The Usefulness of Targeted Messaging Techniques to Promote Healthy Food Choice in the Food Retail Environment

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Objectives:

The present study aimed to assess the effectiveness of various messaging techniques to influence adults' intention to purchase healthy foods. The specific aims were: 1) assess the acceptability and validity of a vignette survey to assess participants' intention to purchase healthy foods; 2) compare the relative influence of food product messaging on intention; 3) examine whether messaging impacts intention differently by sociodemographic group (i.e., age, race/ethnicity, and SNAP eligibility).

Methods:

In the food label vignette survey, participants were randomly shown three food labels and asked how likely they were to purchase the product. The labels varied by: 1) food type (yogurt, cereal, or black beans); 2) cost (25% off coupon vs. no coupon); 3) FDA "Healthy" logo (logo vs. no logo); 4) shopper rating (3-star rating vs. 5-star rating). Phase 1 participants (n=20) completed the survey and participated in cognitive interviews to determine survey acceptability and validity. The survey was modified and administered to Phase 2 participants (n=4941). Data were analyzed using multiple regression. Interaction effects were examined to assess differences in mean scores between demographics.

Results:

Phase 1 participants were predominately male (65.0%), white (65.0%), and had a mean age of 42.85 ± 22.91 years. Interviews revealed that "healthy" was largely defined by the nutrient content of the food and food preference emerged as a primary influence on food choice. Phase 2 participants were predominately female (62.1%), white (67.8%), and had a mean age of 32.19 ± 8.58 years. The influence of the vignette attributes on intention to purchase differed by food type. A 5-star shopper rating had the largest positive effect on purchasing intention (yogurt: β=6.969, p<0.001; cereal: β=6.825, p<0.001; beans: β=7.575, p<0.001). There were few significant interaction effects observed, largely confirming the hypothesis that the relative importance of the vignette attributes would not differ by participant demographics.

Conclusions:

These findings can inform future health promotion campaigns and the application of tailored messaging techniques to increase intention to purchase health foods. Future research should aim to examine additional motivations for food choice and their relative importance on food purchasing decisions in real-world settings.

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Preface

Thank you to all who have offered their support and guidance throughout the process of completing this work. I would firstly like to the thank my participants without whom this work could not be accomplished. Their generosity with their time and insights gave context and life to these research questions.

1.0 Introduction

Of the top ten leading causes of death in the United States, six are associated with poor diet quality (Abdelaal et al., 2017; Murphy et al., 2020). Diet quality can be defined as the extent to which an individual complies with the guidance provided by the Dietary Guidelines for Americans (DGA) 2020-2025 (i.e., adequate intakes of fruits, vegetables, whole grains, and lean proteins) (USDA, 2020). Despite the well-established relationship between diet quality and health, only 9% of US adults are meeting the recommendations for fruit and vegetable intake, with the greatest disparities experienced by those living below the poverty line (Lee-Kwan et al., 2019). Further, racial/ethnic minorities often report poorer total diet quality when compared to non-Hispanic whites (Satia, 2009). In addition to structural and systemic factors (e.g., racism, residential segregation), these inequities may be partly explained by the difficulty individuals face in changing previously adopted habits (Johnson et al., 2010; Ouellette et al., 1998).

Consuming a nutritious diet is a key component of achieving optimal health (USDA, 2020). The DGA are a set of guidelines developed for Americans that provide guidance on how to utilize foods and beverages effectively to support proper growth and development, health maintenance, and disease prevention. The guidelines for 2020-2025 are to: "follow a healthy dietary pattern at every life stage;" "customize and enjoy nutrient-dense food and beverage choices to reflect personal preferences, cultural traditions, and budgetary considerations;" "focus on meeting food group needs with nutrient-dense foods and beverages, and stay within calorie limits;" and "limit foods and beverages higher in added sugars, saturated fats, and sodium, and limit alcoholic beverages." Compliance with these guidelines is associated with positive health outcomes

including maintenance of a health body weight, reduction in chronic disease risk, and reductions in all-cause mortality.

Adopting and maintaining positive health behaviors, specifically those related to diet, has proven to be a significant challenge for many Americans (Johnson et al., 2010; Ouellette et al., 1998). On an individual level, common barriers to healthy eating often include perceived time availability, lack of nutrition knowledge, difficulty understanding and interpreting nutrition information, and perceived high cost of healthy foods (de Mestral et al., 2017; Reyes et al., 2013; Richards Adams et al., 2019). An individual's food choice is influenced by factors beyond their desire to live a healthy lifestyle, such as economic incentives, their perceptions of social norms, and their ability to understand and make informed decisions using food labels (Higgs, 2015; Nikolva & Inman, 2015; Rothman et al., 2006). The Nutrition Facts label, found on most packaged food products in the United States, displays the nutrient content of food with the aim of providing consumers with the information need to make healthy choices (FDA, 2022; FDA 2023). This information, however, is often difficult for the average consumer to understand; providing technical information, such as calorie counts, has been shown to be less effective than using commonly understood symbols (i.e., red light vs. green light food) in helping individuals interpret the healthfulness of a food product (Liu et al., 2014). The proposed regulation of the term "healthy" and the corresponding front-of-package labeling drafted by the Food and Drug Administration (FDA) are an example of an attempt to improve consumers' understanding of the healthfulness of their food through more interpretable messages (FDA, 2023, DPC, 2022) .

In addition, grocery store interventions that manipulate price by offering a coupon or discount for healthy foods have resulted in increased purchasing of target items (Hartmann-Boyce et al., 2018). Purchasing food in the food retail environment (i.e., grocery, supermarkets,

convenience stores) is an occasion where individuals' attitudes about food products and external influences, such as food labeling and messaging, interact to influence food choice (Carroll & Samek, 2018). Previous research has indicated the need to evaluate isolated message components to determine which are most effective in promoting positive health behaviors, particularly among key subgroups (e.g., racial/ethnic minorities, Supplemental Nutrition Assistance Program [SNAP] participants) (Mancino et al., 2018; Williamson et al., 2020).

The need for targeted health promotion messaging becomes apparent when examining the health disparities that exist among subgroups of the general population. Previous research has documented the disparities in diet quality that exist between racial/ethnic minorities and their non-Hispanic white counterparts (Lee-Kwan et al., 2019; Satia, 2009). This difference may be directly and indirectly attributed to the spillover effects of racism, discrimination, and poverty that disproportionately affect these populations (NIMHD, 2017). Those with low socioeconomic status (SES) experience higher rates of food insecurity, poorer access to healthcare, and greater instability in housing and employment than those with higher SES (Gallo et al., 2006; Lawman & Wilson, 2012; Sanjeevi et al., 2018; Vonneilich et al., 2012). These factors result in increased barriers to consuming a healthy diet and make changing previously adopted behaviors more challenging.

Because the determinants of food choice and diet quality are complex and multifaceted, assessment of these behaviors requires that multiple factors be considered. The use of vignettes allows for this type of multipronged analysis. Vignettes are short descriptions of a person or situation that contain references to what are believed to be the most salient factors for decision making (Hainmueller et al., 2015). Vignette methodology refers to the usage of vignettes in a survey format to assess an individual's response to a given set of circumstances. The use of vignettes allows for inquiry into the relative importance of various elements of decision making.

Previous research has utilized vignette methodology to assess a number of food related behaviors, including likelihood of wasting food, novel food acceptability, and perceptions of body image (Ellison & Lusk, 2018; Hartmann-Boyce et al., 2018; Lydecker et al., 2020). Analysis of a vignette survey provides information on what element within a given scenario is the most predictive of action, and thus, can inform future interventions to promote healthy eating.

The need for healthy, nutritious dietary patterns for all is apparent. What remains unclear are the motivations for individuals, particularly those from younger age demographics, racial/ethnic minorities, and low-income populations, to consume those healthy dietary patterns. Previous research has identified the importance and complexity of food retail messaging for encouraging healthy food purchasing behavior (Carroll & Samek, 2018; Higgs, 2015; Nikolva & Inman, 2015; Rothman et al., 2006). Although salient constructs for influencing food choice have been identified (e.g. economic incentives, understandability of food labels, social norms, etc.), further exploration into their relative importance is warranted.

1.1 Significance

While food purchasing does not necessarily equate to food consumption, purchasing healthy foods represents a crucial step in the process of improving overall diet quality (Mancino et al., 2018). Effective messaging techniques to encourage purchasing healthy foods are essential. Previous research has demonstrated that "intention to act" is a key predictor of behavior (Ajzen, 1991). By increasing the strength of an individual's intention to purchase healthy foods through targeted messaging techniques, it may be possible to increase the likelihood that they will take action (i.e., "nudge" them toward purchasing more fruits and vegetables or lower fat dairy) (Just

& Gabrielyan, 2018; Payne & Niculescu, 2018). Knowing what factors are most influential for individuals when making food purchasing decisions is a crucial step in developing effective healthy nutrition promotion campaigns. This will better position health professionals and food retailers alike to effectively encourage healthier food purchasing behaviors in store at the time of purchase. In addition, understanding differences in motivation between subgroups of the population will allow for the application of more appropriate, tailored messaging techniques.

1.2 Conceptual Framework

The Theory of Planned Behavior (TPB) is commonly used to explain the discrepancy that often appears between an individual's intentions and their actions (Ajzen, 1991). The TPB asserts that a significant proportion of the variability observed in acting on a given behavior can be attributed to the strength of the intention to perform the given behavior. This suggests that with an increase in an individual's intention to act, the likelihood of action also increases. Previous research has shown that the TPB can be applied to health behaviors and can successfully predict eating behavior (Conner et al., 2002; Sheeran et al., 2001). This theory provides a framework for how to impact health behaviors, such as diet, in indirect ways by increasing an individual's intention to consume healthy foods.

The conceptual framework for this study is informed by theoretical constructs drawn from the Theory of Planned Behavior (TPB) and the field of behavioral economics. TPB asserts that intention to act accounts for a significant amount of the variability in actual behavior (i.e., increased strength of intention results in increased likelihood of action) (Ajzen, 1991). The present study will focus on two relevant theoretical constructs: 1) social norms (i.e., the perception of

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social pressure to act) and 2) perceived behavioral control (i.e., the belief the individual has the resources necessary to successfully complete the action) on intention to act (i.e., intention to purchase healthy foods). Behavioral economics is a combination of psychology and economics that investigates what happens in environments when some of the actors exhibit human limitations and complications (Mullainathan & Thaler, 2000). When selecting foods, individuals often choose less nutritious foods that are not in the best interest of their long-term health. Relevant theoretical constructs are bounded rationality and the perception, or misperception, of social norms. Individuals apply bounded rationality when they do not have sufficient resources (e.g., information, cognitive ability, time) to make the best decision in the moment (Matjasko et al., 2016). For example, this may occur when individuals have difficulty interpreting food labels or perceive healthy foods as being too expensive (Liu et al., 2014). Individuals are influenced by the (mis)perception of social norms when they exhibit a desire to behave in ways that appear to be acceptable to their peers.

