Indicators and Tools for the Cost of Nutritious Diets

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Abbreviations and Acronyms

CoDD	Cost of a Diverse Diet
CoNA	Cost of Nutrient Adequacy
CoRD	Cost of Recommended Diet
CotD	Cost of the Diet (4 options: energy only, macronutrients, nutritious, food habits)
CPI	Consumer Price Index
EAR	Estimated average requirement
FANTA	Food and Nutrition Technical Assistance III Project
FBDG	Food-based dietary guidelines
FNG	Fill the Nutrient Gap
IANDA	Indicators of Affordability of Nutritious Diets in Africa
LSHTM	London School of Hygiene & Tropical Medicine
MDD-W	Minimum Dietary Diversity for Women of reproductive age
NPI	Nutritious food Price Index
NSO	National statistics organization
RNI	Recommended nutrient intake
SNUT	Cost of Staple-adjusted Nutritious Diet (CotD "nutritious" diet, including two servings of main staple food(s) and excluding taboo foods)
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organization

Indicators of the Cost of Nutritious Diets

Introduction

Several indicators that show the cost of nutritious diets have recently been developed. This document is a brief primer on these indicators, and describes the background, purpose, methods, and outputs of each.

These indicators, summarized in Table 1 at the end of this document, show the cost of foods needed to meet nutritional goals. All of them sum the prices of diverse foods available at a given time and place, using the least costly combination of foods needed to meet a defined standard of diet quality. Some foods are not available in a given market, so are not counted in the index for that time and place. Other foods are available but are too expensive to be counted. Like any measure of access, these indicators are not intended to reflect what people actually spend or purchase.

The indicators can be used for raising awareness and advocacy about access to nutritious diets (i.e. availability and affordability); for research on the determinants and consequences of food prices; and for formulating programs and policies to improve nutrition. For the agriculture sector, reducing the price of nutritious diets can be one important outcome, so indicators of the cost of nutritious diets can be used to design or evaluate programs and investments in nutrition-sensitive agriculture.

Each of these indicators uses food price data. Prices are market phenomena usually collected from retail or wholesale vendors at the time and place of sale, but sometimes collected in other ways such as individual recall during household surveys. Product prices vary greatly depending on exact time, place, quality and conditions of purchase, so accuracy depends on precise reporting of what was being sold. Many price observations are collected on a confidential basis, with public release only of data aggregated over multiple locations and time periods. Food prices are needed to calculate national accounts so almost all countries collect and report them routinely (usually twice per month) via National Statistical Organizations (NSOs), and many governments also collect food prices to promote agricultural development via Market Information Systems (MIS). Many projects and development or humanitarian agencies also collected market price data for other purposes, such as the World Food Program's mVAM system, and private entities that charge fees for real time market price information. Household consumption and expenditure surveys can be a source of price information, although not for monitoring purposes, as these surveys are only conducted every few years.

As a rule of thumb, in order to calculate indicators for the cost of nutritious diets, food price data for should cover foods from all of these food types[1]:

1. Grains, white roots and tubers, and plantains
2. Pulses (beans, peas and lentils)
3. Nuts and seeds
4. Dairy (milk, yogurt, kefir)
5. Meat, poultry and fish
6. Eggs
7. Dark green leafy vegetables
8. Other vitamin A-rich fruits and vegetables (such as pumpkin, mango, papaya, carrot)
9. Other vegetables (such as cabbage, onion, tomato, eggplant, okra)
10. Other fruits (such as orange, melon, apple)

In practice, to achieve sufficient diversity to cover the above food types, datasets typically need to have at least 60 or more individual food items. If the datasets have only a low variety of foods, the results will be inaccurate estimates of the true cost of obtaining a nutritious diet, and/or may produce unrealistic or undesirable diets. A Fill the Nutrient Gap analysis showed that Cost of the Diet was estimated to be significantly lower in Ghana when using data from a longer list of foods compared to a shorter one.[2] As for any analysis, the quality of data needs to be assured for accurate and realistic results.

