

# The “Fill the Nutrient Gap” analysis: An approach to strengthen nutrition situation analysis and decision making towards multisectoral policies and systems change

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## Abstract

Improved nutrition situation analysis can increase the understanding of the likely magnitude and main causes of the nutrient gap among a particular target group, for example, children under 2 or pregnant and lactating women, in a particular context. The World Food Programme, with input from University of California Davis, International Food Policy Research Institute, Epicentre, Harvard University, Mahidol University, Save the Children, and UNICEF, has developed a framework for strengthened nutrition situation analysis and decision making called the “Fill the Nutrient Gap” (FNG), which aims to support identification of strategies to increase availability, access, and choice of nutritious foods, to ultimately improve nutrient intake. The FNG engages stakeholders from different sectors throughout the analytical process to provide input and discuss findings to collectively identify and prioritize context-specific strategies. The FNG analysis contributes to better understanding the nutrition situation because it (a) focuses on the dietary intake side of the malnutrition framework and analyses in-depth the nutrient intake of different target groups; (b) linear programming is used in combination with review of secondary data to characterize barriers to nutrient intake, in particular to understand the availability, cost and affordability of nutritious diets for households and target groups with higher nutritional needs, and model potential interventions to improve them; (c) it links the nutrition situation analysis to decision making by providing an evidence base for decision makers to inform their strategies; (d) it facilitates multisectoral discussion on barriers to nutrient intake and enables a prioritization of context-specific strategies (both nutrition specific and sensitive) to improve the nutrition situation across food, health, and social protection systems.

## KEYWORDS

“Fill the Nutrient Gap” analysis (FNG), Cost of the Diet, food systems, nutrition situation analysis, nutrition-sensitive approaches

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## 1 | INTRODUCTION

To achieve the Sustainable Development Goal 2, “End hunger, achieve food security and improved nutrition and promote sustainable agriculture,” and in particular target 2.2, “by 2030 end all forms of malnutrition...,” effective and strategic multisectoral action is required that addresses the most relevant direct, underlying, and basic causes of malnutrition in a particular context. To identify the most appropriate nutrition-specific and -sensitive approaches, a situation analysis is required that takes a systems approach to assessing what bottleneck individuals, households, and larger communities face to improve their dietary intake and health, and how these can best be addressed.

Meeting nutrient needs is essential in order to be free from malnutrition, but in many countries, the current local diet of vulnerable groups does not provide the nutrients required, resulting in a “nutrient gap” (Dewey, 2013; Vossenaar, Hernández, Campos, & Solomons, 2013; de Pee, 2015; see Figure 1). In order to identify appropriate strategies to improve nutrient intake, it is essential to understand what nutrient intake gap exists within a specific context and the drivers of this situation. However, precisely quantifying the intake of specific nutrients among different population groups and in different geographic areas is difficult, very time-consuming, and costly, and intake varies widely within and among individuals. In addition, measures to fill the gap cannot be tailored to individuals. Therefore, it is not necessary to exactly quantify a nutrient gap to be able to identify appropriate public health nutrition interventions or strategies. Instead, through the use of proxy indicators such as minimum dietary diversity and minimum adequate diet for children under 2 (Daelmans, Dewey, & Arimond, 2009; World Health Organization, 2008) and minimum dietary diversity score for women (FAO & FHI 360, 2016), insights can be gained into the likely adequacy of nutrient intake among different target groups. Linear programming<sup>1</sup> has also been used successfully (a) to gain insights into likely nutrient gaps, by identifying nutrients that are difficult to meet from locally available foods and/or with a given budget, and (b) to model possible interventions for improving nutrient intake, for example, price reductions of specific nutrient-dense foods or food fortification, including in Cambodia, Ethiopia, Bangladesh, Vietnam, Indonesia, Mozambique, Nepal, Laos PDR, and Thailand (Skau et al., 2014; Vitta & Dewey, 2012; Baldi et al., 2013; Berger et al., 2013; Frega et al., 2012; Geniez, Mathiassen, de Pee, Grede, & Rose, 2014).

Proxy indicators and linear programming can give an indication of the dietary and nutrient-intake gaps. In order to then identify ways to improve on those, the context-specific underlying drivers of the limited dietary diversity or the high risk of inadequate intake of specific nutrients must be understood. For example, poor diversity of young children's diets could be caused by issues related to affordability, availability, knowledge,

<sup>1</sup>Linear programming is a technique that can optimize outcomes; it has a number of different applications, but with respect to nutrition, it has been used to identify combinations of foods that meet individual nutrient needs at the lowest possible cost (by taking into consideration the prices of locally available foods) or to develop diets that meet individual needs that most closely reflects current consumption patterns based on dietary intake data (and identify the nutrients that are difficult to meet the requirements of due to cost or availability).

