Improving nutrition during middle childhood and adolescence by 2032

A research roadmap

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Summary

Despite the importance of nutrition during middle childhood (5–9 years) and adolescence (10–19 years) for the health and well-being of current and future generations, the 5–19-year period remains relatively neglected in research, policy and programming agendas.

In 2021, Emergency Nutrition Network (ENN) conducted a research prioritisation exercise using the Child Health and Nutrition Research Initiative (CHNRI) methodology.[a] This research roadmap provides a scoping review of available literature for the six priority research areas identified by the CHNRI exercise (**Table 1**). It collates current knowledge, evidence gaps and lessons learnt from research conducted in other health-related fields to set out a detailed, global research agenda to support nutrition for children and adolescents 5–19 years of age in low- and middle-income countries (LMICs) over the next 10 years.

Table 1: Research areas covered

1	How should antenatal care (ANC) and postnatal care (PNC) interventions be adapted to effectively, and cost-effectively, support the specific health and nutritional needs of pregnant adolescents?
2	What strategies are effective for delivering interventions in schools to improve the quality of diets and the nutritional outcomes of school-age children (SAC) and adolescents?
3	What strategies are effective at involving SAC and adolescents in defining their own context-specific solutions to nutrition problems, and does their involvement result in more effective interventions?
4	What are effective, context-specific behaviour change communication strategies to improve the diets and nutritional status of SAC and adolescents?
5	What improvements can be made to local food systems to support access to healthy diets in schools?
6	What are the optimal cross-sector partnerships and delivery platforms (health, education, social protection, digital platforms, media/technology, etc.) for the effective uptake of nutrition interventions for SAC and adolescents, considering scale, sustainability and youth engagement?

a https://www.ennonline.net/adolescentchnri2022

Research Area 1. How should antenatal care (ANC) and postnatal care (PNC) interventions be adapted to effectively, and cost-effectively, support the specific health and nutritional needs of pregnant adolescents?

Approximately 11% of births occur in adolescent girls 15–19 years of age, 95% of whom live in LMICs, making them and their infants vulnerable to adverse growth and development outcomes and contributing to an intergenerational cycle of malnutrition and ill health. Despite this, available research lacks examples of tailored, effective delivery platforms and implementation guidance for ANC and PNC services that address the specific needs of adolescent girls in LMICs.

Key evidence gaps include a lack of data on the uptake of PNC services and barriers to accessing care; the impacts of tailored services on health and nutrition outcomes, including cost-effectiveness; and a lack of evidence on how other adolescent-responsive health service strategies can be applied to ANC/PNC.

Way forward

Research Question 1.1: What packages of adolescent-responsive ANC and PNC services support optimal nutrition and health outcomes for mother and infant? What are optimal delivery platforms? What is their cost-effectiveness?

- Study design: evidence review and cluster randomised controlled trial (RCT)
- Intervention: adolescent-tailored package of services vs standard ANC/PNC (control)
- Note: packages of interventions should be informed by the World Health Organization (WHO) ANC and PNC guidelines

Research Question 1.2: Does including family members and healthcare providers in education/social and behaviour change communication (SBCC) interventions increase the uptake of, and retention in, ANC/PNC services by adolescent girls?

- Study design: cluster RCT
- Intervention: SBCC intervention targeting pregnant adolescents, their families (male partners, mothers/mothers-in-law, fathers) and healthcare providers vs SBCC intervention for adolescent girls only

Research Question 1.3: Does locating ANC/PNC services for adolescent girls within existing community-based services or platforms for adolescents increase the uptake of, and retention in, ANC/PNC services?

- Study design: cluster RCT or pre-/post-intervention analysis
- Intervention: locating ANC/PNC services within existing community-based services or platforms for adolescent girls vs standard facility-based ANC/PNC services (control)

Research Question 1.4: Does the use of electronic/mobile health (e/m-health) platforms (social media; text messaging) to educate, inform and engage adolescent girls during pregnancy and postpartum increase the uptake of, and retention in, ANC/PNC services, improve knowledge of nutrition and health and improve nutrition and health-related behaviours?

- Study design: cluster RCT
- Intervention: media-based SBCC package including education, promotion and peer-to-peer/peer-to-healthcare provider engagement on ANC/PNC attendance and nutrition and health behaviours during pregnancy and postpartum vs simple text reminders to attend ANC/PNC services (control)

Research Area 2. What strategies are effective for delivering interventions in schools to improve the quality of diets and the nutritional outcomes of school-age children (SAC) and adolescents?

