.org/10.1371/journal.pone.0172134.

Relman, D. A. (2013). Microbiology. Undernutrition--looking within for answers. *Science (New York, N.Y.)*, *339*(6119), 530–532. https://doi.org/10.1126/science.1234723.

Sania, A., Spiegelman, D., Rich-Edwards, J., Hertzmark, E., Mwiru, R. S., Kisenge, R., & Fawzi, W. W. (2015). The contribution of preterm birth and intrauterine growth restriction to childhood undernutrition in Tanzania. *Maternal & Child Nutrition*, *11*(4), 618–630. https://doi.org/10.1111/mcn.12123.

Shekar, M., Kakietek, J., Dayton Eberwein, J., & Walters, D. (2017). *An Investment Framework for Nutrition: Reaching the Global Targets for Stunting, Anemia, Breastfeeding, and Wasting*. The World Bank. https://doi.org/10.1596/978-1-4648-1010-7.

Shroff, M. R., Griffiths, P. L., Suchindran, C., Nagalla, B., Vazir, S., & Bentley, M. E. (2011). Does maternal autonomy influence feeding practices and infant growth in rural India? *Social Science and Medicine*, *73*(3), 447–455. https://doi.org/10.1016/j.socscimed.2011.05.040.

Subramanian, S. V, Ackerson, L. K., Davey Smith, G., & John, N. A. (2009). Association of maternal height with child mortality, anthropometric failure, and anemia in India. *JAMA*, *301*(16), 1691–1701. https://doi.org/10.1001/jama.2009.548.

Tette, E. M. A., Sifah, E. K., & Nartey, E. T. (2015). Factors affecting malnutrition in children and the uptake of interventions to prevent the condition. *BMC Pediatrics*, *15*, 189. https://doi.org/10.1186/s12887-015-0496-3.

Tigga, P. L., & Sen, J. (2016). Maternal body mass index is strongly associated with children: Z-scores for height and BMI. *Journal of Anthropology*, *2016*, 1–10. https://doi.org/10.1155/2016/6538235.

UNICEF/WHO/World Bank Group. (2019). *Joint Child Malnutrition Estimates: Levels and Trends in Child Malnutrition. Key findings of the 2019 Edition*.

Victora, C. G. (1992). The association between wasting and stunting: An international perspective. *The Journal of Nutrition*, *122*(5), 1105–1110. https://doi.org/10.1093/jn/122.5.1105.

Acknowledgments

Following on the success of Maximising the Quality of Scaling Up Nutrition (MQSUN) (2012–2016), the United Kingdom's Foreign, Commonwealth and Development Office (FCDO)-funded MQSUN+ (2016–2020) provided technical assistance to FCDO, Scaling Up Nutrition (SUN) countries and the SUN Movement Secretariat to catalyze multisectoral country efforts to scale up nutrition impact, maximize the quality and effectiveness of nutrition-related programs, increase innovation in nutrition, support evidence generation and knowledge uptake, and develop technical capacity. MQSUN+ was a consortium of five expert organizations: PATH (lead), Aga Khan University, DAI Global Health, Development Initiatives, and NutritionWorks.

MQSUN+ cannot be held responsible for errors or any consequences arising from the use of information contained in this brief. This document was produced by MQSUN+ through support provided by UK aid and the UK Government; however, the views expressed herein do not necessarily reflect the UK Government's official policies.

This brief was produced by Arja Huestis, Monica Kothari, Amanda Coile, Carrie Hubbell Melgarejo, and Carrie Hemminger; special acknowledgments to Rhea Shah and Anya Leslie Samtani for their support in collation and review.

Suggested citation: Maximising the Quality of Scaling Up Nutrition Plus (MQSUN+). *Technical assistance to understand the evidence and research priorities for prevention of acute malnutrition: MQSUN+ retrospective case study.* Washington, DC: PATH; 2021. https://mqsunplus.path.org/resources/assumption-maps-to-assess-signs-of-impact-of-short-term-technical-assistance/

Cover photo: PATH/Evelyn Hockstein