The indicators and tools summarized here were developed by a variety of applied research projects for different purposes. In reverse order of their presentation below, Optifood was developed primarily at the London School of Hygiene & Tropical Medicine (LSHTM) and the World Health Organization (WHO); Fill the Nutrient Gap (FNG) originates with WFP; and the Cost of the Diet (CotD) tool was developed by Save the Children UK. The first four metrics in the list below, the Cost of a Recommended Diet (CoRD), the Cost of Nutrient Adequacy (CoNA), the Cost of a Diverse Diet (CoDD), and the Nutritional Consumer Price Index (NPI), were developed through a project on Indicators of Affordability of Nutritious Diets in Africa (IANDA) funded by UKAid from 2015 through 2017, and a successor project on Changing Access to Nutritious Diets in Africa and South Asia (CANDASA), funded by UKAid and the Bill & Melinda Gates Foundation.[3]

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[1] A detailed list of example foods in each of the 10 categories is available in Appendix 2 of *Minimum Dietary Diversity for Women: A Guide for Measurement.* (FAO and FHI360, 2016). This resource is available at https://www.fantaproject.org/monitoring-and-evaluation/minimum-dietary-diversity-women-indicator-mddw.

[2] This analysis was done using pilot data from the Ghana Ministry of Food and Agriculture (MoFA) in collaboration with the IANDA Project. See: World Food Programme (2017). Findings for IANDA/Cost of the Diet in Ghana. Rome: WFP. https://docs.wfp.org/api/documents/743ba945c9b54668643d77786b71b0a/download.

[3] The Indicators of Affordability of Nutritious Diets in Africa (IANDA) Project was a research grant from the project on Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA). Details on IANDA and IMMANA are at http://ianda.nutrition.tufts.edu/ and http://immana.lcirah.ac.uk, and on the CANDASA project are at https://sites.tufts.edu/candasa.

Cost of Recommended Diet (CoRD)

Purpose: The CoRD indicator is primarily used for advocacy and research. CoRD shows the cost of meeting food-based dietary recommendations, which are designed to provide both nutrient adequacy and prevention of diet-related non-communicable disease within a culturally acceptable diet. This is the most intuitive way to understanding economic access to adequate food ("nutritious food to meet dietary needs for an active and healthy life"[4]). It can also show which food groups are most expensive.

Methods: The CoRD is a series of straightforward calculations to compute the lowest cost of meeting dietary recommendations, which are designed to meet nutritional needs for adequacy and long-term health.[5] Input requirements are (1) food-based dietary guidelines (FBDGs) that are appropriate for the population of the analysis and that include quantitative serving recommendations for different food groups, (2) prices for foods covering all of the food groups, adjusted for (3) information on edible portion of foods, and added water content of any cooked foods (e.g. rice). Typically, FBDGs are primarily targeted broadly to the general population. Where food-based dietary guidelines exist for specific sub-populations (e.g. pregnant women, young children), these sub-population guidelines can be applied to the analysis.

Outputs: The calculations result in the lowest total cost of meeting food-based dietary guidelines. This is typically done for the general adult population, but could be done for specific populations of interest, provided there are FBDGs for those populations.

Cost of Nutrient Adequacy (CoNA)

Purpose: The CoNA indicator can be used for advocacy and shows the minimum cost of achieving adequacy of energy and essential nutrients.[6]

Methods: The CoNA is a linear programming method.[7] It requires (1) food composition data, (2) nutrient requirement data for a given target group (e.g. adult female), and (3) food prices for a diversity of foods. Results become more plausible if a greater variety of foods are in the input data; input data with a low diversity of foods relative to actual foods available will result in modeled diets that would not be palatable or realistic, and also will not capture the true availability of nutritious foods.

