An Evaluation of a Point of Purchase Labeling Intervention to Improve Health Literacy and Healthy Eating Choices

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

August, 2013

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An Evaluation of a Point of Purchase Labeling Intervention to Improve Health Literacy and Healthy Eating Choices

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Acknowledgements

I would like to acknowledge all that have helped to make this project a success. It was a long process and I have had an enormous amount of support along the way. I would like to thank Claire Moore, the Faculty and Staff Wellness Director, for her support of the project. She assisted me in so many ways including getting meetings with various eatery managers, development of the communication materials, and purchasing materials for the intervention. I would also like to acknowledge my amazing interns, Lainey Harrell, Traci Permenter, Christina Thomas, Melissa Tung, and Eddy Trevino. They assisted in implementation, data collection, and data entry. I would also like to acknowledge the Fitness Institute of Texas and their staff, in particular Phil Stanforth and Julie Drake, for their support to me both emotionally and technologically via use of their nutrition analysis software and SPSS statistical software. I would also like to recognize the invaluable input and support of all of my committee members, Dr. Carole Holahan, Dr. Dixie Stanforth, Dr. Alexsandra Evans, Dr. Esbelle Jowers, Dr. Jessica Duncan Cance, and Dr. John Bartholomew. In particular, there are two members of my committee that played an integral role in this project from inception to completion. Dr. Jessica Duncan Cance helped me to come up with the idea and has gone above and beyond in helping me organize and analyze my findings. Of course, I would like to thank my dissertation supervisor, Dr. John Bartholomew for his superb guidance and patience. He has helped me in countless ways that I will forever be grateful for. Lastly, I have to acknowledge and thank my wonderful husband, Reggie Crim, who spent many, many nights playing the role of mom and dad to our three children while I was working on this.

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Obesity related employer healthcare costs increased 8% from 2010 to 2011 (PwC, 2012; Durden, 2008), which has spurred an increase in worksite weight management programs. Due to minimal success of individually focused programs (Anderson, 2009; Mhurchu, 2010), efforts have shifted to the potential impact of environmental interventions. The purpose of this study was to evaluate the influence of a red, yellow, and green (R/Y/G) point of purchase (POP) labeling system on perceived health literacy and purchasing behaviors at three on-campus eateries frequented by university faculty and staff.

Foods were rated as red, yellow, or green based on the Nutrient Rich Food Index. All foods were labeled with stickers that looked like miniature traffic lights with the appropriate color light lit up through menu boards and nametags. Posters, emails and table tents were also used to communicate about the intervention. In order to provide various levels of exposure, the first eatery had the intervention for six weeks, the second for four weeks, and the last for two weeks.

Eatery patrons (N=191 across the three locations) completed a paper and pencil pre-intervention survey assessing healthy eating intentions, knowledge, and behaviors. Post-intervention data collection was conducted via online survey (N=89), and consisted of the pre-test items and additional questions about label awareness and utilization. While the intervention did not appear to influence healthy eating intentions or knowledge, 41.6% of the patrons reported that the labels influenced their food choices. Patrons also reported being aware of, understanding, and using the labels. The average food sales for the six weeks prior to the intervention were compared to the average food sales during the intervention. Food sales data were compared by location and food category (R/Y/G). There was a significant increase in green food sales and a significant decrease in red food sales ($r=-.375$, $p=.044$). However, there were no significant differences between locations. These findings suggest that future research with the traffic light labeling is warranted.

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Chapter 1: Introduction

Rationale

Obesity is an epidemic that has increased in prevalence for several decades. Currently, 67% of adult Americans are overweight or obese (CDC, 2012). An obese individual has an increased risk of cardiovascular disease, diabetes, asthma, arthritis, and some cancers (Kopelman, 2007; Nejat, 2009; Stommel, 2009). With these increased health risks come increased healthcare costs – a cost that is increasingly born by employers. Total employer healthcare costs increased 8% from 2010 to 2011, with obese and overweight employees having 72% and 20% higher costs when compared to normal weight employees (PwC, 2012; Durden, 2008). This has spurred an increase in worksite weight management programs in effort to mitigate these costs. Unfortunately, many of these programs have demonstrated limited effectiveness (Anderson, 2009; Mhurchu, 2010). One concern is that many of these programs are individually focused, which limits the reach of the intervention. Thus, there is a need for more comprehensive worksite interventions.

The Social Ecological Model has been used to argue that both individual and social environmental factors influence an individual's health behaviors (McLeroy, 1988). Smoking continues to be the leading cause of preventable death (Mokdad, 2004; CDC, 2011) and it provides a useful model for how an environmental approach can be successful. Many of the interventions to decrease the incidence of smoking are environmentally based. For example, federal and state government

agencies have continuously increased the sales tax on cigarettes. Research has shown that every 10% increase in cigarette cost generates a 4% decrease in cigarette consumption (Garson, 2007). At the worksite level, establishing a non-smoking campus significantly decreases the percentage of employees that smoke (Beiner, 1999). Based on the success of these interventions, implementing environmental interventions that promote healthier eating might yield similar success. For example, most large worksites provide on-site eateries for their employees. Because poor diet is a primary cause of obesity (Mokdad, 2004), these on-site eateries provide a stage to implement a regular dietary intervention, especially an environmental change, e.g. a change in offerings, price control, advertising, etc., to a large amount of employees.

Given the difficulty in judging the quality of commercially offered foods, a potential intervention model centers on the point of purchase (POP) labeling of food quality. Due to lack of space on menus, a simple form of signage at the POP is ideal. Examples of this approach include listing calories and/or grams of fat. Unfortunately, these have had only moderate success (Dumanovsky, 2010, 2011; Bassett, 2008; Harnack, 2008; Roberto, 2010; Pulos, 2010). There are two primary limitations to this approach. One is that it relies on a general understanding of how many calories or fat one should eat in a meal. The other is that this form of POP labeling neglects to reflect the larger, nutritional quality of the foods. Utilizing a more comprehensive nutrient profiling system – especially one that is easier to

follow and recall - could increase the effectiveness of this type of labeling for dietary change.

Purpose

The purpose of this study was to implement and evaluate the effects of a red, yellow, and green (R/Y/G) labeling system within campus eateries that were most frequented by UT faculty and staff. The R/Y/G labeling system provided POP information in order to assist eatery patrons in choosing healthier foods. Foods given a red label were those that were the lowest in nutrient density and highest in calorie density. Red foods were given a recommendation of "limit these foods." The yellow-labeled foods were those that had higher nutrient density, but also had higher calorie density, or had low calorie density, but limited nutrient density. These foods had the recommendation of "eat less frequently." The green-labeled foods had the highest nutrient density and lowest calorie density. The recommendation for these foods was to "consume often."

Conceptual Model

The Social Ecological Model provides a conceptual framework that emphasizes the importance of going beyond the individual as a vessel for changing health behaviors (McLeroy, 1988). The Social Ecological Model represents multiple levels that need to be addressed to create change. While there are multiple levels of change, this dissertation focused on the initial three levels.

The first level is the intrapersonal level, which contends that an intervention should support changes in an individual's knowledge, attitudes and beliefs.

Perceived benefits and risks reflect what the individual feels they could gain or lose by eating a meal. Unfortunately, the immediate gratification of flavor and taste from food will often override the known health risks associated with consuming that food (House, 2006). However, if the environment supports the known risk of that food, as it would through the red labeling, the perceived benefit of immediate gratification might be reduced as a predictive factor. Thus, the R/Y/G system will provide easy to interpret knowledge about which foods are healthy and inform the individual's decision making. This effect was seen with warning labels on cigarettes. Individuals who reported reading the warnings and thinking about the message were significantly more likely to quit smoking (Hammond, 2003). It is reasonable to investigate how this might apply with well-labeled foods.

The second level within the Social Ecological Model is the interpersonal level. The focus of this level is the social networks of individuals. POP labeling supports the social norm of eating healthy. This also provides for an environmental influence of social modeling and social facilitation. If others are utilizing the food labeling system and selecting healthier foods, this could influence an individual's choice to model that behavior in order to comply with the social norm. A recent review by Larson and Story (2009) showed that individuals are more likely to select healthier foods when eating in front of individuals they do not know. The use of the labels provides a signal for what is healthy and may increase this effect.

The third level of the Social Ecological Model is the organizational level. This is where the organization can support change through formal and informal rules

and regulations. Creating a "corporate culture" of healthy eating can shift the attitudes and norms of the social networks and the individual. The R/Y/G labeling is conducive with such an effort – especially when it is a part of policy for labeling all foods that are offered.

Specific Aim and Objectives

The primary aim of this study was to evaluate a R/Y/G labeling system as a means for changing food purchasing behaviors of employees at the University of Texas at Austin. Within this aim there were several, secondary objectives.

Objective 1:

Establish an objective method for evaluating nutrient density and rating foods within tertiles.

Objective 2:

Implement a POP food rating system within UT campus eateries frequented by faculty and staff.

Objective 3:

Evaluate changes in sales of foods labeled as R/Y/G and analyze shifts in percentages of sales comprised from each of the tertiles.

Objective 4:

Evaluate changes in eatery patron knowledge of which eatery foods should be labeled as R/Y/G.

Objective 5:

Evaluate the utilization and perceived effectiveness of the R/Y/G labeling system by patrons of the eateries.

Objective 6:

Evaluate communication materials for effectiveness in conveying how to utilize the R/Y/G system to select healthier foods and general appeal.

Hypotheses

The primary hypothesis for this study was that the R/Y/G labeling system would increase the sales of green-labeled foods and decrease the sales of red-labeled foods. There were no hypothesized changes in sales of yellow-labeled foods. It was thought that individuals would choose more yellow foods over red foods, increasing the sales of yellow, but also choose more green foods over yellow foods, decreasing the sales of yellow foods.

The secondary hypothesis was that there would be an increase in knowledge of which eatery foods fit within each of the R/Y/G categories. It was also hypothesized that the majority of eatery patrons would report: 1) awareness of the R/Y/G labels, 2) understanding how to use the labels, and 3) that the R/Y/G labels have influenced their choices.

Significance

If successful, the results from this study may lead to a simple, easy to disseminate environmental approach to combating obesity. This could become a campus-wide initiative to improving the nutrition and health of UT faculty, staff, and

students. In addition, this project will add to the limited literature evaluating environmental nutrition interventions.

Limitations

There were several anticipated limitations to this study. Chief amongst these was a function of the type of evaluation being performed. For example, the locations and timing of implementation could not be randomized due to eatery management restrictions, which created additional concerns of internal validity within the project. In addition, I could not control for patron exposure. If patrons visited an eatery that had already implemented the R/Y/G, it could have influenced their purchase at an eatery that had not reached implementation. Likewise, there was a serious threat of participant interactions. The campus community is highly connected and sharing of information regarding this intervention could have easily been disseminated from exposed groups to unexposed groups.

In order to overcome many of these limitations, the project was implemented in a phased manner. The initial eatery implemented the R/Y/G program for the full, six weeks of the project. The second eatery began in week three, continuing for the remainder of the project. The final eatery was limited to beginning implementation at week five of the project. This stepwise implementation was done to allow us to identify if changes in sales were based on one of the threats to internal validity discussed above or were an effect of the program. In addition, it allowed us to identify differences between short-term and lasting effects, as we had data on sales for eateries that had implemented for two, four, and six weeks.

There was another set of limitations due to the implementation methods. Specifically, communication materials were unable to be pre-tested due to time constraints involving funding. However, they followed existing materials and were reviewed by the campus wellness director, O's Campus Café manager, and my advisor. Another limitation was that there was no way to connect the pre-post surveys with the total sales figures that were de-identified. As such, there was no way to determine what percentage of total sales came from the sample that completed the surveys. In addition, the surveys contained a number of face-valid questions. As this has not been studied in this population, there were no existing, validated questionnaires. However, the use of objective, sales data was able to provide a check against the questionnaires. Lastly, the academic population limited the ability to generalize these findings – especially to a less-educated population. Although UT has a wide variance in income and education, the changes in behavior detected are limited to similar populations. Thus, the clientele of the targeted eateries was not reflective of the greater Austin population.

The purpose of this study was to provide pilot data as to the effectiveness of a low literacy, POP labeling approach. Implementing within the environment and population available was somewhat limiting, however still provides valuable information that expands the current literature surrounding similar interventions.

Chapter 2: Literature Review

Obesity and Health-related Concerns

Obesity has become one the largest public health concerns in the United States. Currently, 67% of the adult population is overweight or obese (CDC, 2012). In 2001, only one state had >25% of their population classified as obese. In 2010, 35 states had >25% of their population classified as obese (CDC, 2012). This rapid increase in the prevalence of obesity has made obesity management the focus of many health interventions. Obesity is a major risk factor for life-threatening diseases including cancer, diabetes, hypertension, heart disease, and stroke (Kopelman, 2007; Nejat, 2009; Stommel, 2009).

In addition, obesity increases the risk of many non-life-threatening conditions, such as insulin resistance, osteoarthritis, and sleep apnea (Pi-Sunyer, 2002). These health conditions are not only financially costly to the individual through doctors visits, medical tests and procedures, medications, and loss of physical ability to work, but can also be emotionally taxing. A recent meta-analysis by Luppino, et al, (2010) found that obese individuals are 1.5 times as likely to be diagnosed as clinically depressed as normal weight individuals.
Furthermore, obesity is currently the second leading cause of preventable death, only second to smoking (Mokdad, 2004). However, unlike smoking, where the incidence has been declining, obesity incidence is rising and is likely to quickly surpass smoking as a preventable source of death.

In addition to obesity being a primary public health concern, healthcare costs associated with these obesity-related conditions are of primary concern to US government officials and major health institutes including, but not limited to, National Institutes of Health (NIH), the Centers for Disease Control (CDC), and the American Heart Association (AHA). Obesity-related healthcare costs exceeded $147 billion in 2008 and are predicted to increase at a staggering rate (CDC, 2012). The effects of the rise in obesity-related healthcare costs extend beyond governmental concerns and have captured the attention of employers. In fact, an obese employee (BMI>40) can cost an employer $1200 more per year in healthcare costs than a normal weight (BMI<28) employee (Finkelstein, 2010). Hence, strategies for decreasing obesity rates are of primary concern to many US companies.

Importance of a Healthy Diet

Obesity is caused by an energy imbalance where intake exceeds output. Consumption of energy dense foods facilitates this imbalance. Diets high in processed foods that are low in nutrient density tend to be higher in calories and increase obesity risk (Elfhag, 2005; Ma, 2003). Therefore, changing dietary habits to include less energy dense and more nutrient dense foods has become a popular means for combating the current obesity epidemic.

The implications of an individual's diet extend beyond the effects of overconsumption leading to obesity. The quality of an individual's diet can have other significant health implications (USDA Dietary Guidelines for Americans, 2010). Various macro and micronutrients play important roles in general health

and disease prevention. Protein is a macronutrient that is critical to health. Protein plays a role in more than muscle development and maintenance. It is critical for gene transcription and translation, assists in growing, repairing, and replacing tissues, is essential for blood clotting and vision, and acts as enzymes, hormones, and fluid balance regulators (Whitney & Rolfes, 2008). A diet low in protein can lead to malnutrition, decreased immunity, and slowed wound healing, among other conditions.

In addition to diets low in protein, diets low in nutrient dense foods can also lead to poor health status. Essential nutrients such as Vitamins A, B12, C, and E, calcium, magnesium, iron, thiamin, riboflavin, and folate play major roles in everything from vision to fat metabolism and oxygen delivery (Whitney & Rolfes, 2008). Nutrients such as these are naturally found in unprocessed foods such as fruits, vegetables, whole grains, poultry, meat, and fish. Processed foods tend to be lower in these nutrients and higher in calories. Processed foods also tend to be higher in some of the unhealthier nutrients such as saturated fat and sodium (Eicher-Miller, 2012). Diets high in saturated fat and sodium can increase an individual's risk for cardiovascular disease (Capita, 2003). Unfortunately, there has been a large decrease in the quality of average American's diet due to large increases in processed foods and decreases in unprocessed, nutrient dense foods (Nielsen, 2002).

Worksite Interventions for Obesity

Worksite interventions have been increasing in popularity as a means for combating the obesity epidemic. This is primarily due to the potential for decreases to a company's healthcare expenses. However, the worksite is also an ideal location for an intervention to reach a large portion of the population, as more than 90% of Americans work (US DOL, 2012). In addition, the average member of the working population ages 15-54 spends 43 hours per week at work (US DOL, 2012). Thus, the worksite also provides ample opportunity to target a large percentage of the US population.

More than 90% of US companies have some kind of a worksite health promotion initiative in place (Linnan, 2008). Companies with greater than 750 employees have a greater number of health promotion programs and policies (Linnan, 2008). Within wellness programs, smoking cessation, stress management, and weight management are the most popular (Andrews, 2007). This is likely due to the fact that these areas are associated with the most expensive health conditions (Roehrig, 2009).

With regard to obesity prevention, the primary focus of worksite weight management interventions is to change behaviors related to dietary and physical activity behaviors. A limitation of focusing on physical activity is that not all employees are capable of participation in a physical activity intervention. Physical activity is also strongly impacted by variations in space (area and quality), variations in weather, and the need for equipment. As a result, few worksite

physical activity interventions are successful (Anderson, 2009). However, everyone can make positive changes to their diet and these efforts can make a significant change in weight. In a systematic review of diet interventions versus diet plus exercise interventions, diet plus exercise did result in 25% more weight loss, but diet alone provided the bulk of the change in weight (Wu, 2009). Thus, a single focus on diet is a reasonable means to target obesity prevention and treatment.

The Social Ecological Model states that the environment plays a major role in the health behaviors that individuals engage in (McLeroy, 1988). Considering that the vast majority of the population is spending a large amount of time at work, worksite weight management interventions that focus on the environment would be ideal. Unfortunately, a recent systematic review of worksite nutrition and physical activity interventions showed that less than 10% of worksite interventions were environmentally focused (Anderson, 2009). The same review also revealed that the current individually focused interventions are showing minimal effectiveness. On average, these interventions generated a mere three pounds of weight loss at 6-12 month follow-up (Anderson, 2009). This is not surprising; as many individually targeted weight loss interventions create greater weight loss in the beginning that is not maintained over an extended period of time. In fact, studies have shown that >50% of weight lost will be regained within one year (Curioni, 2005). Thus, these individually focused interventions are not sufficient.

Individually focused interventions also limit the access to the target population. In 2010, only 22% of employees participated in worksite wellness

programs (Osilla, 2012). Hence, an environmental intervention would be a better means of reaching a larger percentage of the workforce. Previous environmental interventions such as those imposed on smoking have demonstrated great long-term success (Garson, 2007; CDC, 2012). While an environmental approach to weight loss is not likely to replicate these values, it could increase the likelihood of long-term implementation. If so, it should be investigated as a means to reach a larger sample over a longer period of time. For example, many larger companies contain an on-site cafeteria or eatery. A study by Roos, et al, (2004) found that more than half of employees at a company with >4000 employees ate lunch at the on-site cafeteria. Blanck, et al, (2009) found that >54% of employees purchase lunch two or more times per week. In addition, they found that approximately 25% of employee purchases are at an on-site cafeteria when they are available. This information supports the use of the on-site cafeteria as a means for reaching a large percentage of the workforce through a dietary intervention.

Conceptual Model

The Social Ecological Model draws a connection between individuals, their relationships, and their environments, and how each of these has an impact on the individual's behavior (McLeroy, 1988). An extension of this model that provides more detailed insight into the targets within each level is the "People and Places Framework" (Maibach, 2007). This framework provides specific constructs that influence health behavior within each level of the Social Ecological Model. It adds detail to the idea that there are several levels within any organization that influence

its members and that it is important to consider the "people" set within the context of their "place." Thus, the most successful interventions will target multiple levels within the context of the organization. While there are multiple levels of this model, this dissertation will focus on three.