The proposed relationship between these concepts as they inform the present study are illustrated in Figure 1. We purpose that the principle of (mis)perception of social norms maps clearly onto the theoretical construct of social norms drawn from the TPB, and thus directly informs intention. Similarly, we propose that the principle of bounded rationality is most closely related to the TPB theoretical construct of perceived behavioral control. Actions that improve an individual's ability to make a rational decision (e.g., making food labels easier to understand, lowering the financial barrier to purchasing healthy foods) will in turn increase their perceived control over their actions in a given situation. In the present study, we hypothesize that providing a coupon and improving comprehension when reading a food label (i.e., bounded rationality) will increase participants' perceptions that they have the resources necessary to make an informed

decision, thus increasing their perceived behavioral control and increasing their intention to purchase a healthy food product. We also hypothesize that food products that receive a higher shopper rating will be perceived as more desirable.
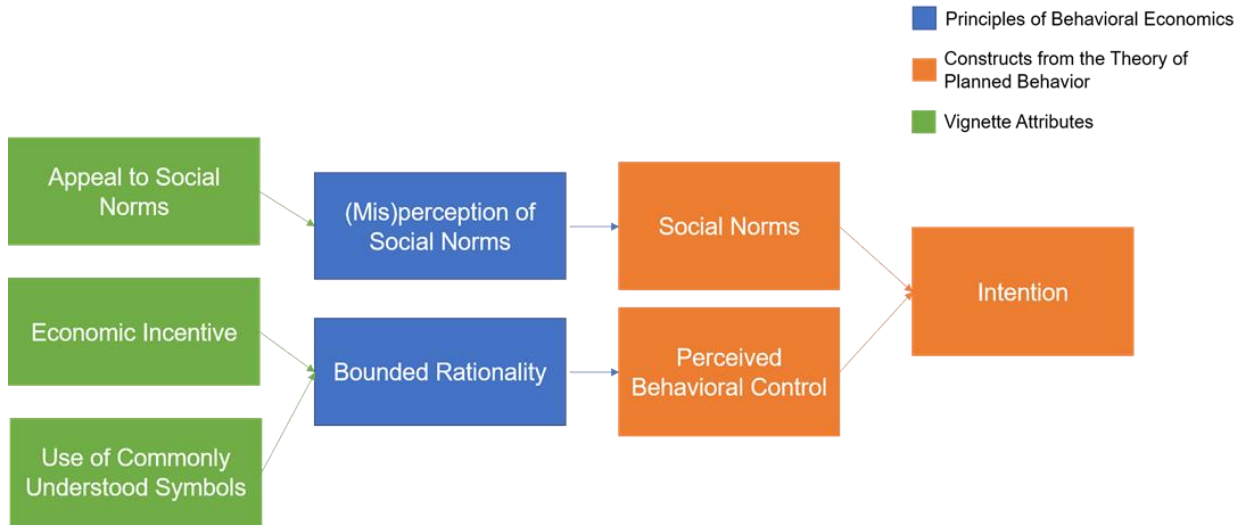
Figure 1. Proposed Theoretical Framework for Intention to Purchase Healthy Foods

This study is novel in its aim to examine the relative importance of factors known to influence food choice and to give priority to understanding this relationship in previously understudied populations, such as young adults, racial/ethnic minorities, and low-income participants. This study carries high public health significance as the findings can inform future health promotion efforts by determining which methods of communication are the most effective in increasing purchasing intention for healthy food items.

1.3 Specific Aims

The present study utilizes vignette methodology to assess the effectiveness of various messaging techniques to influence individuals' intention to purchase healthy foods. The specific aims are as follows:

Aim 1: To assess the comprehension, retrieval, judgement, and response processes of the vignette survey to assess intention to purchase healthy foods. We hypothesize that the format will be valid, well received by participants, and result in low participant burden. To assess this aim, the investigator pilot tested the vignette surveys with a representative subgroup of the target sample (n=20). A series of semi-structured, cognitive interviews were used to determine the acceptability of the surveys by participants. Surveys were revised and finalized based on participant feedback.

Aim 2: To compare the relative influence of economic incentives, commonly understood symbols of healthfulness, and social norms on participants' intention to purchase healthy foods. We first hypothesize that messaging that utilizes economic incentives (e.g., coupons), commonly understood symbols of healthfulness (e.g., front-of-package FDA healthy logo), and appeals to social norms (e.g., shopper rating) will be most effective in increasing participants' intention to purchase healthy foods compared with messages that do not reduce financial barriers, improve comprehension, nor align with social norms. Secondly, we hypothesize that messages utilizing economic incentives will be the most salient determinant of decision making compared to those messages utilizing commonly understood symbols and/or appealing to perceived social norms.

Aim 2b (exploratory): To examine whether the preferred messaging techniques to increase intention to purchase healthy foods differs by participant demographics (i.e., age,

race/ethnicity, and SNAP eligibility). We hypothesize that no difference will be observed by participant demographics.

2.0 Literature Review

Diet plays a complex and multifaceted role in health and disease. Consuming a nutritious diet across the lifespan contributes to a reduction in the risk for chronic disease and all-cause mortality (USDA, 2020). However, poor dietary patterns over time can have the inverse effect and negatively impact health and disease risk. Six of the top ten leading causes of death in the United States are related to poor diet quality (Murphy et al., 2020). These include conditions such as heart disease, the number one cause of death among Americans, as well as cancer and diabetes. Improvements in diet quality are consistently associated with improvements in health outcomes (USDA, 2020).

2.1 Nutrition and Health

The body requires a variety of nutrients in appropriate amounts in order to achieve and maintain optimal health. The six nutrients required by the human body are carbohydrate, lipid, protein, vitamins, minerals and water (Dashty, 2013; Harvey, 2011; Popkin et al., 2010; Semba, 2012). Each nutrient is essential, meaning that it must be obtained from the diet; the body is unable to produce it or cannot produce it in the amount necessary for proper growth, development, and maintenance (Sizer & Whitney, 2017). Although each nutrient is required for health, when consumed in excessive or inadequate amounts, they can contribute to negative health outcomes such as chronic disease and mortality (USDA, 2020).

Nutrient needs change over the lifespan, and special consideration should be given to the physiologic and behavioral changes that occur at each stage. Over the course of childhood and adolescence (age 2-18 years), requirements for all nutrients increase significantly (USDA, 2020). Diet quality, however, declines during this critical period in development and overconsumption of added sugar, saturated fat, and sodium is typical. This increase in nutrient need coupled with the decline in diet quality increases the risk for nutrient deficiency. These trends continue into adulthood (age 19-59 years). Seventy four percent of adults in the United States are overweight or obese (Ogden et al., 2020). There is an increased need for fiber, calcium, and vitamin D during adulthood; however, few individuals achieve the dietary recommendations (USDA, 2020). A recommendation for all adults is to reduce the amount of added sugar, saturated fat, and sodium in the diet. In older adulthood (age 60 years and above), eating food for pleasure, the ability to chew and swallow, and general food safety become a higher priority. The recommendations for protein and vitamin B12 increase during this time to support healthy aging.

2.1.1 Importance of Dietary Patterns and Measuring Diet Quality

A dietary pattern is defined by the totality of foods and beverages an individual typically consumes over time (USDA, 2020). Acute eating episodes rarely have a substantial impact on overall health. Patterns of consumption, however, serve as robust predictors of health and disease risk. A healthy dietary pattern emphasizes nutrient rich foods, meaning those contribute a high level of essential nutrients for relatively few calories (Sizer & Whitney, 2017). They include foods from all major food groups and subgroups that should be consumed on a daily or weekly basis. Guidelines for healthy dietary patterns are not prescriptive in the types of foods from each group that should be consumed. Rather, they only provide the amounts that are recommended from each

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food group. This allows for flexibility and customizability of individual diets based on preferences. Recommended amounts of each food group can be adjusted for age, gender, and physical activity level. An example of a healthy dietary pattern can be seen in **Table 1** (USDA, 2020).

By adhering to the recommended portions of each food group at an appropriate calorie level, an individual is more likely to consume greater portions of fruits, vegetables, whole grains, and lean proteins and decrease their consumption of red meat, added sugar, and saturated fat (USDA, 2020). Consuming a healthy dietary pattern over the lifespan reduces the risk for diet-related diseases such as type 2 diabetes, cardiovascular disease, certain cancers, and all-cause mortality, and contributes to the maintenance of a healthy body weight.

Table 1. Healthy Dietary Pattern for an Adult Based on a 2,000 Calorie/Day Diet (USDA, 2020)

Food Group or Subgroup	Recommended Amount from Each Group
Vegetables	2 ½ cups/day
Vegetable Subgroups	Weekly Amounts
Dark Green Vegetables	1 ½ cups/week
Red and Orange Vegetables	5 ½ cups/week
Beans, Peas, Lentils	1 ½ cups/week
Starchy Vegetables	5 cups/week
Other Vegetables	4 cups/week
Fruits	2 cups/day
Grains	6 ounces/day
Whole Grains	$\geq$3 ounces/day
Refined Grains	<3 ounces/day
Dairy	3 cups/day

Protein Foods	5 ½ ounces/day
Protein Foods Subgroups	Weekly Amounts
Meats, Poultry, Eggs	26 ounces/week
Seafood	8 ounces/week
Nuts, Seeds, Soy Products	5 ounces/week
Oils	27 grams/day
Limit on Calories for Other Uses	240 kcal/day

2.2 Dietary Guidelines for Americans 2020-2025

The publication of the DGAs represents a five-year collaborative effort between the United States Department of Agriculture (USDA), the United States Department of Health and Human Services (HHS), nutrition scientists, and policy officials to develop a set of food and nutrition recommendations (USDA, 2020). The DGA are based on the latest information available in nutrition science, and thus are updated every five years based on research evidence to reflect changes in what is understood to be optimal for human health (Sizer & Whitney, 2017). They are designed for Americans of all ages with the goal of promoting optimal health and disease prevention by consuming a nutritious diet and remaining physically active throughout the lifespan (USDA, 2020). The DGAs for 2020-2025 have established four key recommendations outlined below.

2.2.1 Follow a Healthy Dietary Pattern at Every Life Stage.

Nutrient recommendations shift over the lifespan; however, the DGAs assert that it is never too early or too late to begin consuming a nutritious diet. For the first 6 months of life, it is recommended that infants consume exclusively human milk or iron fortified formula (USDA, 2020). From 6-12 months, complementary foods from all food groups may be introduced. After the first year of life, all individuals should consume a diet that meets their nutrient needs, supports a healthy weight, and prevents disease.

2.2.2 Customize and Enjoy Nutrient-Dense Food and Beverage Choices to Reflect Personal Preferences, Cultural Traditions, and Budgetary Considerations.

The DGAs assert that healthy eating is for all people, regardless of age, gender, race, or income. They provide a framework for healthy eating that can be modified to reflect individual preferences and cultural traditions (USDA, 2020). In addition, the USDA provides food plans (Thrifty, Low-Cost, Moderate-Cost, and Liberal-Cost) to outline how healthy food can be purchased regardless of budget (USDA, 2021a). Each food group represents a wide range of individual food items. Individuals may select from a number of nutritious options, and variety is encouraged (USDA, 2020).

2.2.3 Focus on Meeting Food Group Needs with Nutrient-Dense Foods and Beverages, and Stay Within Calorie Limits.

Over 80% of Americans are not meeting food group recommendations for fruits, vegetables, and dairy (USDA, 2020). Although total intakes of grains and protein foods are on target for the majority of Americans, a closer look at food subgroups indicates an inadequate intake of whole grains, seafood, and nuts, seeds, and soy products.

To encourage increased consumption of these foods, the DGA provide additional information on the types of foods from each food group that should be consumed in the diet. They recommend that vegetables of all types (i.e., dark green, red and orange, legumes, starchy, and other) be consumed. They also recommend that individuals prioritize whole fruits; however, 100% fruit juice may also be consumed to meet the recommendation. Half of all grains consumed should be whole grains, and individuals should limit intakes of refined grains whenever possible. Dairy sources should be low-fat or fat-free, or individuals may choose to consume fortified soy alternatives if they are avoiding dairy products. Protein sources should come from a combination of lean meats and poultry, eggs, legumes, nuts, seeds, and soy products. Although not a food group, the DGAs recognize that oils are an important part of a nutritious diet and recommend those that come from vegetables, nuts, and seafood. For beverages, they recommend consuming those that are calorie free, such as water, and those that are nutrient-dense, such as 100% fruit juice and low-fat and fat-free milk (USDA, 2020).