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[4] FAO (1996). Rome Declaration on World Food Security. http://www.fao.org/docrep/003/w3613e/w3613e00.htm
[5] Dizon, F. and Herforth, A. 2018. The Cost of Nutritious Food in South Asia. The World Bank.
[6] The initial CoNA approach used fixed total energy (2000 kcal.day) and EARs for protein and 16 micronutrients, omitting vitamin D and cholesterol because they are synthesized from non-dietary sources, and omitting iodine and molybdenum due to lack of reliable food composition data.
[7] Masters, W.A., Bai, Y., Herforth, A., Sarpong, D.B., Mishili, F., Kinabo, J. and Coates, J.C., 2018. Measuring the Affordability of Nutritious Diets in Africa: Price Indexes for Diet Diversity and Cost of Nutrient Adequacy. AJAE. https://ssrn.com/abstract=2970745.

Outputs: The CoNA shows the minimum cost of achieving minimum nutrient adequacy for the chosen target group (e.g. adult female), with no other dietary constraints. It also shows which nutrients are the most constraining, and the foods, which contribute most to meeting each nutrient requirement.

Nutritious food Price Index (NPI)

Purpose: The NPI is designed as a counterpart to a country's consumer price index (CPI) for food (simply known as a food CPI). While the CPI weights foods based on expenditure share, typically at national level, the NPI provides an alternative weighting system based on nutritional quality of each food item, thus providing an index of the food prices from a nutritional standpoint.[8]

Methods: The NPI and CPI include the same list of foods tracked by a country's National Statistical Organization. Instead of weighting each food item by expenditure share, as the food CPI does, the NPI weights each food by its nutritional value. In order to assign a nutritional value to each item, the IANDA project and the World Bank used NuVal scores, which are a system of scoring individual foods based on their positive and negative health attributes using an Overall Nutritional Quality Index (Katz et al. 2009)[8,9]. Various other nutritional quality scores or profiling systems could be used to rank and weight individual foods. Methods are described in more detail in Dizon and Herforth 2018.[8]

Outputs: The NPI is a food price index of the most-commonly consumed foods at a nationally-representative level. The alternative weighting system enables comparison between the price of the most nutrient dense food, and the price of food baskets typically purchased. Both indicators can be tracked over time to compare trends.

Cost of Dietary Diversity (CoDD)

Purpose: The Minimum Dietary Diversity for Women of reproductive age (MDD-W) is an indicator of diet quality, validated based on its relationship to nutrient adequacy, that is becoming increasingly widely used. Improving the proportion of women meeting the MDD-W is an aim of many nutrition-sensitive agriculture programs, and there are efforts to incorporate the MDD-W indicator into global monitoring frameworks. The CoDD indicator provides an index of the cost of meeting MDD-W, which can be helpful to understand as a precursor to being able to increase MDD-W. CoDD can be used in research and advocacy efforts; it can be tracked as an informational tool to advocate for interventions and policies that would stabilize access to foods that are most likely to enable minimum dietary diversity.

Methods: Calculating the CoDD requires food price data at multiple time points for at least one food item within each food group in the MDD-W (see list of food groups on p2, above). If fewer groups are available, results are less realistic. Because it is an index rather than an absolute cost

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[8] Dizon, F. and Herforth, A. 2018. The Cost of Nutritious Food in South Asia. The World Bank.
[9] Katz, D.L., Nijke, V.Y., Faridi, Z., et al. (2009). The Stratification of Foods on the Basis of Overall Nutritional Quality: The Overall Nutritional Quality Index. *American Journal of Health Promotion* 24(2): 133–143.

value, it is only meaningful with time-series data, to track how the CoDD changes over time. Methods are described in more detail in Masters et al. 2018.[10]

Outputs: The CoDD is an index of how the cost of minimum dietary diversity fluctuates, showing variation between seasons and regions. It also ranks food groups for their affordability, and can show the lowest-cost item within each food group. The CoDD does not show the actual daily cost of purchasing a minimally diverse diet, as no amounts of each food group are specified.[11] It only provides an index of the fifth least expensive food group, thereby tracking fluctuations in price over time and geography.

Cost of the Diet (CotD)

Background: The Cost of the Diet is a method and software that uses linear programming to better understand the extent to which poverty may affect people's ability to meet their nutrient needs.[12] The tool was developed by Save the Children UK out of the recognition that financial constraints on food access are a major reason that people do not consume nutritionally adequate diets (i.e. unaffordability severely limits their possible food choices).