Schools are widely recognised as the optimal delivery platform for nutrition and health interventions during middle childhood and adolescence. While school feeding programmes reach millions of children globally, their coverage and quality varies across settings and there is a lack of consensus on effective delivery strategies. Another important school-based intervention is weekly iron and folic acid supplementation (WIFAS), recommended by WHO for menstruating adolescent girls in many LMICs; however, few countries are currently implementing this approach at scale.

Key evidence gaps include a lack of data on the prevalence of anaemia and micronutrient deficiencies during middle childhood (5–9 years) in LMICs and the impact of supplementation programmes targeting this age group; a lack of minimum quality standards for school meals; limited solutions to address barriers to delivering WIFAS programmes; and a lack of evidence on the potential benefits, barriers and cost-effectiveness of transitioning from WIFAS to weekly multiple micronutrient supplements (MMS).

Way forward

Research Question 2.1: What are the minimum standards for school feeding programmes associated with improved school attendance and child health, growth and well-being outcomes, and how should these be tailored by context, age and sex?

- Study design: literature review and meta-analysis (as applicable)
- Intervention: school feeding of different quantities and qualities (macro and micronutrient), including fortified foods vs micronutrient supplementation, in primary and secondary schools in a variety of regions

Research Question 2.2: How should WIFAS programmes be contextualised across diverse settings, including overcoming delivery barriers at scale?

- Study design 1: qualitative research to explore barriers and facilitators across diverse contexts
- Follow-on study design 2: pilot implementation, followed by adaptation and scale-up

Research Question 2.3: Should WIFAS programmes be replaced with programmes providing MMS to school-going adolescents, and what is the cost-effectiveness of this?

- Study design: cluster RCTs in various contexts, followed by use of secondary data to model cost differences vs effectiveness
- Intervention: MMS vs iron and folic acid (IFA), such as in the ongoing School-Based Assessment of Micronutrient Interventions in Adolescents (SAMIA) trial

Research Question 2.4: What is the burden of anaemia and other micronutrient deficiencies (iron, vitamin A, zinc, iodine, etc.) during middle childhood and how does this differ by context?

- Study design: cross-sectional surveys in a wide variety of contexts including Africa and Asia

Research Question 2.5: What are the benefits of micronutrient supplementation for addressing the risk of anaemia and micronutrient deficiencies, as well as for other health, growth, and well-being outcomes, during middle childhood and how does this differ by context?

- Study design: cluster RCT at the school level
- Intervention: WIFAS vs MMS vs placebo (control) and impact on haemoglobin levels, micronutrient status and other outcomes of interest (including, but not limited to, school attendance, retention and performance)

Research Area 3. What strategies are effective at involving SAC and adolescents in defining their own context-specific solutions to nutrition problems, and does their involvement result in more effective interventions?

A growing body of evidence demonstrates the benefits of youth engagement on research outputs, as well as on young people and their communities. Many research entities, civil society organisations, policy makers, United Nations organisations and donors have worked to incorporate youth engagement in their various workstreams and developed guidance documents and tools to support these processes. However, while such strategies and guidelines may provide useful platforms to build on, more evidence is needed on the barriers and enablers to youth engagement in LMICs, as well as on relevant and effective context-specific implementation strategies.

Key evidence gaps include a lack of data to inform strategies, models and tools for effective youth engagement in nutrition interventions in LMICs; a lack of data on context-specific barriers and enablers to sustained and effective youth engagement in nutrition interventions; and a lack of consensus on how to describe youth engagement in research and how to measure impact. Understanding is also limited on how to ensure that youth have adequate expertise in nutrition and health topics, as well as training in research methodology, while considering their lived experiences and priorities.

Way forward

Research Question 3.1: What are the optimal strategies for engaging children and adolescents in nutrition interventions in LMICs, and how do they vary by context, age, and sex?

- Study design: compilation of case studies and exemplars, including any reported impacts on nutrition outcomes
- Intervention: using different methods of engaging youth (such as participatory workshops and creative methods including photos, graffiti walls, drawings, games, etc.) at different scales, frequencies and timepoints
- Context: from a variety of contexts and scenarios, including research and programming

Research Question 3.2: What are the barriers and enablers to sustainably engaging children and adolescents in nutrition interventions in LMICs, and how do they vary by context, age and sex?

- Study design: qualitative study
- Methods should be relevant to the context and samples should include both sexes, as well as a range of ages to assess the needs of different groups
- Context: a wide variety are needed – Africa and Asia, urban and rural

Research Area 4. What are effective, context-specific SBCC strategies to improve the diets and nutritional status of SAC and adolescents?