2.2.4 Limit Foods and Beverages Higher in Added Sugars, Saturated Fats, and Sodium, and Limit Alcoholic Beverages.

The DGAs suggest that 85% of daily calorie intake be used for consuming nutrient dense foods that meet the food group recommendations (USDA, 2020). The remaining 15% of calories may be used at the discretion of the individual and may be spent on solid fats and added sugars. The recommendation for all American over 2 years of age is to limit added sugar and saturated fats to less than 10% of total daily calorie intake. Sodium, although an essential nutrient, can be hazardous to health when consumed in excess. The recommendation for healthy adults is to limit intakes to less than 2300 milligrams per day; however, the DGA state that the average intake is 3393 milligrams per day. While consumption of alcohol is not recommended, the DGAs assert that alcoholic beverages may be included in the context of a healthy diet in modest amounts without significantly harming health. They recommend limiting alcoholic beverage intake to 2 standard drinks or less per day for men and 1 standard drink or less per day for women. Those under the age of 21 years, pregnant women, those with certain medical conditions, and those taking certain medications should not consume alcohol at all (USDA, 2020).

2.2.5 Measuring Diet Quality

Overall diet quality can be assessed using the Healthy Eating Index (HEI). The HEI provides a score (0-100) that reflects how closely an individual's dietary pattern adheres to the recommendations made by the DGA (USDA, 2020). Improvements in HEI scores have been associated with decreased risk for chronic disease. While differences exist between demographics,

on average Americans have an HEI of 59 indicating the need for improvement in overall diet quality.

2.3 Considerations for Special Populations

The key recommendations of the DGAs provide a generalized outline for a healthful diet; however, their authors and other authorities acknowledge the need for more personalized guidance based on life stage and sociodemographic factors (NIMHD, 2017; USDA, 2020). Of notable interest are young adults (age 18-25 years), racial/ethnic minorities, and low-income populations. A slight improvement in diet quality can be observed between the ages of 18 to 25 years when many individuals are gaining more social and financial independence (Bea & Yi, 2019; USDA, 2020). Understanding motivations for food choice during this time period could enhance health promotion efforts to this population. Racial/ethnic minorities and low-income individuals face systemic barriers to healthy eating. These include economic instability, insufficient access to healthcare, and built environments that make procuring healthy food more difficult (Gallo et al., 2006; Lafarga Previdi & Vélez Vega, 2020; Lawman & Wilson, 2012; Sanjeevi et al., 2018; Vonneilich et al., 2012.) Therefore, the interventions and underlying theories used to address their specific needs should reflect those differences (NIMHD, 2017).

2.3.1 Age

In addition to shifts in nutrient needs, motivations for food choice also change over the course of the lifespan. Age has been identified as a key predictor in determining food motives

(Konttinen et al., 2021). As individuals age, the importance of health, body weight control, food quality, and ethics of food production when selecting foods increases. Conversely, the importance of convenience, familiarity, and price declines. These findings suggest that intervention techniques should be tailored to match the target demographic.

Motivations for food choice and health behavior for younger generations are of particular concern as they enter the workforce and increase in economic spending power. Recent evaluation of those born between the years 1997 and 2013, often colloquially referred to as "Gen Z," has identified unique characteristics of this subpopulation that will likely influence their response to and level of engagement with health behavior interventions (Schroth, 2019). Most notably, the influence of digital culture and social media has had a profound effect on the way Gen Z interacts with the world around them. Although the need for social approval is exceptionally high in this group, they may have more difficulty communicating in face-to-face interactions. They have also reported higher rates of anxiety and depression compared to past generations (Bitsko at al., 2022). When designing effective health promotion programming for this demographic, a digital or online social component is essential (Chau et al., 2018). It may be helpful to utilize one-on-one interactions, as large groups may be less desirable. Interventions should focus on building autonomy, a trait that is typically lacking in this group on average, to enhance motivation (Schroth, 2019). Connecting the health behavior to a larger social context, such as social justice or climate change, may also be a useful motivation technique.

2.3.2 Low-income Individuals

Diet quality among low-income individuals tends to be poorer compared to higher income individuals. Rates of chronic disease and obesity disproportionately affect low-income individuals

and families and, therefore, has become an area of public health concern (Sanjeevi et al., 2018). Over 6500 food desert tracts exist in the United States (Dutko et al., 2012). A food desert refers to an area where the population has limited access to nutritious and affordable food (Dutko et al., 2012; ver Ploeg et al., 2009). These are often caused by lack of political and financial investment in a given community due to geographical, social, or racial bias and discrimination (Shaker et al., 2022). Living in a food desert tract increases an individual's risk of being food insecure, and poor diet quality is often driven by high rates of food insecurity in this population (Coleman-Jensen, Rabbitt, Gregory, et al., 2021; Coleman-Jensen, Rabbitt, Hales, et al., 2021; Crowe et al., 2018). Food insecurity is the economic and social condition of the inability to procure affordable, nutritious, and culturally appropriate food (Coleman-Jensen, Rabbitt, Hales, et al., 2021). Food insecurity is associated with an increased risk for obesity and other chronic diseases, such as diabetes, heart disease, and cancer (Ghosh-Dastidar et al., 2014; Gregory & Coleman-Jensen, 2017). In addition, food insecure households are less likely to own food preparation equipment, such as small appliances and cooking utensils, compared to food secure households, which may make it more difficult to prepare meals inside the home (Oakley et al., 2019).

Low-income communities often have specific social and behavioral needs that must be taken into account when developing effecting health promotion programming. When compared to high-income groups, low-income communities often report greater levels of stress due to increased discrimination, less stable employment and housing, and lower levels of social support (Gallo et al., 2006; Lawman & Wilson, 2012; Sanjeevi et al., 2018; Vonneilich et al., 2012). A number of governmental programs presently exist in the United States aimed at reducing food insecurity and improving the diet quality of low-income individuals. The Supplemental Nutrition Assistance Program (SNAP) and its corresponding educational program (SNAP-Ed) provide financial food

subsidies and nutrition education to low-income individuals to ease the burden of the cost of food (Food and Nutrition Service, 2021a, 2021b). Effective programs and messaging are sensitive to budgetary constraints, emphasize convenience, and often include peer education.

2.3.3 Racial/Ethnic Minorities

Members of racial and ethnic minority communities, including Black, Latinx, and Native Americans, experience poorer diet quality compared to non-Hispanic white Americans (Satia, 2009). This drop in diet quality is often related to poverty and higher rates of food insecurity among these populations (Coleman-Jensen, Rabbitt, Gregory, et al., 2021). Greater consumption of saturated fat, added sugar, and sodium as a result contributes to higher rates of chronic disease in these communities (Satia, 2009). Therefore, higher rates of chronic disease in these populations are not due to biology. Rather, they are the result of inequitable social advantage favoring those who are wealthy and white (Braveman et al., 2010). Combined effects of racism, the stress of acculturation for immigrants, and well-founded mistrust of healthcare providers contribute to inadequacies in access to treatment, education, and availability of resources in these communities (Lafarga Previdi & Vélez Vega, 2020; Lindsay et al., 2018; NIMHD, 2017; Williams et al., 2011).

Successful health promotion interventions must take into account numerous social and behavioral considerations that are unique to racial and ethnic minority subgroups (NIMHD, 2017). Although these factors differ greatly between populations, some similarities exist. Community-based interventions are often more practical and impactful due to the high priority placed on shared identity and lack of trust and understanding from those outside of the target community (Lafarga Previdi & Vélez Vega, 2020; NIMHD, 2017). Inclusion of the whole family in the intervention is essential due to the substantial social influence the family unit has on behavior (Callender et al.,

2020; Conlon et al., 2015; Kong et al., 2018; Lindsay et al., 2018; Mena et al., 2015; NIMHD, 2017; Ochoa & Berge, 2017; Reifsnider et al., 2020). All health-related interventions and messaging, particularly those related to food and diet, must be culturally appropriate and consider language, the types of foods being presented, and relevant food preparation methods (Lafarga Previdi & Vélez Vega, 2020; Lindsay et al., 2018; NIMHD, 2017; Soderlund, 2017).

2.4 Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is a theoretical framework that can be used to explain why an individual may or may not choose to engage in a particular behavior (Ajzen, 1985, 1991). The present conceptual model is helpful in organizing and understanding motivation for action and can be used to predict which behaviors are most likely to occur (Ajzen, 1985, 1991). Key constructs of the model can be operationalized to promote health behavior change (Ajzen, 1991; Conner et al., 2002; Sheeran et al., 2001).

2.4.1 Background and Development

The TPB was developed in 1985 by Icek Ajzen, a prominent social psychologist (Ajzen, 1985). It built upon the previous established Theory of Reasoned Action (TRA) which centered intention to engage in a behavior as the primary predictor of whether or not an individual would take a given action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA, however, did not account for the degree of control an individual has, or believes they have, over their ability to complete the given action (Ajzen, 1991). To account for this, the construct of perceived behavioral

control was added when developing the TPB in order to effectively address behaviors where an individual may not have complete, localized control over their ability to perform the behavior.

The TPB attempts to predict an individual's action in a specific context (Ajzen, 1991). The theory assumes the basic principle that humans are rational beings and therefore will make decisions that will yield the greatest amount of benefit. The core principle of TPB asserts that intention to act accounts for a significant amount of variability observed in actual behavior (R2=0.41 on average) (Ajzen, 1991; Godin & Kok, 1996). An increase in strength of intention will result in an increased likelihood of action (Ajzen, 1991). In addition to strength of intention, the TPB asserts that perceived behavioral control also significantly influences the likelihood of action. Holding intention constant, the individual with greater perceived behavioral control will be more likely to succeed. For example, if two individuals have the same level of intention to increase their consumption of fruits and vegetables, the individual who believes they have more control over the behavior, perhaps because they have access to adequate resources or have had success in the past, is more likely to be successful in the current endeavor.

