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A PILOT STUDY TO DEVELOP NUTRITIONAL GUIDANCE SIGNAGE FOR A UNIVERSITY CAFETERIA BASED ON A TRAFFIC LIGHT DESIGN

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ABSTRACT
This study describes the creation and implementation of signage that provides guidance to students in making healthy food choices. Information regarding saturated fat, fiber, and sodium content of various cafeteria offerings is presented using a traffic light approach based on daily values, where green indicates that the meal/product is a healthy choice in regards to that nutrient, orange indicates that the food should be consumed in moderation, and red signifies that the food should be consumed sparingly. Daily values were used as the basis for color-coding. Calorie, sugar, and protein content per serving size are also presented. Student feedback indicated that use of the traffic light colors for key nutrients allowed them to make comparisons between choices and healthier decisions with a quick glance. The signage system is suitable for institutional cafeterias, but is readily adaptable to any food service setting.

Keywords: cafeteria, traffic light, nutritional signage, front of package labeling, point of purchase labeling

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INTRODUCTION

The Chapman University, Orange, CA, cafeteria is an on-site residential cafeteria that needed a new nutrition labeling system to address student requests for nutrition information. Prior to the creation of this pilot program, the signs available to students were small, hard to read, and only posted for certain items (Illustration 1). The campus's contract food service provider asked the director of the university's food science program for assistance in developing, implementing, and pilot testing a nutritional signage system for the campus cafeteria, which serves approximately 5,000 plates per day, 1,700 students per week, and where residential students eat most meals. The researchers evaluated a range of labeling schemes before developing a signage system for pilot testing. The goal was to not only provide information to students, but also provide guidance for making healthy food choices.

The food industry has launched multiple nutrition labeling systems within the last five years to help consumers make healthier dietary choices (Lytton, 2010). Front-of-Package (FOP) labeling, and to a smaller extent, Point-of-Purchase labeling in food service are becoming common. The diversity in their presentation, messaging, and nutritional basis highlights the divergent views on how nutritional information is presented and the efficacy of the various systems on consumer comprehension and food selection.

Three types of retail labeling systems

Currently used retail labeling systems can be categorized into three types: nutrient-specific systems, summary indicator systems, and food group information systems (Wartella, Lichtenstein, & Boon, 2010). Each one has distinct advantages and disadvantages.

