NUTRIENT PROFILE MODELS
A critical tool to enable nutrition policy interventions

What is this document?

- Nutrient profile models underpin key nutrition policy interventions.
- There are many existing nutrient profile models that can be adapted for new uses.
- This document includes:
  - Background information on nutrient profile models including their applications, impact and an overview of their development;
  - Five key steps to adapting an existing model for use in a new context; and
  - Examples and resources to guide the process.

What is a nutrient profile model?

- Nutrient profile models classify or rank foods based on their nutritional composition for reasons related to preventing disease and promoting health
- They provide the scientific foundation for regulatory initiatives

<table>
<thead>
<tr>
<th>WHAT ARE THE APPLICATIONS OF NUTRIENT PROFILE MODELS?</th>
<th>WHAT DO THE APPLICATIONS OF NUTRIENT PROFILE MODELS ENABLE?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Front-of-pack labels</td>
<td>• Identification of products not allowed to be marketed to children, served or sold by public institutions, and / or are taxed or subsidized</td>
</tr>
<tr>
<td>• Regulation of health and nutrition claims</td>
<td>• Informative front-of-package labels that provide accessible nutrition information for consumers</td>
</tr>
<tr>
<td>• Marketing restrictions of unhealthy foods and beverages</td>
<td>• Industry reformulation of existing products to improve healthfulness</td>
</tr>
<tr>
<td>• Food procurement regulations for public institutions</td>
<td></td>
</tr>
<tr>
<td>• Food taxes and subsides</td>
<td></td>
</tr>
<tr>
<td>• Nutritional surveillance</td>
<td></td>
</tr>
</tbody>
</table>

DEVELOPMENT

WHEN DOES A COUNTRY NEED A NUTRIENT PROFILE MODEL?

- Countries need nutrient profile models when they are considering implementing a policy or educational program and need to classify foods according to their nutrient qualities

WHO TYPICALLY DEVELOPS NUTRIENT PROFILE MODELS?

- Organizations that are unbiased (independent of industry), transparent, and scientifically credible do so most successfully
- Often, governments convene experts

WHAT ELSE DOES IT TAKE TO DEVELOP A NUTRIENT PROFILE MODEL?

- Clear understanding of national objectives and priorities related to nutrition
- Standardized, mandatory nutrition information for all packaged foods
- Lab capacity to monitor accuracy of nutrient information

How does a country implement a nutrient profile model?

- After identifying an appropriate nutrient profile model (see pages 3-11 for more detail), countries implement it by incorporating it into related policies
- For example, Chile introduced its nutrient profile model as a part of its labeling and advertising law. It made cutoffs stricter over the course of three phases from 2016-2019 (as depicted in the timeline below). While phased implementation is not necessarily recommended, it was what was feasible in this context for industry to comply and monitoring and evaluation mechanisms to be established.

Timeline of Chile Nutrient Profile Model Development and Application

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>PHASED APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>Law 20 606 of food labeling &amp; advertising</td>
<td>First proposed decree with regulation details (including nutrient profile model)</td>
</tr>
</tbody>
</table>

Principles to guide model development

The process to develop a nutrient profile model for a country or context should be

- **Transparent**: Documentation of and a clear line of sight into who developed the nutrient profile model and how it was created
- **Evidence-based**: Draw on published nutrition standards, existing nutrient profile models, relevant food databases and expert input
- **Inclusive and representative**: Maintain an approach that considers the full target population, including any implications (e.g., whether the model consistently flags less expensive products)

### Approaches

**OPTION 1: START FROM SCRATCH**

- Extensive effort and significant resources required
- Needs cohort study to validate relationship of potential cutoffs and health outcomes

**OPTION 2: ADAPT AND EXISTING MODEL**

- Practical; less time and resource intensive
- Avoids duplication
- Reduces confusion
- Decreases likelihood of loss of credibility of NPMs broadly

This document focuses on adapting an existing model since it is more feasible and efficient, and few existing materials focus on this approach.

**ARTICULATE PURPOSE**

At the outset, define the following to be clear on the goals and uses of the nutrient profile model (NPM), and thereby increase its relevance and utility:

<table>
<thead>
<tr>
<th>What to Define</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses of the NPM</td>
<td>• Front-of-package warning labels</td>
</tr>
<tr>
<td>What the NPM is intended to inform?</td>
<td>• Packaged food sodium reduction targets</td>
</tr>
<tr>
<td></td>
<td>• Fiscal policies</td>
</tr>
<tr>
<td></td>
<td>• Several policies simultaneously</td>
</tr>
<tr>
<td>Target population</td>
<td>• All citizens</td>
</tr>
<tr>
<td>Who will be impacted?</td>
<td>• Children or children in schools</td>
</tr>
<tr>
<td>Eligible products</td>
<td>• Foods sold at fast food outlets</td>
</tr>
<tr>
<td>What products will be covered by the NPM?</td>
<td>• Food with anything added to its raw form (e.g., flavored yogurt but not plain yogurt)</td>
</tr>
<tr>
<td></td>
<td>• Processed and ultra-processed foods</td>
</tr>
<tr>
<td></td>
<td>• All foods with exceptions (e.g., food for specialized medical treatment)</td>
</tr>
</tbody>
</table>