Purpose: The CotD has been used by a range of development and academic agencies for a variety of purposes including advocacy and nutrition-sensitive social protection programming design, for example for setting cash transfer amounts or informing the design of Social Behavior Change communication strategies. The World Food Programme (WFP) currently use the CotD extensively to conduct affordability analysis and intervention modelling as part of their Fill the Nutrient Gap (FNG) methodology developed by WFP and partners (see below).

Methods: The CotD tool is a linear programming method and software tool. Input requirements are (1) food list of 60-200 foods found in the selected assessment area (livelihood zones, district, province); (2) price per 100 grams of foods in the food list for up to six seasons or time points in a year derived from primary market surveys or secondary data; (3) optional: typical dietary habits for the foods in the food list, collected using interviews and focus group discussions with local women; and (4) income and expenditure data to determine the affordability of the modelled nutritious diets. The tool has in-build data on the nutritional composition of 3,500 foods, edible conversion factors (to account for food waste) for these foods and target-group specific portion sizes and nutrient requirements based upon World Health Organization (WHO) and Food and Agriculture Organization of the United Nations recommendations for 237 individuals across the life cycle, including periods of pregnancy and lactation.

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[10] Masters, W.A., Bai, Y., Herforth, A., Sarpong, D.B., Mishili, F., Kinabo, J. and Coates, J.C., 2018. Measuring the Affordability of Nutritious Diets in Africa: Price Indexes for Diet Diversity and Cost of Nutrient Adequacy. AJAE. https://ssrn.com/abstract=2970745

[11] Because the MDD-W does not specify any minimum (or recommended) amounts of each food group, no amounts can be specified in this indicator.

[12] Deptford, A., Allieri, T., Childs, R., et al., 2017. Cost of the Diet: a method and software to calculate the lowest cost of meeting recommended intakes of energy and nutrients from local foods. BMC Nutrition, 3(1): 26.

Outputs: The CotD estimates the lowest cost for four standard diets: energy only, macronutrient only, nutritious[13] (with no food frequency restrictions) and food habits nutritious diet (with typical dietary habit restrictions).[14] Diets are calculated at the individual (for specific target groups) and household level. The analysis can provide information on: diet costs and how the cost of diet changes depending on nutrient requirements that the software meets (i.e. energy only versus macro- and micronutrients), dietary restrictions and the season; locally available, inexpensive, nutrient rich sources of food; individuals within the household who are the most expensive to meet nutrient needs for; and nutrients for which it may be difficult to meet needs. When the diet costs are compared to income or expenditure data, the proportion of a population that cannot afford a nutritious diet can be estimated and compared among different regions, seasons or countries.

Most parameters in the CotD software can be modified to examine the potential impact of a wide range of interventions (e.g. micronutrient supplementation, fresh food vouchers, cash transfers, specialized nutritious foods, agricultural interventions) that could impact the cost, quality and affordability of the diet. The parameters could also be changed to model shocks that could impact food prices or availability and typical dietary habits.

Fill the Nutrient Gap (FNG)
Background: The FNG methodology was developed by the WFP and partners.[15] The FNG tool uses context-specific secondary sources of information on factors that directly or indirectly impact whether people can access and consume nutritious foods, and whether they meet recommended nutrient intakes.

Purpose: The aim of the FNG is to formulate recommendations for policies and programming in agriculture, food systems, health, social protection, education and other sectors that can contribute to improving nutrition.

Methods:
Step 1: The CotD analysis is used to model the lowest cost, nutritionally adequate diet, and to show gaps in nutrient adequacy, where meeting nutrient needs is unaffordable. A CotD analysis used for FNG does not require data on typical dietary habits (i.e. the third input requirement in CotD, above) and instead estimates the staple-adjusted nutritious diet, which constrains only

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[13] Nutrients included for CotD's "nutritious diet": energy, protein, fat (at EAR level), 9 vitamins, 4 minerals (at RNI level).

[14] For the FNG (see next indicator), a staple-adjusted nutritious diet is estimated.