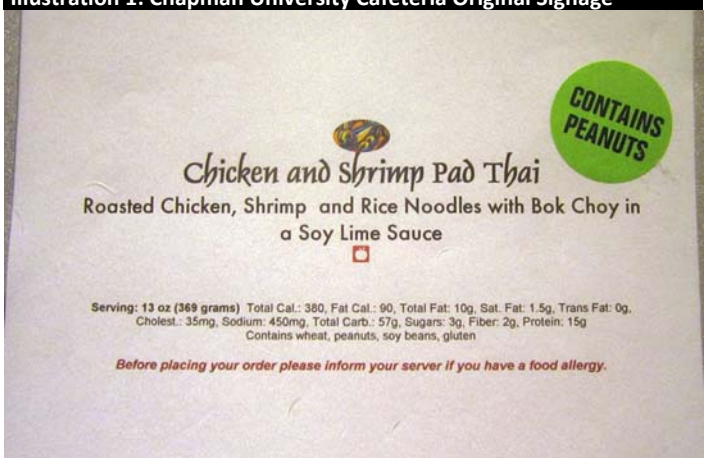
Nutrient-specific systems

Nutrient-specific systems present the amount per serving of certain nutrients from the Nutrition Facts Panel or use symbols based on claim criteria on the front of food packages. They indicate if the product contains "high", "medium", or "low" amounts of particular nutrients and give information in percent daily values (%DV) or guideline daily amounts (%GDA). Some systems also include traffic light colors corresponding to the amounts of specific nutrients. This system offers easy visualization of select nutrients according to their nutrient content claims and reduces the likelihood of overgeneralization that can happen with summary icons. In the United Kingdom (U.K.), a color-coded traffic light system is widely used (Wartella, Lichtenstein, & Boon, 2010). It includes amounts of fat, saturated fat, sodium, sugars, and calories and labels the product as low, medium, or high in each nutrient. The U.K. also launched a nutrient specific panel through Tesco PLC in 2009. A recent nutrient-specific system launched in the United States as a joint initiative by the Grocery Manufacturers Association (GMA) and the Food Marketing Institute is the *Facts Up Front* program, which lists calories, saturated fat, sodium and sugar contents – nutrients the Dietary Guidelines for Americans recommend limiting. The four nutrient facts of concern are always presented together as a coherent set and include serving size and percent daily value for saturated fat and sugar. Two additional nutrients such as fiber and certain vitamins are included on FOP labels if the program chooses to do so (GMA, 2011a).

Summary indicator systems

Summary indicator systems use only a single icon, symbol, or score to deliver a summary of the qualitative nutrient content of the product. They do not give any specific content information and are often based on nutrient algorithms, which consider the positive or negative impacts of various nutrients on health. The numeric score or type or number of symbols denotes the nutritional quality of the product, the

Illustration 1: Chapman University Cafeteria Original Signage



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single symbol purportedly making it easier for a consumer to identify a healthy food (Wartella, Lichtenstein, & Boon, 2010). The Smart Choices™ as well as the Walmart "Great for You" icons are examples of summary indicator systems. The main concern with these systems is that inferences about certain nutrients and the item's overall healthiness are implied with a single symbol. A product with an icon may be perceived healthier in general compared to a product with a nutrient-specific label or no icon at all. This leads to the idea that the summary icon could act as an implicit positive health claim (Wartella, Lichtenstein, & Boon, 2010). These concerns were partly responsible for the Food and Drug Administration (FDA) and United States Department of Agriculture halting the Smart Choices™ program in 2009 (Wartella, Lichtenstein, Yaktine & Nathan, 2011). Some indicator systems use a scientific algorithm to rate nutrient density. For example, Guiding Stars® includes symbols that give products a "grade" – the more stars the "healthier" the food (Fischer, Sutherland, Kaley, Fox, Hasler, Nobel, Kantor, & Blumberg, 2011). Similar to Guiding Stars® is the NuVal® system. This system scores food on a scale of 1-100 based on an algorithm that uses 30-plus nutrients, including protein, calcium, vitamins, sugar, sodium, and cholesterol (NuVal® LLC, 2012).

Food group information systems

Food group information systems use symbols based on the presence of a certain food group or ingredient (Wartella, Lichtenstein, & Boon, 2010). Some symbols indicate if the product includes a serving of a particular food group. The ConAgra Start Making Choices™ program uses MyPyramid food group icons to show the relative percentage of a food group consumed from one serving (based on a 2,000-calorie diet) (Start Making Choices, 2008). However, the program has not adapted to changes such as the shift from MyPyramid to MyPlate. Other programs specify if the food contains an important ingredient such as whole grains (The Whole Grains Council, 2011).

Components of an effective system

A successful labeling system, whether for retail or food service, would be readily noticed and understood, include one standard symbol in a consistent location across products, be practical to implement across the food supply, be accessible to people of all ages and educational levels, and be used for all foods healthy or not (Wartella, Lichtenstein, Yaktine & Nathan, 2011). Regardless of the system used, it is important to indicate nutrients that are linked to public health concerns in America and those that are known to be commonly deficient (fiber, vitamin D, calcium, and potassium) or in excess—calories, saturated fat, and sodium being the most critical. Other important nutrients include total fat, cholesterol, and sugar, (Wartella, Lichtenstein, & Boon, 2010). The nutrient specific system meets these criteria and offers information about key nutrients per serving in a relatively easy-to-read and understand format. It is more comprehensive than the specific nutrient system, which usually focuses on a single food group, and it provides details about key nutrients that a single number or symbol (as in the symbol system) is not able to provide. According to the FDA (2009), FOP labeling with this system is more consistent with the Nutrition Facts panel and provides consumers with readily accessible information about a product's nutritional profile at the point of purchase. It can be used for any food item and highlights both positive and negative attributes so that consumers can be more informed (Lytton, 2010). This system provides a snapshot of the nutrient content of a food and how it contributes to a person's daily diet. If a consumer wants a specific amount of protein or to limit sodium intake, a nutrient specific system can aid him or her in quickly doing that with one glance at the FOP label (Wartella, Lichtenstein, & Boon, 2010).

