The Nutrition Modeling Consortium: Improving Data Use for Nutrition Policy

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Key messages

- Mathematical modeling tools help policymakers maximize the efficiency of their nutrition investments.

- Three examples are provided that highlight how different tools were used to weigh policy trade-offs, identify savings and improve access to nutritious diets.

- More work is needed to improve end users’ understanding of the tools’ potential, and to smooth out between-tool interoperability.

Introduction

Growing recognition of the centrality of nutrition to human and social development is prompting policymakers in low- and middle-income countries (LMIC) to invest in nutrition, yet their capacity to prioritize among interventions and to allocate resources efficiently remains a challenge. Indeed, the range of questions facing policymakers is overwhelming: What are the most urgent nutrition goals to address – child stunting, vitamin A deficiency or anemia? Which interventions will achieve those goals most cost-efficiently? And how can the benefits from this investment on social development over the next 10 years be compared with other interventions in the education, health or other sectors? Such questions, though difficult, need to be considered for informed policy decisions.

“The range of questions facing policymakers is overwhelming”
A tool like PROFILES will demonstrate the cost of inaction to the national economy and indicate what nutrition conditions (e.g., stunting, anemia or vitamin A deficiency) need most urgent attention. Having clarified national priority investments, PROFILES results can then be used by LIST to examine how many lives and DALYs (disease-adjusted life years) will be spared by alternative interventions on a given priority, comparing for instance the impact of exclusive breastfeeding (EBF) versus micronutrient powder supplementation (MNP) on the reduction of stunting.

LIST does only one intervention at a time, however; what about the effects of multiple interventions on different outcomes? A tool like Optima Nutrition (Optima/N) will state what ‘quantity’ of each intervention is needed to obtain the optimal outcome on various conditions (e.g., stunting and child mortality). It will also permit statements about how much more could be achieved with greater budgets, and how those additional resources should be allocated across interventions. To refine this further, a tool like MINIMOD will allocate resources over space and time and among target groups, taking into account the regional severity of the problem, thus allowing policymakers to modulate interventions according to their most cost-effective combination in each region. Other sectors, such as agriculture and education, exert a powerful influence on the context in which malnutrition occurs. Tools like Cost of the Diet (CotD) and Optifood can guide multisectoral actions that are sensitive to nutrition programming needs.

Considerable work has already been done by computer modelers and nutritionists to guide such policy decisions. Tools have been developed to support nutrition actions, from advocacy to financing to resource allocation to learning (Figure 1). Those efforts, however, have been constrained by two key challenges. First, each tool was developed independently by different organizations to pursue different goals using different methods and data. This can generate inconsistent, even conflicting, recommendations. Second, end users are still largely unaware of those tools and their powerful capabilities. Consequently, uptake remains slow and is largely driven by tool modelers themselves rather than by endogenous programmatic demand or policy needs.

The Nutrition Modeling Consortium
To resolve the lack of connection between tools, and to increase uptake by end users, the New York Academy of Sciences, the Micronutrient Forum and the Bill & Melinda Gates Foundation convened a series of meetings between 2017 and 2019 that
The dietary needs of adolescent girls and young children differ significantly.
resulted in the creation of the Nutrition Modeling Consortium (NMC). Membership in the NMC is open to all modeling efforts that use mathematical optimization to improve the allocation of nutrition resources. The NMC currently includes 14 tools (see Table 1), each addressing one or more steps along the ‘policy cycle’ illustrated in Figure 1.

A leading mandate of the NMC is to disseminate information to end users in LMIC about the purpose and capabilities of those tools and how they can be applied to address countries’ specific needs, and also about how to obtain services through the Consortium. A second mandate is to discover and advance the tools’ collective capacities, harmonize them and further their complementarity and interoperability. This includes, for instance, helping to normalize the evidence and assumptions they use to ensure that their results are not contradictory and that they coherently ‘tag team’ with one another when possible to support the entire nutrition portfolio development (Figure 2).

Achieving harmonization is a complex proposition, however. Aside from its aim and origin, each tool differs in its assumptions, objective functions and mathematical approaches. To bring them together, the NMC plans to pilot the simultaneous rollout of several tools in one location so that modelers can de-

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<th>Tool name (acronym)</th>
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termine how their results can inform the use of other tools. The intuition behind such harmonization is illustrated in Figure 2: tools like LitS and PROFILES help top-level decision-makers prioritize the issues to be addressed. Once agreed, these are passed to tools like Optima/N to examine action(s) to be taken. Next, MINIMOD and CotD can allocate resources geographically and among target groups.

Preliminary results from such collaborations are expected later in 2019. In the meantime, to illustrate the potential utility of those tools to country governments, we provide three examples below that illustrate how the use of individual tools in the past helped decision-makers reach better solutions.

1. Cost of the Diet (CotD) identifies ways to make a nutritious diet more affordable in Pakistan

The 2011 National Nutrition Survey in Pakistan found that 43.7% of children < 5 years were stunted, 31.5% underweight and 15.1% wasted. A CotD analysis was applied as part of the Fill the Nutrient Gap (FNG) process in 2016–17 to better understand the provincial malnutrition contexts, and to align actions at national and provincial levels. It sought to address the following questions:

1. What are the barriers to adequate nutrient intake?
2. What is the cost and content of the least expensive diet for specific members of modeled households (breastfed child, lactating woman, etc.), using locally available foods and appropriate portion sizes?
3. What proportion of the population could afford a nutritious diet?
4. What interventions could improve access to nutritious diets?

