

Monitoring Food-Supply Nutrients

ARS Nutrition Monitoring A Three-Part Series

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The Second Step—Conservators of the National Nutrient Database

For more than 115 years, the U.S. Department of Agriculture has provided data on the nutrient composition of foods in the American diet. Over time, a series of USDA institutions responsible for providing this data evolved, and today the data comes from the Beltsville Human Nutrition Research Center (BHNRC), part of USDA's Agricultural Research Service.

“Our mission is to ensure that science-based nutrient profiles exist for the U.S. food supply,” says nutritionist and research leader Joanne Holden, who heads the Nutrient Data Laboratory (NDL) at the nutrition center, which is located in Beltsville, Maryland. “We work with other BHNRC, private, and public-sector scientists to acquire, evaluate, and disseminate accurate nutrient-profile data on foods—and now certain dietary supplements—consumed in the United States.” (See “National Food and Nutrient Analysis Program,” page 14.)

Researchers at NDL are the conservators of the National Nutrient Database for Standard Reference, the major authoritative source of information about food composition used in the United States. Some of the data is also used by other countries in

compiling their food-composition databases. “The Standard Reference—called ‘SR’ for short—is the foundation of almost all of the food and nutrition databases, whether commercial or nonprofit, used in the United States,” says Holden. “It is critical for national food policymakers, researchers, and those responsible for monitoring nutritional status and dietary intake.”

The laboratory's researchers have developed a system for getting commonly consumed foods identified, obtained, and analyzed for their nutrient content, says NDL nutritionist David Haytowitz. “We

work with a large number of industry groups, because they recognize the value of being represented in the publicly available SR database.”

The SR database includes more than 7,900 foods—and provides nutrient-composition values, called “nutrient profiles,” for each of these food entries. SR is available both online and via free download. There is no intellectual property restriction on the database—which is updated annually—and academic, nonprofit, commercial, and other governmental scientific communities are encouraged to download it.

The food industry is responsible for the accuracy of nutrition facts panels required on packaged-food labels. Some food manufacturers use data from the national nutrient databases, provided by the Beltsville Human Nutrition Research Center, to calculate values.



STEPHEN AUSMUS (D1830-30)

A Moving Target

A major challenge in keeping the SR database current, according to Holden, is that the U.S. food supply has changed dramatically and has become increasingly dynamic. Studies have shown that about 30 years ago, more people cooked at home. Now, people often pick up what are called “multi-component” prepared foods from a wide variety of restaurants and ready-to-eat market counters nationwide.

Another challenge is that across the United States, there are hundreds of thousands of food products in stores—and some come on and off the market annually. More than 600,000 unique Universal Product Codes, often called “barcodes,” are found on the products in these grocery stores. Each barcode includes a unique 12-digit manufacturer identification number, and different barcodes are created for different sizes of the same individual product. Store managers use the barcodes to track inventories and to price items.

While SR provides a nutrient profile for more than 7,900 foods, each nutrient profile for each food entry can include about 140 nutrients and other dietary components. In contrast, packaged-food labels carry only about 15 nutrients. “One reason we don’t rely solely on a manufacturer’s label nutrient data is that the label does not provide all the information we need,” says Haytowitz.

So how do NDL researchers accurately track the food supply to create nutrient profiles? They continuously monitor the food supply using annual data from the BHNRC national “What We Eat in America” survey and other sources. They learn of newer products that have become popular in the United States as survey respondents report having eaten the new foods. When the survey uncovers popular new foods, “we add them to our sampling and analytical program,” says Haytowitz. “In that program, we arrange for the purchase of representative samples of foods from all over the country to be analyzed using scientifically validated analysis methods, so that the data represents average values across the country.”

This careful sampling of the food supply is important to other government entities as well, such as the Centers for Disease Control and Prevention, the U.S. Food

Inside the Nutrient Data Laboratory

STEPHEN AUSMUS (D2440-1)



To get an idea of the breadth of users of the National Nutrient Database for Standard Reference (SR), *Agricultural Research* magazine sat down with Nutrient Data Laboratory research leader and nutritionist Joanne Holden (left) to learn more.