The first level of the Social Ecological Model is the individual level. This level works at changing health behaviors of individuals by targeting influences within their control. Within the individual level, the People and Places Framework is used to argue that self-efficacy and outcome expectations, affect, skills, motivation, biological predisposition, and demographics will influence individual health behavior.

The second level of the Social Ecological Model is the interpersonal level. This level works within individual's social networks. Social modeling and social facilitation are key components of the Social Ecological Model that are believed will influence individual's health behaviors. Social modeling is the concept that individuals will mimic the behavior of those around them and social facilitation is the concept that individuals will select "ideal" behaviors when others are watching (Hermans, 2010; Platania, 2001). Both of these have been clearly demonstrated as consistent predictors of behavior during social eating. Individuals are more likely to order what their peers order when eating out and, are more likely to order healthier choices when ordering alone in front of strangers (Larson, 2009).

In addition to social modeling and social facilitation, the People and Places Framework adds the importance of various aspects of social networks as they relate

to the individual. The size of a social network and connectedness an individual feels within that network, diversity of the ties within the network, and the degree of the relationships within the network (i.e. parent, friend, employer) are all important factors to consider when targeting the social network as a means for facilitating change (Maibach, 2007). This is important in workplaces, where people often eat with colleagues. In addition, this framework is used to argue that positive health behaviors can flow from the social leaders having positive health opinions. The worksite creates an ideal environment to target these aspects of the interpersonal level as they will typically contain diversity, different degrees of relationships, and have leaders that support healthy behaviors.

The third level of the Social Ecological Model is the organizational level. At this level, the organization is promoting healthy behaviors through formal and informal rules and regulations. These types of regulations can create a social norm of healthy behaviors. In addition, it can create social cohesion (the unity of a community around shared values) and collective efficacy (the belief that the community can accomplish something together), which are both critical components for influencing the organizational level within the People and Places Framework (Bandura, 2000; Carron, 2000). In addition, implementation of health promoting programs demonstrates the importance of health to organizational leaders. These positive opinions help create an environment and social norm of health.

Food Labeling to Enhance Communication / Marketing in the Workplace

The average American consumes 15-34% of their energy from eating out (Berman, 2008; Lachat, 2011). While there are numerous contributors to a poor diet, e.g. lack of time, cost, and taste preference (House, 2006), knowledge about what foods are desirable has been shown to be a key barrier to consuming a healthier diet – especially when outside of the home (Pomeranz, 2008). For example, although people perceive healthier eating as more expensive, research does not support this view (McDermott, 2010). As a result, many public -health interventions have been attempting to create environments that improve knowledge/awareness of healthy choices when outside the home. For example, many restaurants provide nutrition information on the web. Unfortunately, obtaining this information requires effort on the part of the consumer, as well as foresight about where they will be eating. In addition, it also requires that individuals remember the nutrition information when they are in the moment of ordering their food.

Another attempt at informing consumers when eating out has been through nutrition information on the packaging. Although this approach capitalizes on the opportunity to inform consumers about the foods they purchase, it provides this information after the purchase has already been made. In order to influence consumer's choices, nutrition information needs to be provided before the purchase is made and in a way that requires little effort from the consumer. In response, point of purchase (POP) labeling has become a popular means for delivering

nutrition information. Unfortunately, there is a gap in the literature examining the effectiveness of such strategies. While many of these have been implemented in eatery and worksite settings, few have been evaluated for effectiveness.

Several programs have utilized POP labeling in effort to change eating behaviors. One such program is Guiding Stars (Fischer, 2011). Guiding Stars is a POP system that labels foods with zero to three stars. The stars represent the nutrient density of the food with zero indicating a food with minimal nutrient density and three stars indicating a food with highest nutrient density (Fischer, 2011). The Guiding Stars program demonstrated effectiveness in increasing awareness of healthy foods among college students (Laramore, 2011; Fischer, 2011). However, the POP labeling did not significantly change the purchasing behaviors of the students. In contrast, more successful results were found in a study that examined changes in grocery sales after implementing Guiding Stars POP labeling in a community setting (Sutherland, et al, 2010). After utilizing Guiding Stars to label cereals at the grocery store, there was a significant increase in the proportion of sales of items that earned stars.

Similar to the Guiding Stars POP labeling system, Freedman, et al, (2011) implemented a program called Eat Smart in a college market. The Eat Smart program placed 1.25-inch x 3-inch tags on the shelf space below specific food products that were found to meet the Eat Smart criteria. The tags contained the words "Fuel Your Life Healthy Campus" and the Eat Smart campaign logo. The tags were only placed on foods that were considered healthy within the food categories

of cereal, bread, soup, cracker, canned vegetable, granola/energy bar, and salad dressing. In addition to the shelf tags, there was also a promotional poster in the store window and informational brochures next to the register. While there was an increase in sales of the Eat Smart tagged items within all categories except bread, none of the changes in sales were found to be significant. Interestingly, the Eat Smart campaign was not intended to be a nutrition intervention. Instead, it was primarily interested in testing the effectiveness of the POP labeling in changing purchasing behavior. Unfortunately, there was no subjective component of this study to evaluate if the labels were seen and understood. This limits the non-significant findings as the changes in sales, or lack thereof, could be attributed to no one noticing or understanding the labels.

These studies suggest that POP labeling is sufficient to impact grocery purchases but not the selection of meals – at least for college-aged populations. However, there are a number of limitations with the existing studies. Programs such as Eat Smart and Guiding Stars focus on promotion of healthy foods. While this is an important concept for any nutrition intervention, it does not provide education about foods that are unhealthy and likely calorie dense. The Guiding Stars concept is similar to the current proposed intervention as there is a three-level grading system. However, it may be that stars are less recognizable than stoplights and, therefore, less impactful in generating changes in behavior. In addition, the stars simply identify healthy, healthier, and healthiest choices, which provide no information on the unhealthy choices and do not provide a deterrent from making

such purchases. Such a shift in focus has been more successful in impacting the selection of meals.

POP labeling that deters individuals from calorie dense foods has been implemented. The most basic POP option is simply listing the calories on the menu. Placing calorie content of foods on the menu has shown questionable success in altering purchasing behavior that has warranted further investigation. Recent research has shown more promising behavioral influence, although the effects seen have been small (Dumanovsky, 2010, 2011; Bassett, 2008; Harnack, 2008; Roberto, 2010; Pulos, 2010). New York City passed a citywide mandate for POP calorie labeling. Several studies have surveyed patrons at popular fast food establishments and demonstrated that the majority of patrons saw the calorie information, and 25-40% of those also reported that the POP labeling influenced their purchase (Dumanovsky, 2011; Bassett, 2008; Dumanovsky, 2010). In addition, a systematic review of studies evaluating the effectiveness of POP calorie labeling found that five out of six studies showed significant differences in purchasing behavior (Hanack, 2008). Most of these were cross-sectional studies. In contrast, a randomized control trial by Roberto, and colleagues (2010) also found that individuals ordered significantly lower calorie entrées and consumed significantly less calories when ordering from a menu with calories shown than when ordering from a menu without any POP labeling.

Given the apparent effectiveness of POP calorie labeling, it is not surprising that in 2010, President Barack Obama passed a Healthcare Reform Act that had a

provision for putting calories on the menus of major chain restaurants (Nestle, 2010). Although the Healthcare Reform Act will provide that calories are listed on menus, this is only applicable to major chain restaurants and will not likely infiltrate the majority of worksite eateries. There are other concerns regarding simple calorie labeling as a means for promoting less energy dense foods. A consistent limitation is that people do not have enough knowledge about calories and their caloric needs (Pomeranz, 2008). While POP calorie labeling significantly decreased the calories in the entrée ordered, this effect was enhanced if they added informational signage that stated that the daily calorie recommendation was 2,000 calories (Roberto, 2010). Thus, the individual must be able to consider the caloric labeling within a larger context and criteria for diet. Another criticism of simply listing the calorie content of foods is that it does not provide information on the nutrient density of the food. Nutrient density refers to the volume of healthy nutrients contained within a specific amount of a particular food. Some foods that are higher in calories are also higher in nutrients (i.e. nuts). On the other hand, some foods that are lower in calories are not nutrient dense (i.e. diet soda). Thus, a focus limited to calories misses a large benefit of diet. The challenge, of course, is how to provide greater depth of information about nutrient and calorie density in a quick and practical form that can be understood while making a purchase decision.

A technique that has been effective in changing the eating habits of adolescents is labeling foods as "Go, Slow, or Whoa" foods (Schetzina, 2011). *Go* foods are labeled with green and are considered to be foods that should be

consumed on a regular basis. *Slow* foods are labeled yellow and are to be eaten in moderation. *Whoa* foods are labeled red and should be consumed minimally. This system is appealing as it is simple enough for a child to understand, but the labeling can be based on a wide variety of information (fat content, nutrient density; etc.). Such a system could be effective in adult populations where knowledge around nutrition is limited. In fact, the European Union has suggested implementing a similar POP labeling system as a means for combating their increasing obesity rates (Holdsworth, 2009).

An approach as simple as the R/Y/G labeling system is also less dependent on health literacy. Health literacy refers to an individual's ability to read and comprehend health information as well as their ability to utilize such information in a positive way (Frisch, 2011; Martensson, 2011; Nutbeam, 2008). Nutbeam and colleagues (2008) suggest that improving health literacy involves more than creating understandable educational materials, but also materials that draw upon personal experiences and invite interaction and critical analysis. The R/Y/G system can be presented in a stoplight formation, which creates a symbol that is recognizable (thus drawing on personal experiences) and therefore, easily understandable. The variety of foods that fall within each of the R/Y/G categories allows for a simple, critical analysis of the vast array of options to make a decision. In addition, providing the option to choose red and yellow foods increases autonomy, another construct within an individual's health literacy.

While research among adults with such a system is limited, the few studies that have examined this have shown success. The University of Virginia implemented R/Y/G labeling in their vending machines in 2004. At 1-year follow-up, red item sales decreased 5.3%, yellow item sales increased 30.7%, and green item sales increased 16.5% (Garson, 2007). It is important to note that part of their program also involved a five-cent tax on all red items, making it impossible to evaluate the impact of labeling alone. Thorndike, et al, (2012) implemented a POP R/Y/G labeling system at a cafeteria in a large hospital. They reported a significant reduction of 9.2% in red item sales and a significant increase of 4.5% in green item sales. Both of these studies demonstrate the R/Y/G labeling system can be successful. However, both studies utilized additional incentives and deterrents to complement the R/Y/G labeling. The vending machines charged an additional five cents for red-labeled foods and the cafeteria strategically placed green foods at eye level and red foods at less visible places on the shelves. With this evidence, further investigation into the effectiveness of POP, R/Y/G labeling system as a standalone intervention is warranted.

In addition, there is a lack of subjective evaluation in conjunction with objective evaluation within the current POP literature. In order to fully understand why the POP interventions are or are not effective in changing purchasing behavior requires validation of various theoretical constructs through subjective data collection techniques such as questionnaires. Many of the same POP techniques have demonstrated different results. These differences could be attributable to

differences within the population's knowledge of healthy eating, awareness of the POP labeling used, and/or social and environmental factors. Without a subjective evaluation, it is impossible to identify why one intervention was successful and therefore makes it difficult to duplicate the findings. The lack of studies that provide subjective and objective measure demonstrates a clear gap in the literature that needs further investigation.

Summary

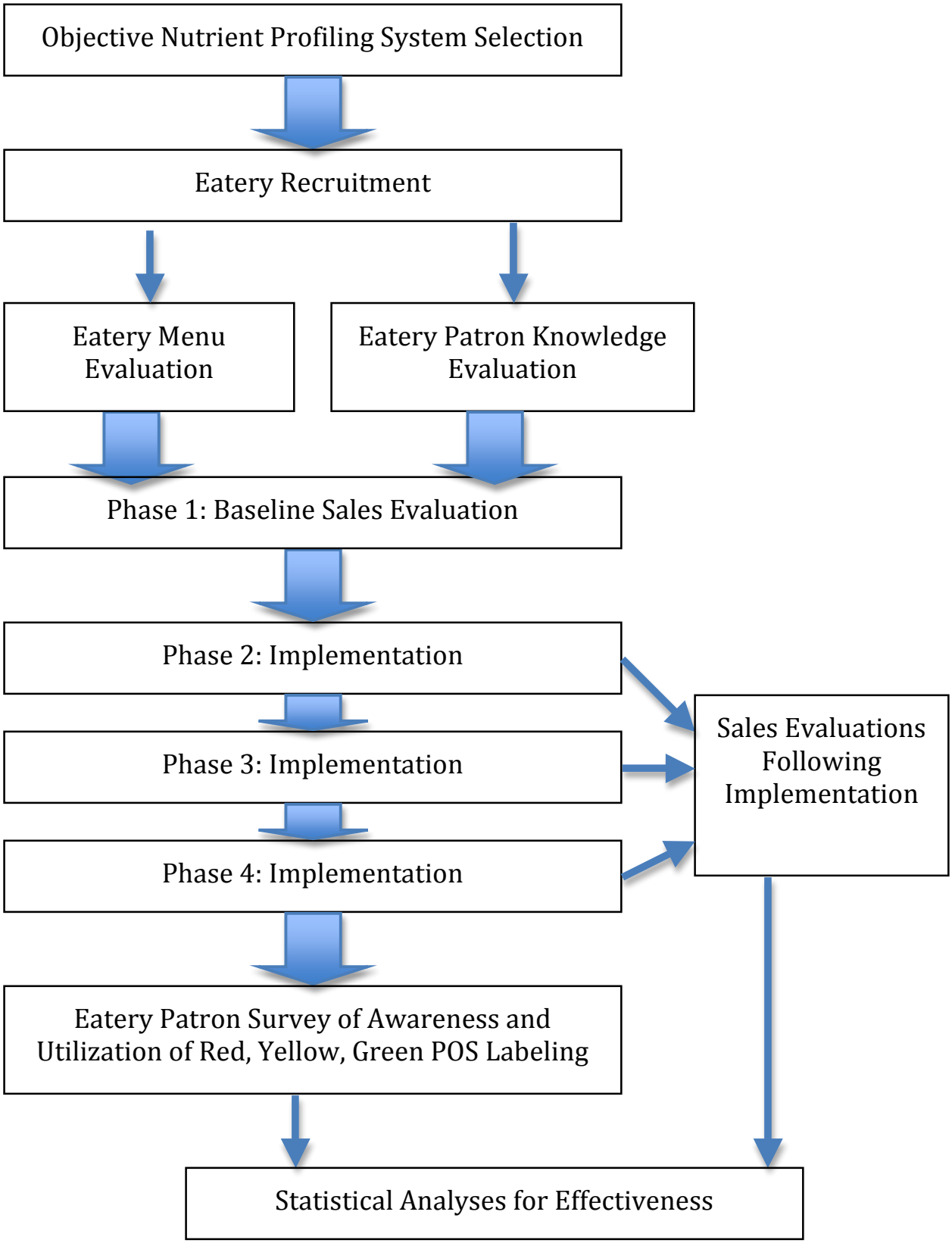
The University of Texas at Austin (UTA) has more than 16,000 employees with an array of on-campus eateries that are frequented by employees on a daily basis for meals and snacks. The most recent healthcare cost reports (fiscal year 2009) showed that the obesity related conditions of diabetes, hypercholesterolemia, and hypertension were three of the four highest costs. Each of these conditions can be improved and/or managed through diet. These are not only the most costly to UT and its employees; they are also the most rapidly increasing costs. Diabetes and cholesterol costs alone increased by more than 160% in the past four years. This information provides ample support for the need to implement a nutrition-focused intervention at UTA. The diversity of UTA's employees also demonstrates a need for an easy to understand and straightforward approach such as the R/Y/G labeling. This dissertation was designed to evaluate a program that implemented the R/Y/G labeling system at eateries on the UTA campus.

Chapter 3: Methods

Overview

UTA has demonstrated an increasing interest in promoting healthy eating on campus. The Wellness Director for faculty and staff recently received a grant from the City of Austin to promote healthier eating for the employees of UTA. This has provided the funding to start a farm to work program as well as monies needed to implement intervention such as the R/Y/G intervention. In collaboration with the Wellness Director, it was decided to implement R/Y/G program in faculty and staff focused eateries. Several steps towards the development of the nutrient profiling system and recruitment of eateries took place and are clearly outlined in the scale development and eatery recruitment sections below. Figure 3.1 illustrates the implementation and evaluation timeline of the program. Prior to beginning data collection, approval was obtained from the Institutional Review Board of The University of Texas at Austin.

Figure 3.1: Implementation Flow Chart
Red, Yellow, Green Program Procedures



Scale Development

A thorough review of nutrient profiling systems was conducted and presented to the Wellness Director in order to select the most appropriate, objective measure for evaluating the menus at the various eateries where the R/Y/G program will be implemented. There were many nutrient profiling systems that have been used in the literature, but only four met the following criteria to be used in this program: 1) Previously validated, 2) Publically available algorithm, 3) Included micro and macro nutrients, and 4) evaluated food in a standardized portion. The four systems that met these criteria were the Guiding Stars scale, Nutrient Rich Food Index (NRFI), NuVal, and WXYfm scale (Drewnowski, 2007; Drewnowski, 2010; Fulgoni; 2008; Scarborough; 2007). We considered the NRFI to be the simplest and most comprehensive of the systems. As a registered dietitian, I felt the NRFI was the best fit for this study and recommended it as the system to use. The Wellness Director agreed with this decision. The NRFI has been validated on multiple occasions, utilizes a standard 100 calorie serving, and is the nutrient profiling system that was utilized in the development of the Go, Slow, and Whoa intervention (Drewnowski, 2011; Fulgoni, 2009; Scarborough, 2007). Utilizing a 100-calorie serving provides the ability to directly compare a foods nutrient density. A food higher in calories will have a much smaller volume evaluated, and therefore have lower nutrient density than a food lower in calories. The earlier versions of the NRFI algorithm were based off of six nutrients: protein, fiber, Vitamin A, Vitamin C, calcium, iron, saturated fat, sodium, and added sugar (Fulgoni, 2009). Over several years and many utilizations of the index, other nutrients have been added to create

more comprehensive and current versions. The most current list of nutrients included are the original six plus monounsaturated fat, Vitamin D, Vitamin E, thiamin, riboflavin, B-12, folate, zinc, and potassium (Fulgoni, 2009). This updated version of the NRFI algorithm rates foods positively for protein, fiber, mono-unsaturated fat, vitamins A, C, E, B-12, thiamin, riboflavin, and folate, and minerals calcium, iron, and potassium. It rates foods negatively for saturated fat, added sugar, and sodium.