Nutritional signage in food service

The majority of label profiling systems focus on retail foods in the supermarket context rather than assessing menu items or meals in the foodservice context (Williams & Colyer, 2009). Because foods purchased in food service establishments are exempt from Nutrition Labeling and Education Act disclosure requirements, menu labeling in restaurants and other types of food service has been infrequent (Burton, Howlett, & Tangari, 2009). In 2008, however, California was the first state to pass a menu labeling law that requires that fast food and chain restaurants with more than 20 outlets in the state post calorie counts for standard items on menus and menu boards (Padilla & Migden, 2008). The FDA soon followed with The Patient Protection and Affordable Care Act, effective March 2010, which requires restaurants with 20 or more establishments nationwide to post calories on menus, menu boards, and food display tags (FDA, 2010). Food establishments with less than 20 outlets can voluntarily register to become subject to new federal menu labeling requirements, unless they make a health or nutrient content claim, in which case they must provide nutrition information whether or not they have 20 or more establishments (FDA, 1993). This act further requires covered food establishments to also provide other nutrient information in writing upon request – total fat, saturated fat, cholesterol, sodium, total carbohydrates, sugars, fiber, and total protein.

Menu labeling is important for consumers – average Americans spend close to half of their food budget eating away from home (Larson & Story, 2009). For some age groups, college students, for example, most of their diet is consumed in a captive or limited cafeteria setting; consequently, there is a great need for nutritional information in cafeterias. Without an effective nutrition labeling system, students do not have a means of comparing foods to make healthy dietary decisions. Many students adhere to specific diets (vegetarian, vegan, gluten free, among others) and some have special nutritional needs to address specific disease states such as celiac disease or lactose-intolerance (Frederick, 2011). At Chapman University, the food service director works with about 20-25 students per year who have food allergies or intolerances. Approximately 200-300 students each day choose to eat at the vegan station.

PILOT STUDY

Solution development for Chapman University's cafeteria

The Head Chef provided recipes for all items prepared in the cafeteria. Food Processor™ (Version 10.4.0, ESHA Research, Salem, OR) was used to analyze the recipes for nutrient content. Nutrition specifications were obtained for ingredients from vendors when available, and for other ingredients the Food Processor™ database was used.

Based on research of the three types of FOP labeling systems, the nutrient-specific signage system for the Chapman University cafeteria was determined to be the best option. The selection of nutrients was based on the *Facts Up Front* system, which includes four main nutrients on each label: calories, saturated fat, sodium and sugars. Two other "nutrients to encourage" are selected for each product and may include potassium, fiber, calcium, protein, iron, and vitamin A, vitamin C, or vitamin D (GMA, 2012b). For this project, calories, saturated fat, sodium, and sugars were selected as "nutrients to moderate." Protein and fiber were selected as the two "nutrients to encourage." These latter two were selected because they are most relevant to Chapman University's demographics. Protein is a nutrient many college-age students are interested in, due to perceptions about the effectiveness of protein on increased muscle gain and weight loss. Fiber was chosen as a nutrient to encourage due to its

Table 1: Assignment of traffic light colors based on %DV for saturated fat, sodium, and fiber and is based on a 2000-calorie diet.