Q: How many users download the national nutrient database annually?

A: Because SR is available free, its use in business, industry, and even academia often goes uncited. Once downloaded, the database can be further conveyed in any number of ways, so we can’t track users by counting downloads from our government site alone.

Q: What types of commercial hardware and software utilize the database via download and import?

A: Personal and business computers, hand-held devices, mobile applications, commercial retail and proprietary software packages, online tools, and more.

Q: Who are the SR database users?

A: Our data underlies virtually all research into the nutrition/health connection. Users include public policymakers, public and private educators, medical and nutrition researchers, regulators, the food and supplement industries, consumers, and commercial businesses.

Q: Which policymakers use the data?

A: In addition to the Dietary Guidelines Advisory Committee, policy users of the data are federal nutrition assistance programs. These include USDA’s Child Nutrition (school meals) and Supplemental Nutrition Assistance (food stamps) Programs and the Special Supplemental Nutrition Program for Women, Infants, and Children (the WIC program). The Department of Defense uses NDL data to formulate feeding programs for soldiers. And international organizations use the data for interventions in countries with malnutrition.

Q: Are creators of U.S. commercial retail products for sale that incorporate SR required to pay a government licensing fee?

A: No, the USDA-ARS national nutrient databases are available copyright free as a government service.

and Drug Administration (FDA), and the National Institutes of Health (NIH), which also need representative data for research studies and for policy development. (See “The National Food and Nutrient Analysis Program,” page 14.)

Accuracy Is Key

“Scientifically validated analytical methods are key to our ability to produce accurate nutrient profiles and therefore to the integrity of the SR database,” says Holden. While many foods come on and

off the market quickly, NDL has fine-tuned methods for honing in on foods with staying power and for those that contain “emerging” compounds important for researchers. Such compounds include, for example, phytoestrogens called “isoflavones” and other plant-based compounds called “flavonoids.” These compounds make up supplemental databases that complement the core SR database.

The laboratory also has methods for consolidating multiple near-identical brand-name food products into an accurate generic profile.

“We recognize the nutritional parallels among multiple brands of a single grocery product,” says Holden. “We contract only with analysts who use scientifically validated food-analysis methods, which enable us to ensure that an accurate nutrient profile exists for each type of food item.” (See “Monitoring Best Practices for Food Analysis,” page 4.) For example, while there are many brands of yellow mustard on grocery store shelves, through years of careful analysis, NDL researchers have determined that a single nutrient profile can represent these brands in the national nutrient database under a line item entitled *Mustard, prepared, yellow*.



“We make sure a valid nutrient profile on popularly eaten foods is in, or added to, our databases to keep current,” says Holden.

Making Nutrition Fun and Games

After being downloaded, the BHNRC national nutrient databases are often imported into commercial software programs. Such is the case for the “Apps for Healthy Kids” software contest—a competition launched as part of First Lady Michelle Obama’s comprehensive “Let’s Move!” initiative. The goal of the initiative is to resolve the challenge of childhood obesity within a generation.

“The ‘Healthy Kids’ competition motivated American entrepreneurs, software developers, and the public of all ages to use our food-nutrient data in a fun, engaging way through tools and games to encourage more nutritious food choices,” says Holden.

A runner-up in the “Tools” category, Dean Jenkins of Olympia, Washington, chose to download SR when crafting his

submission, which can be accessed at www.Papayahead.com. “There is no better source of real science-based nutrient data,” says Jenkins. “We wanted to use the nutrient data to create a product that allows any family or child to make informed choices about what they eat, anywhere, in a fun, easy, and interactive way.”

Jenkins mostly uses a “freemium” business model, which provides basic, useful features for free, but also offers premium features for a fee. “We recently launched for-fee content—also based on the USDA-ARS nutrient databases—that is designed for registered dietitians and others who want to publish meal plans for their constituents,” says Jenkins. “Since we are entering recipes, we needed mostly single-ingredient food nutrient profiles to work with for all our online content.”

The 7,900 nutrient profiles in the SR nutrient database include single- and multi-ingredient foods. These include foods that are raw, cooked, processed, and prepared—from raw eggs to frozen lasagna.