### Key messages

- Making food, health and social-protection systems more nutrition-sensitive requires identification of opportunities for improving access and consumption of nutritious foods.
- The Fill the Nutrient Gap (FNG) analysis takes a systems approach to identify context-specific barriers to accessing and selecting nutritious foods for and by different target groups.
- The review of secondary data together with ‘Cost of the Diet’ linear programming provides an evidence base for policy makers to develop policies and programmes.
- The FNG process engages stakeholders from multiple sectors to contribute to the analysis and identify how they can improve nutrition within their context.

preference, or time constraints, so further analysis is required to identify the factors that play a key role in the context in question. However, there has of yet not been a standardized approach to analysing the likely nutrient intake gap of different vulnerable groups in a specific setting that also identifies the underlying drivers of this situation and then links that analysis to the design of strategies across different systems and sectors that are well-tailored to address these drivers.<sup>2</sup>

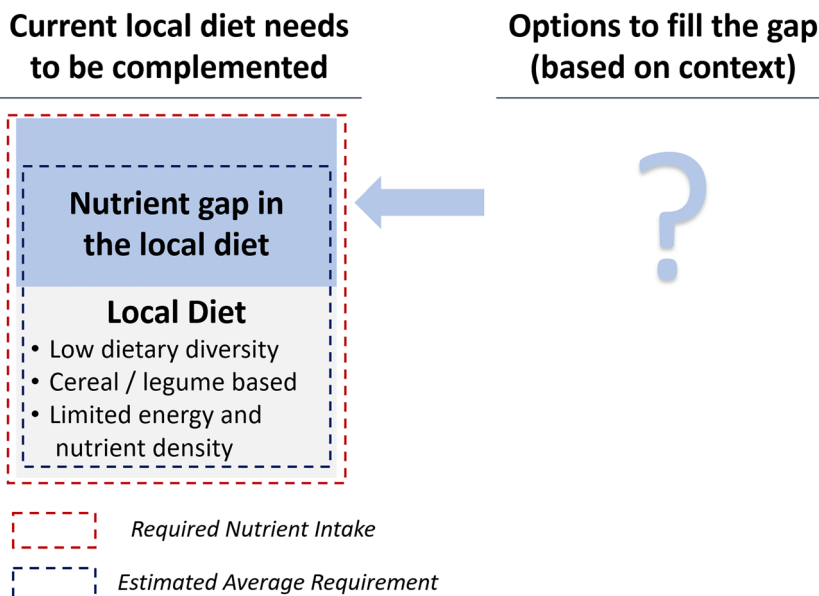
This paper describes the concept, methodology, and a few examples of the “Fill the Nutrient Gap” (FNG) analysis, which has been developed to identify the context-specific constraints and potential pathways to meeting nutrient intake recommendations among specific target groups and the general population. Through engaging actors across food, social protection, and health systems, they identify specific actions to apply across these systems. Results of FNG analyses on specific topics from different countries will be discussed in other papers.

## 2 | METHODS

In order to better gauge the likely magnitude of the nutrient gap and understand the barriers to adequate nutrient intake<sup>3</sup> among a particular target group (e.g., young children, lactating women, or adolescent girls) in a specific context and link this to possible actions across different systems, the “Fill the Nutrient Gap” analysis has been developed by the World Food Programme (WFP) with technical input from key research institutes (University of California Davis, International Food Policy Research Institute [IFPRI], Epicentre, Harvard University,

<sup>2</sup>Although there have been some efforts in the past to provide guidance on interpreting the nutrition situation and linking that to decision making with respect to infant and young child feeding practices and for refugees, these do not take a systems approach focusing on the role different sectors can play in improving nutrient intake (UNHCR, 2011; UNICEF, 2011).

<sup>3</sup>These may include issues related to affordability, availability, and local preferences.



**FIGURE 1** Conceptual model of a “nutrient gap” between recommended and actual nutrient intake and the need to select options to “fill the gap” that are adapted to the context.

Mahidol University, Save the Children UK, and UNICEF). The overarching approach for the FNG is to engage relevant stakeholders in a 4–9-month long process that starts with deciding on the focus of the analysis, proceeds with identification, review, and analysis of sources of information and data sets in a structured and iterative manner, including Cost of the Diet (CotD) analyses and modelling, and concludes with validation, consolidation, and prioritization of strategies for policies and programming.

## 2.1 | Steps of stakeholder engagement

Together with stakeholders, the FNG team from the WFP leads the process, which includes the following steps:

1. Identifying the primary aim of the analysis, for example, revision of social protection programming to be more nutrition sensitive or formulation of a nutrition action plan, and forming the national FNG team including a lead (e.g., Scaling Up Nutrition [SUN] focal point);
2. Defining the focus of the analysis, including target groups of interest, geographic scope, and specific interventions to be assessed for potential contribution to improving nutrient intake;
3. Identifying and requesting sources of information and data and conducting a specific search to fill any gaps;
4. After review of information and analysis of data, validation of findings by a technical working group and, if warranted, gathering and reviewing further information or data;
5. Presenting the findings to the larger group of stakeholders who then set priorities in line with the primary aim of the analysis, for example, on how specific actors such as food producers and processors, agricultural extension workers, and the education system could better align their services and use social safety net programmes as platforms to increase access to nutritious foods for specific target groups;

6. Stakeholders taking steps to ensure implementation of the identified priorities by integrating them in their policies or action plans. This is facilitated by having a strong champion in-country lead the FNG process and through a continued process of engagement of the key stakeholders.