Nutrition behaviours are influenced by a range of factors during middle childhood and adolescence, including existing habits, social and cultural norms and aspirations, access to resources, self-efficacy and structural constraints and opportunities. Diet and physical activity behaviours adopted during this time can persist into adulthood, influencing the risk of developing non-communicable diseases, as well as affecting the health and well-being of the next generation. SBCC strategies are increasingly utilised in nutrition programmes to promote positive behaviour change; however, more evidence is needed to inform development of comprehensive, context-specific, child- and adolescent-responsive strategies in LMICs.

Evidence gaps include limited understanding of the mechanisms of behaviour change that support improved diets during middle childhood and adolescence; a lack of guidance on developing context-specific content and intervention materials; limited understanding of effective school mobilisation strategies, especially in rural settings, and of complementary approaches that target out-of-school adolescents; and a lack of examples of strategies that engage community members across all stages of programme design and implementation. There is also a need for guidance on how to provide SBCC training for teachers and other staff at scale; for examples of feasible, acceptable and effective media-based approaches in LMICs; and for consensus on how the policy environment can support healthy behaviours in children and adolescents.

Way forward

Research Question 4.1: What common framework can be used to design contextualised and effective SBCC programmes for improving nutrition in middle childhood and adolescence?

- Study design: systematic review of current strategies, examples, evidence and toolkits that effectively promote behaviour change during middle childhood and adolescence
- Note: this should include lessons learnt from other sectors, such as sexual and reproductive health (SRH), as well as frameworks that promote gender equity and girls' empowerment. RCTs of a common package of tools, cost-effectiveness analyses and national-scale pilots should follow

Research Question 4.2: What SBCC strategies are effective for rural adolescents and out-of-school adolescents?

- Study design: cluster RCT and cost-effectiveness analysis
- Intervention: different multifaceted SBCC strategies are needed that are specific to adolescents in rural communities and those out of school. Outcomes should extend beyond anthropometry

Research Question 4.3: What is the feasibility, acceptability and effectiveness of large-scale media-based campaigns on nutrition outcomes during middle childhood and adolescence in LMICs?

- Study design: cluster RCT randomised at community level
- Intervention: school-based SBCC vs school-based SBCC and media-based campaigns, including exploration into whether the media campaign reached the target audience, what platforms were most effective and whether there were additional benefits on nutrition outcomes when compared to school-based, face-to-face strategies alone

Research Area 5. What improvements can be made to local food systems to support access to healthy diets in schools?

In recent years, increased attention has been paid to the role of food systems in determining the diets of children and adolescents, particularly those within and surrounding schools. Good school food systems should both promote the availability of healthy, micronutrient-dense foods and restrict access to less healthy food items high in fat and sugar, while incorporating behavioural components. However, existing food systems often overlook the nutritional needs of children and adolescents, and pervasive marketing of unhealthy food and drinks in and around schools promotes the consumption of these items for those who can afford to purchase them. The literature suggests that the following interventions should be considered to improve school food systems, but trialling their acceptability, feasibility and impact in LMICs remains a key evidence gap:

- Healthy food standard regulations should be implemented on all foods consumed at school, including direct provision of food in classrooms and/or cafeterias, food brought to school by students and purchases made from tuck shops and vending machines
- Unhealthy food/beverage vendors and marketing in and around schools should be restricted
- The affordability, availability and desirability of healthy foods in and around schools should be improved through nutrition education and food systems interventions with local producers. This may include school gardens and rearing of small livestock, as well as improving supply chain links
- Good water, sanitation and hygiene practices should be implemented
- Adequate food storage facilities to ensure adequate food safety and hygiene should be implemented

Way forward

Research Question 5.1: Which aspects of school food environments are associated with dietary/ anthropometric outcomes in LMICs?

- Study design: systematic review (initially), including observational and intervention research. This will guide future interventions and identify gaps in knowledge
- Context: all LMICs, ideally

Research Question 5.2: Can school regulation interventions (restricting marketing, setting regulations on what foods are allowed in schools, etc.) impact adolescent diet and nutrition outcomes in urban LMIC settings?

- Study design: cluster RCT, multi-armed
- Intervention: implementing healthy food standard regulations on all foods consumed at school; restricting unhealthy food/beverage vendors and marketing in and around schools (primary and secondary)

Research Question 5.3: Can interventions to support supply chains between local farming systems and school feeding programmes (in primary and secondary schools) increase farming income and improve nutrition outcomes for children and adolescents?

- Study design: cluster RCT (or pre-/post-intervention analysis, where applicable)
- Intervention: supporting local producers of healthy foods (fruits, vegetables, legumes and animal-source foods) to supply schools for school meal programmes (primary and secondary schools)

Research Area 6. What are the optimal cross-sector partnerships and delivery platforms (health, education, social protection, digital platforms, media/technology, etc.) for the effective uptake of nutrition interventions for SAC and adolescents, considering scale, sustainability and youth engagement?