The NDL researchers also produce an additional subset database of approximately 3,000 selected SR foods and profiles for 65 nutrients. These 3,000 profiles are provided to the BHNRC Food Surveys Research Group, which uses them, and ad-

The “Apps for Healthy Kids” software contest—which utilizes ARS food-nutrient data—was launched as part of First Lady Michelle Obama’s “Let’s Move!” initiative. Here, the First Lady meets with students and chefs during a “Let’s Move!” event.



LAWRENCE JACKSON (P060410LJ-0312)

ditional custom-made profiles, to produce another key database—the USDA-ARS Food and Nutrient Database for Dietary Studies (FNDDS). This database is used by the Food Surveys Research Group with modern dietary-intake surveying techniques to obtain national-level data on foods consumed by Americans and the resulting nutrient intakes.

Both of the Beltsville center databases (SR and FNDDS) provide a foundation for multiple USDA consumer-education products. The “Apps for Healthy Kids” competition was administered by USDA’s Center for Nutrition Policy and Promotion (CNPP), in Alexandria, Virginia. Contestants were required to incorporate one of the two full Beltsville center databases or a third database produced by CNPP (for the competition) that is based on the Beltsville center databases. All apps remain the intellectual property of the individuals or organizations that developed them. Contestants were also required to commit to providing the winning submissions free of charge to the public for a 1-year period. They can be viewed online at appsforhealthykids.com/application-gallery.

California entertainment software and game developer David Villatoro and his team downloaded the FNDDS database for use in their first-place submission in the “Game” category, a product called “Trainer.”

“Trainer gives players, who are kids, the responsibility of caring for creatures—all of whom have dietary and fitness needs,” says Villatoro. “Trainer requires the child, or player, to watch how many calories, protein, fat, and carbohydrates are consumed so that the creature can remain healthy.”

Villatoro also wanted to select food items from the national database that the player would be familiar with so that players could learn about the types of nutrients they consume every day. “Once players learn how to create a well-balanced, nutritious meal in the game, the goal is that they will apply what they learn from the game in the real world.”



BOB NICHOLS (10D11507-29)

The game is currently available in a prototype form that allows for future-development feedback. “Once a final version of the game has been developed, we will decide if Trainer will still be available to play for free,” says Villatoro.

The Beltsville center’s national nutrient databases are also available for download and use within products provided by commercial weight-loss enterprises and within the operating systems of mobile hand-held phones and other devices, such as smart phones. Weight Watchers, for example, which has a strong online interactive component, uses nutrient profiles from the BHNRC national nutrient database to represent generic foods within the online program. There are thousands of free and for-fee apps for iPhone, iPod Touch, Android, Windows Phone 7, and BlackBerry hand-held devices. Many of these apps are nutrition/health related and are based on the download and import of the BHNRC national nutrient databases.

“Tweens” (children ages 9-12) are challenged to eat better and be more physically active in PapayaHead.com, winner of second prize in the “Apps for Healthy Kids” competition.



Weight Watchers’ online interactive membership program features nutrient profiles downloaded from BHNRC’s national nutrient database to represent the online program’s generic foods. Members log in to access interactive tools for managing daily food choices.

Many nongovernmental nutritional websites also incorporate the BHNRC national nutrient databases. Michael Moorehead, based in Granbury, Texas, is the founder and creator of Caloriecounter1.com, a free downloadable mobile nutrition app. He has been working with the BHNRC national nutrient databases for many years. “Caloriecounter1.com consists of a core data set, which is the USDA [BHNRC] national nutrient database,” says Moorehead.

Particularly attractive to these program developers is that the science-based nutrient profiles are available free of charge. “For this type of private enterprise, business owners don’t have to pay a licensing fee to the U.S. government,” says Richard J. Brenner, assistant administrator for technology transfer at ARS and director of the Office of Technology Transfer. “Commercial businesses can install this data for use in custom, or proprietary, and retail software products.”