Stakeholders should represent actors across the health, food, and social protection systems, which means that they come from a range of sectors including health, agriculture, education, social protection, trade and industry, etc., and can represent government, academia, United Nations, donors, private sector and civil society. In countries that have joined the SUN movement and have created the SUN structure and networks, the system aligns well with the FNG purpose and process. In non-SUN countries, there is usually another platform for multi-stakeholder collaboration for nutrition that can be engaged.

The FNG information compilation and analysis helps to foster collaboration, particularly as different sections of the analysis require the input and expertise of specific sectors. For example, experts in food safety and procurement can provide useful insights into the availability, quality, and safety of nutritious food in the market and potential for increasing availability and/or quality; local NGOs and researchers can provide insights into food consumption practices or taboos that act as a barrier to adequate nutrient intake, and social protection experts can offer insights on identifying and targeting vulnerable households. Depending on the existing country dynamics, there are two primary models for stakeholder engagement: (a) In settings with a high level of existing stakeholder engagement in multisectoral nutrition planning, bringing all stakeholders on board from the beginning is crucial so that they can all be involved in deciding the focus of the analysis. This increases their contribution and ownership of the process and results. (b) In some countries, presenting initial results first, for example, on nonaffordability of nutritious diets, helps to raise stakeholder interest to get involved, provides further information, and takes part in the next steps of the analysis.

## 2.2 | Review and analysis of secondary information and data

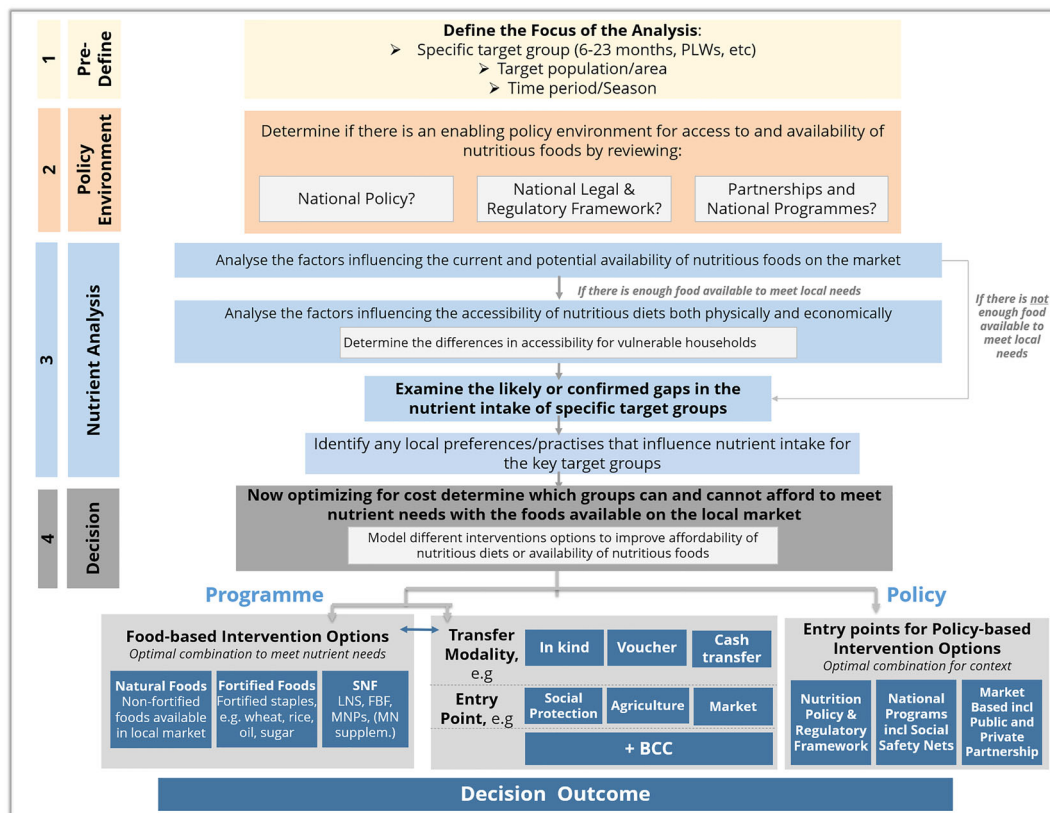
The review and analysis of secondary sources of information and data are aimed at gaining a better understanding of the nutrition situation and in particular the context specific drivers of availability, access, and choice of nutritious foods. Figure 2 shows the conceptual framework that guides the analytical process, which is a systematic, structured (non-formulaic) approach to reviewing scientific and grey literature, analysing secondary data, triangulating this information, using linear programming to understand cost of nutritious diets and their affordability, and modelling what different interventions could achieve in terms of reducing these costs. The specific categories of information, their possible indicators, sources of data or information, questions to be answered, and insights that may be provided are shown in Table 1 and described below.