**DEFINE ATTRIBUTES**

Then, decide on the key attributes of the nutrient profile model:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Categorization type</strong>  Whether it uses cutoffs for scoring to categorize products</td>
</tr>
<tr>
<td>B</td>
<td><strong>Food category delineation</strong>  Whether cutoffs are food category-specific or if a single cutoff is used per ingredient</td>
</tr>
<tr>
<td>C</td>
<td><strong>Ingredients covered</strong>  Whether it includes cutoffs for unfavorable and/or favorable ingredients</td>
</tr>
<tr>
<td>D</td>
<td><strong>Reference amount</strong>  The reference amount used to compare the quality of an ingredient (e.g., per 100g)</td>
</tr>
</tbody>
</table>

Pages 5-8 detail the options for these attributes along with their pros and cons.

Decide on the desired **key attributes of the nutrient profile model**:

<table>
<thead>
<tr>
<th><strong>OPTION</strong></th>
<th><strong>Dichotomous thresholds</strong></th>
<th><strong>Summary indicator</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROS</strong></td>
<td>Cutoffs to indicate whether an ingredient in the product meets a healthy/unhealthy level</td>
<td>Aggregate score that summarizes multiple ingredients to indicate a product’s overall healthfulness</td>
</tr>
<tr>
<td><strong>CONS</strong></td>
<td>Straightforward to understand, apply and enforce</td>
<td>Consideration of the entire profile</td>
</tr>
<tr>
<td></td>
<td>Some products may only need to reformulate minimally to achieve a category switch from unhealthy to healthy</td>
<td>Facilitates tiered taxation</td>
</tr>
<tr>
<td></td>
<td>Less impactful at discouraging unhealthy food purchases</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Often limited scientific backing for meaning of a score</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Can be manipulated by industry if favorable ingredients are included in the score (e.g., adding fiber to improve score)</td>
<td></td>
</tr>
</tbody>
</table>

**IDEAL FOR**

Front-of-package labeling
- dichotomous thresholds make implementation and monitoring more feasible (i.e., warning labels)

**EXAMPLE**

Chilean octagonal warning labels which rely on the Chilean nutrient profile model — flag products high in unfavorable ingredients including sugar, saturated fat, sodium and calories

**Attributes:**
- **Categorization type** Dichotomous thresholds
- **Food category delineation** Across-the-board
- **Ingredients covered** Unfavorable
- **Reference amount** Per 100g / 100mL

## Food category delineation

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Food categories</th>
<th>Across-the-board</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Separate cutoffs for each food category</td>
<td>A single cutoff is used for each ingredient for all products</td>
</tr>
</tbody>
</table>

| PROS | • Accounts for differences in food categories<br>• Can drive more reformulation | • Straightforward to apply and enforce<br>• Easy for consumers to understand |
|      | | |

| CONS | • More difficult to apply and enforce<br>• Categories cannot be easily compared to each other | • Some categories may incidentally be penalized based on their natural composition (e.g., nuts and seeds)<br>• Reduces reformulation potential for some categories |
|      | | |

| IDEAL FOR | Reformulation targets using specific food categories can help drive more change within a category | Front-of-package labeling and marketing restrictions across the board cutoffs using make implementation and monitoring and evaluation more feasible |

### INDUSTRY PUSHES BACK AGAINST THESE MODELS

Industry has used several approaches to weaken nutrient profile models:

- Industry pushes for less strict cutoffs overall, but also advocates for *more and more categories* – so the cutoffs are made for, and comparison is made to, very similar products. This can result in less change in the healthfulness of products, and also be more complicated to communicate and apply.

- Industry also proposes *adding healthful ingredients* (e.g., fiber) to improve a nutrient profile model summary score, without decreasing the amount of unhealthy ingredients in their product.

- Industry *manipulates serving size* to avoid being flagged as unhealthy by nutrient profile models.