2.4.2 Constructs Modifying Intention

The TPB is comprised of three components that are proposed to modify intention. Attitudes, social norms, and perceived behavioral control act both individually and collectively to impact an individual's level of intention to complete a given behavior (Ajzen, 1991). The influence of these factors applies to positive and negative behaviors alike. A diagram illustrating the influence of these factors on intention can be seen in **Figure 2.** In addition to influencing intention, perceived behavioral control has a direct relationship with the likelihood of behavior such that the individual with highest level of perceived behavioral control is the most likely to act (Ajzen, 1991).
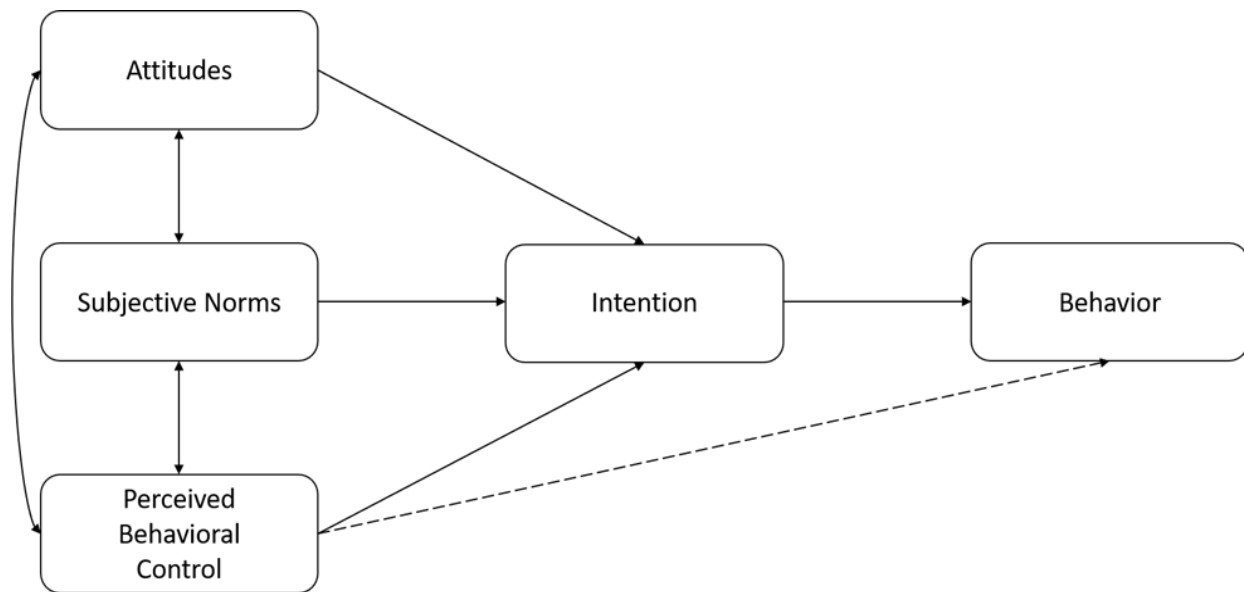
Figure 2. Influence of Attitudes, Subjective Norms, and Perceived Behavioral Control on Intention and

Behavior

2.4.2.1 Attitudes

Attitudes can be defined as the degree to which someone has a favorable or unfavorable appraisal of the behavior in question (Ajzen, 1991). It is a summation of the previously held beliefs about the behavior weighed negatively or positively. An individual's attitude toward a behavior is a factor of the strength of each belief and its subjective evaluation. Stronger beliefs, whether positive or negative, will have a greater influence on the individual's decision to act. The more positively the person feels about the behavior, the greater their intention to perform it will be.

2.4.2.2 Subjective Norms

Subjective norms are defined as the perceived social pressure to perform or not perform a given behavior (Ajzen, 1991). Norms can be *injunctive*, referring to the perception of whether or not a behavior will be acceptable to a given group, or *descriptive*, referring to the examination of

the behavior of those in an individual's environment (Hayden, 2014). The degree of influence subjective norms have on an individual is dependent on that individual's motivation to comply with the social status quo. Individuals with a high desire to comply with norms will be more significantly influenced by this theoretical construct. Subjective norms may encourage or discourage intention depending on how the target behavior is viewed by the social group (Ajzen, 1991).

2.4.2.3 Perceived Behavioral Control

Perceived behavioral control is best understood as the extent to which an individual believes they have the resources required to be successful in performing a given behavior (Ajzen, 1991). It is the perception of the ease or difficulty associated with performing the behavior. This construct is most compatible with and is often likened to the concept of self-efficacy. While actual control is also an important predictor of intention, perceived control is much easier to measure and can reasonably be used as a proxy. As previously stated, perceived behavioral control is the most influential of the three components of the TPB in that it has the ability to directly influence the likelihood of action. If two individuals have the same level of intention to perform a given behavior, the one with the greater perceived behavioral control is more likely to act. It is important to note that perceived behavioral control is not constant and will vary across situations and actions; high perceptions of control over one behavior does not necessarily translate to high perceptions of control over another (Ajzen, 1991).

2.4.3 Conditions for Accuracy and Limitations

The relative importance of each of the above factors will vary based on the behavior; however, perceived behavioral control is believed to be the strongest predictor of behavior, followed by attitudes. In order for the TPB to be operationalized accurately, a number of conditions must be met (Ajzen, 1991). Firstly, the measures utilized to assess intention and perceived behavioral control must be specific to the target behavior. These are not static constructs and are expected to change in magnitude based on the behavior in question. Secondly, intention and perceived behavioral control must remain stable between the period of assessment and when the action occurs. If significant time passes or an intervention occurs that influences these constructs, the ability to accurately predict behavior declines. Finally, the TPB is most accurate when perceived behavioral control matches actual behavioral control. The larger the discrepancy between reality and perception, the more difficult it will be to determine the likelihood of the behavior (Ajzen, 1991).

Limitations exist that may reduce the applicability of the TPB. It has been suggested that the exclusion of moral or personal norms may decrease the accuracy of prediction (Ajzen, 1991). Although social norms are considered in the model, there is no estimation for the influence of personally held beliefs about what is right and wrong. It can be argued that these personal norms may be captured in the attitudes an individual has toward a given behavior; however, without a direct measurement of these motivations, it is difficult to know if all constructs are being accurately weighted. In addition, the model does not directly take into account the influence of past behavior. Again, it can be argued that the influence of past behavior significantly impacts perceived behavioral control and, therefore, is represented by proxy (Ajzen, 1991).

2.4.4 Application to Health and Nutrition Science

The TPB has been used to help characterize intention for a number of health behaviors including substance abuse, sexual health, dental hygiene, exercise, and diet (Conner et al., 2002; Godin et al., 1996; Sheeran et al., 2001). The effectiveness of the theory as a whole in predicting engagement in these health behaviors will depend on the type of behavior being assessed and varies across individual constructs of the theory. Of particular interest is the ability of theory and its component parts to account for the variation observed in eating behavior. The TPB has been used to successfully predict specific eating behaviors such as consumption of fruits and vegetables and intake of saturated fat and added sugar (Godin et al., 1996). Furthermore, it has been able to accurately predict eating behavior over extended periods of time, showing its usefulness for estimating long-term nutrition related behavior change (Conner et al., 2002).

The literature indicates that perceived behavioral control is the most important component of the TPB for predicting engagement in health behaviors, including diet, as it is the component most highly correlated with positive outcomes (Ajzen, 1991; Godin et al., 1996). When perceived behavioral control has been measured correctly, intention accounts for 41% of the variability observed in eating behavior, on average, with the greatest correlation for the consumption of fruit and vegetables ($R^2=0.47$ and $R^2=0.41$, respectively) (Godin et al., 1996). In addition, attitudes play an influential role in predicting eating behavior. They are a stronger predictor than subjective norms, indicating that self-considerations are more potent motivators for behavior than external considerations (Ajzen, 1991; Godin et al., 1996). The TPB rests on the assumption that humans are rational beings and will act in their best interest (Ajzen, 1991).

2.5 Principles of Behavioral Economics

In theory, it is generally expected that individuals will make rational decisions. Occasionally, however, human behavior deviates from expected, rational outcomes. Irrational decision making can often be attributed to an individual's attitudes toward a behavior (Mullainathan & Thaler, 2000). In order to explain this phenomenon, the field of behavioral economics has identified a number of behavioral biases that are known to influence an individual's behavior and cause them to make decisions that may not always be in their best interest. Although initially developed to explain financial decision making, the principles of behavioral economics have been used to explain variation in a wide range of behaviors, including health behavior (Liu et al., 2014; Matjasko et al., 2016; Mullainathan & Thaler, 2000).

2.5.1 Background

Behavioral economics is a blend between the fields of psychology and economics that aims to explain decision making when humans behave in "irrational" ways, meaning they are influenced by human limitations and complications (Mullainathan & Thaler, 2000). Standard economic models of behavior assume that humans are capable of unbounded rationality (i.e., they will apply sound logic to all decision making), unbounded willpower (i.e., they will make decisions with the best long-term outcome in mind), and unbounded self-interest (i.e., they will always prioritize beneficial outcomes for themselves over beneficial outcomes for others). However, observation of humans in real-world settings has shown that human behavior often diverges from these assumptions.

Humans fail to behave in line with these market expectations in three key ways. Humans exhibit bounded rationality in that there are limits to human cognitive ability and capacity for problem solving. For example, the absence of nutrition information on restaurant menus may make it more difficult for diners to determine what is a healthy meal option. In addition, humans exhibit bounded willpower when they make decisions that are not in their best, long-term interest (Mullainathan & Thaler, 2000). This is commonly observed in health behavior when an individual chooses to engage in a behavior, such as smoking, because it is satisfying in the short-term but contributes to poor health in the long-term. Finally, humans exhibit bounded self-interest when they are willing to behave in ways that go against their own self-interest in order to benefit others (Mullainathan & Thaler, 2000). This can be seen in coping strategies of food insecure parents who reduce their own food intake to allow children to eat more (Chaudhuri et al., 2021).

2.5.2 Common Behavioral Biases Observed in Nutrition Behavior and Solutions

Behavioral economists have used the principles of behavioral economics to examine the field of nutrition and eating behavior in an attempt to explain why many individuals consume poor quality diets (Hartmann-Boyce et al., 2018; Just & Gabrielyan, 2018; Liu et al., 2014; Mancino et al., 2018; Matjasko et al., 2016; Payne & Niculescu, 2018). A number of behavioral biases have been identified that are known to impact eating behavior. These biases may result in an individual making less healthy food choices and thus negatively impact health. Several strategies, described below, have also been identified to help individuals overcome these biases and "nudge" them toward healthier dietary behavior.

2.5.2.1 Bounded Rationality

The principle of bounded rationality states that an individual, when making a choice, may not have all of the resources necessary to make the best decision. The required resources may be in the form of information, cognitive ability, health literacy, or time, among others. This phenomenon can be observed when an individual attempts to interpret the information presented on a nutrition facts panel. Without prior knowledge of nutrition, they may have difficulty making sense of the information presented, and therefore be unable to use the information in a meaningful way. Their decision making could be improved by offering simplified messaging free from technical terms that matches the level of understanding of the audience (Matjasko et al., 2016). It is important to note that simply providing more information is not necessarily more effective. The information provided must be easily understood. This may come in the form of commonly understood symbols, such as stop light colors or physical activity equivalents, to signify the healthfulness of a food product or offering nutrition information in the native language of the target population. Research has shown that understandability of nutrition information is most impactful for those who lack nutrition-related knowledge (Liu et al., 2014). This often includes low-income individuals and under resourced communities who are often limited in their access to health education.

2.5.2.2 Time Inconsistent Preferences

Time inconsistent preferences occur when an individual makes a decision that favors immediate gratification at the expense of long-term wellbeing (Loewenstein et al., 2003; Matjasko et al., 2016). Individuals may consciously or unconsciously assume their future selves will exhibit greater levels of self-control than their current selves (Liu et al., 2014). This is commonly observed in young adults who may be less concerned about long-term health consequences. An example of

this bias may include indulging in a high sugar snack or choosing a meal that is high in saturated fat despite the known health consequences (Matjasko et al., 2016). A strategy to help combat this bias is to increase the convenience of healthy foods and decrease the convenience of unhealthy foods. This could include a grocery store placing healthy snacks in the check-out line or an individual avoiding keeping unhealthy foods in their home. Someone may also choose to utilize pre-commitment devices, such as grocery lists, to minimize the amount of decision making that needs to occur at the point of sale (Liu et al., 2014).

2.5.2.3 Status Quo Bias

People exhibit inertia, meaning they are most likely to continue doing things they have previously done in the past; this is known as status quo bias (Matjasko et al., 2016). Status quo bias can make it difficult for individuals to change previously established patterns of behavior and can become particularly difficult to overcome when alternative options are scarce. This is commonly observed in eating behaviors when an individual relies on the portion served at a restaurant to determine how much they should consume or when someone chooses to eat French fries because they are the default side dish for their meal (Liu et al., 2014). Status quo bias can be used to encourage healthier choices by making the healthier option the default. For example, an individual may choose to use smaller plates or bowls at home to encourage more appropriate portion sizes.