Vitamin D's Debut in the National Nutrient Database

Until recently, authoritative values for the amount of vitamin D in the vast supply of food products on the market were not available. Researchers at the Beltsville Human Nutrition Research Center's Nutrient Data Laboratory (NDL) headed up vitamin D food-analysis studies on food products collected randomly from across the nation. For the first time, the researchers were then able to add vitamin D values for 3,000 foods to several of the lab's nutrient data products.

At the same time, the Institute of Medicine (IOM), part of the National Academies, invited NDL researchers to provide input to the IOM committee on revising the Dietary Reference Intakes (DRIs) for vitamin D.

Before the DRIs were revised, the NDL researchers worked with the nutrition center's Food Surveys Research Group to provide ARS food-consumption survey data tables showing nationwide actual vitamin D intakes from foods. "Because estimates of vitamin D intake from food were not available until recently, the data tables were key to assisting IOM with the new 2010 DRIs for vitamin D," says NDL research leader and nutritionist Joanne Holden.

These vitamin D developments have made vitamin D the "it" vitamin in recent years among consumers and the press.

A number of professionals use specialized software products containing the SR database. The Academy of Nutrition and Dietetics (formerly the American Dietetic Association) has a membership that includes nearly 52,000 registered dietitians, among others, nationwide. Many of these professionals run small local businesses in which they provide nutritional advice one-on-one. "I have an online tool called "Nutrihand Pro" that I use when advising my clients, which contains the USDA [BHNRC] national nutrient database," says registered dietitian Marjorie Nolan, based in New York City. "I use the software for logging in the foods consumed by individual clients and many nutrition tracking features. For more than 2 years, the software has helped me advise, track, and monitor the progress of my clients."

Food manufacturers also tap the BHNRC national nutrient databases. The food industry is responsible for the accuracy of Nutrition Facts panels that are required on packaged-food labels as regulated by FDA and the USDA Food Safety and Inspection Service, which regulates meat products. These food manufacturers, particularly smaller ones, do not always procure chemical food analyses for producing information used on packaged-food labels. Some manufacturers use the data from the BHNRC national nutrient databases to calculate values.

For example, Salem, Oregon-based ESHA Research specializes in nutritional analysis software and databases for the United States and Canada. One of ESHA's products is a business-to-business food-labeling software package that incorporates the SR database.

"U.S. food manufacturers must label food packages and containers with nutrient profiles according to the Code of Federal Regulations," says Elizabeth Braithwaite, ESHA's database manager. Also, FDA has proposed nutrition-labeling requirements for restaurants with 20 or more locations.

The proposal requires that calorie-content information be listed on restaurant menus and menu boards, with other nutrient information available in written form upon request, according to Braithwaite.

At ESHA, the SR data is imported electronically into the master database, which also contains brand name and restaurant items. The user keys in a product's recipe ingredients (formulation), processing losses, and serving size, and the program calculates



At Shoppers Food Warehouse stores, people can learn better nutrition and ways of living with diabetes through a program called "Eating Healthy With Diabetes." Jessica Kiel (left), registered dietitian and president-elect of the Maryland Dietetic Association, encourages shoppers to use USDA's ChooseMyPlate.gov interactive tools—which use USDA-ARS national nutrient data—to make better, healthier food choices.



STEPHEN AUSMUS (D2445-1)

Clinical dietitian Berit Christensen (right), at the National Rehabilitation Hospital in Washington, D.C., uses materials from ChooseMyPlate.gov and the USDA-ARS National Nutrient Database to teach a recovering stroke patient how to manage weight and blood pressure through better nutrition.

the nutritional analysis per serving. ESHA provides its customers regular updates through product-support agreements that include the SR's annual updated values.

When it comes to the voluntary labeling of the 20 most frequently consumed raw fruits and vegetables and fish, nutritional assessment via proprietary software or other means is not needed. FDA provides posters with general nutritional information for these items that retail stores can put up in the areas where the items are sold. NDL assists FDA in the nutritional data reported for these items, according to Haytowitz.

Downloads for Government Use

Not all commercial downloads for consumer use of the BHNRC national nutrient databases come at a cost. USDA also downloads and imports the national nutrient databases into innovative free products

designed specifically for U.S. consumers—to help them achieve their nutritional and dietary goals based on the *Dietary Guidelines for Americans*.