1. Malnutrition characteristics—review of prevalence and trends data of malnutrition characteristics (stunting, wasting, anaemia, underweight, overweight/obesity) and, if available, data on specific micronutrient deficiencies. Data sources include the following: Demographic and Health Surveys, Multiple Indicator Cluster Surveys, National Nutrition Surveys, SMART surveys, etc.

Depending on the data that are available, the following subgroupings are considered:

- a. Target populations (e.g., children 6–23 months, pregnant and lactating women, adolescent girls, and school-age children).
- b. Geographical areas—certain areas that face greater food insecurity and/or poverty or distinct agroecological conditions. This could be divided by urban/rural, livelihood zones, geographical features, for example, mountainous areas or flood plains, and states/regions.
- c. Socio-economic groups—Different socio-economic groups often face different barriers to adequate nutrient intake and also may have different dietary patterns.
- d. Seasonality and trends over time—Times of the year that some of the population may face greater food insecurity and/or prevalence of malnutrition. Periods during which food availability of access were better or worse or disease outbreaks affected the population.

2. Enabling environment—Through interviews with stakeholders and review of documents, the extent to which the policy environment enables access and availability of nutritious foods for the population in general and for vulnerable groups is assessed. Documents to review include the national nutrition policy, agricultural policy (e.g., is there a focus on staple food production or on cash crops and is there a prioritization of horticulture, aquaculture and fisheries, poultry production, homestead-food production, etc.), and social protection policy (e.g., is there a nutrition component). National legal or regulatory frameworks related to access and



**FIGURE 2** The Fill the Nutrient Gap conceptual framework

**TABLE 1** Overview and examples of the type of information reviewed during the analysis and the insights gained from these sources

Topic	Data/information to be reviewed	Indicator/key questions	Insights
1. Malnutrition characteristics	Prevalences and deficiencies in the population of interest	Prevalence of stunting, anaemia, wasting, and overweight	Prevalence and, for some, seasonal patterns of various nutritional problems within population
2. Enabling policy environment	National Policies, Legal & Regulatory Frameworks	Is there a national fortification policy (mandatory or voluntary)? If yes, are fortification levels adequate? What foods, what scale of implementation, reaching whom?	Identify legal and regulatory restrictions, gaps in the policy framework and possible entry points for policy actions
	Partnerships and National Programmes	Are there government social safety nets/social protection programmes? And if yes, is a fortified complementary food/SNF incorporated into it?	Identify current or potential entry points for nutrition-specific interventions within social protection and social safety net programmes at national level. Also identify possible capacity gaps at a national level.
3. Availability of nutritious foods on the local market	Market surveys, agricultural surveys, local production information	What foods are available on the local market during the nonlean season? What foods are available in the lean season?	Availability and price of commodities in local markets, potential of local value chains to supply nutritious foods
4. Access to nutritious foods	Food security and vulnerability analysis, household expenditure surveys, market catchment maps	% of all expenditure spent on food and % of expenditure on food that is spent on nongrain food, household dietary diversity score, distance to nearest market	Household food security and vulnerability, market accessibility
5. Nutrient intake	Minimum acceptable diet (IYCF)/dietary diversity; minimum dietary diversity women (MDD-W)	Proportion of children 6–23 months of age who receive a minimum acceptable diet (apart from breast milk)—UNICEF definition; proportion of women with adequate dietary diversity	Access to nutritious foods for nutritionally vulnerable groups such as children aged 6–23 months and women of reproductive age
6. Local practices	Focused ethnographic studies, ProPan modules, qualitative studies	What are the socioeconomic and cultural practices influencing dietary practices?	Socioeconomic and cultural factors influencing feeding practices, and recommendations for future IYCF programming or other food based interventions for key target groups
7. Cost optimization	Cost of the diet analysis	What is the minimum cost of a diet that meets nutrient needs with foods available on the local market (unfortified) and what are “problem” nutrients of which intakes are difficult to meet?	The price of a cost optimized diet (with and without fortified foods), and who can afford this in the local population

Note. IYCF: Infant and Young Child Feeding; SNF: specialized nutritious food.

availability of natural as well as processed and fortified foods (e.g., are there import tariffs for any specialized ingredients such as micronutrient premix or equipment) and information on their enforcement is also of interest. This section serves to identify current or potential “upstream” actions that may be needed to increase availability and affordability of nutritious foods. As part of this section, information on Public–Private Partnerships and National Programmes related to increasing nutritious food availability, processing, storage, distribution, and affordability is also reviewed, in particular to identify potential entry points and platforms for improving availability and access to nutritious foods.