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## Ingredients covered

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Only unfavorable ingredients</th>
<th>Favorable and unfavorable ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredients that consumers should avoid (e.g., sodium, sugar, saturated fat)</td>
<td>Ingredients ones should be increased (e.g., vitamin A, iron, fiber) in addition to unfavorable ingredients</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not as easily manipulated by industry</td>
<td>• Can support a comprehensive, balanced diet</td>
</tr>
<tr>
<td>• Clear guidance for consumers</td>
<td>• Can be manipulated by industry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IDEAL FOR</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-of-package labeling Warning labels for unfavorable ingredients can clearly and concisely caution the customer of high levels of ingredients that should be avoided</td>
<td><strong>Nutri-score</strong> is front-of-package label which relies on the nutrient profile model developed by the United Kingdom Food Standards Agency and is used by France. It summarizes the healthfulness of a product (both favorable and unfavorable ingredients) by assigning a letter score.</td>
</tr>
<tr>
<td>Public food procurement Covering favorable and unfavorable ingredients can promote a healthy diet holistically (e.g., in schools)</td>
<td></td>
</tr>
</tbody>
</table>

### ATTRIBUTES:

- E. **Categorization type** Summary indicator
- F. **Food category delineation** Food categories
- G. **Ingredients covered** Favorable and unfavorable
- H. **Reference amount** Per 100g / 100mL

# Nutrient Profile Models: Adapt an Existing Model

## Reference Amount

<table>
<thead>
<tr>
<th>OPTION</th>
<th>Per 100g/100mL compared to product weight</th>
<th>Per 100 kcal/kJ compared to calories within a product</th>
<th>Per serving compared to product serving size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROS</strong></td>
<td>· Straightforward to apply and enforce</td>
<td>· Comparable to WHO recommended daily intake</td>
<td>· May more accurately capture actual consumption</td>
</tr>
<tr>
<td></td>
<td>· Widely used, allows for model comparison</td>
<td>· Better accounts for different calorie intake between women / men and adults / children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Aligns with Codex Alimentarius</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONS</strong></td>
<td>· Without volume corrections, can penalize calorie-dense foods with across-the-board cutoffs (e.g., nuts but not sugary beverages)</td>
<td>· More difficult to implement and enforce (need to know calorie content)</td>
<td>· Difficult to apply and enforce (serving sizes rarely defined)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· Can be manipulated by industry (e.g., smaller servings)</td>
</tr>
<tr>
<td><strong>IDEAL FOR</strong></td>
<td>Front-of-package labeling Allows for direct comparison of products and is readily implementable</td>
<td></td>
<td>Public food procurement For interventions in restaurants or cafeterias, serving size is particularly relevant</td>
</tr>
</tbody>
</table>

## NPMs for Fiscal Policies

Fiscal policies (e.g., taxes, subsidies) for unhealthy foods are gaining traction. A nutrient profile model may be used as the basis for a fiscal policy that promotes consumption of healthier foods. There are several nutrient profile model approaches to explore further:

- Use a model already in place for an existing policy (e.g., front-of-package labeling)
- Adapt or develop a model to inform fiscal policies

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Identify relevant existing models that could be used or adapted:

**A. Find nutrient profile model(s) that serves the purpose with desired attributes**

- Review existing models in the literature and assess their potential fit—including the relevant regional model developed by WHO (see page 13).
- The systematic review by Labonté et al. is a helpful starting place for a longlist of models, since it includes the 78 nutrient profile models considered for nutrition policy published in the literature as of 2018.
- Additional resources to find and review existing models are included on page 13.

**Questions to ask to assess potential models**

- Was it created for the same purpose? Who is the target population? What products does it cover?
- Does it have the desired delineation, ingredients covered, reference and categorization type?
- Would it be feasible to apply? Is it regionally / culturally relevant?
- What context-specific changes would be required? Are they major or minor?

**B. Review development and validation**

- Assess which potential models have the validity, credibility and evidence-base to stand up to challenges and criticism by industry and other partners—noting a model may need slight adaptations for the context.

If there is not a relevant and valid model that meets desired attributes after slight modifications for the context — revisit and refine Step 2.

**Questions to ask to review model development and validation**

- Did a credible organization develop it?
- Was it thoroughly validated (ideally using predictive validity methods)?

Then, test how the potential nutrient profile model(s) perform in the context of the relevant food supply of the country, compared to others under consideration, by doing the following:

### Identify or develop a food database

- Needs to contain nutrition information on food (and beverages) available for purchase to the representative population
- Information like product name, brand, package size, nutrition information and list of ingredients are important

### Analyze the potential nutrient profile model(s)

- Exclude ineligible products
- Sort products according to the various nutrient profile model categorizations
- Calculate: (i) mean nutrient value within a category; (ii) proportion of products considered healthy / unhealthy for each nutrient profile model; (iii) percent of products within 10-20% of the threshold where you might expect reformulation
- Identify areas of agreement and disagreement (i.e., when products are categorized differently) between nutrient profile models
- Assess whether each nutrient profile model flags: (i) any important staple foods as unhealthy; (ii) healthy products that target nutrient deficiencies
- Can also assess correlations between the nutrient profile model(s) and nutrient density scores or other independent measures of diet quality

### What makes for a useful food database for these analyses?

**Useful food databases should:**

- Contain photographs or detailed information on packaged food
- Ideally be open access
- Include products that are representative of what the target population can access, purchase and consume
- Be representative of the market for a product category, if a large exhaustive dataset is not available or feasible

**Examples of existing databases include:**

- SMILING database (covers Cambodia, Indonesia, Laos, Thailand, & Vietnam)
- USDA Food and Nutrient Database for Dietary Studies

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1 Several studies have compared nutrient profile models to the performance of Chilean III or Pan American Health Organization nutrient profile model given use.
Finally, select the nutrient profile model that is the best fit:

What defines a useful nutrient profile model?