The algorithm for the NRFI is:

[(protein gm/%DV)+(fiber gm/%DV)+(Vitamin IU/%DV)+(Vitamin C mg/%DV)+(Vitamin E IU/%DV)+(B-12 mg/%DV)+(thiamin mg/%DV)+(folate ug)+(calcium mg/%DV)+(iron mg/%DV)+(potassium mg/%DV)+(riboflavin mg/%DV)-(saturated fat gm/%DV)-(added sugar gm/%DV)**-(sodium mg/%DV)] x100

*all % DV are capped at 100%
**certain variations have used total sugar in place of added sugar

Utilization of the algorithm with the 15 positive and 3 negative nutrients was attempted. There are a variety of resources that make recommendations for nutrient intakes nationally as well as globally; i.e. the World Health Organization (WHO), The United States Department of Agriculture (USDA), National Cancer Institute (NCI), and the Food and Drug Administration (FDA) (Drewnowski, 2008). Although the daily recommendations from these entities are generally similar, there are discrepancies. These discrepancies are more evident when evaluating

recommendations based on age and gender. Given the evolution of the NRFI, it is understandable that several variations of recommended %DV's have been utilized. The source (i.e. WHO, USDA, etc.) where these values were derived from has also varied. For the purposes of this study, the USDA Dietary Reference Intake (DRI) and Recommended Daily Allowance (RDA) recommendations were utilized in order to determine the percent DV for each of the nutrients. These values can vary by gender and age. Therefore, the highest need among gender between ages 18-50 years was utilized as the reference percent DV.

Monounsaturated fats did not have a USDA recommended value; therefore polyunsaturated fat was used in its place. Polyunsaturated fatty acids have been proven to have positive health benefits. In fact, based on evidence from the Nurses Health Study, polyunsaturated fat have a greater cardio-protective effect than monounsaturated fats (Willet, 2012). Given this information, they were deemed to be an acceptable replacement for monounsaturated fats. Two of the negative nutrients (saturated fat and added sugar) recommendations were based on a percentage of daily caloric intake. Therefore, the standard USDA recommendation of 2000 calories per day was utilized to determine these %DV's. However, the nutrition software utilized did not have the ability to distinguish between total sugar and added sugar. Previous versions of the NRFI have used total sugar in place of added sugar. However, as a registered dietitian, I did not feel that giving negative points for total sugar was a good alternative to added sugar because highly nutritious foods, like fruits, are made of natural sugar. Therefore, added sugar was not utilized in the nutrient analyses and cholesterol was used instead. Cholesterol is

also nutrient that has a maximum daily intake recommendation and is considered a negative health nutrient when consumed in excess (Willet, 2012). As such, it was considered a comparable replacement for added sugar.

Eatery Recruitment

The faculty and staff Wellness Director set up meetings with managers of several of the on-campus eateries. She and I attended these meetings where we discussed the proposed R/Y/G program. Full disclosure of methods for evaluating the menu items and labeling of items was made at each of these meetings. Several eateries agreed to participate. However, not all of the eateries had a large range of selections and most had only one site. O's Campus Café was chosen as the eatery to evaluate as it has three locations and a menu with large variability in price, nutritional value, and selections. The manager and owner of O's agreed to provide baseline sales as well as sales data during and after program implementation. They also agreed to allow us to put up signage around the menus and eateries that describes what the program is and how to utilize the color-coding system on the menus. Letter of support from O's Campus Cafe manager can be found in Appendix A and a map of the locations of the cafes can be found in Appendix B.

Recipe Analyses

Nutritionist Pro software was utilized for nutrient analysis of all foods and recipes. Nutritionist Pro is a nutrition software system that has been widely utilized for nutrition analysis in research (Collins, 2007; Kontogianni, 2010). This software utilizes the USDA food database as well as nutrition information obtained by the Axxya Systems in order to provide detailed nutrition information for over 100,000

foods and food products. This software provides an extraction tool that allows for foods and recipes to be exported into excel where all the nutritional information can be formatted to a 100-calorie portion.

The manager of O's Campus Café had agreed to share all of their recipes for the entrées and side items sold. Unfortunately, this proved to be a more difficult task than originally anticipated. Many recipes were provided several weeks before implementation. These recipes were entered into our nutritional software and analyzed shortly after being received. However, a new executive chef was hired one week before implementation was scheduled to begin. The new executive chef eliminated several of the menu items that had originally been given and added many new recipes. New recipes that were added to the menu options were given periodically throughout the entire 6-week implementation period. In addition, many of the new recipes lacked exact ingredients and amounts. This resulted in some recipes only being able to be partially analyzed and therefore, not included in the program. Once entered, food and recipe nutrient information was extracted and put into excel format for scoring. The NRFI algorithm was utilized to score each recipe. Once scored, the recipes were categorized as a red, yellow, or green food based on the previously mentioned scoring criteria.

The NRFI algorithm created 15 possible positive points and three possible negative points. Originally, it was intended that the scale would be split into tertiles providing that Red foods would be those that scored <3, Yellow foods would be those that scored 3-9, and Green foods would be those that scored >9. However, upon evaluation of the foods provided from the eatery, it was clear that this method

for rating the foods would be unacceptable. 174 foods were evaluated. This resulted in scores ranging from -1.3254 to 7.0778. Originally, it was attempted to create even tertiles within this range. However, this created a large imbalance of red to yellow to green foods. Therefore, the foods were placed in order by score and then split into thirds. Upon detailed evaluation of the foods and their ratings, a few minor adjustments were made to cut-points within the scoring to ensure that the rank associated with each food made the most sense. This resulted in the final ratings of <1 being Red foods (n=56), 1-3 being Yellow foods (n=62), and >3 being Green foods (n=48). It should be noted that the O's Hamburger received a green rating and the O's Cheeseburger received a yellow rating. However, the informational signage we had created had a picture of a cheeseburger next to a red stoplight. It was assumed that this would be misleading and confusing, therefore the ratings for the O's Hamburger and O's Cheeseburger were changed to yellow and red, respectively. The completed list of foods and their colored ratings is available in Appendix C.

Communication Materials

The communications materials included email advertisements, posters, table tents, and colored, mini stoplight tags for the menu boards. Due to time constraints designated by the City of Austin grant, the posters, table tents, and menu tags had to be designed and purchased without being tested within a focus group. The Wellness Director, O's Campus Café manager, and my advisor all provided input and approval of the materials prior to printing.

The posters provided a quick explanation of the meaning of the Red, Yellow, and Green labeling with examples of foods that were thought to likely fit within that category. Because the posters had to be developed and printed early in the program's development, foods from the O's Campus Café menu that had been tested and showed to fit within each category could not be used. The posters were printed in color on ½" thick stock and were 11"x14".

The posters were placed throughout each eatery where managers approve. We were able to place a minimum of two posters in each eatery; one at the entrance, where patrons enter the line to order food, and the second near the register. The McCombs Business School and Law School locations were fairly spread out with several areas for selecting food, therefore a third poster was placed within each of these eateries near where food was ordered. A copy of the poster can be found in Appendix D.

The table tents were printed on a high-gloss cardstock that was 8 ½" x 11" so that they could be folded in ½ to become a 2-sided table tent. One side was the same as the posters. The second side was a more detailed explanation of the program. Table tents were placed on all dining tables, on counter eating spaces, and at the registers. A copy of the second side of the table tents can be found in Appendix E. The table tents at the ACES location were able to stay on the tables for the entire six weeks. However, after 2-3 weeks, the table tents ability to stand up dwindled. Towards the end of the program, many of the tents remained on the tables and counter spaces, but they laid flat like a piece of paper. We attempted several strategies to stabilize them in the upright position, but none were successful

for more than a day. The custodial staff continuously threw the table tents in the McCombs location away. We only had a limited number of the table tents made and were only able to replace these two times before we ran out of replacements, which resulted in only three days of exposure to the tents at this location. Attempts were made to get the O's Campus Café staff and the custodial staff to help prevent them from being thrown away. However, the custodial staff is separate from the O's Campus Café and the employees that cleaned the dining area changed daily. This was similar to the situation at the Law School. Therefore, table tents were only placed within O's Campus Café managed spaces, limiting the dining room exposure to the table tents.

The stoplight stickers were 1"x2" stoplights with the appropriate color (i.e. red, yellow, or green) lit up. These stoplight images matched those found on the posters and table tents. The stickers were a plastic material that had a reusable adhesive. This enabled us to change the labels on the menu boards daily. For items that were consistently in the same place, the stoplight stickers could adhere to a laminated nametag that was placed near the food's shelf location.

An email message was drafted and sent to all UTA employees during the second week of implementation. This email provided advertising about the program as well as an explanation of how the program works. A copy of the informational email can be found in Appendix F.

These communication materials were intended to provide education to patrons about the healthiest choices. Ideally, individual's knowledge about healthy and unhealthy foods within the eatery will translate to other environments when

they come across similar foods. Similarly, the POP labeling should have increased the individual's self-efficacy to select the healthiest foods. However, the use of the communication materials was designed to not only inform individuals of what the R/Y/G labels mean, but to alter the physical and social environments. This effort to create a social norm represents a key construct for creating behavior change within the Social Ecological Model. By having posters, table tents, and labels all around the eateries, we hoped to create a positive message about healthy eating. In addition, the email and communication materials were intended to reinforce a social norm of healthy eating within each eatery.

Implementation

Once recipes were analyzed and color-coding had been assigned, a spreadsheet with the recipe titles and color assignments was given to the manager of O's Campus Café and each of the research interns. O's Campus Café provided white, laminated tags for our team to use. Foods that were kept in the same place on shelves and/or in cold boxes were labeled utilizing these tags. The name of the product was hand-written in black, permanent marker and the appropriately colored stoplight was stuck on the tag next it. These tags were then placed on available shelf or counter space near the item. The original adhesive for these tags was not effective as tags were falling off regularly. By the 3rd week, new adhesive had been purchased and was more effective at keeping the tags in their desired locations. A member of the research team was present at the ACES and Law School locations every day of implementation. This provided ample opportunity to inspect that all labels were in place and to fix any labels that had fallen down.

Two of the locations (ACES and Law School) had white, dry-erase menu boards that changed daily. This is where the daily specials would be hand-written in addition to other regular grill items. Originally, the manager had stated that the staff member that writes the specials on the board would be able to put the appropriate stoplight sticker next to each food. However, after a few days of implementation, we learned that this was not always being done. Therefore, a research team member took over preparation of these boards each day. Lunch service began at 11am and the menu boards were always prepared by 10:45am. The stoplight tags were placed next to the food titles on the menu boards by a research team member each morning and a picture of the menu board was taken and sent to me. This picture provided visual confirmation that the board was labeled correctly and allowed for validation of what foods were being served on what days. A sample of one of these menu boards with the stoplight stickers is available in Appendix G. The McCombs location did not have a menu board that changed; therefore daily visits were not necessary. In order to validate that the tags and stoplight stickers were in place and next to the correct foods at the McCombs location, weekly check-ins were completed with a checklist. The checklist included questions like:

1) Are the stoplight tags next to all menu items? Yes/No

2) Identify if the following menu items have the appropriate tag next to them:

    a) Turkey and cheddar sandwich: Green Tag Yes/No

    b) Fruit Salad: Green tag Yes/No

The complete checklist can be found in Appendix H. Each week the checklist was evaluated to ensure that tags were in place. Based on these evaluations, it was confirmed that all labels remained in place for each week of implementation.

O's Campus Café has three locations: ACES, McCombs Business School, and the Law School. In order to control for several threats to internal validity, we staggered the implementation at each eatery. Each of the phases of implementation lasted two to four weeks. Phase 1 (February 1-March 22) was used to collect baseline sales at each of the eateries and for survey recruitment. Phase 2 (March 25-April 5) followed and we implemented the R/Y/G signage and communication materials throughout the ACES location. The other two eateries remained unchanged. We continued to collect sales information from all three eateries during each phase of implementation. During Phase 3 (April 8-19), we implemented the program in McCombs location, while the Law School remained unchanged and implementation at the ACES location continued. Likewise, during Phase 4 (April 22-May 3) we implemented the program in the Law School and continued implementation at the other two locations. In the final phase, Phase 5 (May 4-May 31), all implementation procedures and sales data collection ceased, and we focused on recruiting survey participants to complete the post survey. Please see Figure 3.2 for a visual representation of this implementation process.

This step-wise implementation allowed us to compare differences in sales between and within eateries with and without program implementation. This provided better control of sampling error, testing error, local history, and selection

error. The order of implementation was not selected at random due to the requests of the eatery manager.

Figure 3.2: R/Y/G Program Implementation

	Phase 1: Week 0-3	Phase 2: Weeks 4-5	Phase 3: Weeks 6-7	Phase 4: Weeks 8-9	Phase 5: Weeks 10-11
Email Communication	None	All Staff	None	None	Survey Participants
R/Y/G Implementation	None	O's 1	O's 1 O's 2	O's 1 O's 2 O's 3	None
Survey Recruitment	All Locations	None	None	None	All Participants

Survey Recruitment

In order to test for changes in nutrition knowledge following program implementation, we conducted pre- and post-implementation surveys. Theoretically, the environmental changes as a result of the R/Y/G labeling would increase an individual's nutrition knowledge. This increase in knowledge would correlate with the changes in sales; ideally, the increase in Green food sales and decrease in Red food sales. In addition, the Social Ecological Model and People and Places Framework both contend that the environment can influence an individual's attributes of motivation and personal health beliefs and values; which, in turn, influence behavior. The surveys also had questions that evaluated patron healthy eating values pre and post in order to test this construct.

Survey participants were recruited from the three eateries where the program was be implemented. We had a goal of 75 surveys from each location and we had two weeks to recruit. During Phase 1, members of the research team went to the various eatery locations and recruited patrons to complete the survey. All patrons that entered the eatery were approached for participation. Research interns were given a script to use when asking eatery patrons to participate (See Appendix I). This script ensured that the patrons that were asked to fill out the survey were faculty or staff at the university and that they ate at the eatery regularly. Each participant was also asked to provide their email address as a means for contacting them with the post survey. All participants were shown a copy of the informed consent prior to participation and were given a copy if requested (See Appendix J). This study was deemed exempt by the UT IRB and therefore, no

signatures were required. Once the patron had agreed to participate and provided their email address, they were given a survey to fill out. The surveys were coded by location (A, B, or C) and number. The participant's email address was written down on a separate piece of paper next to the survey's code. Participants were then given the paper survey and a pen. All surveys were completed at the time they were given and were returned to the research team upon completion. A total of 191 individuals agreed to participate in this study: 80 from the ACES location, 55 from the McCombs location, and 56 from the Law location. Due to the nature of the recruitment, all participants were self-selected.

Emails with a link to the post-survey were sent to all participants at weeks 1, 2, and 4 following program implementation. The email link was sent to the email address each participant had provided through Survey Monkey. The post survey contained the same questions as the pre-survey. In addition, it was expanded to include a second set of questions that evaluated several of the other theoretical constructs utilized in the development of this intervention. Of the 191 original participants, 89 completed the post-survey. The majority of the population that completed the post-survey did so following the first email at one-week post implementation conclusion (N=80). Emails at weeks two and four only produced an additional nine participants. Of the 89, 28 had filled out the pre-survey at ACES, 20 at McCombs, and 28 at Law.

Pre- and Post-Surveys

Nutrition Knowledge: The pre- and post-surveys tested general nutrition knowledge by providing a brief description of the R/Y/G coding system and then

asking the patrons to rate several of menu items as red, yellow, or green. The manager of O's Campus Café provided a list of the top 14 selling menu items to be included in these questions. The four highest selling items were breakfast tacos, therefore only two of these were included and the remaining eight foods were the next highest selling foods on the list. The top selling foods were used as an attempt to capture nutrition knowledge that could be most influenced by the labels. In essence, the highest selling foods should receive the highest visibility, and therefore the most viewings of their R/Y/G labels. It was anticipated that even though an individual may not eat from the ten foods selected, they would observe the labels on these foods and be able to more accurately report the appropriate label. Patron's answers to each of these items was scored as a pass (1) or fail (0) and then summed in order to create a total nutrition knowledge score with a range of 0-10. A few examples of the menu item questions are below and the full survey is provided in Appendix K.

Examples:

Apple Chipotle Chicken Salad Sandwich

A. Red
B. Yellow
C. Green

Turkey and Bacon Club Wrap

A. Red
B. Yellow
C. Green

Self-Reported Knowledge and Values: In addition to having the patrons rate the menu items, the pre and post-surveys also assessed the patron's self-reported nutrition knowledge and healthy eating values. These questions were rated on

scales of 0-3, with zero representing lowest levels of self-reported knowledge and concern and three representing the highest levels. These questions are below and the full survey is provided in Appendix K.

How would you rate your knowledge of "healthy" eating?

A. Very knowledgeable B. Somewhat knowledgeable
C. Less knowledgeable D. Not at all knowledgeable

Which of the following statements best describe you:

A. I don't worry about what I eat
B. I try to eat healthy, but it is not a major concern
C. I am a generally healthy eater and make regular efforts to choose healthy foods
D. I always choose healthy foods

Post-Survey Understanding, Awareness, and Impact: Five point Likert scales were utilized to evaluate agreement with statements such as "I feel that the R/Y/G labels are clear and accurate." Questions like this were utilized in identifying the participants understanding and interpretation of the labels in order to evaluate the health literacy level of the communication materials. The majority of the questions were for evaluation of the impact and effectiveness of the R/Y/G communication materials. These questions asked the patrons if they saw the R/Y/G communication materials and if they utilized them when making food choices. In addition, there were questions about how the participants perceived other's utilization of the labeling and ordering habits intended to evaluate more of the environmental and cultural impact of the labeling. All of the responses to these questions were transcribed into a numerical rating with higher values representing positive responses and lower values representing negative responses. For example, higher levels of agreement with the statement "I have purchased more green labeled foods"

would receive a higher score where agreement with the statement "I have purchased more red labeled foods" would receive a lower score. Examples of these questions are below and the full survey is available in Appendix L.

Examples:

Have you seen the red, yellow, and green labeling on the menus? Yes No

How have the red, yellow, and green labels influenced your choices about the foods you have selected?

A. I have chosen more "green" labeled foods.
B. I have tried to choose foods NOT labeled "red."
C. I have tried to choose more "yellow" labeled foods in place of "red" labeled foods.
D. I have tried to have at least one "green" labeled item in my purchase.
E. I have tried to purchase less "green" labeled foods.
F. I have tried to purchase more "red" labeled foods.
G. They have had no influence on my choices

Sales Data Collection

Sales data were separated by location in order to account for exposure. Pre-sales data for ACES and the control cart locations were collected during Phase 1. Post-sales data were collected from Phases 2-4. Pre-sales data for McCombs was collected during Phases 1 and 2. Post-sales was collected during Phases 3 and 4. Pre-sales data for Law were collected during Phases 1-3 and post sales were collected during Phase 4. All sales data was provided in a receipt format, which caused for labor-intensive sales data entry. Due to time constraints, only Tuesday, Wednesdays, and Thursdays were included in the sales data entry process. Tuesdays through Thursdays were selected over other days because it was noticed during survey recruitment that Mondays tended to be busier days and Fridays were less busy. By selecting the middle of the week, it was believed the sales data would

be consistent across the three days, and not show large variations as it would if larger or smaller sales days were included. Individual item sales were reported as a number for the given day. The numbers for each day were then added together to create a total number for that item during the pre- and post-implementation periods. This number was then divided by the total number of days within that period in order to create a daily average for that item. This enabled comparison between the different locations for the individual items. However, due to the variations in menu offerings, sales were converted to a percentage of total sales for each period collected in order to equalize the menu comparisons across locations and allow for direct comparisons of the different categories.

Many of the foods were included in lump sales, which inhibited those items from being included in the evaluation. For example, there were four grab n' go salads. Two of which were rated yellow, one was red, and one was green. However, at the ACES and McCombs locations, all salad sales were reflected as "Grab n Go Salads," which made it impossible for differentiation between which salads sold. Other examples of this were the breakfast tacos, grab n' go chips, and the granola bars. Some items that were lumped together in this manner all had the same rating, and therefore were still utilized in the analysis (i.e. all whole fruit was rated green). Likewise, the special of the day was reflected as an individual item within the sales receipts, although it was often three items that were labeled: the entrée and two sides. For this, we counted each special of the day sale as a sale of the entrée and side items individually, as many side items were green or yellow while the entrée was red. The O's Campus Café Manager stated that almost all daily specials were

sold with the side items. However, we had no ability to distinguish if and/or when they were not, and therefore excluded the entrée sales from the analyses.

