Overall **N**utritional **Q**uality **I**ndex
Version 1
(ONQI.v1)

- REFERENCE MANUAL-

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Précis

The United States is the epicenter of a global obesity pandemic. Insulin resistance, metabolic syndrome, and type 2 diabetes are epidemic as well. What used to be "adult onset" diabetes is diagnosed with increasing regularity in children under the age of ten. The combination of dietary patterns at odds with recommendations and relative lack of physical activity is, or soon will be, the leading cause of premature death in the land.

There is widespread consensus among experts that improvements in activity levels and dietary patterns have enormous potential to promote health and prevent disease. Healthful eating and activity patterns (along with other sensible behaviors, such as tobacco avoidance) could reduce the rate of heart disease by as much as 80%, diabetes by up to 90%, and cancer by nearly 60%. Were any such advances the result of a medical breakthrough, it would surely warrant- and earn- a Nobel Prize. As it is, they are the potential products of applying what we already know.

In the case of diet, there are two ways to close the gap between how we eat at present and how we should eat for optimal health. One involves a fundamental shift in the pattern of the diet, as reflected in such advice as "eat more fruits and vegetables." Such advice is valid, and important, but subject to considerable resistance. At the current rate of progress toward Healthy People 2010 goals for fruit and vegetable intake, for instance, it is only modest hyperbole to project hitting the target by approximately the year 3010!

There is another way to improve dietary patterns and that is one food choice at a time. The range in nutritional quality for every food category represented on supermarket shelves, from greens to granola bars, sandwich meat to salad dressing, cookies to cooking oils, and even the proverbial soup to nuts- is vast. Choosing the most nutritious offerings in each category offers a powerful means to reduce intake of calories, sodium, added sugar, and harmful fats, while increasing intake of fiber, beneficial nutrients, vitamins, and minerals.

But between the average consumer and those choices is a rolling sea of competing claims, half truths, marketing hype, and hopeless confusion.

Upon those troubled waters, the ONQI offers a lighthouse beam. An unfailing, ever reliable guide to better nutrition both within and across food categories. A beacon to better health that comes of better eating. An illumination… of how actually to get there from here.

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ONQI Definition / Characterization

The ***Overall Nutritional Quality Index*** (ONQI) is an algorithm designed to generate a single, summative score for the "overall nutritional quality" of a food based on its micronutrient and macronutrient composition and several other of its nutritional properties (e.g., energy density). The ONQI is further designed to stratify foods into a rank order of relative nutritiousness both universally (i.e., across all food categories) and within specific food categories (e.g., breads, cereals, frozen desserts, etc.), while avoiding the characterization of any food as "good" or "bad" in absolute terms. The ONQI is further designed to convert the pooled knowledge, judgment, and discriminating ability of top experts* in nutrition and its associations with public and personal health into a tool that any consumer can use. Thus, the ONQI enables the "average shopper" to choose foods on the basis of overall nutritional quality with the ease and fidelity of top nutrition experts. By virtue of the ONQI algorithm sophistication and the expansive array of nutrient data it incorporates, the ONQI is applicable to any food item, recipe, meal, meal plan, or overall dietary pattern. It is designed to have applications at point of purchase in retail supermarkets, on food packaging, in restaurants, in print materials (e.g., books, periodicals), and on-line.

Consulting Participants on the ONQI Scientific Expert / Development Panel (N.B. Not all members of the ONQI development panel remain involved in the project; see advisory board roster, p. 19***):**

- Chair: Dr. David L. Katz, Yale University Prevention Research Center
- Dr Keith Ayoob, Albert Einstein College of Medicine
- Dr Leonard Epstein, University at Buffalo, The State University of New York; inventor, Traffic Light Diet
- Dr David Jenkins, University of Toronto; inventor, Glycemic Index
- Dr Francine Kaufman, University of Southern California; Past President, American Diabetes Association
- Dr Robert Kushner, Northwestern University
- Dr Ronald Prior, Arkansas Children's Nutrition Center, USDA HNRC
- Dr Rebecca Reeves, Baylor College of Medicine; Past President, American Dietetic Association
- Dr Barbara Rolls, Pennsylvania State University
- Dr Sachiko St. Jeor, University of Nevada
- Dr John Seffrin, President & CEO, American Cancer Society
- Dr Walter Willett, Harvard University