	SAT. FAT	SODIUM	FIBER
Green	0-1 g 0-5% DV	0-120 mg 0-5% DV	6-25 g 20-100% DV
Orange	2-4 g 6-19% DV	121-456 mg 6-19% DV	2-5 g 6-19% DV
Red	5-20 g 20-100%DV	457-2400 mg 20-100% DV	0-1 g 0-5% DV

Values are based on 21 CFR 101.9 Nutrition Labeling of Food (FDA, 1993).

importance to health and low prevalence in the American diet (Steinborn, 2011).

The second step was to identify the best system to display the values for the nutrients. The traffic light labeling system was chosen due to its success in the U.K. (Food Standards Agency, 2009; Institute of Medicine, 2010). According to the U.K. Food Standards Agency, the comprehension of the FOP labels is highest (58-71%) when the information combines traffic light colors, text, and %GDA (Food Standards Agency, 2009). In focus groups surveyed by the FDA, most participants considered the traffic light symbol system to be better in conveying nutrition characteristics than summary symbols (Institute of Medicine, 2010). A successful food service approach of the traffic light system is described by Thorndike et al. (2012). During a three-month trial in the cafeteria at Massachusetts General Hospital (Boston), sales of healthy items, which were colored green, increased by 4.5% and those marked red fell by 9.2%. Due to its success, the cafeteria has continued to use the labels (Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012).

In the traffic light system developed for Chapman's cafeteria, each color denotes a recommendation based on its saturated fat, sodium, and fiber content—green indicates that the meal/product is a healthy choice in regards to that nutrient, orange indicates that the food should be consumed in moderation, and red signifies that the food should be consumed sparingly if that nutrient is of concern. Daily values were used as the basis for color-coding (Table 1). According to the FDA, 5% or less of a daily value for all nutrients is considered low and 20% or more is high (FDA, 2004). Therefore, all food items containing sodium and saturated fat in amounts 5% or less of their DV per serving size were colored green, 6-19% of DV were colored orange, and 20-100% of DV were colored red. For fiber, because one wants to increase rather than limit amounts of fiber, all items with a daily value of 5% or less were colored red, 6-19% were colored orange, and 20-100% were colored green. The FDA Food Labeling Guide was used to find the appropriate daily values for each nutrient: 20 grams for saturated fat, 2400 milligrams for sodium, and 25 grams for dietary fiber (FDA, 2009). The serving sizes were based on Recommended Amounts Customarily Consumed as provided in the Code of Federal Regulations (FDA, 1993). Since calories, sugars, and protein do not have specific DVs, the amounts per serving for these nutrients were simply listed instead of arbitrarily assigning color codes.

The Chapman University residential cafeteria is configured with multiple stations—deli, soups, cereals, dressings, dessert, condiments, milk, sushi, American, Italian, vegan, salad bar, eurostation, and wok. A sign was created for each station, thus some signs included up to eight entrees or items per sign with one to two signs per station. The items included were those served on a regular basis, either daily or several times a week. Adobe Illustrator™ (CS4 Mac 14.8.0, Adobe Systems, San Jose, California) was used to create the signage.

To develop a hierarchy within each graphic, calorie and serving size information were made more prominent compared to the other nutrients because calories tend to be among the first thing most consumers look at when viewing nutritional information (Steinborn, 2011).