3. Availability of nutritious foods in the local market/area—review of information on availability of nutritious foods (natural and fortified), including information on local production and on processing capacity, such as from market or agricultural surveys and scoping studies for production of specific nutritious foods. This provides a

deeper understanding of issues related to the diversity, quantity, and geographic coverage of the supply of nutritious foods and the local capacity to improve supply in the future. Market and consumer surveys on complementary foods, including snack foods, can be used to gain insights on availability, price, and demand for specific foods for young children (Pries et al., 2017). For example, in Ghana, there was a specific market survey that examined the availability of complementary foods in different markets across the country (Masters, Kuwornu, & Sarpong, 2011).

4. Household access to nutritious foods—review of reports and analysis of data to determine if the target populations have access (both physically, i.e., self-production or good market access, and economically, i.e., affordable transport to markets) to sufficient and diverse foods across seasons. Good sources of information include scoping studies for the feasibility of providing food assistance in the form of cash or electronic vouchers, data on market



access (time, distance, cost) as well as proportion of household's food that is purchased versus self-produced. For example, market catchment maps were used in Ghana to gain a sense of how accessible markets were for certain communities and thus how feasible a market-based intervention might be in these areas (WFP, 2016). As part of this section, the aim is also to review current levels of food insecurity and the vulnerability of households to greater food insecurity due to potential shocks, for example, due to climate conditions, as well as coping strategies used in response to shocks and their impact on access to nutritious foods.

5. Nutrient intake—search for information on likely or confirmed gaps in nutrient intake of specific target groups, in particular related to the Infant and Young Child Feeding practices and the coverage of supplementation and/or mandatory and voluntary food fortification. For example, Demographic and Health Surveys include the minimum acceptable diet indicator for young children (Daelmans et al., 2009; World Health Organization, 2008), which is based on data on dietary diversity and meal frequency, and not meeting the minimum acceptable diet criteria indicates that nutrient intake recommendations are unlikely to be met. Similarly, where available, data on the Minimum Dietary Diversity for Women (FAO & FHI 360, 2016) are reviewed, as well as data on nutrient intake and gaps that are typically collected by 24-hr recalls. Data are consolidated by target group because of their different nutrient needs and programming opportunities.
6. Local practices—understanding socioeconomic and cultural factors that influence food choices, purchasing patterns, and feeding practices is crucial. It will give ideas as to what may act as a barrier or facilitator to achieving adequate nutrient intake or limit or enhance the effectiveness of certain proposed food-based interventions (Paul et al., 2012). This type of information is often hard to find. Some possible sources include information on local preferences and behaviours gathered with ProPAN (Daelmans et al., 2013) or knowledge, attitudes, and practices surveys (FAO, 2014) that can inform behaviour change communication to improve feeding practices. Focused ethnographic studies, findings from formative research, or focus group discussions carried out by local academia or NGOs can also provide good insights. In both Ghana (Pelto & Armar-Klemesu, 2011) and Madagascar (Institut Pasteur de Madagascar, 2015), insights into local practices were gained from publications on formative research. When interpreting ethnographic data, it is important to consider how generalizable the information is. Market insights and consumer trend reports from private companies can also shed very interesting light on lifestyles and consumption patterns and therefore demand for nutritious foods. The opportunity cost of food preparation is also good to take into account and to understand whether time and convenience may further limit accessibility of nutritious diets (Pelto & Armar-Klemesu, 2011).
7. Cost and affordability assessment and optimization—utilizing the CotD software developed by the Save the Children, UK (Deptford et al., 2017; Save the Children, 2014), the minimum cost of a locally available diet that meets the nutrient requirements of specific target

groups or households of a certain composition is estimated. This is done using the prices of locally available foods that are either from secondary sources, that is, price monitoring data collected for estimating the consumer price index or household income and expenditure surveys<sup>4</sup> or collected through market surveys (primary data collection). The proportion of households that can afford this diet in different geographic areas (or among social safety net beneficiaries compared with nonbeneficiaries) can be estimated, using secondary sources of income or expenditure data, from national household income and expenditure surveys. Where available, data from other linear programming analyses such as from Optifood (WHO et al., 2014) or previously conducted CotD analysis are also reviewed for information on composition of diets that meet nutrient requirements, minimum cost of nutritious diets, and “limiting nutrients,” that is, those nutrients that are particularly difficult or costly to meet and therefore less likely to be consumed in adequate amounts.