2.5.2.4 Visceral Cues

The desire to eat is often triggered by visceral cues, such as the sight, smell, or sound of food, rather than a physiological hunger. These visceral cues can result in impulsive, emotional food choices (Matjasko et al., 2016). For example, someone may enter a movie theater and smell

popcorn being prepared. Although they may not have previously been hungry, they purchase and consume the popcorn because the smell and sight of it made it appear appetizing. The individual may come to associate eating popcorn with going to the movie theater and seek to repeat the behavior on future occasions. In order to reduce the influence of visceral cues, individuals may choose to obfuscate by keeping food out of sight, distract themselves by shifting their attention toward a non-food related activity, or abstract the food in question by focusing on "cool" aspects of the food, such as color or shape (e.g., imagining French fries as tan, long, and thin as opposed to hot, crunchy, and salty) (Liu et al., 2014).

2.5.2.5 (Mis)perception of Social Norms

The perception, or misperception, of social norms refers to the desire individuals have to behave in ways that are acceptable within their social environments. This can include the influence of peers, family members, the institutions of which they are a part, their communities and society at large (CDC, 2022). However, they may not have accurate information. This can be observed among college students who mistakenly believe that drinking rates are higher among their peers than they actually are or among immigrants to the United States who abandon traditional diets in an attempt to "fit in" with the dominant culture (Matjasko et al., 2016). This can be combatted by offering examples of peers who are engaging with the target behavior (e.g., peer-to-peer antismoking campaigns), utilizing shopper ratings to promote healthy products, or rephrasing to make the healthier choice sound like the "correct" choice (e.g., "right-size" vs. "down-size" a portion) (Liu et al., 2014; Matjasko et al., 2016).

2.6 The Role of Food Labels in Food Choice

Food and nutrition labels are often used as a means to convey important information about ingredients, nutrient content, and allergens on food packaging (CDC, 2022). Regulation of most food labeling in the United States is the responsibility of the Food and Drug Administration (FDA) (CDC, 2022). One of the most common labeling tools utilized is the Nutrition Facts label (FDA, 2022). The Nutrition Facts label appears on the majority of packaged food products sold in the United States and provides information on calorie, fat, protein, carbohydrate, and selected vitamin and mineral content of foods (CDC, 2022). The label provides this information to consumers with the goal of aiding in food choice and health decision making. In 2016, the Nutrition Facts label was updated to reflect growing scientific evidence supporting the role of diet in chronic disease development (FDA, 2022). The label was reformatted to improve decision making around healthy food choice by providing more nuanced information about nutrients of concern (e.g., including grams of added sugar) and making the interpretation of the label easier for consumers (e.g., increasing size and bolding font of calories and serving sizes) (FDA, 2022). These changes are reflective of the FDA's larger goals of improving the accessibility of food labels (FDA, 2023).

In 2022, the White House Conference on Hunger, Nutrition, and Health called for a more comprehensive approach to promoting positive dietary habits for Americans (DPC, 2022). Among the strategies identified were an increased use of front-of-package labeling and a call to update and regulate the claim "healthy" on food packaging. The FDA responded by providing draft guidance for defining and regulating the term "healthy" (FDA & HHS, 2023). Criteria are specific to food type and include limits on added sugars, sodium, and saturated fat as well as the inclusion of minimum food group equivalents. A sample of proposed criteria are listed in **Table 2.** In addition, the FDA has drafted a front-of-package "healthy" logo to supplement the information found on

the Nutrition Facts label and act as a short-cut for consumers to be able to determine if a given food product meets the requirements to be considered "healthy." The stated aim of these initiatives is to "empower all consumers to make and have access to healthy choices" (DPC, 2022). It may also encourage food production companies to adapt the formulation of their products to meet the new criteria.

Table 2. Sample of Proposed Criteria for the "Healthy" Nutrient Content Claim (FDA & HHS, 2023)

Food Group	Food Group Equivalent Minimum	Added Sugar Limit	Sodium Limit	Saturated Fat Limit
Grains	¾ oz whole grain eq.	5% DV (2.5 g)	10% DV (230 mg)	5% DV (1 g)
Dairy	¾ cup eq.	5% DV (2.5 g)	10% DV (230 mg)	10% DV (2 g)
Vegetable	½ cup eq.	0% DV (0 g)	10% DV (230 mg)	5% DV (1 g)
Fruit product	½ cup eq.	0% DV (0 g)	10% DV (230 mg)	5% DV (1 g)

Note: eq=equivalent, DV=Daily Value, g=grams, mg=milligrams

2.7 Importance of Purchasing Behavior in the Food Retail Environment

The retail environment represents a critical juncture in food acquisition (Mancino et al., 2018). Americans purchase over 65% of their total calories from large grocery stores. The nutrition quality of the food purchased from grocery stores is significantly higher than food purchased at specialty or convenience stores and restaurants. This association is even more pronounced when examining food purchases of low-income individuals and SNAP participants (USDA, 2019). In addition, over 75% of American households visit the grocery store at least once per week (Todd & Scharadin, 2016). This indicates the potential for grocery stores to play an important role in

improving the healthfulness of the diet as they are the primary and most frequent food provider for the majority of Americans. However, the abundance of food desert tracts and lack of availability of culturally appropriate foods for immigrant communities may limit the usefulness of grocery store intervention (Dutko et al., 2012; Shaker et al., 2022).

Purchasing food in a grocery store may help individuals overcome time inconsistent preferences. Food purchased at the store is, in most cases, intended for consumption at a later point in time, dampening the influence of immediate gratification (Mancino et al., 2018). However, because many decisions need to be made in relatively short period of time, shoppers are more likely to be influenced by behavioral nudges present in the retail environment (Just & Payne, 2009). This further emphasizes the potential for modifications to the food retail environment to influence the purchasing behavior of shoppers.

Previous research has identified a number of potential strategies grocers could employ to help "nudge" shoppers toward healthier food choices; however, the effectiveness of these interventions is mixed. Among the most effective strategies are those that utilize an economic strategy, such as reducing the price of healthy foods through coupons (Hartmann-Boyce et al., 2018). Others focus on altering the retail environment, such as changing where items are located in the store. These were less effective overall when compared to economic incentives; however, they may be more practical for many stores as they do not require any alteration to pricing. Appealing to social norms through shopper ratings is another way food retailers may attempt to increase the purchasing of an item. Previous research has established the importance of shopper ratings for driving consumer purchasing decisions (Chen et al., 2014; Sigurdsson et al., 2020; Xie et al., 2016). Positive reviews from members of the peer group signal quality to shoppers, information they did not previously possess (Xie et al., 2016). In the food retail environment,

adding shopper ratings has been shown to increase sales of healthy food products (Sigurdsson et al., 2020).

Behavioral "nudges" may be especially important for low-income shoppers and SNAP participants (Just & Gabrielyan, 2018; Payne & Niculescu, 2018). Such strategies include reducing financial barriers to purchasing healthy foods (e.g., coupons), increasing the convenience of healthy foods (e.g., offering pre-cut fruits and vegetables), and appealing to social norms (e.g., shopper ratings) (Chen et al., 2014; Just & Gabrielyan, 2018; Sigurdsson et al., 2020; Xie et al., 2016). Interventions increasing visibility of fruits and vegetables have been shown to significantly increase purchasing for those foods among all shoppers, including SNAP participants (Payne & Niculescu, 2018).

2.8 Vignette Methodology

Vignettes are short descriptions of a person or situation that contain references to what are believed to be the most salient factors for decision- and judgment-making (Alexander & Becker, 1978). The use of vignettes in survey research allows for standardization across participants and, therefore, reduces individual biases when compared to simpler, short-form questions. Vignettes become particularly useful for understanding complex decision making when several variables may impact the outcome. Vignettes offer a highly specific assessment of a particular situation or behavior. This, however, may limit their generalizability. Therefore, it may be beneficial to pair them with other methods of assessment (Alexander & Becker, 1978).

There is ample evidence to support the usefulness of vignette methodology in food behavior and nutrition research. Vignettes administered via an online survey have been used to

assess intentions regarding food waste among predominately middle-income adults in order to determine the relative importance of situational attributes in making the decision whether or not to throw away a food item (Ellison & Lusk, 2018). They have been used to assess the acceptability of new, unfamiliar food products such as insect protein (Hartmann et al., 2018). Vignettes have also been used to evaluate dynamics within families. Recent studies have used them to evaluate perceptions of norms including parent perceptions of parent-child interactions regarding body image and food choice (Lydecker et al., 2020). Another examined differences between older and younger parents' acceptability of fast food dining (Kellershohn et al., 2021). Cumulatively, the research indicates that vignette methodology is appropriate for nutrition research, can be applied to a variety of demographics and subpopulations, and can effectively assess food acceptability and preferences.

2.8.1 Application to the Present Study

Vignette methodology has been shown to closely reflect actual behavior (Hainmueller et al., 2015). Vignettes help to identify which attributes contribute most to intentions about a given food or food-related behavior and can be used to determine if those attributes differ across key subgroups of the population. Identifying which of these factors are modifiable may offer a clear pathway for intervention. Previous research has highlighted the importance of economic incentives, easily understood messaging, and social norms in food-related decision making (Hartmann-Boyce et al., 2018; Liu et al., 2014; Matjasko et al., 2016). Vignettes allow for the assessment of each factor individually across demographic subgroups as well as the comparison of each factor relative to the other. This is more reflective of real-world decision making where many factors simultaneously influence a given behavior.

3.0 Methods

The present study applied a mixed method, sequential research design. Participant recruitment and data collection occurred in two phases: <u>Phase 1</u>: Cognitive interviews and finalization of vignette survey; <u>Phase 2</u>: Administration and evaluation of the vignette survey.

3.1 Phase 1: Cognitive Interviews

Participants completed brief, investigator-led cognitive interviews to assess the comprehension, retrieval, judgement, and response processes of the vignette survey (Collins, 2003). Interviews took place in-person at the Oak Hill Research Facility or virtually, depending on the participant's preference. Interviews were held individually. Participants were asked to complete the vignette survey and open-ended reflection questions independently. They were then asked by the investigator to verbally expand on their survey responses and provide more detail on how they formulated their responses. They were also asked to provide overall feedback on the vignette survey design and shared suggestions for improvement. Interviews were audio recorded and transcribed verbatim and lasted approximately 30-60 minutes. Responses were examined for themes (see 3.3.1 Phase I Analyses) and study measures were revised and finalized based on participant feedback. A complete interview guide can be found in **Appendix A**.

3.1.1 Phase 1 Participants

A total of 20 participants were recruited to participate in Phase 1 of the study. Sample size was determined based on the point of saturation at which the rate of new problem identification declined (Blair & Conrad, 2011; Emmel, 2013; Meadows, 2021). Participant inclusion criteria are listed in **Table 3**. Stratified convenience sampling techniques were used to ensure representation across key demographic characteristics. Target recruitment numbers for each demographic characteristic are displayed in **Table 4**.

Table 3. Phase 1 Participant Inclusion Criteria

18 years of age or older
Purchased food products from a food retailer within the last 6 months
Have internet access via computer, smartphone, or tablet
Able to participate in cognitive interview either in person or virtually
Able to speak/read/write in English

Table 4. Phase 1 Target Recruitment Numbers for Key Demographic Characteristics

	Age		
Race	18-25 years	26-64 years	65+ years
White	3	3	3
Minoritized Groups*	3	3	3
plus an additional 2 SNAP participants of any race or age			

*Minoritized groups included Black, Latinx, Asian, American Indian and Alaska Native, Native Hawaiian and Pacific Islander, Other, and Mixed Race participants

3.1.2 Phase 1 Recruitment

Participants were recruited through word-of-mouth, flyers, e-mail listservs, and social media posts (i.e., Facebook, Instagram, Twitter). Resources and protocols from the University of Pittsburgh Clinical and Translational Sciences Institute (CTSI) and Community Research Advisory Board (CRAB) were utilized to oversample racial/ethnic minority and SNAP participants. Based on input from the CRAB and expert researchers, community partners at Adagio Health, University of Pittsburgh Medical Center, and Cornell Cooperative Extension were identified to help advertise the study to SNAP participants through their networks.