Soliciting Feedback

Once the data input for recipes and initial signage design was complete, the researchers presented the signs for feedback to the cafeteria dining committee, which includes seven members from Chapman's student board of directors. In addition, two focus groups were organized to solicit opinions from cafeteria users and to provide recommendations for the final design. The only criterion for their inclusion in the focus groups was that they should consume a majority of their meals in the cafeteria. To solicit participation in the focus groups, the researchers sent messages to three student organizations on campus. Students came voluntarily to either of the two focus group meetings, with six students in attendance at each meeting. A list of questions was prepared in advance to help the moderator facilitate the discussion and a scribe took notes. These focus groups provided beneficial advice and criticism that improved the final sign content and design. They gave the researchers an understanding of the food perceptions of this target audience. They provided information on the nutrients students are most interested in and an understanding of how students classify foods as "healthy" or "unhealthy". The researchers took note of the initial reactions of the students upon seeing the signage, and this feedback provided an indication of how the graphics could influence their food selection. The focus groups revealed that students are most interested in foods that are low in sodium, sugar, fat, and calories. They tend to look more at the amount of each nutrient in a serving rather than the daily value. They were also interested in knowing whether a food item is vegetarian, vegan, or gluten free due to dietary needs and preferences. The focus groups' feedback compelled the researchers to add vegetarian, vegan, or gluten free symbols to the signage, as well as a legend for the color codes to provide an explanation for each color. Also, the labels for saturated fat, sodium, and fiber were moved to the top to make them more prominent, the visibility of the calories icon was increased, and the distinction of low, medium, and high for each nutrient was taken out because it became confusing when low is green for sodium and fat, but red for fiber.

IMPLEMENTATION

Feedback from the focus groups and dining committee was taken into account and a final design was created (Figures 1 and 2). Each sign has up to eight food items or entrées. Each graphic includes the name of the item, its serving size, calorie content, sugars content, protein content, saturated fat content, sodium content, and fiber content if applicable. Gluten free, vegetarian, and vegan symbols were added next to the name of the item when applicable. The symbols and key

Figure 1: Cereals Sign

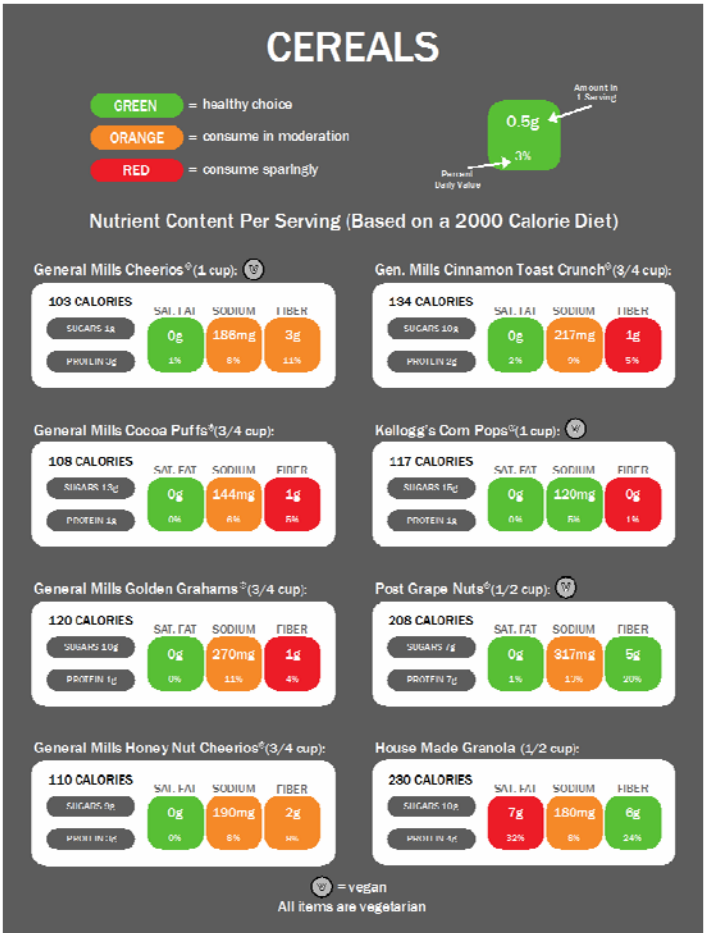

Figure 2: Soups Sign

are only included at the bottom of the sign if the items shown on that particular sign require these symbols. For example, at the vegan station all items listed are both vegetarian and vegan. Therefore, these symbols are not necessary. The only symbol used on this sign is the gluten free symbol. At the dessert station all items are meatless but still use animal products such as milk and butter, therefore they are vegetarian but not vegan. Like the vegan station, a statement is made at the bottom stating that all items are vegetarian rather than including symbols on every item on the sign. None of the items at the wok station were vegan or vegetarian but some were gluten free, consequently only this symbol is used.