ONQI Project: Mission & Objectives

- To develop a (the) definitive algorithm to stratify food items within any category, and across food categories, based on overall nutrition quality.
    - *To measure overall nutritional quality using the best science available, encompassing nutritional biochemistry; physiology and metabolism; dietetics; and epidemiology and public health.*

- To develop an algorithm for assessing the overall nutritional quality of foods that entirely avoids the "good food/bad food" dichotomy and controversy.
    - *Specifically, to develop a novel metric for the nutritional quality of individual foods, and the nutrients in those foods, based on the relationship among nutrients in foods, the overall quality of the diet, and associations with health outcomes.*

- To place the ability of top nutrition experts to discriminate among food choices on the basis of nutrition into the hands of every consumer.

- To provide the public a powerful and empowering means to improve dietary intake patterns, and thereby health, one food choice at a time.

ONQI Project Vision Statement:

- A single, trusted, reliable and universal nutrition guidance system available to consumers at every point of purchase, freely accessible on-line, and on every package in the food supply enabling all consumers to choose foods for consumption on the basis of overall nutritional quality with complete confidence, great convenience and ease, and unfailing immunity from any and all potential deception related to marketing.

- An improvement in the approximation of prevailing dietary patterns to recommended dietary patterns, specifically (in the United States) the current version of the *Dietary Guidelines for Americans*.

- An improvement in the public health, as reflected in particular by declining rates of obesity, diabetes, insulin resistance, cardiovascular disease, and cancer, by virtue of improvements in prevailing dietary patterns.

Proviso

The ONQI is a tool, and like any other tool- including the very best- is well suited to a particular function. In the case of the ONQI, that function is to guide food choice/selection on the basis of overall nutritional quality.

Nutritional quality is a measure analogous to density. Just as the density of diamond does not vary with the size of the stone, nor does the nutritiousness of broccoli vary with its serving size. Thus, the ONQI tool in its unadorned application does not offer guidance for portion sizes, or other elements involved in constructing an optimally balanced dietary pattern. To be maximally useful, a tool must be used well, and more or less as intended. The ONQI is no exception.

That said, among the factors considered in scoring the nutritiousness of foods by use of the ONQI are properties that influence satiety. Consequently, foods that score well on the ONQI scale will, in general, facilitate portion control. As for dietary balance, an adaptation of the ONQI applicable to the entire diet- accounting for balance and variety along with the nutritional quality of individual food choices- is under development.

Nonetheless, this delimiting precaution is warranted. A tool used well is empowering; a tool used badly is potentially harmful. A hammer is excellent for driving nails, rather poor for opening windows. The ONQI is a powerful tool, simple to use. But the true measure of its utility, as that of any tool, is contingent upon how it is put to use.

ONQI Project Overview

Origins of the Project

The ONQI project traces its origins to July, 2003. At that time, U.S. Secretary of Health convened a group of 15 academic thought leaders to share ideas for improving dietary intake patterns in the United States, and specifically for curtailing the spread of epidemic obesity, with him, FDA Commissioner Mark McClellan, and the Directors of the NIH & CDC.

The ONQI concept was proposed at that meeting[1]. Specifically, the following recommendations were made:

- Develop a universal guidance system based on the relative nutritiousness of foods within and across all categories.
- To do so, convene a multidisciplinary group of leaders in nutrition and its implications of public health under the auspices of the US FDA or the Institute of Medicine (IOM).
- Provide the group the financial support and time required to convert their collective knowledge and judgment into a universally applicable algorithm for nutrition scoring.
- Convert nutrition quality scores into a set of symbols, reflecting relative nutritional quality, interpretable at a glance.
- Apply those symbols to the entire food supply.
- Provide the requisite support for on-going oversight of the scoring system, and its timely revisions based on changes in nutrition science, epidemiology, and/or the food supply.

[1]Katz DL. Verbal commentary to Secretary of Health Tommy Thompson, July, 2003, Washington, D.C.

Katz DL. ***A food supply for dummies***. Op-Ed: Hartford Courant; NY Newsday; etc. 10/03

While there was strong philosophical support for the recommendation in 2003, and some follow-up discussion with FDA officials responsible for oversight of an advisory group convened to address obesity control, no formal action was taken.