USDA's recently launched ChooseMyPlate.gov website, which replaces MyPyramid.gov, provides a wealth of free tools based on BHNRC's national nutrient databases. ChooseMyPlate.gov is developed and sponsored by CNPP. To support the website and its tools, CNPP has created a new database using several BHNRC

At home, school, or work, consumers can use USDA's free ChooseMyPlate.gov, an interactive website for creating a customized healthy dietary plan that includes required daily vitamins and minerals, and age- and gender-appropriate daily portions and calorie levels. Users can also tap tools called "Daily Food Plan," "SuperTracker," and "Food-a-Pedia."



databases. In fact, the ARS Food Patterns Equivalents Database is specifically being designed for use with the ChooseMyPlate.gov website and tools.

ChooseMyPlate.gov emphasizes the five food groups: fruits, vegetables, grains, proteins, and dairy and aligns with the consumer message to "Make Half Your Plate Fruits and Vegetables." The USDA Food Patterns, based on the 2010 *Dietary Guidelines*, also are available on ChooseMyPlate.gov.

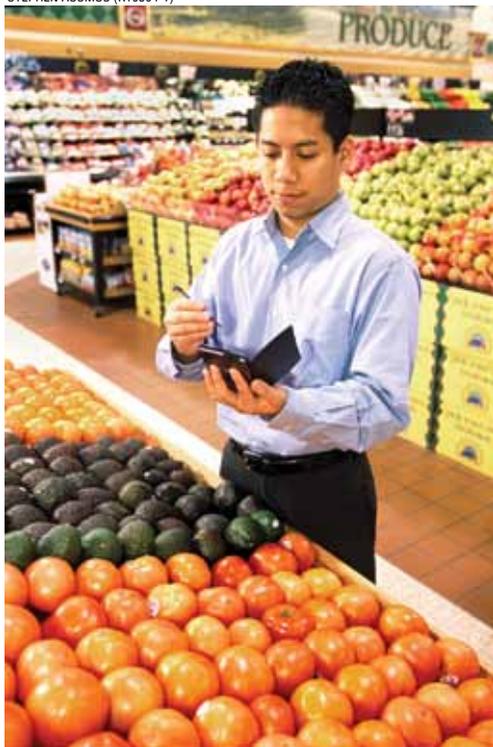
At ChooseMyPlate.gov, individuals can easily create their own customized healthy dietary plan to ensure that they get their required daily vitamins and minerals, while consuming age- and gender-appropriate daily portions and calorie levels.

On the site's "Interactive Tools" page, users can tap the "Daily Food Plan" option that allows them to find out the amount of each food group they need daily, simply by entering their age, gender, weight, height, and physical activity level.

The new and improved USDA "SuperTracker" tool provides users with free diet and physical activity assessment and planning tools. SuperTracker demonstrates how a person's diet and physical activity compare to the *Dietary Guidelines*, recommended intakes for nutrients, and physical activity guidelines. Users can get a free nutrient-by-nutrient report, complete with a status (over, under, ok) for single nutrients.

The interactive USDA "Food-a-Pedia" provides quick access to food information, food groups, calories, and comparisons. For example, if users wish to check the nutritional difference between spinach lasagna and meat lasagna, Food-a-Pedia





Among the thousands of apps for iPhone, iPod Touch, Android, Windows Phone 7, and BlackBerry, many are nutrition/health related and are based on the download and import of the BHNRC national nutrient databases.

Downloads for Research Use

The SR database is also imported into custom business software marketed to clinical research dietitians who develop diets for feeding studies, such as clinical trials and epidemiological studies. For example, Princeton, New Jersey-based Viocare, Inc., produces ProNutra and ProNESSy—both of which utilize the SR and FNDDS databases.

The products are tailored to users who both design and assess diets. Research dietitians design nutrient-intake studies and use such custom software products, for example, during studies conducted in research hospitals, universities, and clinical facilities nationwide.