Statistical Analyses

The primary hypothesis was that there would be changes in sales of the red, yellow, and green-labeled items. The secondary hypothesis was to examine the differences in sales at the locations. The location represents the amount of exposure; i.e. Location 1=six weeks exposure, Location 2=four weeks exposure, and Location 3=two weeks exposure. Therefore, my secondary hypothesis was that the differences in sales from baseline to post implementation would not significantly differ after two, four, or six weeks of exposure. My primary and secondary hypotheses were tested by a 2x3x3 (time x food category x location) repeated measures ANOVA. Any significant time x food category interaction effect detected supported Hypothesis 1, and a full decomposition of the interaction was performed to determine the nature of the interaction. If a three-way interaction were significant, it would suggest a different pattern of effect for each location. This, again, will be decomposed into the simple effects to determine the nature of the interaction. Bonferroni corrections were applied to all direct, post hoc comparisons.

It was also hypothesized that there would be improvements in patron nutrition knowledge. This was tested by the pre and post knowledge surveys. These data were evaluated by a series of paired t-tests to determine change over time for all participants. In order to test our hypotheses that patrons would 1) be aware of the R/Y/G labels, 2) understand how to use them, and 3) utilize labels to influence purchasing choices, we utilized data collected from the post

implementation awareness surveys. The awareness part of the post survey was evaluated by logistic regressions, with the location as the grouping variable.

An attrition analysis was performed in order to detect any differences between those that filled out the pre-survey only and those that completed both the pre and post-surveys. One-way ANOVA's were performed on all data that were collected at the pre-test including gender, age, education, income, visitation frequency, healthy eating knowledge, healthy eating concern, and nutrition knowledge scores.

Power Analysis. The goal of 75 people per location would have yielded an initial sample size of 225. Power analyses for the repeated measures ANOVA demonstrated a need of 42 total pre and post surveys in order to achieve adequate power (>0.8) at a medium effect size (>0.25). Since the post-survey included a repeat component of the pre-survey, I attempted to recruit enough people to answer the pre survey in order to fulfill the 159 people needed for the post survey. It was expected that there would be at least a 75% post-survey reply rate. This would have yielded approximately 168 post-surveys, which would have provided ample power for the statistical analyses. Unfortunately, the goal of 75 per location fell short at the McCombs and Law locations and there was only a 46.6% post-survey reply rate. All data were analyzed with IBM SPSS Statistical Software Version 20.

Ch. 4: Results

Population

A total of 191 people completed the initial survey. Eighty participants came from the ACES location, 55 from McCombs, and 56 from the Law School. Each participant verbally confirmed that they were a member of the UTA faculty or staff, that they ate at the O's Campus Café >/= 4 times per month, and that they were willing to provide their email address and participate in this study. Of the participants, 83 (43%) were male. The majority of the participants were 30-59 years of age (64.5%). Of the total, 6.3% had a high-school diploma only, 43.9% had a college degree, 22.2% had a graduate degree, and 27.5% had a doctoral degree. Most of the participants had an annual household income greater than $90,000 per year (40.1%). Approximately half of the participants (50.5%) ate at O's Campus Café 1-3 times per week. In addition, most participants reported that the location where they were surveyed is the only location they had eaten at the past month. See Table 4.1 for detailed population demographics.

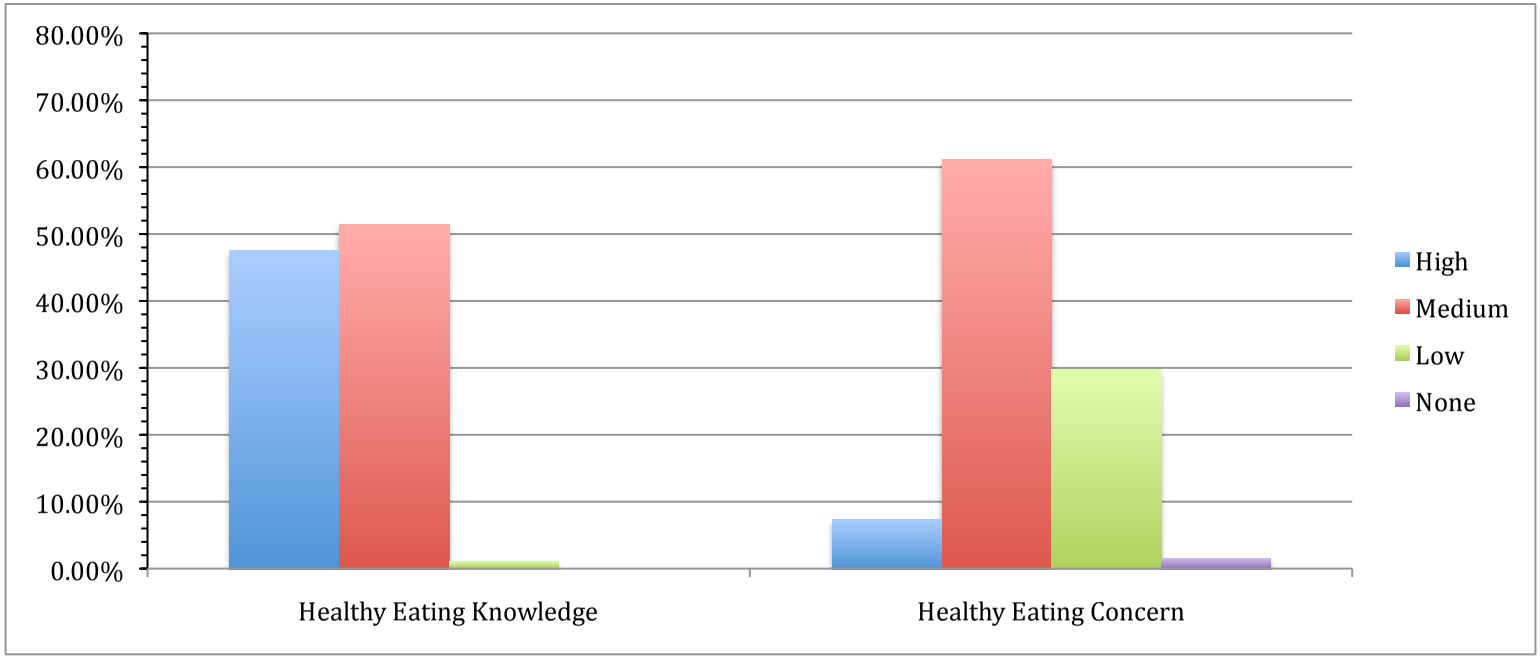
Table 4.1: Pre-Survey Population Demographics

Age	Frequency of Visitation	Annual Household Income	Highest Education Level
18-29 years = 20.6%	>4 times per month = 100%	<$30,000 = 13.2%	HS Diploma/GED = 6.3%
30-44 years = 37.0%	<1 time per week = 35.1%	$30,000-59,999 = 29.7%	**College Degree = 43.9%**
45-59 years = 27.5%	**1-3 times per week = 50.5%**	$60,000-89,999 = 17.0%	Graduate Degree = 22.2%
>60 years = 14.8%	>3 times per week = 14.4%	**>$90,000 = 40.1%**	Doctoral Degree = 27.5%

Pre-Survey Results

None of the participants reported that they were "not at all knowledgeable" about healthy eating. Only 1% of the population reported being "less knowledgeable", while the majority of the population described themselves as "somewhat knowledgeable" (51.4%) or "very knowledgeable" (47.6%). When self-reporting their concern over healthy eating, 61.2% of the participants reported that they are "generally healthy eater(s) and make regular efforts to choose healthy foods." Less than 2% reported no concern about what they eat and less than 8% reported that they always choose healthy foods. About 1/3 of the population reported that they try to eat healthy, but it was not necessarily a major concern (see Figure 4.1).

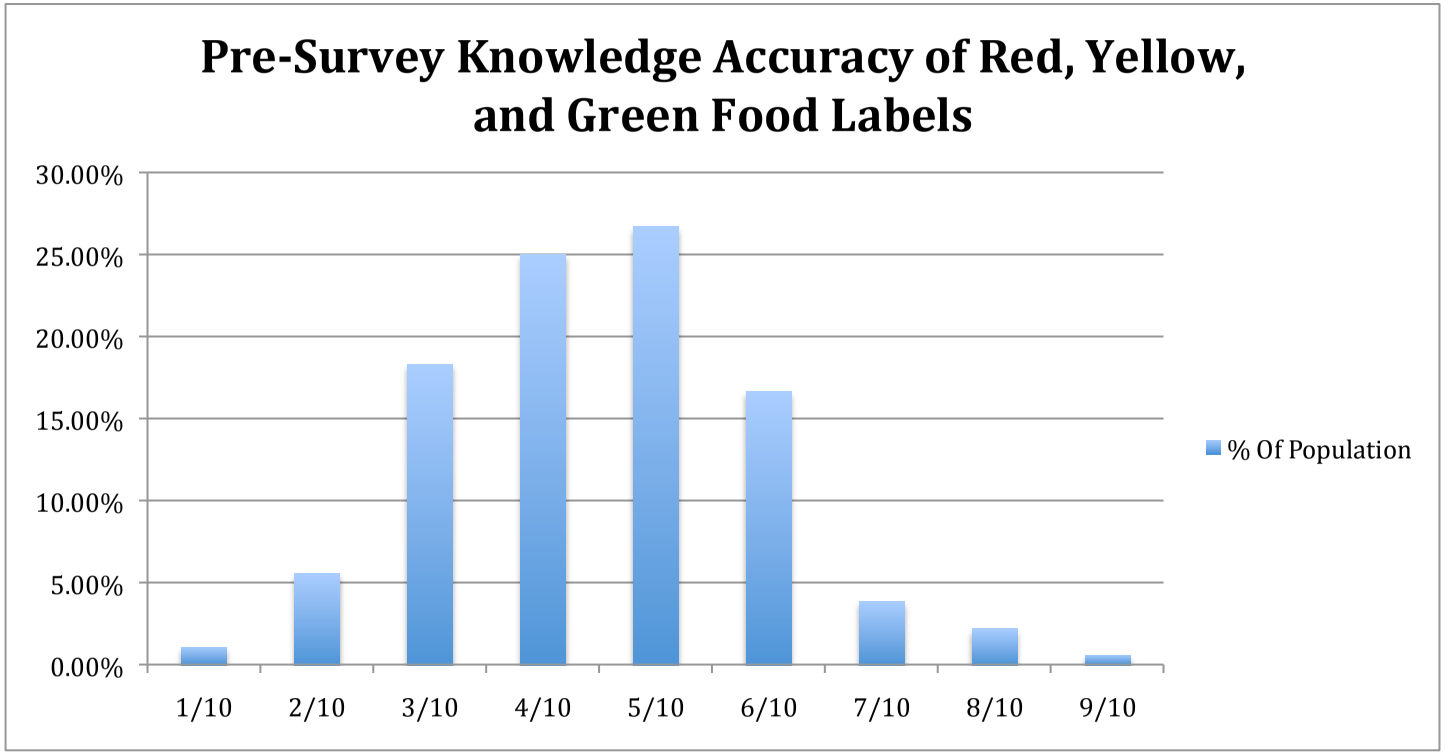
Figure 4.1: Percentage of Pre-Survey Participants Self-Reported Healthy Eating Knowledge and Concern



**Healthy Eating Knowledge: High= "Very Knowledgeable", Medium= "Somewhat Knowledgeable", Low= "Less Knowledgeable", and None= "Not At All Knowledgeable."
**Healthy Eating Concern: High= "I always choose healthy foods", Medium= "I am a generally healthy eater and make regular efforts to choose healthy foods", Low= "I try to eat healthy, but it is not a major concern", None= "I don't worry about what I eat."

Asking participants to rate each of the top ten selling food items as red, yellow, or green assessed knowledge of correct food labeling. Each correct answer was given one point, for a possible total of ten points. The most common number of correct answers was four or five out of ten (25% and 26.7%, respectively). Nobody missed all ten, and nobody got all ten correct. See Figure 4.2 for detailed breakdown of scores. Although the foods assessed were reported to be the top ten selling foods, the majority of the survey participants reported only consuming 1-3 of the foods in the past month (58.8%). In fact, 13% of the participants reported that they had not purchased any of the top ten foods in the past month, while 21.5% had purchased between 4 and 7 of the foods, and only 6.8% had purchased 7-10 of the foods.

Figure 4.2: Percentage of Participants that Achieved Correct Labeling of Top Ten Selling Foods at Pre Survey



Of the 191 participants that filled out the survey, 89 filled out the post survey. The post survey respondents were fairly evenly split among locations with 36.4% reporting ACES as the location that they frequent, 26% reporting McCombs, and 36.4% reporting the Law School. An attrition analysis was performed in order to detect any differences between those that only completed the pre survey (non-completers) and those that completed both the pre and the post survey (completers). No significant differences were found for gender, age, income, eatery visitation frequency, healthy eating knowledge, or healthy eating concern ($p>.05$). However, the non-completers did report significantly higher levels of education ($p<.05$). The bulk of the completers remained in the college degree category for highest level of completed education (55.7%). However, smaller percentages had completed graduate or doctoral degrees (15.9% and 21.6%, respectively) than in the non-completers (22.2% and 27.5%). Although the completers reported lower levels of education, there was no difference in their performance on the nutrition knowledge assessment regarding how to correctly rate the top ten selling foods. Due to the lack of differences between populations' knowledge, concern, and demographics, the population that completed the post survey was considered to be an accurate subset of the original population surveyed.

Post-Survey Results

Of the original survey sample, 89 (42% male) completed the post-survey. Although the frequency of visitation did not significantly differ between completers and non-completers at the pre-test, there was a large decrease in frequency of

visitation among the completers from pre to post-test. At the pre-test, 51.1% of the completers frequented O's Campus Café 1-3 times per week and 36.4% visited <1 time per week. At the post-test, there was a shift to less frequent visitation where 43.8% of the completers visited 1-3 times per week and 44.9% visited less than 1 time per week. Those that reported visiting >3 times per week remained fairly consistent: 12.5% at the pre-test and 11.2% at the post-test. See Table 4.2 for detailed changes in frequency of visitation.

Table 4.2: Changes in Frequency of Visitation Among Completers

	% Pre Frequency of Visitation	% Post Frequency of Visitation
<1x / week	36.4%	44.9%
1-3x/ week	51.1%	43.8%
>3x/week	12.5%	11.2%

Change from Pre-test in Behavior and Knowledge

There were no self-reported increases in healthy eating knowledge or concern. In fact, there was a large decrease in self-reported knowledge of healthy eating. Of the completers, 47.7% reported they were somewhat knowledgeable about healthy eating and 51.2% reported they were very knowledgeable at the pre-test. The percentage of those that reported being very knowledgeable dropped to 27% and shifted the percentage of those reporting to be somewhat knowledgeable to 69.7%. The majority of the completers reported that they made regular efforts to eat healthy (64.4%). This percentage was maintained at the post-test (61.8%), demonstrating no reported increases or decreases in the group's concern for healthy eating.

Similar to the self-reported knowledge of healthy eating, the knowledge of the top ten foods ratings did not increase at the post-survey. The post-survey population most often rated four or five out of ten foods correctly (see Figure 4.2). This did not significantly differ from the pre-test scores ($p>.05$). The total pass/fail rates were broken down into individual items for further evaluation (See Table 4.3). The percentage of total sales during the data collection period was also included for each item in order to investigate any differences among higher selling foods. This breakdown revealed that there was a lot of variation in the changes of the rating knowledge of the individual top ten food items. The potato, egg, and cheese breakfast taco, potato, bean, and cheese breakfast taco, chipotle chicken salad wrap, crispy chicken avocado wrap, chicken tender basket, and turkey and cheddar

sandwich all had increases in percentage of people that correctly rated them. The yogurt parfait, ham and provolone sandwich, and hamburger had decreases in the percentage of patrons that correctly rated them. The cilantro tuna salad sandwich had no change. Table 4.3 has a detailed breakdown of pre and post pass rates as well as the percentage of total sales each item comprised at the time of this study.

Table 4.3: Comparison of Pre and Post Correct Ratings of Top Ten Foods by Completers

Food	Correct Label	Percent Correct Pre	Percent Correct Post	Percent Total Sales
Potato, egg, and cheese breakfast taco	Red	14.3	23.6	n/a
Potato, bean, and cheese breakfast taco	Green	8.4	9.0	n/a
Chipotle Chicken Salad Wrap	Yellow	54.2	55.1	2.5
Crispy Chicken Avocado Wrap	Red	27.2	40.4	12.1
Yogurt Parfait	Green	47.0	41.6	5.7
Chicken Tender Basket	Red	79.3	83.1	6.4
Turkey and Cheddar Sandwich	Yellow	66.3	68.5	3.4
Cilantro Tuna Salad Sandwich	Yellow	48.2	48.3	3.0
Ham and Provolone Sandwich	Yellow	73.8	68.5	1.5
Hamburger	Yellow	26.2	18.0	1.0

Awareness of Labels

The majority of completers reported seeing and utilizing the red, yellow, and green labeling system. Specifically, 53.9% saw the labels on the menu boards, 47.2% saw the labels on the individual items, and 62.9% saw the informational posters (See Table 4.4). The informational email that was sent to all faculty and staff describing the program was only reported to have been seen by 38.2% of the completers, and 12.4% of them reported that it increased their desire to eat at an O's Campus Café (See Table 4.4). No gender differences in intervention awareness were detected. In addition, an individual's frequency of visitation showed no significant impact on their awareness of the communication materials.

Table 4.4: Intervention Awareness

Communication Type	Percent Aware of Communication
Labels on Menus	53.9
Labels on Individual Items	47.2
Informational Posters	62.9
Informational Email	38.2

Understanding the Information in the Labels

In order to evaluate the understanding of the information in the label of the population and the intervention, several questions were asked about the completer's understanding of the labels. The data indicated that 68.5% of the

population reported that the labels were not confusing and 52.8% reported that the labels aligned well with their understanding of healthy foods. In addition, 43.8% reported that they felt the red, yellow, and green labels were clear and accurate. See Figure 4.3 below for a more detailed breakdown of the self-reported understanding of the intervention.

Unfortunately, approximately half of the survey participants reported they were not aware of the menu or item labels, and slightly less than 40% reported they were not aware of the poster. Therefore, a sub-analysis was conducted in order to identify differences in self-reported understanding among those that reported being aware of at least one component of the intervention. If a participant reported awareness of any of the three forms of communication within the eatery (item label, menu label, or poster), they were included in the sub analysis (N=64). Interestingly, there were no significant differences in post-test knowledge or change in knowledge scores between those that reported awareness and those that did not ($p>.05$). However, there was a positive trend of self-reported understanding of the intervention among those that reported awareness (see Figure 4.4). There was an 8.1% increase in those reporting the labels were not confusing, an 11.3% increase in those that reported the labels aligned well with their understanding of healthy foods, and a 9.4% increase in those reporting the labels to be clear and accurate.