In late 2005, a confluence of circumstances resulted in the willingness of Griffin Hospital, a Yale-affiliated, non-profit community hospital in Derby, CT, and home to Yale University's Prevention Research Center, to provide financial and material support for the very project proposed to the Secretary of Health in 2003.

The ONQI project was thus initiated in late 2005, and the first draft of the ONQI algorithm was created in February, 2006.

Methods

The ONQI project was initiated in an explicit effort to satisfy the criteria proposed to the US Secretary of Health in 2003, and to replicate, to the extent possible, the very process that the FDA or IOM "would have" applied. The salient elements in such a process include:

- Engagement of a multidisciplinary team of nutrition and public health scientists
- Avoidance of conflicts of interest
- Isolation of the science-based development effort from any outside or commercial influence
- Reliance on objective sources of data to the extent possible
- Transparency of methods
- A fully iterative process, with consensus-based decision-making

The ONQI project was implemented in satisfaction of these principles. The sequence of methodologic steps was approximately:

1) A review of literature pertaining to nutrition guidance and nutrient profiling from both the US and abroad by staff at the Prevention Research Center.
2) Concurrent with #1, a delineation of a master list of potential members of the ONQI Scientific Expert Panel based on a need to include thought leaders in nutrition science and public health nutrition; diverse disciplines; and the representation of leading institutions and organizations.
3) A winnowing of the list to achieve a panel of between 10 and 15 participating consultants.
4) Invitations extended to a total of 16 nutrition and public health scientists.
5) Fourteen of those invited to join the ONQI development panel did so; 3 of these subsequently stepped down. One participant stepped down after recognizing a potential conflict of interest; one did so after recognizing a personal conflict with the goal of the project; and one simply did not participate in the information exchange process and was lost to attrition. The final panel of 11 consultants represented fields from nutritional biochemistry to chronic disease epidemiology, pediatric endocrinology to behavior modification.
6) The identities of the consulting scientists were kept in confidence to avoid any and all outside influence.
7) The consultants were compensated for their time but did not have any financial interest in the final product; the details of the agreement between the panel members and Griffin Hospital were addressed in a letter of understanding.
8) Beginning in early 2006, a draft of the ONQI algorithm and its justifications were circulated to panel members for review and critique. The basic formula is based on the Dietary Reference Intakes (DRIs); Food and Drug Administration (FDA) Nutrition Facts Panel; US Department of Agriculture (USDA) MyPyramid and the Dietary Guidelines for Americans, 2005; and relevant international standards.
9) An iterative process of editing took place based on feedback from panel members via e-mail and at regularly scheduled conference calls, with process oversight and logistical support rendered by staff at the Prevention Research Center.

a. Over a period of 18 months, starting in March 2006, 13 conference calls were held to make revisions to the ONQI based on consensus, and to address validation/testing.
b. Work was managed in between calls primarily via e-mail exchanges.

10) Once an initial, consensus-based version of the ONQI formula was in circulation, validation testing was initiated. Consensus approval of the form of the algorithm was deemed commensurate with ***face validity***.

11) Content validity testing was conducted in the following manner:
    a. Members of the ONQI panel were given foods lists of varying length and variety and asked to rank-order the foods on the basis of overall nutritional quality across food categories (lists of approximately 20 foods) and both within and across food categories (lists of approximately 100 foods).
    b. A mean ranking for the ONQI panel was established.
    c. The ONQI algorithm was used to rank order the same foods, and correlation analysis was performed.
    d. This process was terminated with a food list of roughly 100-120 items, and with a correlation coefficient between ONQI and expert panel rankings of between R= 0.88 and R = 0.92, depending on certain fine adjustments to the algorithm.
    e. At that point, the process was reversed: the ONQI was used to rank order over 1000 foods, and the relevant rank-ordered lists were circulated to the expert panel members for review. Any apparent anomalies identified in the food rankings resulted in scrutiny of the nutrient data entered, and a determination to either acknowledge that the ONQI ranking was correct, or to adjust the algorithm. This process continued until no further adjustments to the algorithm were deemed necessary.
    f. Plans for criterion validity testing have been developed, and planning for this activity is now under way. See p. 49 for details.

12) The initial working version of the ONQI algorithm was finalized in July 2007.

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