This research area focused on the use of structural and community-based interventions to improve nutrition and health in children and adolescents, particularly those out of school. Structural interventions – including legislation, taxation and the implementation of policies promoting and supporting the consumption of healthy, nutrient-dense foods and engagement in physical activity, while restricting less healthy diet and activity behaviours – have been shown to influence food access and consumption at the population level. Community-based interventions provide opportunities to work with a range of local organisations to target social norms and environments that influence dietary choices and engagement in physical activity, and to reach out-of-school children and adolescents with nutrition interventions.

Key evidence gaps include a lack of data on the impacts of legislative policies improving the availability of, and access to, healthy nutritious foods, while restricting that of unhealthy foods/beverages, on diets and nutritional status during middle childhood and adolescence. Examples of social protection programmes targeting middle childhood and adolescence are lacking, particularly for vulnerable children and adolescents who are out of school, and a lack of qualitative evidence on the barriers and enablers to accessing services for out-of-school children and adolescents. Quantitative research on the impact of contextualised community-based platforms on nutrition outcomes beyond schools is also needed.

Way forward

Research Question 6.1: Can social protection programmes targeting food security and nutrition outcomes be adapted to improve nutritional status during middle childhood and adolescence, particularly for those out of school?

- Study design: systematic review (initially) of current social protection programmes that effectively promote food security and improve dietary intake and quality. This will identify gaps in knowledge and inform future interventions
- Context: diverse LMICs, particularly targeting those where many children and adolescents are not in school

Research Question 6.2: What are the barriers and enablers that out-of-school children and adolescents experience to accessing nutrition, health and social protection services in LMICs, and how do they vary by context, age and sex?

- Study design: qualitative study
- Notes: sample should include a range of ages and sexes to assess different needs

Research Question 6.3: What are the optimal community-based platforms for delivering nutrition interventions to children and adolescents beyond schools at scale, and how do they vary by context, age and sex?

- Study design: compilation of case studies and exemplars, including any reported impacts on nutrition outcomes, from a variety of contexts, including research and programming

Cross-cutting considerations

Funding and cost-effectiveness: Across research areas, funding limitations were highlighted as key barriers to the implementation and/or sustainability of nutrition interventions/programmes during middle childhood and adolescence, with interventions/programmes targeting secondary schools and out-of-school children and adolescents being particularly under-researched. In all research areas, there is a need to incorporate estimations of cost-effectiveness to assess suitability, sustainability and scalability across LMICs.

Monitoring and evaluation: Many interventions across high-, middle- and low-income settings failed to incorporate the adequate, long-term monitoring and evaluation components essential to assess impact, identify effective intervention strategies, establish formal standards for nutrition-related policies in schools and coordinate various intervention components. More research is needed on what indicators and outcomes to measure, as well as on the optimal timing and platforms for the monitoring and evaluation of nutrition interventions/programmes during middle childhood and adolescence.

Multi-sector engagement: While the focus of many school-based interventions has been on implementation via the education sector, the increasing focus on multicomponent strategies to holistically address malnutrition relies on effective engagement across sectors – for example, incorporating social protection systems to address food insecurity, ensuring access to basic health services and facilitating access to healthy food via engagement with the agricultural and commercial sectors.

Conclusion

One of the 10 recommendations from the 2021 Lancet series on adolescent nutrition was that *"donors and research funding agencies … invest in and prioritize the knowledge gaps thwarting action for adolescent nutrition."* While this research roadmap is not exhaustive, it provides detailed background evidence on priority research areas, identifies evidence gaps and outlines specific research questions to guide the efforts of researchers, funders and governments over the next 10 years.

Opportunities for collaboration and coordination

To streamline and optimise efforts to address these (and other) research gaps related to improved nutrition during middle childhood and adolescence, collaboration and coordination between partners is key. The Global Adolescent Nutrition Network (GANN) is a network of researchers, programmers, government representatives, donors, and United Nations agencies, coordinated by ENN, that provides a platform to identify emerging research, share operational experiences and disseminate information.

The GANN would welcome expressions of interest to co-develop concept notes around the research questions outlined in this roadmap with group members. We would also appreciate hearing any details from researchers on how content in this report is being used to shape research plans, whether within or external to the GANN. This is both to improve the coordination of future activities and to understand the utility of this type of report. Any feedback on the content is welcome and can be shared with the GANN coordinator at **natasha@ennonline.net** or **office@ennonline.net**.

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