[15] For brochure and FNG country summaries see https://www.wfp.org/content/2017-fill-nutrient-gap?_ga=2.77024085.1188987735.1527233359-1325315182.1507034485

For slide decks and reports, see WFP VAM shop (vam.wfp.org) and select miscellaneous assessments and country of interest. Webinar: http://www.securenutrition.org/resource/fill-nutrient-gap-webinar-resources-english-francais-and-espanol ;

Article on Pakistan FNG: http://www.ennonline.net/fillingthenutrientgapinpakistaninsightstoaddressmalnutrition

for the local staple consumption ("must include" two servings per day for all individuals, but one for 6-23 month old child) and any taboo foods ("cannot include").

Step 2: Solutions to filling the nutrient gaps are explored. The FNG analysis is designed and conducted together with in-country stakeholders from different constituency groups (government, UN, academia, private sector, civil society) that work in the food system, health system and/or social protection system. The analysis seeks information (and identifies gaps) on food system-related information, such as access to markets, agricultural production and characteristics, availability of nutritious foods, affordability of nutritious foods based on price relative to income (using CotD analysis) and (public) private sector initiatives to improve availability and affordability of nutritious foods; social protection system related information such as coverage, targeting and design of social safety nets programs; health system related information, such as coverage of supplements, home-fortification and nutrition education; education system related information; and also information on food choice and preparation practices, intra-household food distribution, and infant and young child feeding practices, from surveys as well as qualitative enquiries.

Outputs: Recommendations for adding to and modifying of existing policies and programs in any sector that are most needed, relevant and feasible in the country's context. The FNG analysis focuses on different target groups, such as young children, pregnant and lactating women and adolescent girls, in different areas and situations, by distinguishing for example whether they live in urban or rural areas, in food-secure or -insecure areas, belong to higher or lower socio-economic groups etc. The CotD analysis is used to model the impact of approaches that increase availability and affordability of nutrients from affordable nutritious foods, fortified foods and supplements and/or improved purchasing power, which is used as inputs for the multi-sectoral discussion on which strategies and intervention to prioritize and develop.

Optifood
Background: Optifood was developed by the London School of Hygiene & Tropical Medicine (LSHTM) in collaboration with the WHO, Food and Nutrition Technical Assistance III Project (FANTA) and Blue-Infinity, funded by the United States Agency for International Development (USAID), World Health Organization and UBS Optimus Foundation.

Purpose: Optifood was designed to determine the extent to which nutrient requirements for specific target groups can be met using local foods within acceptable dietary patterns (i.e. based on existing patterns) and to develop, test and compare alternative food-based recommendations or interventions for improving dietary adequacy of specific populations. Optifood can be used to identify (and test) food-based recommendations (FBRs) for behavior change programming; to assess nutritional adequacy of local food environments; to compare the nutritional benefits of promoting specific natural foods, fortified products or supplements;

and to determine the affordability of a nutritious diet *based on current dietary patterns and local food availability for specific target populations* (not household level).[16,17]

Methods: Optifood is a software tool based on linear programming analyses that takes into account requirements for multiple macro and micronutrients[18], local dietary patterns and food prices (optional) simultaneously. The tool includes four modules for checking constraints (Module I); and for a specific target population, determining whether a nutritionally adequate diet can be selected (Module II), testing different combinations of food-based recommendations/interventions for improving dietary adequacy (Module III) and determining the lowest cost, nutritionally best diet.

As an input, data on the target population's mean body weight and dietary patterns, including commonly consumed foods, frequency of consumption, portion sizes and food group and sub-group patterns (i.e., serves per week), are required. One source of this input is actual food consumption data from specific target groups of interest. Alternative secondary sources for this input also can be used. Local market costs of the foods consumed and upper-limits for expenditure can also be taken into account. The tool has in-built food composition data and recommended nutrient intakes (RNIs); however, users can also add customized, locally appropriate, food composition data and RNIs.