As granting agencies, both NIH and USDA's National Institute of Food and Agriculture fund epidemiology studies, also referred to as "population studies," which track the nutrient intakes of individuals within specified populations.

provides a quick comparison. Food-a-Pedia also allows users to find out the number of different cups or ounce equivalents of each food group present in a food as well as calorie sources (solid fats, added sugars, and alcohol) in a food.

"Researchers involved in population studies needed special software programs to conduct their research and requested NIH funding to support their development," says Viocare's CEO and president Rick Weiss. "We developed ProNutra at the request of research dietitians, and the software was refined with help from two USDA-ARS human nutrition research centers and NIH."

Viocare worked directly with researchers at the ARS Western Human Nutrition Research Center in Davis, California, and BHNRC in developing the software, according to Weiss.

Downloads for Use Within Local Communities

There are more than 5,500 U.S. hospitals registered with the Washington, D.C.-based American Hospital Association. These hospitals are challenged to provide nutritionally appropriate meals to upwards of 38 million patients admitted annually. There are a number of ways foodservice directors in hospitals achieve these goals, and one is by using software that incorporates the BHNRC national nutrient databases.

West Hills, California-based Compu-trition, Inc., for example, has a software

The National Food and Nutrient Analysis Program

Are U.S. consumers getting adequate vitamins and minerals from their daily diets? The U.S. Departments of Agriculture (USDA) and Health and Human Services (DHHS) work together to make sure that thousands of people are interviewed annually about what they've eaten. Then research nutritionists translate "foods eaten" into "nutrients consumed."

Researchers at the Agricultural Research Service's Beltsville Human Nutrition Research Center develop and validate analytical methods for finding out what's really in the foods, beverages, and dietary supplements people consume. These analytical methods help to improve values in USDA food-composition databases and, in turn, allow food-consumption survey results to be interpreted for a snapshot of the nation's nutritional status.

The heart of the USDA-ARS program to determine science-based nutrient profiles of U.S. foods and supplements is the National Food and Nutrient Analysis Program (NFNAP). This year (2012) marks the 15th anniversary of the NFNAP interagency agreement between USDA-ARS and DHHS. The National Institutes of Health is the lead agency.

Through these collaborations, food-nutrient data are generated and updated on a regular basis for use in a variety of health-monitoring assessments, programs, and studies—as well as by the general public. Private and public agencies use the data to conduct critical population studies, many of which are grant-based.

School meal planners use USDA-ARS national nutrient databases to ensure adequate nutrition. New USDA meal requirements update meal patterns and nutrition standards for nearly 32 million children who participate in school meal programs.

lineup that includes nutrition care management features that incorporate the 23rd edition of SR. The software is capable of analyzing the nutrient content of meals, tracking diet orders, and managing recipes and menus while also measuring nutrition-health outcomes, such as weight change and carbohydrate intake. Food and nutrition professionals within a variety of healthcare and hospitality industries use these Computrition software products to provide nutritionally appropriate meals and assessments.