Interested participants were directed to contact the study investigator by phone or email to be screened for eligibility. A complete eligibility screener can be found in **Appendix B**. Eligible Phase 1 participants were then contacted by the study investigator to schedule an interview. Participants from Phase 1 were compensated $20 for their participation. All study materials and procedures were approved by the University of Pittsburgh Institutional Review Board (IRB) (#22120068).

3.2 Phase 2: Vignette Survey

In Phase 2, participants completed an online survey, including the vignettes finalized in Phase 1 of the study, outlined below. The average time to complete the survey was approximately 20 minutes. Complete surveys are provided in **Appendix C**. Survey components included:

Assessment of TPB Constructs

Participants were asked to indicate the extent to which they agreed with three statements assessing their perceived importance of purchasing healthy foods, their confidence in their ability to purchase healthy foods, and their belief that that ability was under their control using a 5-point Likert scale (1=Never to 5=Always) (Ajzen, 2002, 2019).

Vignette Survey

Food label vignettes were used to assess the relative importance of economic incentives, the proposed FDA healthy logo, and the influence of shopper ratings on intention to purchase food products. Participants were shown three separate vignettes with different food types: yogurt, ready-to-eat cereal, and black beans. Three components (i.e., presence of a 25% off coupon vs. no coupon, FDA healthy logo vs. no logo, and 3-star vs. 5-star shopper rating) were experimentally varied across vignettes to create eight unique scenarios for each food type. Each participant was randomized to see one scenario per food type. A sample vignette with an unrelated food product (i.e., pretzels) was provided at the start of the survey to orient the participant to the various elements present on the label (**Figure 3**). Participants randomly viewed three vignettes, one version for each food type, and were asked how likely they would be to purchase the food based on the scenario provided. Participants responded using a 100-point visual analog scale, ranging from 0 (definitely would not purchase) to 100 (definitely would purchase). Following each vignette, participants were asked what factors contributed to their decision making and were provided with a list of commonly cited responses identified in Phase 1. Participants could select multiple responses and had a write in option.

Sociodemographic Information

Participants reported their age, gender, race/ethnicity, level of education, income, household size, SNAP participation status, zip code, the frequency with which they purchase

groceries, and where they typically purchase their groceries. An additional 'SNAP eligible' variable (yes/no) was created using participant reported income and household size. Eligibility was determined using criteria provided by the U.S. Department of Health and Human Services (USDA, 2021b; HHS, 2023). Participants earning 130% of the federal poverty level or less were considered SNAP eligible.
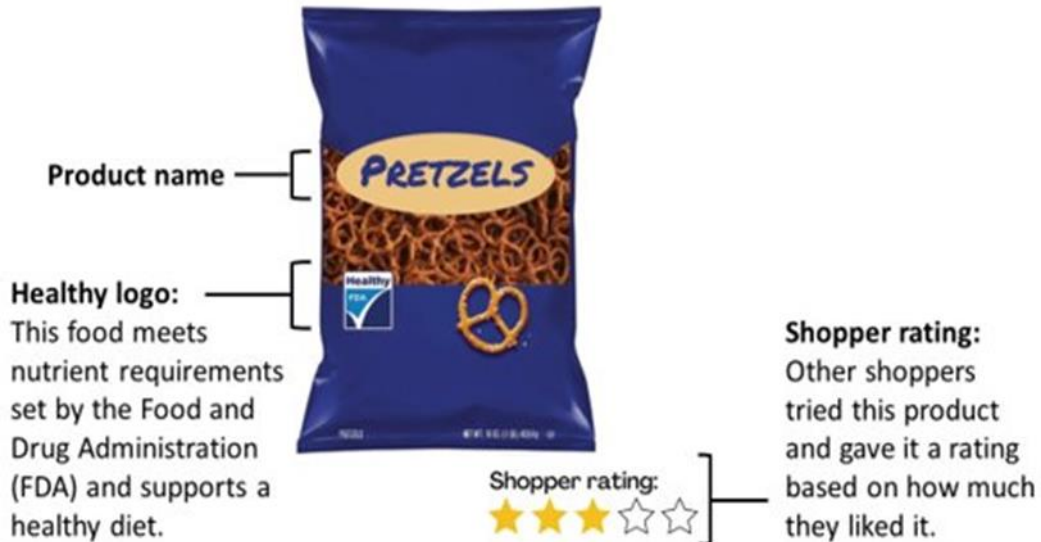
Figure 3. Sample Vignette

3.2.1 Phase 2 Participants

Sample size for Phase 2 of the study was determined through an *a priori* power analysis conducted using G*Power version 3.1.9.7 (Faul et al., 2007). The required sample size to achieve 80% power for detecting a medium to large effect ($f^2=0.25$), at a significance of $\alpha=0.05$, was n=44 for a linear regression analysis. In order to examine subgroup differences, a total of n=44 participants in each demographic group of interest (i.e., race/ethnicity [American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, Black or African American, White, Mixed Race or Other, and Latinx], age [18-25 years, 26-64 years, and 55+ years], and SNAP participants)

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needed to be recruited. Thus, a total sample size of n=484 was adequate to test the study hypotheses. We aimed to recruit an even age distribution and equal proportions of male and female adult participants, racial/ethnic identities with emphasis on Black and Latinx participants, and SNAP participants. Phase 2 participant inclusion criteria are listed in **Table 5**, and a complete eligibility screener can be found in **Appendix B**.

Table 5. Phase 2 Participant Inclusion Criteria

18 years of age or older
Purchased food products from a food retailer within the last 6 months
Able to participate in online survey
Able to speak/read/write in English

3.2.2 Phase 2 Recruitment

Sampling techniques mirrored those used in Phase 1. A survey link or QR code was available on all recruitment materials for participants to directly access the survey. Participants were screened for eligibility by answering questions on the first page of the online survey. Based on feedback received in Phase 1 interviews, the question regarding having access to the internet was removed from this list of screening questions. It was determined that in order for a participant to access the survey and view the screening questions they must first have access to the internet, making the question redundant and potentially confusing for some participants. The complete eligibility questionnaire for Phase 2 can be found in **Appendix B**. Phase 2 participants provided their consent to participate in the research study by clicking to advance to the online vignette survey. Following completion of the survey, Phase 2 participants had the option of entering their email address to be included in a random selection of 260 participants to receive a $10 gift card.

3.3 Data Analysis

3.3.1 Phase 1 Analyses

Qualitative data were analyzed using NVivo version 14.0. Aim 1 assessing acceptability of the vignette survey was summarized using qualitative coding techniques to determine salient categories, themes, and patterns in the data (Erlingsson & Brysiewicz, 2017). The vignette survey was revised based on participant feedback from Phase 1 cognitive interviews. Descriptive statistics for demographic data were calculated using means and standard deviations or percentages, where appropriate.

3.3.2 Phase 2 Analyses

Quantitative data were analyzed using SPSS version 28.0 (IMB Corp., 2020). Descriptive statistics for demographic data and vignette survey results were calculated using means and standard deviations or percentages. Aim 2a examining the relative importance of vignette attributes was assessed using a multiple linear regression model adapted from Ellison & Lusk (2018). The dependent variable was intention to purchase the food item (100-point scale), and the independent variables were the vignette attributes of interest: coupon, FDA healthy logo, and shopper rating. A multiple linear regression analysis was selected because it allows for the determination of total variance as well as the relative contribution of each independent variable. To assess exploratory Aim 2b to assess differences in mean scores between sample subgroups (i.e., age, SNAP participants, and race/ethnicity) was evaluated by examining the interaction effects between

subgroup characteristics and vignette attributes (Agresti, 2018; Ellison & Lusk, 2018; Ellison et al., 2022). Statistical significance was set at $p < 0.05$.

4.0 Results

4.1 Phase 1

4.1.1 Phase 1 Participant Characteristics

Participants were predominately male (65%) and White (65%) with an average age of 42.85±22.91 years old (range 18-79 years). The majority of participants had completed college or more education (60%) and 50% reported a household income of $50,000 per year or more. Fifteen percent of participants were currently receiving SNAP benefits. Recruitment targets identified in **Table 4** were met for each subgroup. Participant demographic information can be found in **Table 6**.

Table 6. Demographic Characteristics (%[n] or Mean [Sd]) of n=20 Participants Who Completed Phase 1 Cognitive Interviews

Characteristics	% (n) or M (SD)
Age (years)	42.85 (22.91)
Gender	
Male	65.0% (13)
Female	35.0% (7)
Ethnicity, % Hispanic/Latinx/Spanish	1.0% (2)
Race	
Asian	10.0% (2)
Black or African American	20.0% (4)
White	65.0% (13)
Other	5.0% (1)

Education	
Finished high school	15.0% (3)
Associate's degree	5.0% (1)
Some college	20.0% (4)
Finished college	25.0% (5)
Graduate degree	35.0% (7)
Employment	
Employed for wages or self-employed	35.0% (7)
Currently unemployed or retired	15.0% (3)
Student	45.0% (9)
Stay at home parent or caregiver	5.0% (1)
Household Income	
Less than $20,000 per year	15.0% (3)
$20,000 - $34,999 per year	10.0% (2)
$35,000 - $49,999 per year	15.0% (3)
$50,000 - $74,999 per year	10.0% (2)
$75,000 - $99,999 per year	5.0% (1)
$100,000 or more per year	35.0% (7)
I don't know	10.0% (2)
Household Size	3.00 (1.89)
Adults living in home	2.80 (1.58)
Children living in home	0.45 (1.00)
% Currently receiving SNAP	15.0% (3)

4.1.2 Cognitive Interview Results

Results from a qualitative analysis of cognitive interview transcripts revealed three overarching themes into which participant responses could be classified: 1) "I was confused:"

Vignette survey feedback; 2) What's in a name?: Discerning healthfulness; and 3) Food Moods:

Motivations for food choice. Emergent themes, core categories, and category descriptions can be

found in **Table 7**. The themes are described below in greater detail along with exemplary quotes.

Table 7. Emergent Themes, Core Categories, and Category Descriptions from Phase 1 Qualitative Analyses

Theme	Core Category	Category description
Theme 1. "I was confused:" Vignette survey feedback	Participant recruitment	• Recommendations for inclusion criteria and where/how to recruit low-income participants
	Survey logistics/suggestions	• Confusion around survey questions • Recommendations for size of text, organization of survey questions, etc.
Theme 2. What's in a name?: Discerning healthfulness	Confidence in ability to purchase healthy food	• Ability to identify and purchase healthy foods using the resources available
	"Healthy" definition	• Factors that determine whether or not a food is considered "healthy" • "Healthy" is personal; there is no universal definition.
Theme 3. Food Moods: Motivations for food choice	Usefulness of food labels	• Extent to which external packaging, labels, and ratings are used to influence purchasing decisions
	Individual factors	• Factors related to an individual's personal motivations
	External factors	• Factors related to motivations outside of the individual

4.1.2.1 Theme 1. "I Was Confused:" Vignette Survey Feedback

Over the course of the cognitive interviews, participants offered feedback on the design of the survey and suggested improvements for Phase 2 implementation. Their comments illuminated necessary changes to participant inclusion criteria, recruitment strategies, and the format and wording of questions in the survey. This feedback was used to finalize the vignette survey prior to initiating Phase 2 of the study.