- Fits the application that you are using (e.g., a front of pack warning label needs a specific type of nutrient profile model)
- Likely flags a large proportion of ultra-processed products as unhealthy, but not all
- Flags products or nutrients of concerns consistently
- Does not flag products with needed fortification ingredients
- Is feasible to apply and is actionable

Successful examples of nutrient profile model adaptation and testing

This approach has been used several times:

In **India**, researchers compared the WHO South-East Asia Region Organization model to the Chilean food labeling and advertising law model using data from the Mintel Global New Products Database Asia-Pacific Island Region.

**Jamaica, Colombia and Brazil** all compared the Pan American Health Organization (PAHO) model to the Chilean food labeling and advertising law model using data collected from packaged foods in supermarkets and retail outlets representative of where people shop.

In **South Africa**, researchers compared a model based on Food Standards Australia/New Zealand’s (a version focused on unfavorable ingredients and one that accounts for unfavorable and favorable ingredients) to both the PAHO model and Chilean food labeling and advertising law model using data collected from packaged foods in large supermarkets.

# Additional examples

<table>
<thead>
<tr>
<th></th>
<th>PAHO²</th>
<th>WHO South-East Asia Region³</th>
</tr>
</thead>
</table>
| **Uses**           | • Marketing restrictions for children  
                     • Regulation of school food environments  
                     • FOP warning labels  
                     • Taxation policies  
                     • Agricultural subsidies  
                     • Foods provided by social programs | • Marketing restrictions for children |
| **Target population** | • People living in the PAHO member states | • Children in South-East Asia |
| **Eligible products** | • Processed and ultra-processed products | • All except special food supplements for specific disease conditions |
| **Categorization type** | • Dichotomous thresholds | • Dichotomous thresholds |
| **Food category delineation** | • Across-the-board | • Food categories |
| **Ingredients covered** | • Unfavorable — Free sugars, sodium, saturated fat, total fat, trans fats | • Unfavorable — Total fat, saturated fat, total sugars, added sugars, sodium, calories |
| **Reference amount** | • Per 100 kcal / kJ | • Per 100g / 100mL |
| **How thresholds were developed** | • An expert consultation group was commissioned by PAHO in December 2014  
                     • The group reviewed and discussed relevant evidence including WHO guidelines on sugar and other nutrients to develop the model | • Adapted from WHO Western Pacific model, which was based on WHO European model  
                     • Thresholds based on principles in PAHO nutrient profile model  
                     • Pilot tested in five member states by examining its applicability to foods commonly consumed by children and engaging stakeholders in discussion  
                     • Regional workshop held to review and finalize the model |
| **Illustrative cutoffs for classification** | • Sodium: > 1 mg per 1 kcal  
                     • Free sugars: > 10% of total calories  
                     • Other sweeteners: Any amount  
                     • Total fat: > 30% of total calories  
                     • Saturated fat: > 10% of total calories  
                     • Trans fat: > 1% of total calories | • Cutoffs for 18 food categories, e.g.:  
                     • Cereals  
                       • Total fat: > 12 g per 100 g  
                       • Sodium: > 0.35 g per 100 g  
                     • Frozen dairy  
                       • Total sugars: > 12 g per 100 g  
                       • Calories: > 230 kcal per 100 g |

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Resources

Common nutrient profile models

- **World Health Organization.** WHO Regional Office for Europe nutrient profile model. 2015.
- **World Health Organization.** WHO nutrient profile model for the Western Pacific region: a tool to protect children from food marketing. 2016.
- **World Health Organization.** WHO Regional Office for Europe nutrient profile model. 2015.

Guides and frameworks

- **World Cancer Research Fund International.** Building momentum: lessons on implementing a robust front-of-pack food label. 2019.--section on nutrient profile models
- **World Health Organization.** Guiding principles and framework manual for front-of-pack labeling for promoting healthy diets. 2019.—appendix 2

Examples of adapting an existing model

- **Frank et al.** A fit-for-purpose nutrient profiling model to underpin food and nutrition policies in South Africa. Nutrients. 2021;13(8):2584.