Figure 4.3: Self-Reported Understanding of R/Y/G Intervention

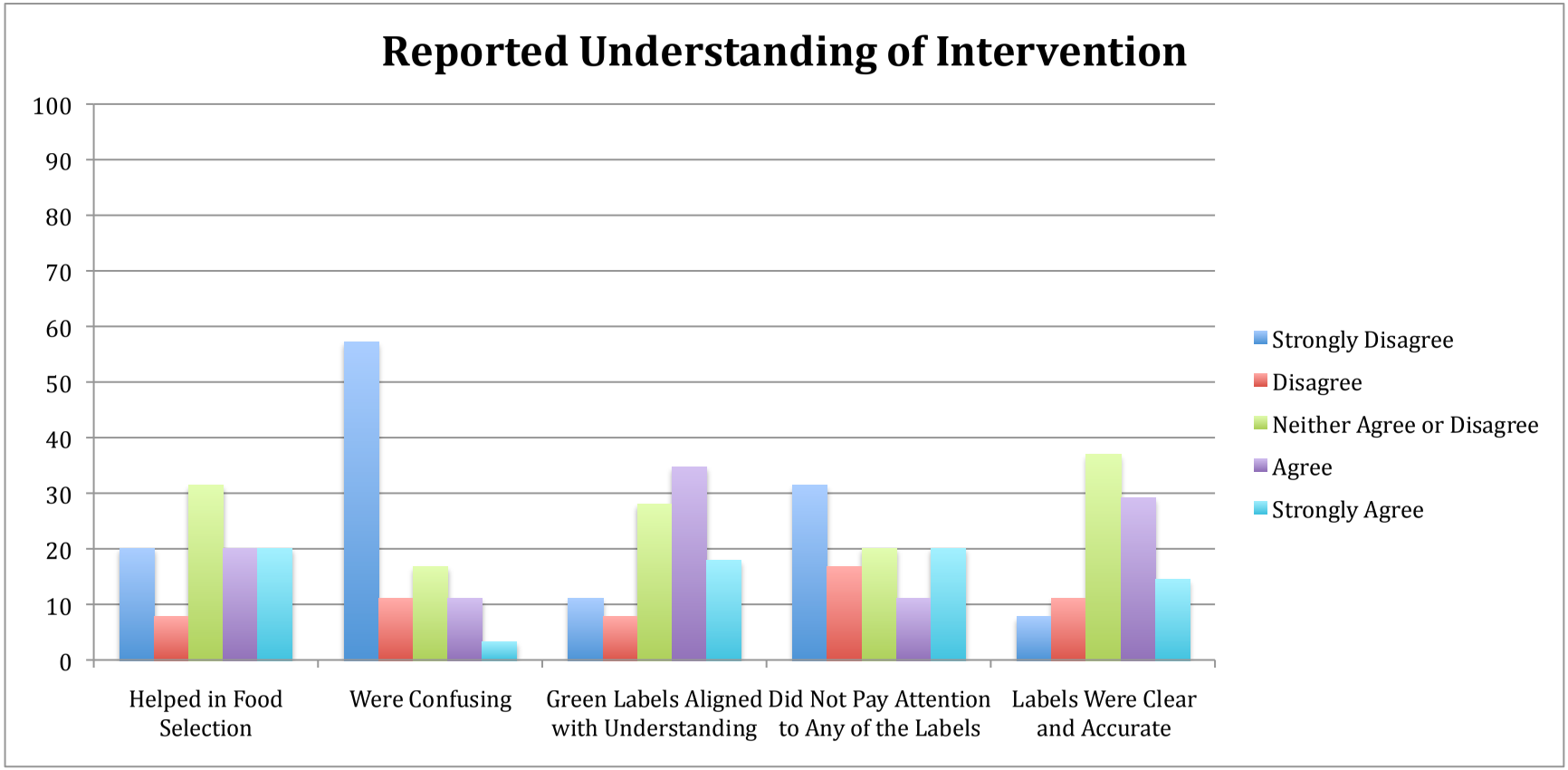
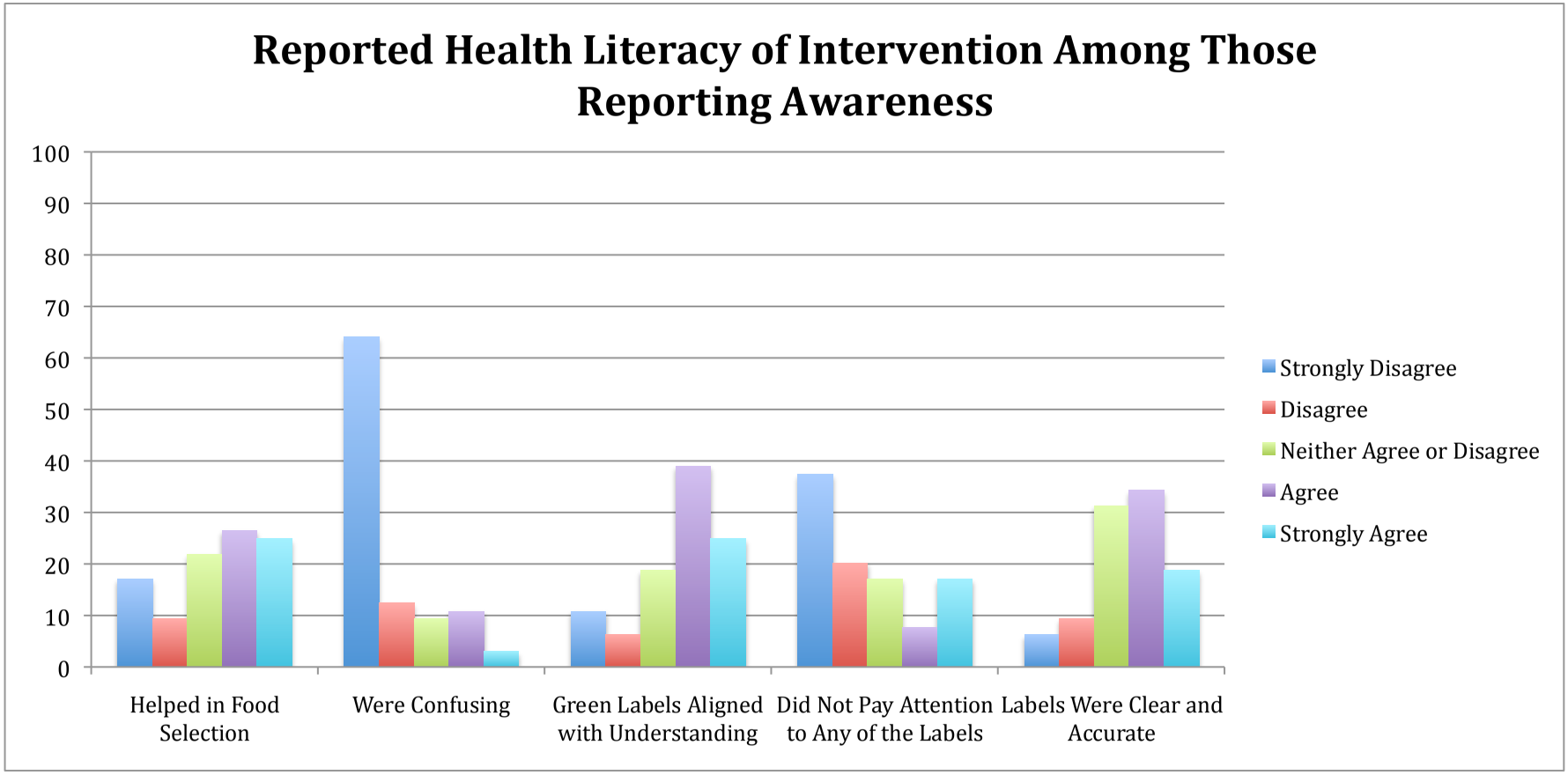
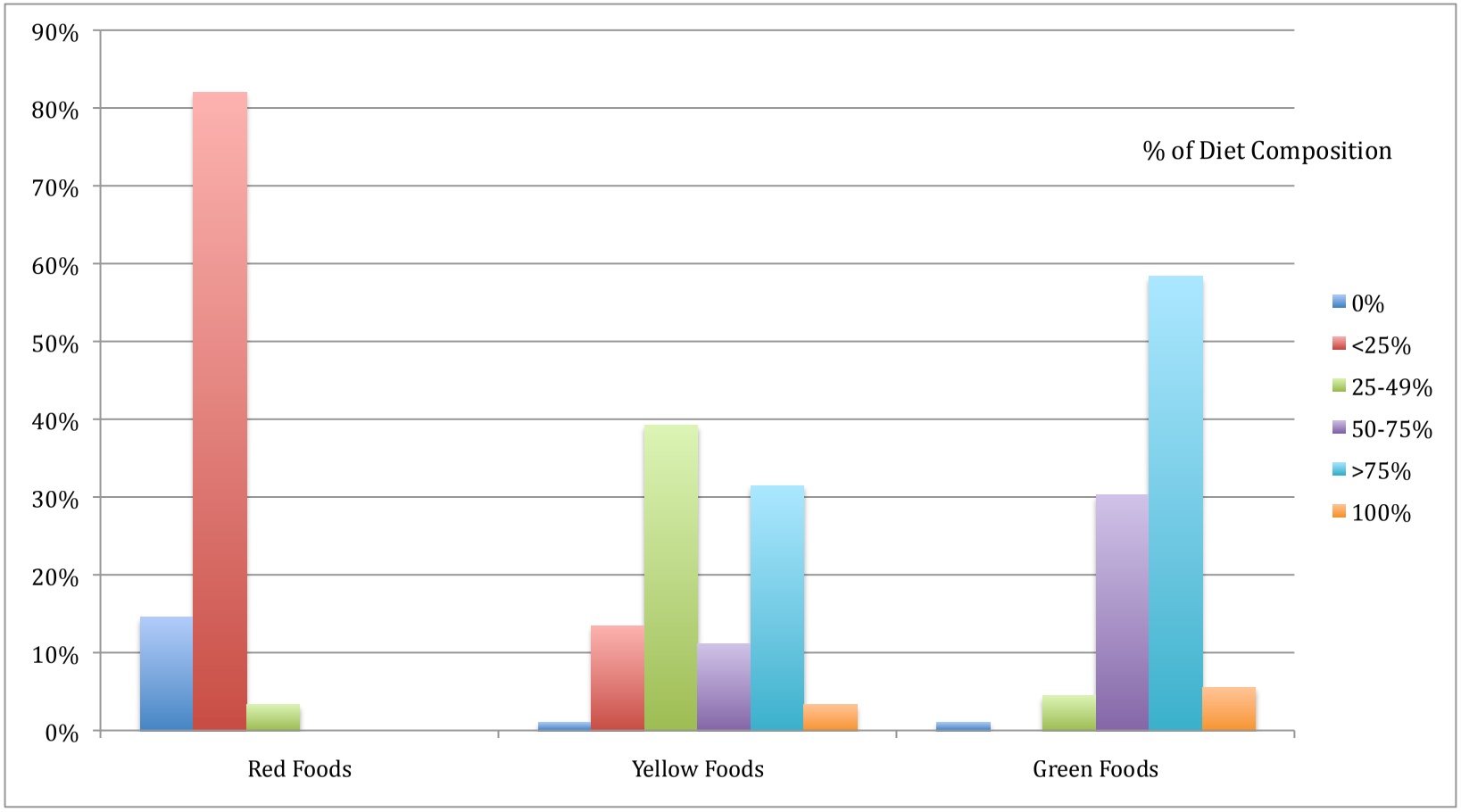


Figure 4.4: Self-Reported Understanding of the R/Y/G Intervention by Those Reporting Awareness



In addition to the self-reported understanding and literacy of the red, yellow, and green labels, questions were provided that tested the completers' health literacy of the red, yellow, and green labeling concept. There was evidence of a basic understanding that the red foods should be eaten minimally, yellow foods less often, and green foods more frequently based on the survey responses of the participants. When asked what percentage of their diets should each of these categories comprise. Of the participants, 82% said that <25% of their diet should be red, 39.3% said that 25-49% of their diet should be yellow, and 58.4% said their diet should be >75% green (See Figure 4.5).

Figure 4.5: Completers Assessment of Red, Yellow, and Green Diet Composition



Impact of Labeling on Purchasing Behavior

When asked about the impact that the red, yellow, and green labeling had on their behaviors; the completers reported largely positive behavior changes. Almost half of the completers (48.4%) reported that they did pay attention to the red, yellow, and green labels and 41.6% of them reported that the intervention had some type of impact on their food purchases. Specifically, the completers reported increasing their purchases of green foods, purposely purchasing foods not labeled red, and attempting to purchase more yellow foods in place of red foods. Although they reported increased purchasing of green foods overall, there was not a large report of purchasing at least one green food on a regular basis. See Figure 4.6 for more detailed descriptions of these behavioral impacts.

It was anticipated that there would also be differences in self-reported behavioral changes based on awareness. Therefore, another sub analysis was conducted using only those that reported awareness to identify any behavioral impact differences (see Figure 4.7). Similar to the self-reported understanding, there was a more positive trend of self-reported behavioral impacts among those that reported awareness of the communication materials. Specifically, there was a 13.1% greater reporting that the intervention had some impact on their purchasing behavior among those that reported awareness (41.6% vs. 54.7%).

Figure 4.6: Self-Reported Behavior Changes and Impacts as a Result of R/Y/G Labeling

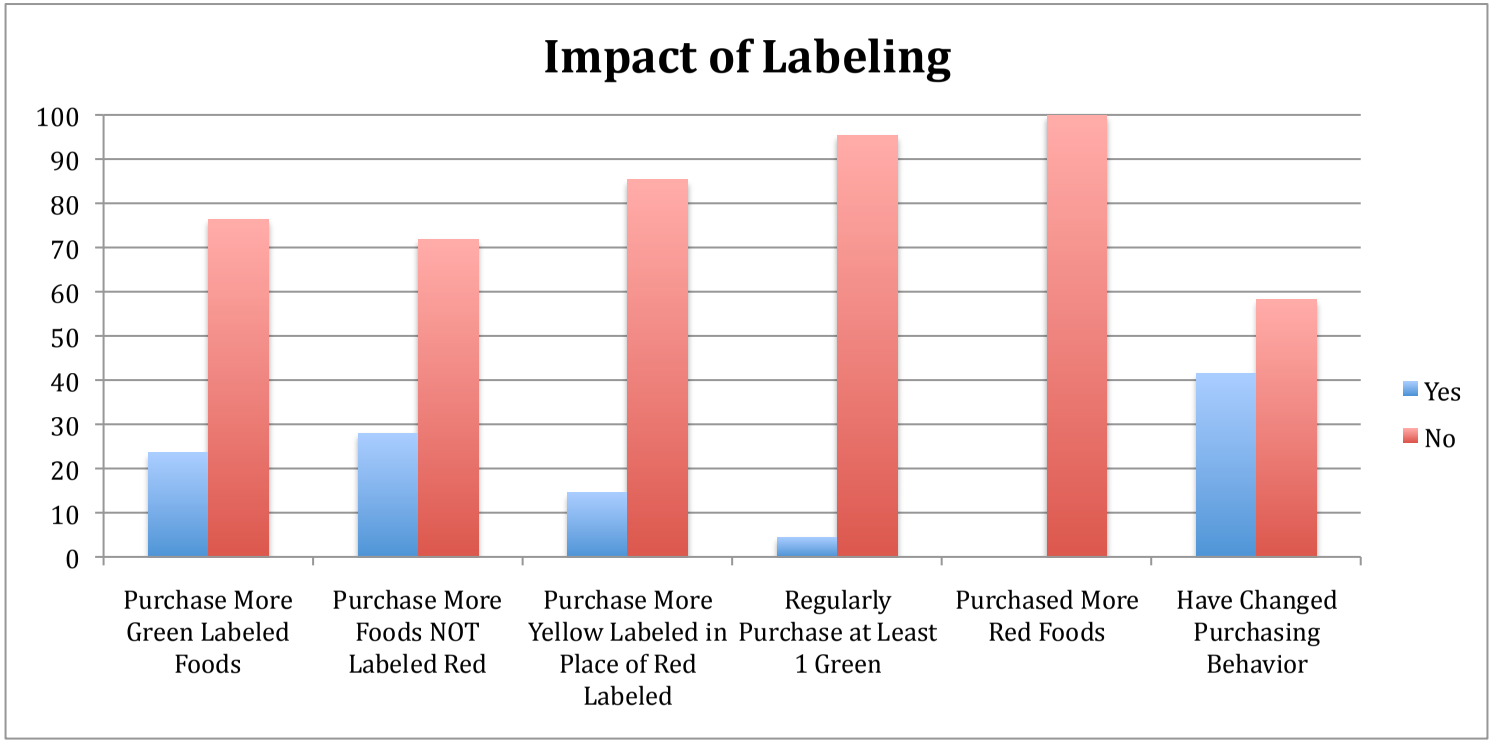
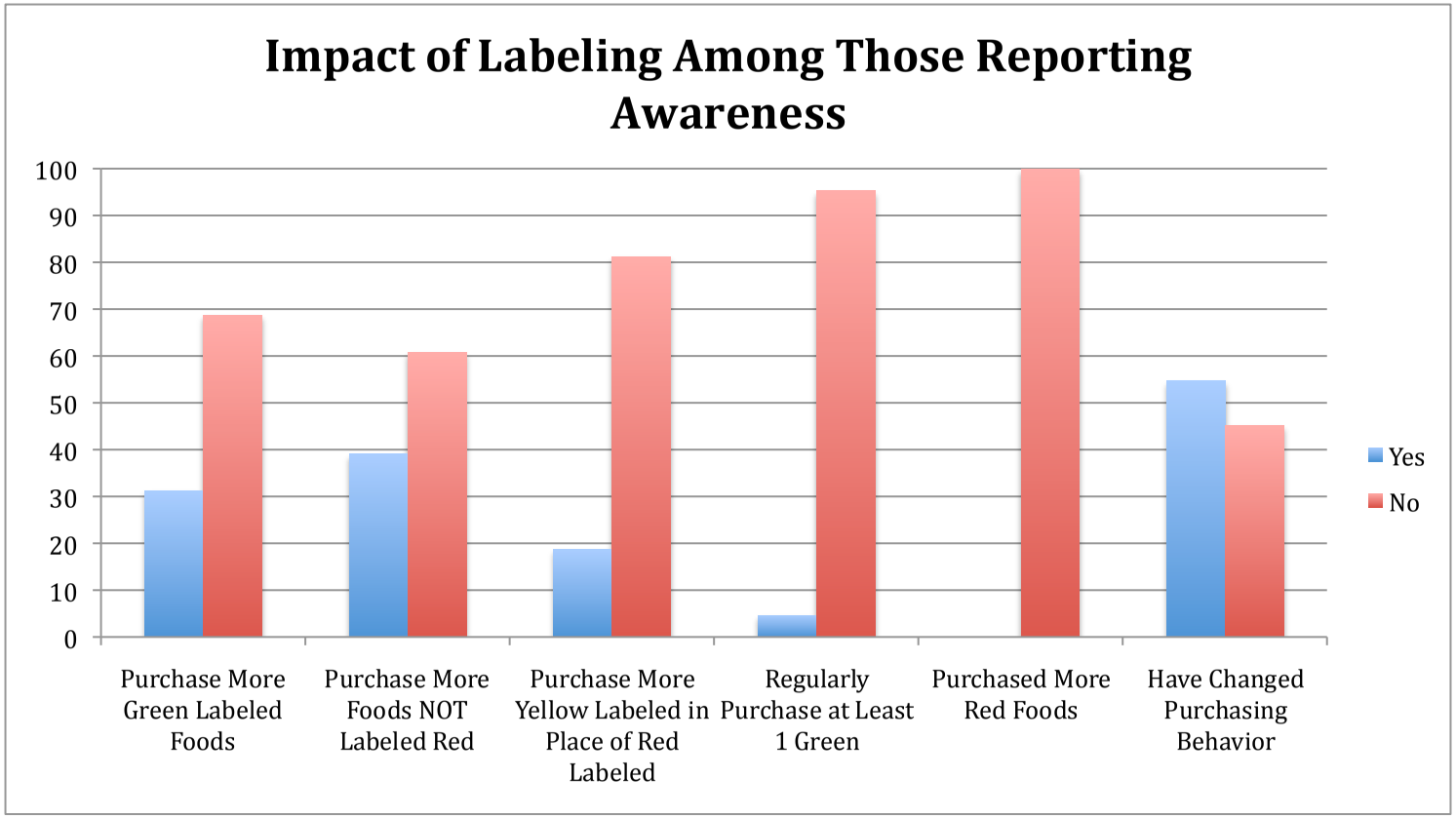


Figure 4.7: Self-Reported Behavior Changes and Impacts as a Result of R/Y/G Labeling Among Those Reporting Awareness



Perceptions of the Locations

Another construct evaluated through the post-survey was the establishment of feelings that O's Campus Café promoted a healthy culture. Although not a large percentage of the population reported seeing others patrons utilize the red, yellow, and green labels, there was approximately one fifth of completers that reported they did (20.2%). In addition, the completers reported that when observing other patron's purchases, they generally purchased yellow foods and they felt that others purchased comparably healthy foods as themselves.