### 2.3 | Modelling of potential interventions and practices with the CotD tool

Based on the information reviewed and analysed from the seven above described categories of information, key barriers to accessing nutritious foods and achieving adequate nutrient intake among specific target groups in a particular context are identified, for example, fortified staple foods might not be available in rural areas; there might be excessive staple food intake or taboos for pregnant women to consume foods such as eggs and fish. This information together with inputs from key stakeholders results in a listing of interventions that would be feasible and of interest to model with the CotD tool. It is also possible to model potentially detrimental practices such as low breastfeeding or excessive snack food (Bose et al., 2018) or staple food consumption (Deptford et al., 2018). The modelling assesses the impact the interventions could have to lower cost or increase income and hence improve affordability of nutritious diets. Cost can be reduced by interventions that are aimed at increasing availability of nutritious foods: that is, making nutrient-rich foods available that were previously not in the area, by expanding production, strengthening the value chain to limit food loss, or improving the transport of food to new or larger areas. Affordability can also be improved by lowering the prices of nutritious foods through increased production or subsidies or free distribution (through provision of vouchers for certain quantities or in kind) of (a) naturally nutrient-dense foods (animal source foods, vegetables, fruits), (b) fortified staple foods or condiments, (c) bio-fortified commodities, (d) specialized nutritious foods (SNFs) for certain target groups, or (e) nutritional supplements. The interventions can be targeted at the general population or to specific target groups and they can be combined to form a potential “optimal” package of interventions targeting a household consisting of different members. In this way, programmatic interventions such as the introduction of home gardens or fish ponds can

<sup>4</sup>Some sources of this might be from regular market monitoring, Living Standards Measurement Study, or Household Integrated Economic Survey.

be modelled, assuming certain crops, productivity, and own consumption, as well as policy interventions impacting the price of locally available foods such as food subsidies or an intervention that improves the supply of a specific food. It is also possible to model the potential effectiveness of cash transfers or income generation activities to improve affordability of nutritious diets. The modelling enables a comparison of the possible contribution of a wide range of different interventions aimed at improving access to nutrients. Modelling is conducted using the CotD tool, adjusting parameters to reflect the types of interventions mentioned previously.

## 2.4 | Consolidation of findings and setting priorities

The consolidated information from the situation analysis and the results of the modelling with the CotD tool are distilled into key messages to form the basis for the discussion on suitable packages of policy and programmatic interventions and the entry points for specific sectors. For example, the analysis may demonstrate that most nutrient dense foods are available but are not very affordable or commonly consumed, so stakeholders may identify market-based interventions to reduce the price of these foods or in-kind provision of these foods through social safety nets, coupled with behaviour change communication, as appropriate strategies. Insights from formative research or focused ethnographic studies can help “unpack” some recommendations related to specific behaviours and barriers to improved dietary practices. Where a high prevalence of micronutrient deficiencies and high staple food consumption are identified and food fortification is feasible, (improved) fortification of these staple foods, home fortification for more nutritionally vulnerable target groups (e.g., 6–23-month-old children), and dietary diversification to the extent possible could be recommended. Such a finding could also be an impetus for countries to update their fortification standard and/or revive industry participation and tightening up of food fortification regulation and monitoring. Furthermore, the analysis will have identified information gaps and stakeholders may determine ways to address those.

## 3 | RESULTS

The FNG was piloted in 2015–16 in three countries: El Salvador, Ghana, and Madagascar. Following a validation process of the approach carried out with key research institutes and partners,<sup>5</sup> the consolidated analytical approach has since then been applied in almost 15 countries.<sup>6</sup> Per country, the findings from the FNG analysis and the priorities identified by stakeholders for different sectors are made available on the WFP website.<sup>7</sup>

<sup>5</sup>University of California Davis, IFPRI, Epicentre/Harvard, UNICEF.

<sup>6</sup>Guatemala, Ecuador, Pakistan, Laos PDR, Cambodia, Sri Lanka, Indonesia, The Philippines, Tajikistan, Niger, Tanzania, Mozambique, Uganda, and Rwanda.

<sup>7</sup>See the FNG page at [www.wfp.org](https://www.wfp.org) ([https://www.wfp.org/content/2017-fill-nutrient-gap?\\_ga=2.166197434.5496478.1524481420-2098354097.1517214777](https://www.wfp.org/content/2017-fill-nutrient-gap?_ga=2.166197434.5496478.1524481420-2098354097.1517214777)) and the VAM shop website (<http://vam.wfp.org/>); see assessments miscellaneous).

Experience to date has found that stakeholders can be engaged in different ways depending on the timing of the process in relation to national policy review or formulation and the existing platforms and dynamics of multisectoral collaboration.

For example, from the pilot countries, in El Salvador, the analysis informed the redesign of the government's social protection programming; in Ghana, the government, and in particular, the Ghana Health Services (GHS), was a key stakeholder in the FNG process and used the findings to refine the national planning for nutrition; and in Madagascar, the analysis informed the formulation of the new National Nutrition Policy and Action Plan (2017–21).

In Ghana, stakeholder engagement was high, with large meetings at the start and conclusion of the FNG process that involved participants from government, UN agencies, NGOs, and academia, representing health, agriculture, and social protection sectors. A smaller technical working group meeting was held between GHS and WFP to discuss and validate the findings of the analysis. At the final wider multi-stakeholder workshop, co-hosted by GHS and WFP, the findings were presented and stakeholders jointly formulated recommendations.