Participant Recruitment

Participants emphasized the need to recruit a diverse sample of adults for Phase 2. One participant (66 years, female, White, SNAP participant) questioned the need to have access to the internet in order to participate in the study saying, "*So are you excluding people who don't have internet? […] I think you should not eliminate them.*" Based on this feedback, it was determined that, since the survey could only be accessed online, the screening question regarding access to the internet was redundant and may cause confusion for participants accessing the survey through a public use computer. The question was removed from the Phase 2 eligibility questionnaire. In addition, participants offered advice on where and how to recruit individuals for Phase 2. One participant (66 years, female, White, SNAP participant) offered suggestions regarding neighborhoods in Pittsburgh, PA where individuals from target demographics could be found: *"And then you'll grab poor people in Homewood. I have no idea where they go for shopping. No idea. And then you have like elite area which is Squirrel Hill. Everybody has car; they have butcher."*

Survey Logistics/Suggestions

While discussing the survey, participants offered suggestions for improving design, format, and wording of the questions being asked. Participants were asked to affirm their understanding

of the questions (e.g., *"Yep, pretty straight forward."* [29 years, female, Black]) or offer feedback on what was unclear. Some offered suggestions on how to improve the layout of the survey, for example, *"Split up the text […] Okay, so definitely to make this bigger little bit."* (66 years, female, White, SNAP participant).

Participants expressed some confusion regarding the open-ended reflection questions that followed each label vignette. For example, one participant (31 years, male, Latino) stated, *"I just didn't know how much to actually add into there."* As a result, in the final vignette survey, the open-ended response questions were replaced with a multiple select question in which participants could select factors that impacted their decision making from a list. Factors included on the list were identified from Phase 1 interviews (e.g., food preferences, typical shopping habits, price, etc.). Confusion also arose from student participants in regards to how they should answer questions assessing household income and household size. There appeared to be uncertainty as to whether they should report on themselves as individuals or their family at their home address. One student (20 years, male, White) stated, *"I was only confused because I'm like a student right now, and like I'm living with 2 other college like friends, who are both considered both adults though. But like as of right now, technically, none of us work so we don't really make an income. It's more or less like our parents helping us pay rent, or like my mom will send me money for groceries sometimes."* Some participants had difficulty identifying whether or not they received SNAP benefits. This was largely due to lack of familiarity with the program (e.g., *"Honestly, I don't know what it is. I assume we don't get it."* [35 years, male, Asian]). In all cases where participants were unclear about what SNAP benefits were, they selected either "no" or "I don't know" as an answer choice.

4.1.2.2 Theme 2. What's in a Name?: Discerning Healthfulness

Participants shared perspectives on their perceived level of confidence in identifying healthy foods and were asked to describe how they define the term "healthy." Their responses indicated that the criteria for determining whether or not a food should be considered "healthy" may vary significantly from person to person.

Confidence in Ability to Purchase Healthy Foods

Participants cited previously acquired knowledge about nutrition as a key contributor to their confidence in being able to purchase healthy food items. Some felt they had adequate knowledge to be able to make healthy choices (e.g., *"I think I know how to read the nutrition labels."* [26 years, female, White]), while lack of knowledge appeared to be a barrier for others (e.g., *"Something might be better than another thing, but I might not know that. […] I would have to do more research on it before purchasing it."* [20 years, male, Other]). Misinformation in food and nutrition advertising was cited as a challenge to building confidence in food choices as messaging may be perceived as being misleading. For example, one participant (69 years, female, White) stated, *"Oh, "healthy," you could be eating something that's terrible, and they'll say healthy."* Several participants expressed a high level of confidence in their ability to purchase healthy foods. They believed they were able to make their own determinations about the healthfulness of food, regardless of what appears on the packaging or in marketing (e.g., *"I usually know what's in food, so the label doesn't mean that much. I know what's in there."* [77 years, male, Black, SNAP participant]).

"Healthy" Definition

The way in which participants defined the term "healthy" for themselves centered around three primary ideas. The first was the relationship between diet and health outcomes. Participants

perceived healthy foods to be those that promoted optimal health and wellbeing and unhealthy foods as those that contribute to the development or exacerbation of disease. For example, one participant (69 years, female, Black) stated, *"As I'm getting older, I am looking for certain things in, or things not, in the processed foods that could cause some, you know, health issues or increase my health issue."* In addition to health outcomes, participants also cited the nutrient composition of foods as a way of determining healthfulness. Many indicated that they look to the presence of added sugar, sodium, and saturated fat as a way of determining whether or not a food in healthy (e.g., *"Is it talking about calories? Is it like fat content? sugar content? salt content? like those are all things I think of."* [26 years, female, White]). Several participants also showed concern for the perceived quality of the food or how it was made. They stated they prioritized freshness or looking for terms such as "organic" or "non-GMO" when looking for healthy foods. One participant (35 years, male, Asian) described this thought process saying, *"It's more about like for me, it's like the additives shouldn't be there, if possible. Organic, you know."*

In addition to identifying components and qualities of food that make it "healthy," participants also highlighted the fact that eating healthy can be personal to the individual. They conveyed that there is not one, set definition of healthy; it can change depending on individual needs and preferences (e.g., *"I guess in general terms, kind of like from person to person, I would say, like, what makes your body feel the best from a day to day basis."* [20 years, male, White]).

4.1.2.3 Theme 3. Food Moods: Motivations for Food Choice

When asked to provide additional detail on their decision making and thought processes in responding to the vignette survey, participants identified a wide range of factors that contribute to their motivations for purchasing food products. Participants discussed elements that were present

on the food label and/or packaging that encouraged or discouraged them to purchase an item as well as personal and environmental factors that influenced their level of intention.

Usefulness of Food Labels

Participants frequently discussed the role food labels and packaging played in their decision making. Some gave high priority to attractive packaging when selecting foods to purchase and were deterred if they felt the package was too bland (e.g., *"I think the packaging is quite plain, so you know, it doesn't really like stand out to me."* [27 years, male, White]). Many stated they look to the information printed on a package to determine whether or not to purchase it. They expect to find information about nutrient content and/or how the product was made. A lack of this information reduced their likelihood of purchasing the product. For example, one participant (35 years, male, Asian) stated, *"If this thing said on it like, […] Greek yogurt or like 2% or something, this is not a problem. This is what I would buy. But I couldn't really tell anything about it other than that was yogurt, and I was like, oh, that can be like full fat, cow milk or could be, you know, a lot of water. I really don't know."* Others also expressed a desire for food labels to be more accessible, particularly those with sensory disabilities. They recommended alternative formats so labels could be more easily interpreted (e.g., *"Put ingredients for people who are disabled who cannot see."* [66 years, female, White, SNAP participant]).

When speaking directly about the proposed FDA healthy logo, participants diverged on their interpretations and perceptions of the label. For some, the presence of the logo on a food product provided validation that the food was in fact "healthy." For example, when asked how they interpreted the FDA healthy logo, one participant (30 years, female, White, SNAP participant) said, *"I think that someone else has done the research to make sure that it's got proper nutrients."* For others, however, the label was met with skepticism (e.g., *"Like healthy, according to what?*

According to who?" [26 years, female, White]). When the label appeared on a food product in the

vignettes, participants differed in their perception of the importance of the label in their decision

making. Some felt that it increased their intention to purchase a food (e.g., *"It was the FDA label.*

Yeah it was certified so that definitely helped." [20 years, male, White]), while others did not pay

it much attention (e.g. *"I like didn't really take into consideration the healthy logo that was on it."*

[22 years, male, White]).

Similarly, shopper ratings were also met with mixed interpretations. Some participants felt

that a high shopper rating conveyed confidence that the product could be trusted (e.g., *"And the*

shopping rating is really good with like 5 stars. So it's like it's backed up by like experience." [20

years, male, Asian]). Others felt desensitized to shopper ratings and felt they do not convey useful

information about a product. For example, one participant (35 years, male, Asian) explained, *"In*

the whole Amazon world, like, who trusts the 5 and 5.5 stars anymore? Like everything is 5 stars,

but it can't be. So I don't trust the shopper ratings to be honest."

Individual Factors

The majority of the factors influencing intention to purchase foods participants cited were

related to individual preferences or constraints. Many insights had to do with the food itself.

Participants described the importance of their personal taste when selecting foods to purchase or

not purchase (e.g., *"Because I don't eat black beans. Period. I don't. I don't care if I had a coupon.*

It's free. I'm not gonna get them because that's something I just don't eat." [69 years, female,

Black]). They also indicated a preference for foods and brands that were familiar to them. One

participant (69 years, male, White) described this sentiment saying, *"I might know another brand*

that I know tastes better or tastes good that I'm familiar with. Another brand that I'm familiar with

and that's it, familiarity with other brands." This sentiment was reiterated when participants

discussed their typical shopping habits; if they had purchased the product in the past, they were more likely to purchase it again (e.g., *"It's just something that I would normally buy."* [26 years, female, White]).

Other commonly cited motivations had to do with the individual's beliefs about healthy eating and food more generally. Some felt that the healthfulness of food was simply not a priority (e.g., *"Like the healthiness, is not the most priority."* [26 years, female, White]). Others placed a high level of importance on consuming nutritious foods. When speaking about choosing foods for the home, one participant (30 years, female, White, SNAP participant) stated, *"So it's important to me to make sure that [the children] have the nutrients that they need. So we try always to make sure that we have healthy food options."* Several participants discussed the importance of enjoyment when selecting foods, particularly those they viewed as snacks or "fun" foods. For example, one participant (20 years, male, Asian) explained, *"If I were to buy like snacks, it would just be for like enjoyment, so I wouldn't like care too much about like the healthy part of it."* Others described a sense of obligation they feel to eat healthy; they feel they must choose healthy foods, even when they may not want to (e.g., *"I'm probably like at war within myself and the things that I know in my head."* [69 years, female, White]).

Additional factors influencing food choice were related to aspects of the individual's lifestyle. Convenience was an important consideration for those with busy schedules (e.g., *"What's convenient for me, just because with my schedule I'm really busy all the time."* [20 years, male, White]). Some described thinking about their grocery shopping in terms of the meals they planned to prepare, rather than as single foods or ingredients. One participant (77 year, male, Black, SNAP participant) described his trips to the grocery store saying, *"Well, usually I plan my meals, so when I go to the store I have an idea. I'm not just going in there helter skelter. I have an idea what I need*

[…] for a couple of days." Several participants cited their active lifestyles and personal fitness as motivation for food selection. One participant (21 years, male, Black) shared, *"[I'm] getting back into lifting as well, so I'd like to make sure I have the right things in my body and not really fill it with junk that kind of keeps me half full instead of as full as I can be throughout the day."*

External Factors

The cost of food emerged as a salient factor in determining whether or not a participant would purchase a given food item with some being willing to accept a lower quality food if it was at an affordable price (e.g., *"I think that I have kind of average stuff as long as it's cheap."* [27 years, male, White]). The presence of a coupon was incentivizing in most cases (e.g., *"If I can get that 25% off, it always helps."* [21 years, male, Black]), however there was some nuance to the value participants placed on having the discount. For items that are already perceived to be inexpensive, such as black beans, the presence of a coupon had less influence. One participant (35 years, male, Asian) stated, *"…honestly, in this case the coupon didn't really make a difference, because you know [beans are] usually like a dollar, 2 dollars, so you know, that 25% off, it's okay. It's not a big deal."*

Many participants referenced the influence of other people or occasions in their rationale. Family members' preference played a large role in determining what was purchased for the home (e.g., *"Nobody in the family really enjoys eating it, so we never buy it."* [58 years, male, White]). Additionally, concerns around the healthfulness of food appeared to decline when participants were thinking of shopping for social gatherings or parties. One participant (69 years, female, White) explained planning food for a party stating, *"If we're having a group, so many people don't care, and I don't like to be like this, but they don't care, so why am I cooking healthy?"*

Additionally, participants considered the intended purpose of the food and the availability of other options when deciding how likely they were to purchase the item. If the food was meant to be eaten on its own, standard for quality were higher than for foods that function as an ingredient. One participant (20 years, male, Asian) described the difference between yogurt and beans saying, "*... this is like something to add to food, whereas yogurt's like a base. So yogurt, I feel like I can eat it by itself more easily than just beans, because it's kind of hard picture, if you're just eating straight up beans out of a bowl.*" Some participants described the choice to purchase certain foods relative to what else was available in the store; they were not outright opposed to purchasing the item shown in the vignette, but they would prefer to buy something else (e.g. *"If it was on my list, and I had to buy it, I would pick it if I didn't have a lot of options."* [35 years, male. Asian]).