Relationship Amongst Measures

A correlation matrix was examined in order to evaluate any potential correlations among survey constructs tested. Healthy eating knowledge and concern were significantly correlated at both the pre and post-tests ($p<.01$). Awareness of the menu labels, item labels, posters, and the informational email were all significantly correlated with each other, as well ($p<.01$). Several of the behavioral impacts evaluated were significantly correlated with intervention awareness. Reporting an increase in purchasing of green foods was significantly correlated with awareness of the item labels ($p<.05$), posters ($p<.01$), and the informational email ($p<.05$). Increasing purchases of foods not labeled red and reporting that the labels had some influence on their purchasing behavior were both significantly correlated with awareness of menu labels ($p<.01$), item labels ($p<.05$; $p<.01$), posters ($p<.01$), and the informational email ($p<.05$; $p<.01$).

In addition, awareness of the menu labels, item labels, posters, and informational email were all significantly correlated with individual's reporting that the labels assisted them in selecting healthier foods and those reporting the labels to be clear and accurate ($p<.05$). Individual's reporting awareness of the posters significantly correlated with individual's reporting that the labels aligned well with their understanding of healthy foods and that they paid attention to the labels ($p<.01$). There was a significant correlation between awareness of the menu and item labels with reporting that the labels were not confusing ($p<.05$) and awareness of the menu labels significantly correlated with those reporting paying attention to the labels ($p<.01$).

Reporting increasing purchasing of green foods, increasing purchasing of foods not labeled red, purchasing more yellow foods in place of red foods, and that the labels had an impact on your food choices were all significantly correlated with reporting that the labels were helpful in selecting healthier foods ($p<.01$), they aligned well with their understanding of healthy foods ($p<.05$), they paid attention to the labels ($p<.05$), and they found the labels to be clear and accurate ($p<.05$). (See Appendix M for Correlation Matrix)

Post-Survey Results By Location

Given that each location had a different degree of exposure (2 weeks, 4 weeks, or 6 weeks), the post-survey responses were further decomposed to identify any differences based on location and, presumably, exposure. Logistic regression was utilized to test these differences. There was a non-significant difference between the 6-week (ACES) and 4-week exposure (McCombs) reports of having

seen the menu labels (p>.05), but there was a large discrepancy from the 2-week (Law) exposure that was significant (Exp(B)=.33, p<.05). Interestingly, there was a great amount of variation among all three exposure group's reports of seeing the individual item labels: 64.5% of the ACES reported seeing the individual item labels, 30.8% of the McCombs, and 43.8% of the Law. However, only the McCombs was significantly different from the ACES (Exp(B)=.244, p<.05). The reports of the seeing the posters were high among all three groups, and there were no significant differences between locations (p>.05). The ACES group percentage that reported having seen the informational email was significantly greater than both the McCombs (Exp(B)=.266, p<.05) and Law (Exp(B)=.283, p<.05) locations. However, all three groups reported little to no impact on desire to eat at O's Campus Café as a result of the email. Detailed analyses of their reports of awareness by location are available below in Table 4.5.

Table 4.5: Participant Reported Intervention Awareness By Location

	ACES (6-wk)	McCombs (4-wk)	Law (2-wk)
% that saw menu labels	64.5%	61.5%	37.5%*
% that saw item labels	64.5%	30.8%*	43.8%
% that saw posters	71.0%	53.8%	62.5%
% that saw email	58.1%*	26.9%	28.1%

*Significantly different from other locations ($p<.05$)

When comparing the impact on the group as a whole to the impacts on the groups by location, there were not very large differences. The ACES group generally reported higher than combined average levels of impact and the McCombs and Law consistently reported lower than average. However, none of these differences reached significance ($p>.05$). See Table 4.6 below for detailed descriptions of differences.

Table 4.6: Intervention Impact Comparison By Location

	Combined	ACES (6-wk)	McCombs (4-wk)	Law (2-wk)
Purchased more green foods	23.6%	32.3%	15.4%	21.9%
Purchased more non-red foods	28.1%	38.7%	19.2%	25.0%
Purchased more yellow in place of red foods	14.6%	16.1%	15.4%	12.5%
Regularly purchased at least one green food	4.5%	0.0%	3.8%	9.4%
Labeling has impacted purchasing behavior	41.6%	54.8%	30.8%	37.5%

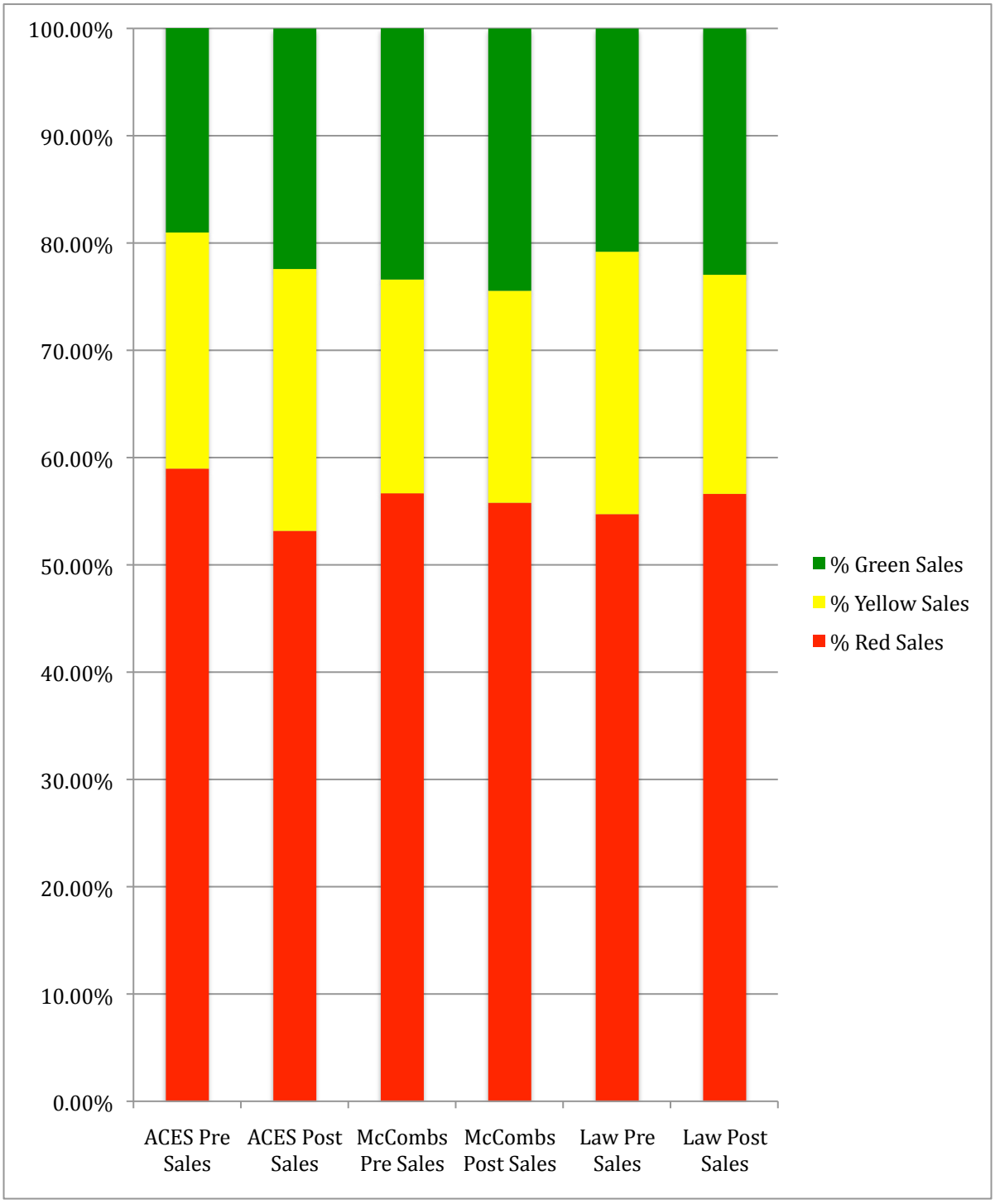
The breakdown by location for survey items related to the understanding of the intervention materials also followed the pattern of greater length of exposure having greater reported understanding and usage. ACES had a higher than average percentage of participants that reported the labels assisted them in selecting healthier foods, were not confusing, aligned well with their previous understanding of healthy foods, that they paid attention to the labels, and that they thought the labels were clear and accurate. The McCombs and Law groups reported these results slightly below the combined completer average. However, all the results were fairly close to the combined group average and therefore were not considered to vary by exposure.

Sales Data

A total of 87 foods were evaluated through the sales information provided. Of these foods, 43 were red, 34 were yellow, and 10 were green. Detailed breakdowns of the individual items color ratings and sales can be found in Appendix C.

As predicted, there was a significant increase in total green sales (21.6% to 23.4%) and a significant decrease in total red sales (56.0% to 55.1%) within the intervention locations ($r=-0.375$; $p=.044$). The sales data were then decomposed by location for evaluation. Although the overall model was significant, there were no significant differences in sales by location. See Figure 4.8 below for changes in sales by location.

Figure 4.8: Pre and Post Sales by Category and Location



Ch. 5: Discussion and Conclusions

Hypotheses and Results

This study was designed to test an informational intervention to convey nutritional information and drive healthy selections in a manner that requires low health literacy. Specifically, a red, yellow, and green stoplight was utilized as a metaphor to convey the nutritional value of the foods. Given that the stoplight is a universal symbol that relays common concepts in any situation (i.e. green means go, red means stop, yellow means slow down), it was expected to be well received and understood by those at various levels of health literacy. For example, there is established evidence that the stoplight provides an intuitive method for identifying healthy and unhealthy foods with children (Schetzina, 2011).

It was hypothesized that adults would also find the stoplight intuitive and therefore utilize it as a quick and efficient means for identifying healthier choices. This approach appears to have been effective in our adult population as evidenced by the post survey responses. Not only did the majority of people report that they found the stoplight labels to be clear, accurate, and easy to understand, they also reported that the labels aligned well with their understanding of healthy foods.

Within the social ecological model, it is recognized that individual and social environmental factors impact health behavior choices. The labeling of foods with the stoplight is designed to influence both of these levels. At the intrapersonal level, the stoplight's intuitive nature provides an individual with the knowledge of which foods were healthy. In this case, the general understanding of the red, yellow, and green concepts was demonstrated by the population's ability to select reasonable

percentages of each category of food for daily consumption. Also at the intrapersonal level, knowledge and beliefs are a driving force behind behavior. One of the original hypotheses was that there would be an improvement in healthy eating knowledge following exposure to the R/Y/G labeling. Unfortunately, the improvements in knowledge were not evidenced by changes in the pass/fail rates of the top ten foods test. This could be due to the fact that many of the patrons reported regularly purchasing very few of the top ten foods. It was hypothesized that these foods would be seen often, however if individuals purchase the same foods every time they eat at this eatery, they might not be paying attention to the labels on other foods. It may have been more beneficial to ask the patrons to identify and rate several foods they regularly purchase at the pre-test, and then ask them to do the same at the post-test. This would provide a better assessment of the intervention's impact on their knowledge. In addition, there was no evidence of an improvement in self-reported knowledge. Thus, this aspect of the hypothesis was not supported. However, it is important to recognize that more than half of the participants reported that they were very knowledgeable about healthy eating at the pre-test. Thus, there may be a ceiling effect for this construct.

At the social level of the social ecological model, the labeling was expected to have a two-fold effect: 1) creating an environment conducive for healthy eating and 2) patron selection of green and yellow items creating a template for behavioral modeling. The successes of these efforts were demonstrated in several ways from the post survey. Almost a quarter of the population reported that they were purchasing more green foods as a result of the labels and a little more than a quarter

of the population reported that they were purchasing more foods not labeled red. More than 20% of the population reported seeing others utilize the labels and most people reported that they observed others ordering equally healthy choices, indicating some impact on the perception of a social norm for healthy eating.

Likewise, it was anticipated that providing POP labeling would also foster an environment that was supportive of healthy eating. This was clearly evidenced by the significant findings associated with the awareness and utilization of the intervention. The majority of the population reported seeing the various communication materials and the observations of these materials were significantly associated with individual's positive food choices. There were significant correlations between observing menu labels, item labels, posters, and the informational email and self-reported purchasing of more green foods and less red foods, replacing red foods with yellow foods, and general utilization of the labels to select healthier foods.

In summary, the process data evaluated for this study clearly demonstrates the general success of this intervention. It was found that people took notice of the labels, found them easy to understand and helpful for choosing healthy foods. A majority reported using the labels regularly. Based on these findings, we would assume that there would be significant changes in the sales of the foods as originally predicted.

The overall model evaluating changes in sales was significant, which indicates success of the intervention in changing purchasing behavior. However, this effect was minimal and would not warrant recommendations to implement this

intervention for widespread use. There was a significant decrease in red foods and a significant increase in green foods, as predicted. Unfortunately, these changes in sales were very minor (1.0% overall decrease in red sales and 6.5% increase in green sales).

Comparison to Similar Studies

The impact on self-report is similar to other studies that have used POP labeling. Our findings of patron awareness of the labels were consistent with other studies that reported 60-75% awareness of the labels (Bassett, 2007; Dumanovsky, 2010 and 2011; Pulos, 2010). However, our findings demonstrated greater utilization of the labels than what was reported in other studies (47.6% vs. <30%) (Bassett, 2007; Dumanovsky, 2010 and 2011; Pulos, 2010). It is also important to note that this dissertation offered a more in-depth subjective assessment than has occurred in other studies. The extensive subjective evaluation makes this study truly unique and provides valuable contributions to the literature surrounding POP labeling.

With regard to objective measures, although the findings of this study are significant, the changes to sales were minimal. This is consistent with previous findings that had objective evaluations of behavior change. Sutherland, et al (2010), showed that POP labeling of healthy foods within a grocery store generated a significant increase in sales of foods labeled as "healthy." Similar to this study's results, the increases in sales minimal: <0.5% after one year of implementation and <1% after two years (Sutherland, 2010). Freedman, et al (2010), also found non-significant and minimal increases (3.6%) in sales of foods that were labeled healthy

within a market setting. Thus, while neither of these studies evaluated POP labeling effects on purchasing behavior within a restaurant style setting, the similarity in results calls the use of POP into question.

The majority of the literature that evaluates restaurant POP labeling involves calorie labeling. Several of these studies found that adding calorie labels caused patrons to order significantly lower calorie foods. Interestingly, like the changes in sales that were found in this study, although significant, the changes in calories were of minimal impact. For example, Pulos, et al (2010), found that entrée sales at intervention restaurants had significantly lower average calories after implementing calorie labeling on the menu. However, the average difference in calories from pre to post intervention was a meager 15 calories, or just 0.0075% of the general recommendation of 2000 calories per day.

Although the majority of POP labeling studies performed within foodservice eateries has shown minimal impacts, Thorndike, et al (2011), was able to demonstrate a much larger impact with the red, yellow, and green labeling system. Specifically, red sales decreased by 9.2% and green sales increased by 4.2%. Unlike this study, Thorndike, et al, (2011) was able to implement for a longer duration (6 months) and was able to include all foods within the eatery location. Given the challenges in this dissertation with both brief duration and collecting data on only a sub-set of foods (see limitations described below) there is some reason to continue to pursue this line of research.

Design Limitations

There are a number of limitations to this dissertation associated with the design of the intervention.

Power: Anytime there is a null effect, there is a question of power. The power analysis demonstrated a need for 225 pre-survey participants with an anticipated post-survey completion of 75%, resulting in 168 post-survey participants. Unfortunately, we were only able to recruit 191 pre-survey participants and the post-survey completion of 46% provided a little more than half of the post-survey completions originally anticipated. However, the effects for the survey were of sufficient magnitude to result in significant tests. In contrast, there were only 3 locations. While the analysis was not nested – which would be expected for this design – the limited number of settings and the short duration undermines the ability to detect a significant effect.

Nutrition Rating System: The cut points for establishing the red, yellow and green tertiles were based on all the foods that were provided for analysis at the pretest. There were approximately 170 different foods and recipes and the tertiles were set up so that there was a fairly even distribution of red, yellow, and green foods (56, 62, and 47 foods). However, the food provider did not utilize the majority of these foods. In addition, while the majority of the offered foods were labeled, sales data were only available for approximately 30-40 items at each location – and these were not equally distributed amongst the categories. As a result, the amount of green foods that were included in the sales data analyses was approximately 3 per location. This greatly limited our ability to detect significant changes in the

percentage of total sales attributable to green foods. However, the amount of red foods was well represented and provided a fair test of the intervention. Despite this, the changes in sales of red foods were minimal.

In addition, the fact that the NRFI evaluates all foods on a 100-calorie serving amount provides fair assessment of nutrient density. Unfortunately, this does not control for the serving size that is actually being sold. For example, when 100 calories of the Cilantro Chicken Salad was compared to 100 calories of the Cilantro Chicken Salad Sandwich, the sandwich showed greater nutrient density. Hence, the sandwich received a yellow rating, where the chicken salad alone received a red. However, when the calories are compared for the two items, the sandwich had a lot more calories. For weight management and obesity prevention, it is important to consider the calorie density of foods in addition to the nutrient density.

Exposure Time: Another factor that could have influenced the lack of change in sales could be the exposure time. When evaluating changes in sales at the individual location level, there was an increase in sales of red-labeled foods at the Law location. This could be due to the fact that the Law location had the shortest amount of exposure. In addition, the implementation at the Law location occurred during Phase 4 and the informational email about the intervention was sent out during Phase 1, which would also be expected to undermine the effect. Unfortunately, the small number of foods and locations prevented a sufficiently powerful assessment of differences as a function of duration of implementation.

In addition, the time of year when the intervention took place could have created a diminished effect. Pre-survey recruitment took place in early March.

Implementation began after spring break and ran through the last week of classes and "dead" days, which occur between classes and exams. There was a clear decrease in frequency of visitation from pre- to post-test (see Table 4.2). The timing of implementation could have contributed to the observed decrease in frequency of visitation and overall food sales during the posttest. Such a reduction might make it difficult to detect change in sales.