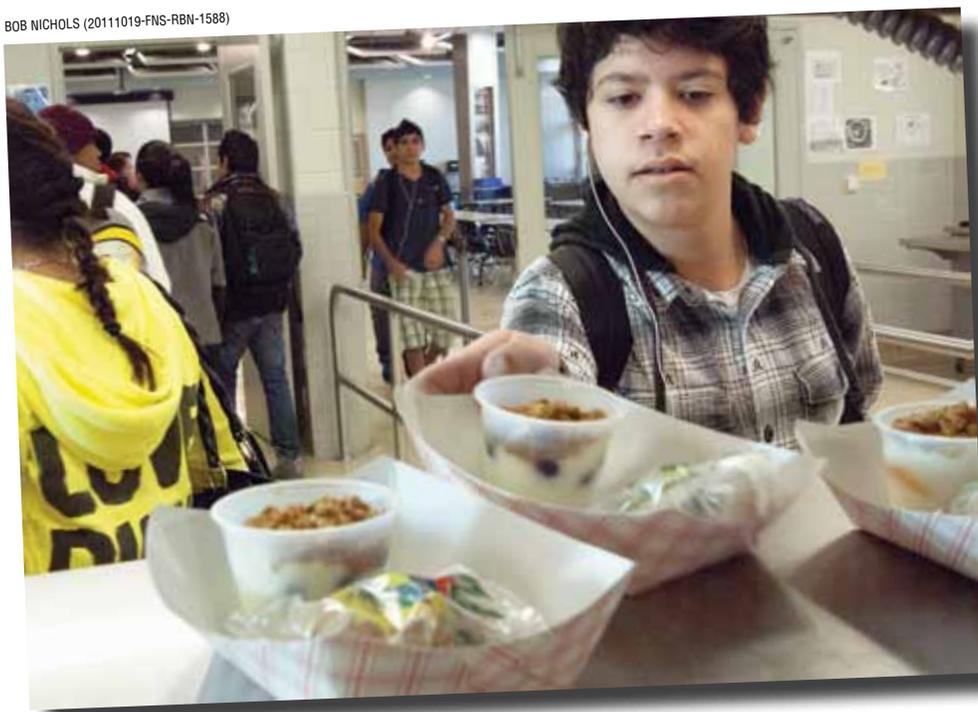
“Our cutting-edge software adaptations make use of the BHNRC nutrient databases for clinical management, food systems management, recipe analysis programs, calorie counting analysis, and for producing FDA-compliant labels for retail clients,” says Marty Yadrick, director of nutrition informatics at Computrition.

Experts involved in the federally funded USDA school meal programs, which provide lunch and breakfast to upwards of 32 million children during the school year, also depend on computer products that incorporate BHNRC nutrient data. Many of the nation’s school foodservice directors—who oversee meal planning in school cafeterias and central kitchens—have a long tradition of using USDA-approved computer software products to ensure that menus meet nutritional requirements.

The SR database has been used to support a special Child Nutrition Database, which offers nutrient information on foods that are commonly served under USDA’s Food and Nutrition Service child nutrition programs. The Child Nutrition Database is updated yearly with nutrient values from the annually released SR.

At the request of USDA, the Institute of Medicine (IOM), part of the National Academies, reviewed the school lunch program for alignment with the 2010 *Dietary Guidelines for Americans*. As a result, the

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IOM issued the report *School Meals: Building Blocks for Healthy Children*, which recommended that the USDA standards for school meal menu planning be revised.

USDA then proposed new regulations based on the IOM report and after analyzing comments from the public and from professional groups, including foodservice personnel, a final rule was published January 26, 2012. This rule requires most schools to increase the availability of fruits, vegetables, whole grains, and fat-free and low-fat fluid milk in school meals; reduce the levels of sodium, saturated fat, and trans fat in meals; and meet the nutrition needs of schoolchildren within their calorie requirements. Under the new rule, school foodservice operators and directors will focus their menu planning on meal patterns based on adequate food-group intakes for both the National School Lunch and School Breakfast Programs.

“When the school lunch program was originally conceived decades ago, policymakers were concerned mostly with solving malnutrition. Childhood obesity was not on anyone’s radar,” says pediatrician Virginia A. Stallings, who chaired the IOM Committee on Nutrition Standards for the National School Lunch and Breakfast Programs that produced the new recommendations. “There was a minimum amount

of calories required, but there was no cap on the amount of calories provided, since the goal was to reduce undernutrition and poor growth.”

Stallings says during the past decade, using the ARS national “What We Eat in America” survey, policymakers have focused more on dietary patterns. “What we’ve learned is that if we get the dietary patterns right—by providing the right foods and the right food groups—children will in turn get the nutrients they need.” Stallings is director of the Nutrition Center at Children’s Hospital of Philadelphia.

The BHNRC develops and maintains the gold standard for America’s nutrient data—the National Nutrient Database for Standard Reference. The food industry, commercial businesses, government groups, research and academic institutions, and local schools and hospitals tap this critical treasure trove of data for a wide variety of consumer and professional uses.—By **Rosalie Marion Bliss**, ARS.

This research is part of Human Nutrition, an ARS national program (#107) described at www.nps.ars.usda.gov.

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