The signs were created to have the maximum clarity possible while still providing enough detail to be useful. There is enough flexibility so that students not nutrition-literate can look at the colors and make a good decision. However, there is also enough information included in the design to be beneficial to those students who are familiar with nutrient amounts and %DV and can make a decision based on this additional information.

A total of seventeen signs were created and printed in color on 8.5" x 11" sheets and laminated to prevent damage from any spills and to make them last longer. The laminated sheets were adhered to the clear food shields above food items at their respective stations (Illustration 2) to ensure that they were easily and clearly accessible. After a few days of the signs being posted, the researchers administered a voluntary survey (Figure 3) to students eating at the cafeteria during a lunch period. This survey was conducted to gauge the utility of the signs. Eighteen students (not part of the original focus groups) agreed to complete the survey. Fourteen out of 18 students had noticed the signs within the first few days of them being posted in the cafeteria, and six used the signs to make food selections. While the feedback was positive, given the small sample size the researchers decided to conduct a larger survey at a later time once the signs had been posted for an extended period.

Unsolicited comments in the months following the release of the signage continued to be positive. Via direct feedback to cafeteria employees and the Student Board of Director's dining committee, or via Facebook and written responses on restaurant dining feedback

Illustration 2: New Nutrition Signage Implemented in the Chapman Cafeteria

Figure 3: Survey questionnaire administered to students a few days after the initial posting

	Student Questionnaire for New Nutrition Signage in the Cafeteria
1.	Are you interested in knowing the nutritional values of food items in the cafeteria?
2.	Did you notice the new signs with nutrition information posted this past week?
3.	What stood out the most on the signs if you did look at them?
4.	Did you use the sign to make your food selection(s)?
5.	Do you have any comments or suggestions regarding the signs?

cards, students have requested that the signage be kept in the cafeteria permanently. Due to the positive feedback, the cafeteria decided to keep them posted regularly and placed a re-positional adhesive on the back of each sign so that they remain affixed but can easily be removed for cleaning, updates, and addition of food items to the signage.

A surprising find was that several items considered "healthy" to most students, such as granola and soup, were in fact some of the least nutritional. The cafeteria house granola is high in fat, with 32% of the daily value for saturated fat in one serving, due to the use of large amounts of butter (Figure 1). Soup is often perceived as a "healthy" option, yet every soup in this cafeteria is high in sodium, and most are high in saturated fat and low in fiber (Figure 2). According to an article in *Healthy Eating Research*, underestimating the number of calories, fat, and sodium in foods is common (Larson & Story, 2009). Certain foods typically perceived as "healthy" may actually be higher in these nutrients than expected. Therefore, these labeling graphics work towards a key project objective: providing guidance to students to make healthy food choices using information grounded in science.