Locations: There were some limitations of the eatery used that could have impacted the results. One of these was the lack of a good control location. Although there was a large overlap of foods served, the eateries were all different from each other. ACES and Law had rotating hot menus, while McCombs had a consistent hot grill menu. In addition, it appeared that the population that most utilized eateries varied greatly by location. While ACES appeared to attract mostly faculty and staff, we found that McCombs and Law had a much larger student draw. This could have greatly impacted the sales of each location and is a large limitation when comparing the locations to each other.

The lack of change in knowledge surrounding the top ten foods can also be partially attributed to the differences among locations. First, not all locations sold all the items that were on the list. Without exposure to each of the items, we cannot expect the participants to know what their ratings should be. Second, although these items were reported as the top ten selling items for the business, the percentage of total sales these items generated during our data collection periods was minimal. For example, the hamburger and the ham and provolone sandwich both had large decreases in the percentage of people that accurately rated them.

This is not surprising when it is recognized that the burger only contributed 1% of the total sales and the ham and provolone sandwich a meager 1.5%. Contrast this with a top selling item like the crispy chicken avocado wrap, which contributed 12.1% of the sales and had a 13.2% increase in the percentage of people that correctly rated it. Likewise, the manager of O's Campus Café declared that the breakfast tacos are by far their most popular and highest selling items. Although we were unable to evaluate any changes in sales of breakfast tacos, both showed an increase in the percentage of people accurately rating them. The potato, egg, and cheese taco showed almost a 10% increase in the rating accuracy. These findings support that the labels could have had a larger impact on individual's knowledge than what was represented from the survey findings. It is recommended that future studies target the most popular items.

Population and Environment: Other limitations of this study include the population studied and the environment in which the intervention was implemented. The population utilized was a highly educated with higher than average socioeconomic status. This limits the translatability of this study to other populations. However, given the effectiveness of the stoplight labeling with children, there is a likelihood that this could be an effective means of health communication with other populations and future research with different populations is warranted.

The environment provided several limitations. The city in which we implemented poses a threat to validity as Austin is recognized as a "healthy" city with health conscience residents. In fact, Austin was the ranked as the 11th

healthiest city in the nation by the 2013 American College of Sports Medicine 's American Fitness Index (Chamness, 2013). This was supported within the population studied by the pre-survey data showing that 98.9% of the individuals surveyed declared themselves as either somewhat knowledgeable or very knowledgeable about healthy eating and, 68.6% reported that they make regular efforts to eat healthy or that they always eat healthy. In addition, UTA is like a community within the city of Austin. With >15,000 employees and close to 50,000 students spanning over 20 acres, it truly resembles a small city. There is an ongoing effort to create a healthy campus through the campus wellness network. This promotes a culture of wellness throughout campus that certainly could have created a confounding effect.

Procedural Limitations

Part of what makes this study unique is the design and implementation. Unlike much of the research in this area, this study was designed to evaluate two facets of behavior change: subjective and objective. There were many hurdles that had to be overcome during the design, implementation, and evaluation processes of this intervention.

Eatery Selection: During the design process, the selection of potential eateries for implementation of the program proved to be difficult. This was in part due to the effort to include input from the UTA Healthy Dining Workgroup. This workgroup is comprised of several campus dietitians, the Faculty and Staff Wellness Director, and other employees with a vested interest in improving the healthy eating options available on campus. When eatery recruitment began, we had approval

from the Food Service Director at the UT Division of Food and Housing to implement the program in all the campus dining halls. This would have allowed for a much broader inclusion of students in the participant pool. Unfortunately, several members of the Healthy Dining Workgroup voiced concerns about implementing within student-focused locations because labeling foods red might have a negative association for those at risk for eating disorders. It was agreed that we would only implement within locations that targeted more faculty and staff. Fortunately, O's Campus Café was very supportive of the initiative and willing to allow implementation at all of their locations. However, utilizing O's Campus Café did create a limitation due to the fact that their flagship location was much larger than their two auxiliary locations along with differences in the menus.

Survey Recruitment: The recruitment and follow-up for the survey also proved to be more difficult than originally anticipated. There was a goal of 75 surveys per location. This was not achieved at two of the three locations. One of the issues with the recruitment was a lack of people that eat at O's Campus Café on a regular basis. Part of the inclusion criteria for participation was that they must be faculty or staff and report eating at O's Campus Café >4 times per month. A large number of people were not eligible to participate due to the fact that they did not meet these criteria. Additionally, the customer base was relatively small, with the same people encountered during the second week of data collection.

In addition, we had a large attrition rate for the post-survey. Although it was established during consent to participate that there would be a follow-up survey, less than 50% of the original sample completed the post-test. Fortunately, there

were no statistically significant differences between the completers and non-completers. Unfortunately, the lack of response affected the statistical power. For improved response rates, it would be advisable to include some form of incentive.

Recipe Analysis: The analyses of the recipes and various foods were a challenge that was unanticipated. During eatery recruitment, the manager of O's Campus Café stated that they had lists of the various menu items with detailed ingredients lists. When asked for this information, it became apparent that not all the recipes were documented and not all ingredients and exact amounts of ingredients were available. Unfortunately, this created a recurring challenge during the recipe analysis process where a recipe would be partially entered and we would then have to wait for feedback about an amount or type of a specific ingredient. In addition, some of the most common foods that were offered were never obtained for analysis, despite many efforts requesting the recipes. Another hurdle to recipe analysis was presented when the O's Campus Café hired a new chef within weeks of implementation. The new chef overhauled the menu. These changes to the menu are why many of the foods that were analyzed were not used during the data collection. The menu changes were also why many of the foods that were offered could not be evaluated, as we did not receive the new recipes before implementation had begun.

Foods Offered: Although the menu at O's Campus Café provided a larger variety of red, yellow, and green foods than other campus eateries, it was still quite limited. Particularly, there were limitations of green rated entrees and alternatives. On most days, if a patron wanted to purchase the entrée of the day, they were

limited to only red items as there was not a second entrée available. In addition, those with special dietary needs, such as vegetarians, were often limited to one or two options, which meant they would have to purchase whatever food was available, regardless of its label. These restrictions may have forced patrons to purchase red or yellow foods when their intent was to purchase green foods. It would be beneficial to have a larger spread of diet specific foods within each category to overcome this limitation in future studies.

Implementation: There were also several hurdles that had to be overcome during the implementation of the intervention. To begin, it was originally anticipated that the employees of O's Campus Café would be trained to put the appropriate stoplights next to the foods on the menu boards and on the individual grab and go food items. Within the first week, it was apparent that the employees did not have the time to place the labels. In addition, the individual food items were not consistently labeled. In order to overcome this, a schedule was developed in which a member of the research team would assist with writing the menu boards and putting the correct labels next to the menu items. This is also why the grab and go items were given large, permanent tags. However, this provided another hurdle since the adhesives used for the tags did not hold well. A suitable tag was not found until week three of implementation, which meant that many of the grab and go items were without labels at some point during the first several weeks. For future studies, I would recommend anticipating and requesting no assistance from those that lack a vested interest in the study (i.e. eatery employees). Implementing within

an eatery with a more permanent menu would be recommended so that labels can be placed at the beginning and do not require a high degree of maintenance.

The table tents created a hurdle for the awareness component of the intervention. At the ACES location, the tables at which people eat are encompassed within the eatery. However, at the McCombs and Law locations, the tables are in a separate space. The table tents at ACES were left in place for several weeks because the O's Campus Café employees were made aware of the intervention and that the table tents were a part of it. This was not the case at the other locations since the spaces where the table tents were put up were cleaned by custodial services. After all of the tents at McCombs were thrown away, we attempted to make custodial services aware of the intervention and asked that they not throw away the table tents again. Unfortunately, we were told that there is too much variation in the employee who is assigned to clean that space and they could not guarantee that the table tents would be left alone. After a second set of table tents was thrown away, no more were put out. This creates an advantage of communication about the intervention to the patrons of the ACES location over the other locations. There were no significant differences in sales between the locations; therefore, it is not believed that this limitation had a large influence. However, it is recommended that durability of communication materials be pre-tested in the future. In addition, it would be a good idea to question how the facility is maintained in order to ensure that materials are maintained.

Sales Data: Lastly, this intervention is designed to shift people from red-labeled to yellow or green labeled foods. One might expect that this would be most

likely to occur with related food options. For example, there were four salads and four breakfast tacos offered. Within these, there were options for red, yellow, and green. Thus, it was anticipated that an individual coming in for a breakfast taco or a salad would be more likely to purchase a healthier version of that item rather than changing their order to a different type of food. In other words, it might be more likely for an individual to select a green-labeled salad over a red or yellow salad than for someone to choose a green-labeled salad instead of a red-labeled cheeseburger. Unfortunately, each location prepared a small number of these items and all breakfast tacos and salads sold out each day. This made it impossible to determine how the labels might have influenced the purchase. In addition, there were several days where the entrée of the day had two options, one green and one red. However, we could not evaluate if people chose the green over the red because the sale of an entrée was entered as "entrée of the day," with no differentiation between versions. A similar issue impacted side dishes, which were not tracked individually in the sales data. As a result, there was no way to test the most likely behavioral responses to the intervention through the objective data collection.

The reporting of the sales data also posed a problem. The original description of how the sales were reported was an itemized, digital list. Although the sales were reported in a somewhat itemized fashion, they were provided in hard copy on long, paper receipts. As a result, all the sales data had to be transcribed by hand. Also, the itemization was difficult to understand. For example, french fries would be included as three line items. When asked why this was, we were told that one line represented french fries being sold as a single item, one line represented

french fries as a part of a combo, and one line represented french fries added to an order as a side. Although this was an inconvenience that could be overcome, it did make the sales evaluation a more difficult and tedious process than was anticipated. For future research like this, it would be advisable to request samples of the sales data the eatery will provide before selecting the eatery to be included in the intervention.

Strengths

While there were many hurdles and limitations encountered with the study, there were many strengths and unique components that promote the success of this study. First of all, there was a large amount of collaboration to design and implement this study. Collaborators included myself, my advisor, the Faculty and Staff Wellness Director, many campus dietitians, members of the Healthy Dining Workgroup, nutrition student interns, several managers of various campus eateries, and the owner, manager, and staff of O's Campus Café. Almost all of the collaborators were working on this project on a voluntary basis and receiving no financial or other incentives. Furthermore, the managers of the various eateries that agreed to participate demonstrated a willingness to contribute to health initiatives that many believed would not exist. In fact, members of the Healthy Dining Workgroup voiced concerns that no eatery would want to implement a POP labeling system such as this based on the fact that they would have to label some of their foods as "bad" by giving them a red label. Not only did we not get this type of pushback from managers we recruited, we had 100% buy-in from all management

we approached with positive feedback about providing information about the unhealthy foods.

Another major strength of this study was the theoretical design. Much of the research surrounding POP labeling provides anecdotal justification, if any. This study is grounded in theory and the subjective findings support the theoretical constructs that were utilized. The constructs within the individual, social, and environmental levels of influence clearly affect behavior decisions. The results of this study demonstrate that, although minimal, positive and significant changes can occur when an intervention focuses on these constructs.

As previously mentioned, the subjective component of this study is one of the greatest strengths. The subjective data reported from other nutrition labeling studies is grossly limited and involves no health behavior theory. This study adds to current literature an understanding of how POP labeling can influence these important theoretical constructs for behavior change. Furthermore, it expands the understanding of how and to what extent we can expect POP labeling to be utilized to create population shifts in behavior. It is important to recognize that although the findings of this and other studies like this are significant, the impacts associated do not merit widespread use. On the other hand, it is important that minor shifts at the environmental level can have large implications. For example, a 1% reduction in sales of "unhealthy" foods at a grocery store that sells 100,000 items per month translates to 1,000 fewer "unhealthy" items sold each month. Expand this to several hundred locations, nationwide and a significant population impact may be seen.

Conclusions & Future Directions

The findings of this dissertation were significant and impactful for future research in this area. Despite the challenges to implementation, the process data and subjective responses demonstrated the largest results. If easy to understand information is available at point of purchase, people are more likely to utilize it for decision-making. These findings suggest that this strategy is promising, but not ready for widespread use.

Future directions for this line of research would include implementation in eateries with a larger variation of foods. In addition, it would be interesting to see if the stoplights on more permanent menus made a greater impact. The majority of the menus utilized by O's Campus Café were dry erase boards where the stoplight labels would be placed next to the handwritten name of the food. Putting the stoplight labels next to a more permanent menu - such as an overhanging sign or an actual handheld menu - would provide greater consistency and could possibly be more impactful.

It would also be interesting to test this within a lower health literacy population. Lower education and socioeconomic status individuals tend to be highest at risk for obesity and diet related health concerns, making this population more of a target for interventions such as this. O's Campus Café is considered a mid-range priced eatery. It is assumed that UT employees that have a lower socioeconomic status would eat at a lower priced eatery and/or bring their lunch with them. Therefore, it is not likely that this population was reached with the intervention. Furthermore, the survey data demonstrated that there is a large

population of individuals with higher levels of education, healthy eating knowledge and concern, and higher socioeconomic status. Considering the greatest benefit of the intuitive stoplight symbol is that it is understood by children, it would be beneficial to test this within adult populations with lower levels of health literacy.

Given the success of previous studies to change purchasing behavior by putting calories on the menu, it would also be interesting to see if a fusion of these two approaches could create an even greater impact (Bassett, 2007; Dumanovsky, 2010 and 2011; Harnack, 2008). One of the limitations of the stoplight system was that some foods with healthier ratings also packed in more calories. An example of this was the chicken salad and the chicken salad sandwich. The chicken salad as a stand-alone item was rated red but once it was made into a sandwich it's rating improved to yellow. This was due to the improved nutritional value that the whole wheat bread brought. However, the sandwich had quite a bit more calories than the chicken salad alone. Providing both the stoplight rating of the food and the calories overcomes the limitations of both of these approaches and may create greater change in behavior.

Lastly, it would be interesting to test if people select healthier versions of normally unhealthy foods. The O's Campus Café manager stated that some of the feedback the patrons provided about the intervention was that they would like the chef to simply make the foods that were red healthier so that they could have a better rating. This would mean doing things like baking fries instead of frying them, using leaner beef and possibly a whole wheat bun for the burgers, using a lower fat mayonnaise in the chicken and tuna salad, etc. It would be interesting to test if

people would respond to having a healthier option available. For example, you could order a red or a yellow burger with red or green fries.

Regardless of the direction the next study, this dissertation supports the basic hypotheses that point of purchase labeling impact awareness of food quality and, to some extent, purchasing behaviors. Thus, utilizing a low health literacy label provides a clear and understandable method for communicating healthy options. In addition, this study supports the evidence that environmental approaches can reach large numbers of people. More than 40% of the study participants reported that the labels influenced their choices. Thus these data would be expected to support future research in this area.

January 25, 2013

Dr. James Wilson, Ph.D.
Chair, Institutional Review Board
P.O. Box 7426
Austin, TX 78713
irbchair@austin.utexas.edu

Dear Dr. Wilson:

The purpose of this letter is to grant Brittany Crim, a graduate student at the University of Texas at Austin, permission to conduct research at O's Campus Cafe. The project, "Red, Yellow, and Green Food Labeling to Influence Consumer Purchasing and Knowledge" entails O's Campus Café allows analysis of their recipes and sales over several months at all of their locations. In addition, O's Campus Café will allow red, yellow, and green labels be places on menu boards and individual food packages. They will also allow posters and table tents describing and promoting the program to be placed throughout each location. There are three locations in total. Lastly, the project will ask faculty and staff patrons to complete a 5-10 minute survey two times. The surveys will include questions about their current nutrition knowledge, impressions of labeling, utilization of the labeling, and how often they frequent that establishment. All patrons on given recruitment days will be asked to participate, provided they are faculty or staff. Recruitment will occur in person at the point of purchase in each of the O's Campus Cafés. The purpose of this research is to identify if the intuitive red (unhealthy), yellow (less healthy), and green (healthy) labels improve healthy food sales and decrease unhealthy food sales, as well as improve knowledge about healthier food choices. I, Jeff Worden, General Manager of O's Campus Cafe, grant permission to Brittany Crim to conduct "Red, Yellow, and Green Food Labeling to Influence Consumer Purchasing and Knowledge" at O's Campus Cafe.

Sincerely,

Appendix B: Map of O's Locations

FoodName	
Asian Chicken Salad	GREEN
Broccoli Crunch	YELLOW
Cashew Chicken Wrap	GREEN
Curried Cauliflower	GREEN
Curried Cauliflower	GREEN
Greek Pasta Salad	RED
Greek Salad	GREEN
O's 3-Cheese Pizza	GREEN
O's Artichoke Sun-Dried Tomato Pizza	YELLOW
O's Asian Chicken Salad	YELLOW
O's Augratin Potatoes	YELLOW
O's Babbaganoush/Pita	YELLOW
O's Baja Mahi Fish Taco	YELLOW
O's Baked Potato	YELLOW
O's Baked Potato Soup	GREEN
O's Banana Fresh	GREEN
O's BBQ Chicken Pizza	RED
O's Beef Lasagna	YELLOW
O's Beef Sroganoff	YELLOW
O's Beef Stew	GREEN
O's Bevo Burger	YELLOW
O's Bevo Burger No Cheese	GREEN
O's Bevo Burger with Cheese	YELLOW
O's Borracho Beans	GREEN
O's Breakfast Taco Bacon, Egg, and Cheese	YELLOW
O's Breakfast Taco Bean, Potato, and Cheese	GREEN
O's Breakfast Taco Potato, Egg, and Cheese	RED
O's Breakfast Taco Sausage, Egg, and Chees	RED
O's Broccoli and Cheddar Soup	YELLOW
O's Broccoli and Cheese Casserole	YELLOW
O's Buffalo Chicken and Ranch Wrap-Up	RED
O's Buttered Baby Carrots and Sweet Peas	GREEN
O's Candy Bar Snicker	RED
O's Candy M&m Peanut	RED
O's Candy M&m Plain	RED
O's CBA Wrap	YELLOW
O's Cheese Pizza	RED
O's Chicken Cacciatore	GREEN
O's Chicken Caesar Salad	RED
O's Chicken Enchiladas	RED
O's Chicken Gumbo Soup	GREEN
O's Chicken Noodle Soup	GREEN
O's Chicken Parmesan	YELLOW
O's Chicken Picatta	YELLOW
O's Chicken Pot Pie	YELLOW
O's Chicken Salad	RED
O's Chicken Salad Deli Sandwich	YELLOW
O's Chicken Tender Basket	RED

O's Chicken Tenders	RED
O's Chicken Tortilla Soup	YELLOW
O's Chinese Vegetable Stir Fry	GREEN
O's Chip Potato Jalapeno Kettle	RED
O's Cinnamon Roll	RED
O's Clam Chowder Soup	GREEN
O's Classic Baked Ziti	YELLOW
O's Cookie Choc Chip	RED
O's Cookie Oatmeal Rsn	RED
O's Cool Ranch Doritos	YELLOW
O's Corn Chowder	YELLOW
O's Couscous Savoury	YELLOW
O's Cowboy Panini	RED
O's Cream of Broccoli Soup	RED
O's Cream of Mushroom Soup	YELLOW
O's Cream of Potato Soup	RED
O's Creamy Spinach Casserole	GREEN
O's Creamy Tortilla Soup - Vegetarian	GREEN
O's Crispy Chicken Avocado Wrap	RED
O's Cucumber Hummus Sandwich	RED
O's Dannon Yogurt Light and Fit Peach	YELLOW
O's Dannon Yogurt Light and Fit Strawberry	YELLOW
O's Doritos Nacho Cheese	RED
O's Eggplant Casserole	GREEN
O's Fiesta Chicken Salad	YELLOW
O's French Dip Roast Beef Sandwich	RED
O's French Fries	RED
O's French Onion Soup	YELLOW
O's Fresh Cut Fruit	GREEN
O's Fried Pickle Baket	YELLOW
O's Fried Pickles	YELLOW
O's Fruit, Apple	GREEN
O's Fruit, Orange	GREEN
O's Garden Burger	YELLOW
O's Garden Salsa Sun Chips	RED
O's Garden Vegetable Soup	GREEN
O's Garlic Buttered Pasta	YELLOW
O's Garlic Mashed Potatoes	YELLOW
O's Garlicky Broccoli Rabe	GREEN
O's Grape Red Sdls Fresh	GREEN
O's Greek Pasta Bake	GREEN
O's Greek Salad	YELLOW
O's Greek Wrap	YELLOW
O's Green Beans Almondine	GREEN
O's Green Chili with Pork	GREEN
O's Grilled Chicken Avocado Wrap	RED
O's Grilled Vegetables	GREEN
O's Ham and Pineapple Pizza	YELLOW
O's Ham and Provolone Deli Sandwich	YELLOW