The El Salvador pilot pursued smaller stakeholder meetings with NGOs (such as Plan and Fundación Salvadoreña para la Salud y el Desarrollo Humano [FUSAL]), UN agencies (such as WHO and FAO) and the government (the Department of Social Protection); once, some of the results of the initial CotD analysis were available. Stakeholders then provided further input and identified strategies to be modelled and explored as part of national policy and programming. In particular, there was close collaboration with the Secretaria Técnica de la Presidencia (the social protection division of the government) to help design strategies to better meet the nutrient needs of the most vulnerable, hence reducing their risk of malnutrition and its consequences.

In Madagascar, the Office National de Nutrition (ONN—the government body responsible for nutrition) and the Institut National de la Statistique de Madagascar (the National Bureau of Statistics) were involved from the very start, including in the food price data collection that was required for the CotD analysis as no good sources of price data were yet available, and to validate results throughout the process. Draft results were also presented to the UN agencies (UNICEF, UNFPA, and WHO) for their suggestions. Based on stakeholder feedback, the analysis was further refined, and its findings then reviewed and discussed by the ONN and WFP team, and the proposed recommendations for the nutrition action plan were then shared with key stakeholders (UNICEF, FAO, World Bank, and United States Agency for International Development) for input. Consolidated recommendations were used for the formulation of the National Nutrition Policy and Action Plan.

## 4 | DISCUSSION

The FNG analysis is a “systems focused” situation analysis of the barriers to consuming an adequately nutritious diet among different target groups and the context-specific reasons for this situation, by

reviewing information from a range of sources to identify constraints that individuals, households, and larger groups of people face to access nutritious foods. Such constraints can include unaffordability due to high food prices relative to income, unavailability of fresh foods due to seasonal drought, agricultural sector being focused on food self-sufficiency and staple-food production, limited market access due to poor infrastructure, low and irregular household income, absence of a standard for food fortification, etc. Through the identification of context-specific causes that underlie poor availability, limited physical and economic access and low consumption of nutritious foods, nutrition-specific and -sensitive strategies can be identified, for different sectors that can directly or indirectly improve nutrient intake, including of specific vulnerable groups, and ultimately nutritional status and health.

Conducting the FNG analysis has shown that by focusing on the food environment and the wider food system as factors that underlie the dietary intake situation and affect the consumption of nutritious foods (Herforth & Ahmed, 2015), and using a wide range of data from different sources, stakeholders from different sectors can better understand how they can contribute to improving the situation. This has led to the setting of sector-specific targets, such as increasing the diversity of foods in markets, enabling recipients of social safety net support to further diversify their diet, improving knowledge, sharing of information about nutrition among agriculture extension workers, etc. Thus, nutrition-specific and -sensitive approaches that are appropriate to the specific context and sector are identified and prioritized.

Nutrition situation analyses typically use the UNICEF conceptual framework for causes of malnutrition, which distinguishes direct, underlying, and basic causes (Johnsson, 1995). This has been very helpful to show that causes of malnutrition are multifactorial. However, its application has largely been limited to analyses of cross-sectional data, predominantly collected through household surveys, identifying correlations at individual or household level between indicators of the different causes of malnutrition and nutritional status, and the choice of indicators determined the correlations that could potentially be detected (Bloem, de Pee, & Semba, 2008; Young & Marshak, 2017). For example, in the case of inadequate dietary intake, one of the two direct causes of malnutrition surveys may only use an indicator of food security at household level, such as coping mechanisms (e.g., skipping meals or eating less). When this indicator shows no problem with food security, it may be erroneously concluded that “food is not the issue” so that it must instead be disease or infection that is causing malnutrition. However, where dietary quantity is not a problem, dietary quality may still be a serious issue constraining healthy growth and development, leading to malnutrition. Or when the focus is on 6–23-month-old children and prevalence of minimum adequate diet is low whereas household food security was largely adequate, it may be concluded that caring practices are not optimal, implying that carers should make better choices, although in-fact they cannot afford adequately nutritious foods for the family, including for children of that age. Nutrition situation analyses that assess the correlation between indicators of the different factors of the UNICEF

framework typically conclude that the relationships depicted in the framework apply and that improvements across basic, underlying, and direct causes are required. As such, these recommendations do not explore the more complicated relationships that maybe at play that hinder people's access to nutritious foods. In order to change the nutrition situation, the underlying systemic drivers of inadequate availability and access and poor choice of nutritious foods need to be better identified and addressed.