Output: The Optifood outputs consist of optimised diets for each module given designated model constraints and objective functions. The analyses identify 'problem nutrients', (i.e. those for which requirements are difficult to meet using local foods in the context of local dietary patterns) and good food / food sub-group sources of nutrients and promising FBRs, which can be tested and compared (on the basis of nutrient adequacy and/or cost). Further, Optifood can then be used to test the potential impact, for improving dietary adequacy, of existing national/regional FBRs, new foods/supplements (e.g., biofortified foods, fortified foods or supplements) or changing habitual dietary patterns (i.e. changing portion sizes or consumption frequency). Finally, it can identify the cost and most expensive nutrients in the lowest cost nutritionally best diet.

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[16] Daelmans B, Ferguson E, Lutter CK, Singh N, Pachon H, Creed-Kanashiro H, Woldt M, Mangasaryan N, Cheung E, Mir R, Pareja R, Briend A. Designing appropriate complementary feeding recommendations: tools for programmatic action. *Matern Child Nutr* (supplement 2):116-138 (2013).

[17] Ferguson E.L., Darmon N, Fahmida U, Fritiyani S, Harper TB, Premachandra I. Design of optimal complementary feeding recommendations and identification of key problem nutrients using goal programming. *J Nutr* 136: 2399-2404 (2006).

[18] Energy, protein, fat, Ca, Fe, Zn, B1, B2, B3, B6, B12, folate, vitamins A, and C.

Table 1. Summary of indicators and tools for the cost of a nutritious diet

INDICATORS OF COST PER DAY

Indicator	Population	Data required and nutritional standard to be met	Results available	Recommended uses
Cost of Recommended Diet (CoRD)	General population; a target population may be specified if food-based dietary guidelines exist for that population	- Price per gram of each food - Dietary recommendations (e.g. national food-based dietary guidelines) - Quantity of each food category recommended (e.g. 400 grams of fruits and vegetables per day)	- Cost per day of meeting dietary recommendations (such as national food-based dietary guidelines) - Cost per day of each food group in the recommended diet	Useful to understand whether diets that follow dietary guidelines are affordable to most people, and which food groups are the most expensive. Based on simple calculations that do not require specialized models or software.
Cost of Nutrient Adequacy (CoNA)	Any target population of interest for which nutrient requirements are available (e.g. adult women, pregnant women, young children)	- Price per gram of each food - Nutrient composition of each food for energy, protein, nine vitamins and seven minerals (Fe, Zn, Ca, Mg, Cu, P, Se) - Nutrient requirements, such as estimated average requirements (EARs) for the population of interest	- Cost per day of achieving nutrient adequacy - Quantity and cost per day of each food and of each nutrient in the lowest-cost adequate diet - Cost per unit of each limiting nutrient, to show the most costly nutrients	Useful to model the lowest possible cost of meeting nutrient needs. Designed to track and compare the cost of nutrients over long periods of time and across different populations, as the model does not include information on typical food habits. Requires software capable of linear programming.

Indicator	Population	Data required and nutritional standard to be met	Results available	Recommended uses
Cost of the Diet (CotD) and Fill the Nutrient Gap (FNG)	Household of a certain composition; or any target population of interest for which nutrient requirements are available (e.g. adult women, pregnant women, young children)	• Price per gram of each food • Nutrient composition of each food for energy, protein, fat, nine vitamins and four minerals, using embedded food composition table (within the CotD software) or custom data • Estimated average requirements for energy, percentage energy from fat and recommended nutrient intakes (RNIs) for protein, nine vitamins and four minerals (Fe, Zn, Ca, Mg) using embedded database or custom data • Portion sizes for all foods found on the market using embedded portion size database or custom data • Optional: Typical food habits of the household or target individuals • Typical, average, or 'model' household size and composition of the target area • Income and expenditure data from household surveys across the population (in order to estimate affordability)	• Daily, monthly and/or annual cost of achieving nutrient adequacy, aligned with usual dietary patterns, by season (optional) for the model household and individuals within the household • Quantity and cost per day, week, or year of each food selected by the model • The amount and percentage of energy and nutrients provided by each edible portion of food selected by the model, summarized by day, week or year • The percentage of target intakes met for each nutrient by day, week, season or year • Cost attributed to each food group per week • Affordability of the nutritious diets as a percentage of income or expenditure data, or proportion of households that can afford the diet	Useful to model the lowest cost of meeting nutrient needs within a reasonably realistic dietary pattern, and then show what such a diet would resemble for individuals and the household. This model shows if locally available foods can meet nutrient requirements, what combination of foods would be needed and how affordable such a lowest cost nutritious diet is. Useful to identify impact of fortification or lowering cost of local nutritious foods on cost of meeting nutrient requirements. A software package is available for the modeling, with embedded data on food composition, nutrient requirements, and portion sizes. Training is required to use the software.