CotD analysis of local foods in rural and urban areas showed: that food availability was not a barrier to a nutritious diet but that nutritionally adequate diets would be unaffordable for 68% of households; that the nutrient requirements of adolescent girls were the most expensive to meet; and that calcium, iron and vitamin B₁₂ were the key problem nutrients based on local food availability and prices.

Among interventions identified for increasing the affordability of a nutritionally adequate diet, vouchers for animal-source foods and vegetables were most effective in meeting adolescent girls’ nutrient needs, while fortified cereal and legume blends were best to meet the nutrient needs for children 6–23 months and pregnant and lactating women. However, no single intervention alone would significantly reduce the cost of a nutritious diet across households. Those two interventions were thus combined with cash transfers, producing the greatest impact on the affordability of nutritious household diets.

Details of these packages and accompanying stakeholder-developed recommendations can be found in the Pakistan Summary Report (at www.wfp.org/fillthenuitriegtap).

2. MINIMOD identifies more cost-effective strategies for addressing vitamin A deficiencies among young children in Cameroon

Vitamin A (VA) deficiency is common in Cameroon, but shows large regional variations in terms of prevalence and severity (Figure 3). The cost of existing programs also varies – for example, the yearly cost of high-dose vitamin A supplementation (VAS) per child reached ranges from US$0.66 in the north to US$2.05 in the south (Figure 4), due to regional differences in population densities, infrastructure and so forth, all of which affect region-specific program coverage.

MINIMOD uses economic optimization routines to estimate the efficiency gains (vis-à-vis a Cameroon business-as-usual (BAU) scenario involving national VAS distribution and an underperforming VA-fortified edible oils program) that could result from regional VAS targeting and other investments, such as vitamin A-fortified edible oils program and developing a VA-fortified bouillon cube program.

Figure 5 identifies the most cost-effective interventions to achieve adequate VA intake in the south macro-region of Cameroon, where baseline levels of inadequate VA intake are relatively
low (19%) and VAS costs are high (US$2.05 per child reached). For this macro-region, the tool suggests that improving the edible oils program and developing a fortified bouillon cube program could, jointly, within 4 years essentially eliminate inadequate VA intake (< 2.5%). Savings from doing so could be as high as US$5.4 million. Similar results emerge for the cities macro-region (not shown). However, in the north macro-region (not shown), where the prevalence of inadequate VA intake among children is very high (~60%), the fortification programs alone cannot eliminate this public health problem. Therefore, until new food-based delivery platforms can be implemented, VAS will need to continue in the north macro-region. The policy choices that emerged from these analyses are clear and important, and highlight the inefficiencies in this case of maintaining BAU.

**Figure 3**: Vitamin A deficiency among children < 5 years by region in Cameroon

**Figure 4**: Yearly cost per child reached with vitamin A capsules in Cameroon

**Figure 5**: Combination of cost-effective strategies for addressing vitamin A deficiencies in children – Cameroon, south macro-region
Optima Nutrition (Optima/N) aims to provide practical advice to governments on the allocation of current or projected budgets across programs to minimize stunting, wasting, anemia or under-five mortality at both the national and regional levels. Planners may choose from interventions that include vitamin supplementation programs, IYCF (infant and young child feeding) education, treatment of SAM (severe acute malnutrition), treatment and prevention of diarrhea, fortification of foods, WASH (water, sanitation and hygiene), family planning and malaria prevention interventions.

3. Optima Nutrition (Optima/N) helps to identify the best mix of interventions to reduce stunting in Bangladesh

Costing nutrition interventions, assessing their cost-effectiveness and doing cost–benefit analysis are well-refined analytical routines. Until Optima/N, however, one question eluded an answer: what is the optimal allocation of resources across interventions to obtain a given outcome (e.g., maximizing the number of non-stunted children < 5 years)? Optima/N answers such questions as:

- How can a fixed budget be allocated across interventions to minimize stunting, wasting, anemia and mortality in children < 5 years?

**Figure 6:** How can an additional US$10 million be optimally allocated across regions and programs in Bangladesh to minimize stunting?
Which programs and regions should receive further funding, if funding were available?

How might trends in undernutrition change under different funding scenarios?

How close can the country get to its target under a BAU scenario versus the same funding level but reallocated optimally?

What is the minimum funding required to meet the nutrition targets if allocated optimally?

An Optima/N application was conducted in Bangladesh to determine how an additional US$10 million could be allocated across regions – and to a selection of interventions within those regions – to minimize stunting (Figure 6).

The analysis suggested that the greatest number of stunting cases could be averted by focusing on Dhaka and Chittagong. Both regions would absorb the lion’s share of funding, with complementary feeding education and VAS being the priority interventions for the additional funding. Other regions were also allocated a slight increase in funding but it contributed less to the total reduction in stunting, even after their package of interventions had been optimized. Such findings create context for the political choices that may drive policy decisions.

Conclusions
The three analyses above offer a glimpse of the possibilities offered by modeling tools. Other aims not described here include advocacy (using PROFILES and Cost of Hunger), intersectoral planning (Optifood), food fortification program design (IMAPP) among others. Collectively, these tools provide extraordinary opportunities to effectively use data in nutrition planning. The fact that each tool was developed independently from the others and with distinct goals in mind inherently creates the possibility of seeing diverging recommendations but the creation of the Nutrition Modeling Consortium and the activation of its mandate will hopefully make it possible to preview and mitigate such challenges. More information on the Consortium and on each of the tools is available at www.nyas.org/NMC

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