Two concurrent developments have put the importance of achieving an adequate nutrient intake back into focus—the introduction of detailed nutrient specifications for products for treatment of acute malnutrition (WHO, 2012; WHO, WFP, UNSCN, & UNICEF, 2007) and the release of user-friendly linear programming tools for nutrition, for example, in the form of Optifood (Daelmans et al., 2013; Ferguson et al., 2006) and CotD (Deptford et al., 2017). The linear programming tools have enabled a much more specific look at nutrient-rich foods and the required quantities and combinations to meet nutrient intake recommendations for specific groups, such as young children or lactating women. Most of the analyses conducted with these two tools have found that (a) for some nutrients, it is particularly challenging to meet required intakes, including iron, zinc, and calcium for young children; and (b) the relatively high requirement for nutrient-dense foods (i.e., animal source foods, vegetables, and fruits) means that costs of a nutritious diet are relatively high and in fact unaffordable for many households (unless they would purchase nutritious foods only for a specific member of the household; Baldi et al., 2013; Berger et al., 2013; Daelmans et al., 2013; Geniez et al., 2014).

Setting achieving nutrient intake recommendations as the ultimate goal, because it is on the pathway to improving nutrition and hence reducing stunting, is the key to identifying nutrition-sensitive actions and targets. The 2013 Lancet series on nutrition evaluated the impact on stunting for those interventions for which that had been assessed and concluded that when the coverage of those efficacious nutrition-specific interventions would be increased to 90% in the 36 highest burden countries, stunting prevalence would decrease by 20% (Bhutta et al., 2013). This has led many to conclude that the remaining 80% should be addressed by nutrition-sensitive interventions, which act on the underlying and basic, rather than the direct, causes of malnutrition. However, nutrition-sensitive interventions have rarely been assessed for their impact on stunting and are designed in many different ways and applied in very different contexts, due to which their impact will also vary widely (Ruel, Quisumbing, & Balagamwala, 2018). This has led to a paucity of action as to which nutrition-sensitive interventions to prioritize. By recognizing that the pathway to impact of nutrition-sensitive interventions on malnutrition goes through change of the direct causes, that is, inadequate dietary intake and disease, having a nutritious diet, can be set as the first or immediate nutrition goal for both nutrition-specific and nutrition-sensitive interventions, rather than the ultimate goal of reducing stunting. The FNG has been developed to unpack the impact pathways towards meeting nutrient intake recommendations; that is, it has put “Filling the Nutrient Gap” as the outcome of interest.



The other key defining characteristic of the FNG that is much appreciated by country stakeholders is the multisectoral collaborative process through which the analysis is conducted, which provides for an understanding and dialogue across sectors that bridges their traditional silos.

The FNG serves a dual function as an analytical approach that helps to strengthen decision making based on a comprehensive analysis of the barriers and opportunities to achieving adequate dietary intake among different target groups within a specific context, as well as a policy advocacy approach that facilitates multisectoral discussion around nutrition. In this regard, it goes beyond the powerful advocacy messages conveyed by tools such as profiles (Burkhalter et al., 1999) and the Cost of Hunger (Martínez & Fernández, 2007), which demonstrate the high costs of inaction and in the case of Profiles the potential impact nutrition interventions can have. It is also broader than other tools intended to inform complementary feeding or situation analysis such as the Propan, MoRes, Optifood, and CotD (Untoro et al., 2017), as FNG provides a framework to bring together the different insights provided by these tools to develop a more holistic picture than can be gained from using any one of them alone. The FNG analysis can help operationalize the approach taken by the SUN movement to develop multisectoral nutrition policies and plans, in particular related to achieving adequate dietary intake, as well as to strengthen collaboration by focusing it on specific local circumstances, needs, and opportunities.

After stakeholders have formulated recommendations for prioritization of policies and programmatic strategies based on the FNG findings, subsequent steps need to be taken to design implementation, including the estimation of the implementation costs of different interventions in comparison to what they are likely to achieve in terms of meeting nutrient intake recommendations. Such programme-costing analyses are not part of the FNG situation analysis. Also, other initiatives should characterize the disease and infection side of the causal framework for the likely contribution to malnutrition and poor health and the needs and opportunities to improve that situation, both in terms of prevention as well as treatment of disease, infection, and inflammation, which affect nutritional status through increased losses, poor utilization, and increased needs for nutrients.

## 5 | CONCLUSION

The FNG analysis helps to gauge the magnitude of the nutrient gap and identify the barriers to achieving adequate nutrient intake among specific target groups within a context and thereby identify appropriate strategies to overcome these barriers through greater linkages and synergies between the food, social protection, and health systems. This is achieved through a process that facilitates multisectoral discussion and consensus building based on evidence and better use of national data. As a result of this process, stakeholders can jointly identify the roles and responsibilities each of these sectors that can take on in order to improve the nutrition situation in their country and ensure that their interventions are based on an in-depth

understanding of the key constraints in a specific context for different subgroups. This collective evidence-based understanding is critical to ensure that interventions are specific to address prevailing issues and stakeholders operate in a coordinated manner, stepping outside their “silos,” allowing for the development of a holistic package of context-specific solutions to accelerate progress within countries to achieve Sustainable Development Goal target 2.2, ending all forms of malnutrition by 2030.

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## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest

## CONTRIBUTIONS

IB and GB prepared the first version of the manuscript; SdP and LK critically reviewed the manuscript, and SdP and IB revised and finalized the manuscript.

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