LIMITATIONS OF THE PILOT PROGRAM

The limitations to this program are similar to FOP labeling in general. Some students are confused about the color codes. Because a green color can indicate high amounts of fiber or low amounts of sodium or saturated fat, it can be misleading to some who expect a green color to indicate high levels of all nutrients. Also, protein and sugars were not color-coded because there is no daily value to classify an amount as high, medium, or low. Therefore, they were colored a neutral gray. While this removed any chance for bias, it also makes these nutrients less prominent compared to the color-coded nutrients. According to viewers, protein and sugars became the last nutrients they viewed. Certain food items seemed healthier options at first glance due to one or more green icons but on further analysis, taking into consideration the protein and sugars, these food items were actually less healthy choices compared to products with fewer green icons. For example on the condiments sign, peanut butter has two orange lights for sodium and saturated fat, while the raspberry and strawberry preserves are both green for those nutrients and might appear to be healthier at first glance. However, the sugar content for the preserves is much higher and the protein content is much lower compared to peanut butter. With these two nutrients taken into account, the peanut butter may arguably be the healthier alternative. Similarly, Sweet and Sour Chicken (331 calories, 25g sugars) has three orange lights while Thai Green Curry with Chicken (259 calories, 7g sugar) has one red (for saturated fat) and two orange lights. Thus, even though Thai Green Curry with Chicken has significantly lower calorie and sugar content and higher protein than Sweet and Sour Chicken, the single red light might suggest that it is the less healthy option. Therefore, a viewer may be challenged to determine whether three orange signs are healthier than one green, one orange, and one red or one red and two orange lights. The best option in such cases would rest on the nutrients the student is more interested in for their diet; however, this takes away from the "at-a-glance" idea.

The recipes included in these signs are only a portion of all those that are served at the cafeteria. For example at the Italian station, pasta with basil marinara sauce and cheese and pepperoni pizza are served daily, while other dishes such as the pasta with parmesan sage cream sauce may only be served once per week. Another seasonal dish or new dish may be served as the specialty item at that station for that particular day. Additional signs need to be made to include those items, even if they are not items served on a daily basis. If these signs were available for all foods available in the cafeteria, there would be greater use and the concepts would be reinforced and healthier choices could be made at every station. A digital signage system would be ideal and flexible, however, further research needs to be done on this concept.

This study did not measure the impact of the nutritional signage on actual food choices. Student feedback was positive but the evidence of the impact of the signage is anecdotal. The next phase of this project will include an intervention study to quantify the changes in eating habits of users of the cafeteria.

CONCLUSIONS AND APPLICATIONS

Since this signage system is grounded in daily values and nutrients already part of the nutritional facts panel, a traffic light signage for any food can be created as long as it has a nutritional facts panel. If this data is not available, software programs such as Food Processor™, Genesis R&D®, or Nutritional Pro™ by Axxya, or other inexpensive programs available online can be used to analyze each recipe and derive the necessary nutrient facts. A graphic design program such as Adobe Illustrator™ (San Jose, CA) or PowerPoint by Microsoft (Redmond, WA) is needed for creating signage. Nutrients can be added or removed as deemed important in a given situation. The costs associated with this pilot program include lamination of the signs, nutrition analysis software, and labor associated with analyzing recipes and designing the graphics.

The project took 40 hours to complete, however selecting the nutrients to depict, devising the basis for the color codes for each nutrient, and finalizing the design were the most time intensive elements of the process. Thus, if the same nutrient selection, basis for color-coding, and design are used in future projects, the time required would be a function of the number of recipes needed to be analyzed. Recipes took, on average, 15-20 minutes each to analyze, depending on the length and complexity of the recipe. This analysis can be performed by a manager or student assistant as long as such individuals have access to food analysis software and a graphic design program.

In addition to prepared entrees, nutritional signage for self-serve items such as cereals, condiments and salad dressings also serve an important purpose in helping students who create their own meals, at salad or hamburger stations for example, make healthy choices. For operations that do not serve a consistent menu each day (non-cycle), the signs would have to be rotated daily (not permanently affixed), assuming that the items are offered consistently. Complete menu changes or food items offered only occasionally might pose a challenge if not enough time is available for nutritional analysis.

This signage system developed for the Chapman University residential student cafeteria is especially suitable for institutional cafeterias but readily adaptable to any food service setting, as long as the signage can be prominently displayed and provides a comparison of the various options available on the menu. It is especially effective in the school cafeteria setting and could be used for various age groups, as it gives students the ability to make informed, self-directed choices. Feedback from student users of this cafeteria indicates that the use of the traffic light system, selection of nutrients, and the design of the graphics are helping them make healthier food choices.

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