Tool	Population	Data & standards	Results available	Recommended uses
Optifood	Any target population of interest (e.g. adult women or men, pregnant women, young children, etc.)	• RNIs for protein, fat, Ca, Fe, Zn, B1, B2, B3, B6, B12, folate, vitamin A, vitamin C • Optional food expenditure constraints (e.g. max cost per week) • Food consumption data (food list, food portion sizes, food patterns – food group and food sub-groups) for target group of interest • Average body weight of the target population, and for adults, a crude estimate of their physical activity levels • Food composition data for foods not in Optifood's internal food composition data base	Module II: • Problem nutrients, nutrients for which adequacy would be difficult to meet using local foods within acceptable dietary patterns • Two nutritionally best diets; one of which has a food pattern close to the median food pattern of the target population • The amount and percentage of energy and nutrients provided by each food and food sub-group in the two nutritionally best diets • Number of servings of each food and food group (17 groups) in the two nutritionally best diets modelled to meet nutrient needs and the cost per week (optional) Module III: • The maximum nutrient contents achievable in any diet • The minimum nutrient contents of diets that achieve the FBRs tested • A comparison across all sets of FBRs tested of their minimum nutrient contents Module IV: • The cost of the lowest nutritionally best diet given local dietary patterns (i.e., not necessarily nutritionally adequate) • The % contribution from each food to overall diet cost • The most expensive nutrients requirements to achieve • The %RNI achievable before it influences overall diet cost	Useful to formulate and test food-based recommendations for specific target groups Useful to evaluate and compare what difference possible interventions (special foods / supplements) can make. Useful to inform the design of behavior change communication strategies for improved or lower-cost diets. Useful to identify agricultural interventions to improve nutrient intakes of key target groups.

Note: A software package is available for the modeling, with embedded data on food composition, nutrient requirements, and portion sizes. Training is required to use the software.

INDICATORS OF CHANGE OVER TIME*

Indicator	Population	Data required and nutritional standard to be met	Results available	Recommended uses
Nutritious-food Price Index (NPI)	General population	• Price of food per unit specified in the consumer price index (no conversion to price per gram) • Rating of each food by its nutritional value (e.g. NuVal scores from 1 to 100)	• Unit-free index (100 in base case) that shows the cost of foods weighted by their nutritional value • Identifies change in cost of more rather than less nutritious foods, for comparison with conventional food CPI	Useful as a direct comparison to the food CPI, which tracks the change in price of foods weighted by expenditure shares. In contrast, the NPI uses the same food list weighted by nutritional value.
Cost of a Diverse Diet (CoDD)	General population (implicitly, women of reproductive age, for whom the MDD-W indicator was defined)	• Price per kcal or per gram of each food • Threshold number of food groups needed (e.g. five of 10 groups for MDD-W, or four of seven groups for the minimum diet diversity for infants and young children)	• Unit-free index (100 in base case) that shows change in cost of reaching minimum diet diversity • Identifies lowest-cost food in each group • Identifies lowest-cost groups to reach minimum diet diversity	Useful as a basic index of the change in cost of a minimally diverse diet, which does not require any additional information beyond food prices and food groupings; does not require specialized models or software, and does not require CPI weights.

*These indicators track the changes in price of nutritious diets over time relative to a base time point, but do not provide a cost per day.

Note: In addition to *nutritional* data requirements shown here, all cost indicators require each food's market price at every time and place for which the indicator is to be calculated, and can be compared to income or wages for use as a measure of affordability.