O's Harvest Tomato and Basil Soup	GREEN
O's Hot Italian Panini	RED
O's HSS Fire Roasted Vegetarian Vege Soup	GREEN
O's Italian Meatball Sub	YELLOW
O's Kit Kat	RED
O's Meatloaf	YELLOW
O's Milky Way	RED
O's Minestroni Soup	GREEN
O's Miss Vickie's Jalapeno	RED
O's Miss Vickie's Smokehouse BBQ	RED
O's Muffin Blueberry	RED
O's Muffin Cranberry Nut	RED
O's Mushroom, Onion, and Basil Pizza	YELLOW
O's Nature Valley Granola Bar Oats 'n Honey	RED
O's Oikos Yogurt Blueberry	YELLOW
O's Oikos Yogurt Strawberry	YELLOW
O's Original Baked Lays	YELLOW
O's Pan Seared Pork Chop	RED
O's Pan Seared Salmon	YELLOW
O's Pepper Steak	YELLOW
O's Pepperoni Pizza	RED
O's Philly Cheese Steak	YELLOW
O's Plain Bagel	YELLOW
O's Planter's Nuts and Chocolate Trail Mix	YELLOW
O's Pretzal M&Ms	RED
O's Quaker Chewy Granola Bars Oatmeal Rai	YELLOW
O's Red Pepper Hummus	RED
O's Roast Beef and Pepper Jack Sandwich	YELLOW
O's Roasted Brussels Sprouts	GREEN
O's Rosemary Roast Potaoes with Garlic	GREEN
O's Ruffles Original	YELLOW
O's Santa Fe Chicken Wrap	YELLOW
O's Santa Fe Turkey Panini	RED
O's Sausage Pizza	RED
O's Scone Blueberry	RED
O's Scone Cranberry Orange	RED
O's Shepard Pie	GREEN
O's Skittles Original	RED
O's Snickers	RED
O's Spanish Rice	GREEN
O's Spinach Enchiladas	GREEN
O's Starburst Fruit Chews	RED
O's Steam Baked Rice	YELLOW
O's Strudel Apple Cinn Braided Bread	RED
O's Sun Chips Harvest Cheddar	YELLOW
O's Sun Chips Original	YELLOW
O's Sweet Potato Fries	RED
O's Tilapia Fish Taco	YELLOW
O's Tomato & Artichoke Pizza	GREEN

O's Tomato Basil Soup	GREEN
O's Traditional Hummus	RED
O's Tuna Melt Sandwich	RED
O's Tuna Salad	RED
O's Tuna Salad Deli Sandwich	YELLOW
O's Turkey and Cheddar Deli Sandwich	YELLOW
O's Turkey Club Sandwich	RED
O's Turkey Reuben Grilled Sandwich	YELLOW
O's Turkey Tetrazzini	YELLOW
O's Twix	RED
O's Vegetable Beef Soup	GREEN
O's Vegetable Lo Mein	YELLOW
O's Vegetable Muffaletta	YELLOW
O's Veggie Pizza	RED
O's Wild Rice and Mushroom Casserole	GREEN
O's Wild Rice Soup	GREEN
O's Yogurt Parfait	GREEN
O's Yogurt Vanilla Hny Greek	YELLOW
O's Zucchini Pizza Casserole	GREEN
O's Zucchini Saute	GREEN
Roasted Edamame	GREEN
Southwestern Black Bean Salad	GREEN

GREEN FOODS
Choose these foods OFTEN.

They are low in calories and high in nutrients.

YELLOW FOODS
Choose these foods LESS OFTEN.

They are higher in calories, but also high in nutrients.

RED FOODS
Try to LIMIT these foods.

They are high in calories and low in nutrients.

Have you noticed the traffic lights?

We have evaluated our menus and put traffic light labels on them to help you make healthier choices!

Here are some of the nutrients we considered:

Healthy Nutrients	Unhealthy Nutrients
Protein	Saturated Fat
Fiber	Sodium
Mono and Polyunsaturated Fat	Added Sugar
Riboflavin	
Iron	
Vitamin C	
Vitamin A	
Calcium	

Appendix F: Informational Email

Please come by O's Campus Cafe over the next few weeks to see how they are making healthy eating easier!

O's Campus Cafe has analyzed their menu and labeled their foods in order to make it easier for you to make the healthiest choices. All foods have been given a red, yellow, or green rating based on how nutrient dense they are. Foods that have received a "Red" rating have very little positive nutrient content, are higher in unhealthy nutrients, and should be consumed minimally. Foods that have received a "Yellow" rating have some positive nutrient content, some unhealthy nutrients, and should be consumed less often. Foods that have received a "Green" are high in positive nutrient content, have little to no unhealthy nutrients, and can be consumed frequently. The healthy nutrients evaluated in these developing these ratings are protein, fiber, unsaturated fat, vitamins A, C, E, B-12, thiamin, riboflavin, and folate, and minerals calcium, magnesium, iron, and potassium. The nutrients considered unhealthy are saturated fat, cholesterol, and sodium. For more information on how the foods have been evaluated, please contact Brittany Crim at nutrition@austin.utexas.edu.

We have already started labeling the menus at the ACES and McCombs Business School locations and will soon be labeling the menus at the other O's Campus Cafe locations in the Law School. For more information on what O's has to offer and where they are located, please visit their website at http://www.oscampuscafe.com/.

We hope to see you there!

O's Special Menu

Special Entree:

- Chicken Enchiladas
- Spinach + Mushroom Enchiladas

served w/
- Spanish Rice
- Borracho Beans
- Chips + Sour Cream

Soup:
- Chicken wild Rice
- Potato Leek

Tacos:
- Hamburger
- Pineapple + Ham

Grilled Menu Special

- Chicken Avocado wrap $6.50
- Chicken Tenders
- Fish Tacos one $4.00 two $7.50
- Bacon Burger $5.95
- Burger $5.95
- Cheese Burger $6.95
- Philly Cheese Steak $6.25

Sub & Go Salads

- Chicken Caesar
- Fiesta Chicken
- Greek Salad
- Asian Chicken

} $6.50

Appendix H: Eatery Weekly Checklist Date_____

1. Are there at least 2 posters visible within the eatery? Yes No

2. Are there stoplight tags next to all menu items? Yes No

3. Identify if the following menu items have the appropriate tag next to them:

    a. Turkey and Cheddar Sandwich_____ Yes No

    b. Ham and Provolone Sandwich_____ Yes No

    c. Bevo Burger with Cheese_____ Yes No

    d. Chicken Tenders _____ Yes No

    e. Asian Chicken Salad_____ Yes No

    f. Nacho Cheese Doritos_____ Yes No

    g. Oikos Greek Yogurt_____ Yes No

    h. Chocolate Chip Cookie_____ Yes No

    i. Fruit Salad_____ Yes No

    g. Snickers Bar_____ Yes No

Appendix I: Recruitment Script

"Hello, my name is _____. We are conducting a research project that is evaluating current and future nutrition knowledge and beliefs of faculty and staff. Are you an employee of UT?"

If they answer yes, then proceed. If they answer no then "Ok, this study if for UT faculty and staff, but thank you for your time. Have a nice day."

"On average, how many times per month would you say you eat at O's Campus Café?"

If they answer >/=4x per month, then proceed. If they answer <4x per month then "Oh, well thank you for your time."

"Great. Would you mind taking a few minutes today to answer a one-page survey for our research project? Would you also mind if we then emailed you a follow-up survey for you to fill out in a few months? You only need to provide us with your email address, which will be kept completely confidential and will only be used for the purposes of this study."

If they answer yes, then proceed. If they answer no then "Ok, well thank you for your time and have a nice day."

"Great, thank you so much for your help. First we will need you to fill out this informed consent. *(present informed consent)* This provides information for you about the study as well as information about what you are agreeing to do. This does not waive any of your rights, including your ability to withdraw from the study at any point. Please read through this consent and tell me if you still agree to participate."

Once participant has read consent and verbally consented, proceed.

"We will need to get your email address from you so that we can send you the link to the follow-up survey. It will be similar to the survey you are about to complete, but will have a few more questions. We will send it to you in approximately three months. Both today's survey and the follow-up survey will be completely anonymous. Your email will be kept confidential and will not be tied to your surveys at any point. Would you mind giving me your email address?"

Document email address on sheet provided..

"Thank you. Here is the survey and a pen. Take your time filling it out and just hand it to me when you are finished. Do not write your name on the survey. Thank you, again."

IRB USE ONLY
Study Number: **2012-12-0031**
Approval Date:
Expires:

Consent for Participation in Research

Title: Red, yellow, and green point of purchase labeling to change food purchasing behavior at a worksite setting.

Introduction

The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. The person performing the research will answer any of your questions. Read the information below and ask any questions you might have before deciding whether or not to take part. If you decide to be involved in this study, this form will be used to record your consent.

Purpose of the Study

You have been asked to participate in a research study about the effects of point of purchase labels on food selections**. The purpose of this study is** to identify if point of purchase labels of foods change the purchasing behavior, nutrition knowledge, and values.

What will you to be asked to do?

If you agree to participate in this study, you will be asked to

- Complete a one page written survey. This survey will ask you questions related to the nutritional value of foods and your feelings about healthy eating. No information that can identify you will be collected as a part of this survey.
- Provide your email address. In order to send you a follow-up survey, we will need to collect you email address. This information will be kept separate from the survey information in a confidential location. It will only be used to send you the link to the survey and will be discarded after the follow-up survey information has been sent.
- Complete a two-page follow up survey online. No identifiable information will be collected as a part of this survey.

This study will take approximately 10 minutes today, and 20 minutes at the follow-up and will include approximately 225 study participants.

What are the risks involved in this study?

There are no foreseeable risks to participating in this study.

What are the possible benefits of this study?

There are no direct benefits to you for participation in this study. It is hoped that the results will allow us to improve identification of healthy eating on campus.

Do you have to participate?

No, your participation is voluntary. You may decide not to participate at all or, if you start the study, you may withdraw at any time. Withdrawal or refusing to participate will not affect your relationship with The University of Texas at Austin (University) in anyway. By participating in this study, you are not waiving any of your legal rights.

What are my confidentiality or privacy protections when participating in this research study?

The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you with it, or with your participation in any study. All email addresses will be destroyed 2 months after data collection completion.

Whom to contact with questions about the study?

Prior, during or after your participation you can contact the researcher **Brittany Crim** at **512-471-0081** or send an email to **bcrim@austin.utexas.edu**

This study has been reviewed and approved by The University Institutional Review Board and the study number is **2012-12-0031.**

Whom to contact with questions concerning your rights as a research participant?

For questions about your rights or any dissatisfaction with any part of this study, you can contact, anonymously if you wish, the Institutional Review Board by phone at (512) 471-8871 or email at orsc@uts.cc.utexas.edu.

Participation

If you agree to participate, please tell the researcher at this time. You may keep this copy of this form for your records.

Appendix K

Pre/Post Eatery Patron Survey Survey ID_____

1. What is your gender? Male Female

2. Please describe your age: 18-29 30-44 45-59 >60

3. Please describe your highest level of education received:
   a. High school diploma/GED b. College degree c. Graduate degree d. Doctoral degree

4. Please describe your annual household income:
   a. <$30,000 b. $30,000-$59,999 c. $60,000-$89,999 d. >$90,000

5. How often do you eat at O's Campus Café on a weekly basis?
   a. >3 times per week b. 1-3 times per week c. <1 time per week

6. Which of the following O's Campus Café locations have you visited in the past month?
   a. ACES b. McComb's Business School c. Law School

7. How would you rate your knowledge of healthy eating?
   a. Very knowledgeable b. Somewhat knowledgeable
   c. Less knowledgeable d. Not at all knowledgeable

8. Which of the following best describe you:
   a. I don't worry about what I eat
   b. I try to eat healthy, but it is not a major concern
   c. I am a generally healthy eater and make regular efforts to choose healthy foods
   d. I always choose healthy foods

9. Please rank the following campus eateries in order of which you feel has the most healthy options available to the least number of healthy options available:
   _____ Littlefield Café
   _____ O's Campus Café
   _____ Jester City Limits
   _____ The Union
   _____ The Student Activity Center (SAC)

10. Below are descriptions of three categories (red, yellow, and green). After reading the descriptions of the categories, please match the following foods in the category you feel it belongs:

    RED category: Foods in this category have very little positive nutrient content, are higher in unhealthy nutrients, and should be consumed minimally.

    YELLOW category: Foods in this category have some positive nutrient content, some unhealthy nutrients, and should be consumed less often.

    GREEN category: Foods in this category are high in positive nutrient content, have little to no unhealthy nutrients, and should be consumed frequently.

    1. Potato, egg, and cheese breakfast taco
        A. Red
        B. Yellow
        C. Green

    2. Potato, bean, and cheese breakfast taco
        A. Red
        B. Yellow
        C. Green

    3. Chipotle chicken salad wrap
        A. Red
        B. Yellow
        C. Green

    4. Crispy Chicken Avocado Wrap
        A. Red
        B. Yellow
        C. Green

    5. Yogurt Parfait
        A. Red
        B. Yellow
        C. Green

    6. Chicken tender basket
        A. Red
        B. Yellow
        C. Green

    7. Turkey and cheddar Sandwich
        A. Red
        B. Yellow
        C. Green

    8. Cilantro Tuna Salad Sandwich
        A. Red
        B. Yellow
        C. Green

    9. Ham and Provolone Sandwich
        A. Red
        B. Yellow
        C. Green

    10. Hamburger
        A. Red
        B. Yellow
        C. Green

11. How many of the previous foods have you purchased in the past month?
    a. 0
    b. 1-3
    c. 4-7
    d. 7-10

Appendix L

Post Eatery Patron Awareness Survey:

1. Have you seen the red, yellow, and green labeling on the menus? Yes No
2. Have you seen the red, yellow, and green labeling on individual food items? Yes No
3. Have you seen posters about the red, yellow, and green labels? Yes No
4. Did you receive an email about the new red, yellow, and green labels at O's Campus Café? Yes No
5. What impact did this have on your choice to eat at O's Campus Café?
    A. Increased my desire to eat there
    B. Decreased my desire to eat there
    C. Had no impact on whether or not I wanted to eat there
6. What percentage of your diet do you think should be red foods?
    A. 100% B. >75% C. 50-75% C. 25-49% D. <25% E. 0%
7. What percentage of your diet do you think should be yellow foods?
    A. 100% B. >75% C. 50-75% C. 25-49% D. <25% E. 0%
8. What percentage of your diet do you think should be green foods?
    A. 100% B. >75% C. 50-75% C. 25-49% D. <25% E. 0%
9. How have the red, yellow, and green labels influenced your choices about the foods you have selected? (Select all that apply)
    A. I have purchased more "green" labeled foods.
    B. I have purchased foods NOT labeled "red."
    C. I have purchased more "yellow" labeled foods in place of "red" labeled foods.
    D. I have regularly purchased at least one "green" labeled item in my purchase.
    E. I have purchased less "green" labeled foods.
    F. I have purchased more "red" labeled foods.
    G. They have had no influence on my choices
10. On a scale of 1 to 5, please indicate how strongly you agree with the following statements (1=Do not agree, 5=Strongly agree):
    A. The red, yellow, and green labels help me select healthier foods ____
    B. The red, yellow, and green labels are confusing ____
    C. The green labels align well with my previous understanding of healthy foods _____
    D. I do not pay attention to the red, yellow, and green labels ___
    E. In general, I try to eat healthy foods ____
    F. I feel that the red, yellow, and green labels are clear and accurate ___
11. Do you see others using the red, yellow, and green labels when ordering food at O's Campus Café?
    A. Yes
    B. No

12. When you eat at O's Campus Café, what kind of foods do your friends/coworkers order?
    A. Mostly red labeled foods
    B. Mostly yellow labeled foods
    C. Mostly green labeled foods
    D. My friends/coworkers don't eat at O's Campus Café
13. How healthy do you feel you are eating in comparison to the average O's Campus Café customer?
    A. Much healthier
    B. Somewhat healthier
    C. About the same as others
    D. Somewhat less healthy
    E. Much less healthy
14. How often do you eat at O's Campus Cafe on a weekly basis?
    A. >3 times per week
    B. 1-3 times per week
    C. <1 time per week
15. Have you eaten at any other O's Campus Cafés in the past 3 months? Yes No

	HE Know	HE Concern	Menu Labels	Item Labels	Posters	Emails	Impact 1	Impact 2	Impact 3	Impact 6	RYG Assist	RYG Confuse	RYG Match	RYG Attention	RYG Clarity
HE Know	1														
HE Concern	**.329****	1													
Menu Labels	-.015	-.027	1												
Item Labels	-.177	-.202	**.422****	1											
Posters	-.010	-.068	**.597****	**.493****	1										
Emails	-.001	.042	**.448****	.183	**.364****	1									
Impact 1	-.051	.049	.195	**.270***	**.317****	**.271***	1								
Impact 2	-.045	-.066	**.377****	**.210***	**.376****	**.229***	**.300****	1							
Impact 3	.124	.056	.191	.055	.186	.068	**.295****	**.449****	1						
Impact 6	-.033	-.036	**.414****	**.299****	**.412****	**.322****	**.659****	**.741****	**.490****	1					
RYG Assist	.007	-.027	**.280****	**.243***	**.273****	**.249***	**.586****	**.527****	**.450****	**.721****	1				
RYG Confuse	-.031	-.173	**.337****	**.271***	.164	.120	.203	.185	.156	**.226***	**.236***	1			
RYG Match	-.066	.030	**.181**	.132	**.279****	.082	**.254***	**.290****	**.232***	**.382****	**.421****	**.225***	1		
RYG Attention	-.118	.062	**.337****	.182	**.282****	**.283****	**.476****	**.381****	**.261***	**.524****	**.576****	**.288****	.161	1	
RYG Clarity	-.095	-.043	**.327****	**.303****	**.284****	**.238***	**.419****	**.299****	**.258***	**.444****	**.578****	**.468****	**.716****	**.218***	1

HE Know=Healthy Eating Knowledge; HE Concern=Healthy Eating Concern; Impact 1=Purchase more green labeled foods; Impact 2= Purchased more foods not labeled red; Impact 3=Purchased more yellow labeled in place of red labeled; Impact 6=Have changed purchasing behavior; RYG Assist=Labels helped in food selection; RYG Confuse= Found the labels confusing; RYG Match=Green labels align well with my understanding of healthy foods; RYG Attention= Did not pay attention to the labels; RYG Clarity= Found the labels clear and accurate

*p<.05

**p<.001

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