4.2 Phase 2

4.2.1 Phase 2 Participant Characteristics

Figure 4 includes a flow diagram of participants in Phase 2 of the study. A total of 5169 individuals were screened for eligibility for Phase 2 of the study. The recruitment of participants beyond the previously identified target of n=484 was allowed to provide an ample sample size for further subgroup analyses and to improve overall statistical power. Of those, 4941 individuals accepted into the study and completed the vignette survey. Participants were excluded if there were inconsistencies in responses (e.g., mismatch in stated household size and sum of reported adults and children living in the home) or if their survey responses were determined to be improbable or impossible (e.g., completing the survey in less than two minutes) (Goodrich et al., 2022).

Additionally, responses were excluded if they included a duplicate email address or were not submitted in English. With these deletions, a total of 3566 participants were included in the final analyses. A *post hoc* power analysis revealed 100% power for detecting a medium to large effect ($f^2=0.25$), at a significance of $\alpha=0.05$, with a sample size of n=3566 for a linear regression analysis.
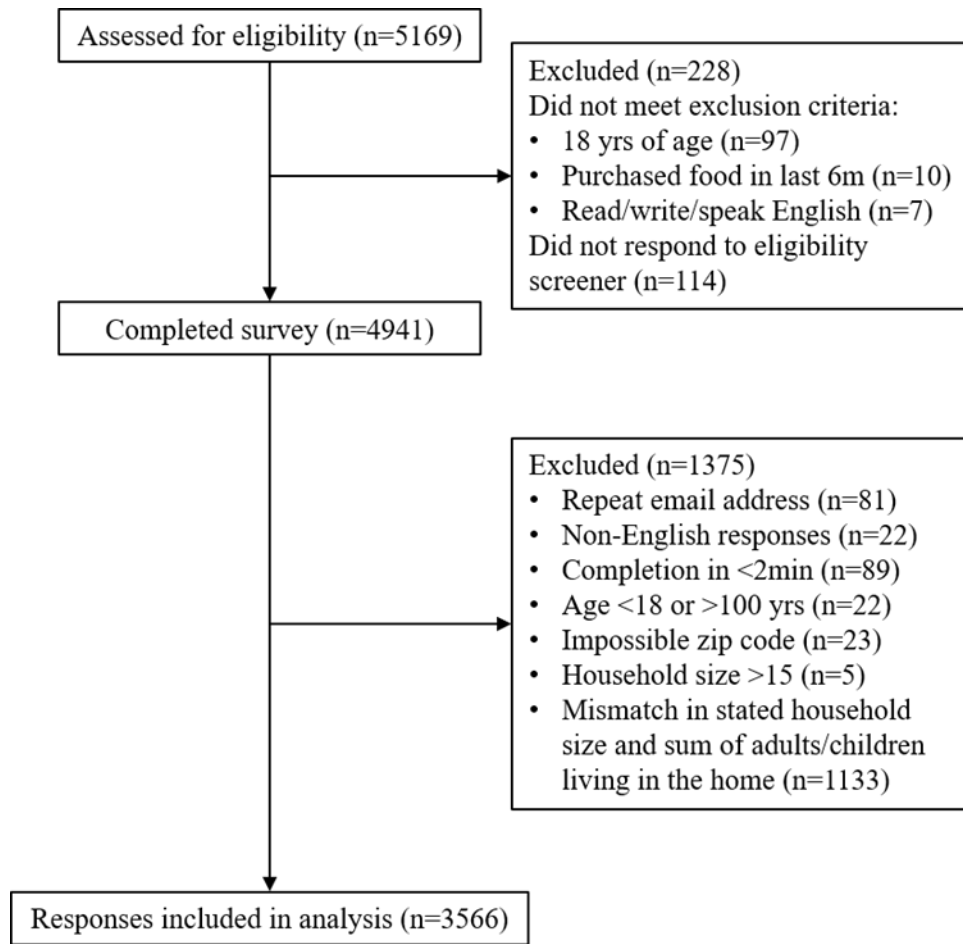
Figure 4. Phase 2 Participant Flow Diagram

Participants were predominately female (62.1%) and White (67.8%) with an average age of 32.19±8.58 years old (range 18-81 years). Nearly half of participants had completed college or more education (45.1%) and 60.0% reported a household income of $50,000 per year or more. The majority of participants were currently employed (83.1%), and 13.9% of participants were determined to be SNAP eligible. Participant demographic information can be found in **Table 8.**

Table 8. Demographic Characteristics (%[n] or Mean [SD]) of Participants Who Completed Phase 2 Vignette Survey

Characteristics	% (n) or M (SD)
Age (years) (n=3422)	32.19 (8.58)
Gender (n=3418)	
Male	37.0% (1264)
Female	62.1% (2124)
Other[a]	0.9% (30)
Ethnicity, % Hispanic/Latinx/Spanish (n=3415)	37.0% (1264)
Race (n=3411)	
American Indian or Alaska Native	5.9% (202)
Asian	3.1 % (106)
Black or African American	17.0% (581)
Native Hawaiian or Pacific Islander	3.3% (114)
White	67.8% (2313)
Mixed Race or Other	2.8% (95)
Education (n=3416)	
High school or less	8.3% (282)
Technical school or Associate's degree	26.6% (908)
Some college	20.0% (684)
Finished college	33.2% (1135)
Graduate degree	11.9% (407)
Employment (n=3416)	
Employed for wages or self-employed	83.1% (2838)
Currently unemployed or unable to work	8.9% (303)
Other[b]	7.9% (275)
Household Income (n=3413)	
Less than $20,000 per year	5.0% (171)
$20,000 - $34,999 per year	12.6% (430)
$35,000 - $49,999 per year	21.1 % (719)
$50,000 - $74,999 per year	30.5% (1040)
$75,000 - $99,999 per year	19.0% (650)
$100,000 or more per year	10.5% (359)
I don't know	1.3% (44)
Household Size (n=3183)	3.91 (1.37)
Adults living in home (n=3183)	2.76 (1.00)
Children living in home (n=3042)	1.20 (0.91)
% SNAP Eligible[c] (n=3183)	13.9% (444)

[a]Other gender includes participants identifying as transgender male (n=12), transgender female (n=7), non-binary (9), agender (n=1), and other (n=1)

[b]Includes participants identifying as stay at home parents or caregivers (n=56), students (n=152), retired (n=59), and other (n=8)

4.2.2 TPB Assessment

When asked about purchasing healthy foods, 71.7% of participants indicated that it is important to them to purchase healthy most of the time or always. A similar proportion of participants (70.7%) felt confident in their ability to purchase healthy food most of the time or always, and 69.5% of participants felt it was under their control most of the time or always. Responses to the assessment of TBP constructs are described in **Figure 5**.
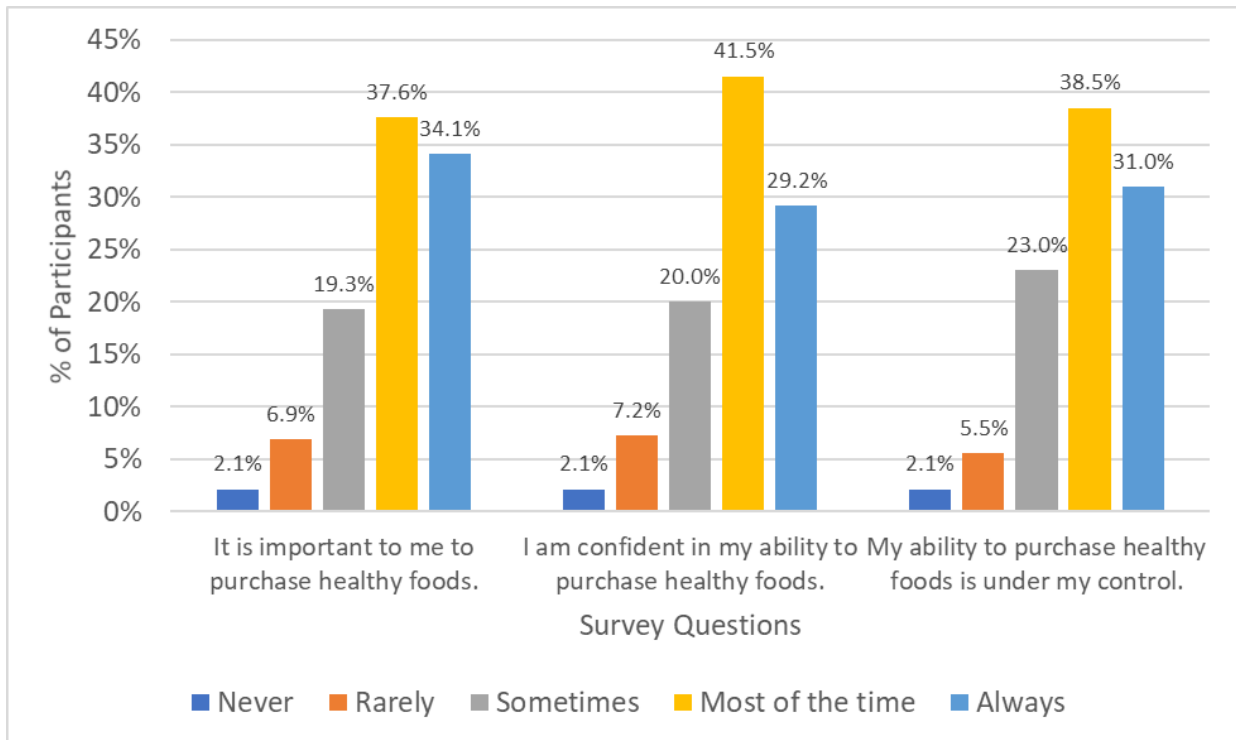
Figure 5. Assessment of Importance and Perceived Behavioral Control for Purchasing Healthy Foods

(n=3547)

4.2.3 Grocery Shopping Behaviors

The majority of participants (71.9%) identified as the primary food shopper for their household and most (76.6%) reported purchasing groceries one time per week or more. A summary of reported grocery shopping behaviors can be found in **Table 9.** When asked where they typically shop for groceries, the majority of participants (66.8%) selected "Large grocery store or super market chain." Roughly half of participants also selected "Convenience store, corner store, or bodega" and "Local grocery store." A complete ranking of food retailers is provided in **Figure 6.**

Table 9. Summary of Grocery Shopping Behaviors (n=3411)

Question	% (n)
Are you the primary food shopper for your household?	
Yes	71.9% (2453)
No	11.8% (403)
Shopping is shared equally	16.1% (549)
I don't know	0.2% (6)
How often do you purchase groceries?	
More than once per week	41.5% (1416)
Once per week	35.1% (1196)
2-3 times per month	21.4% (730)
Once time or fewer per month	2.1% (69)
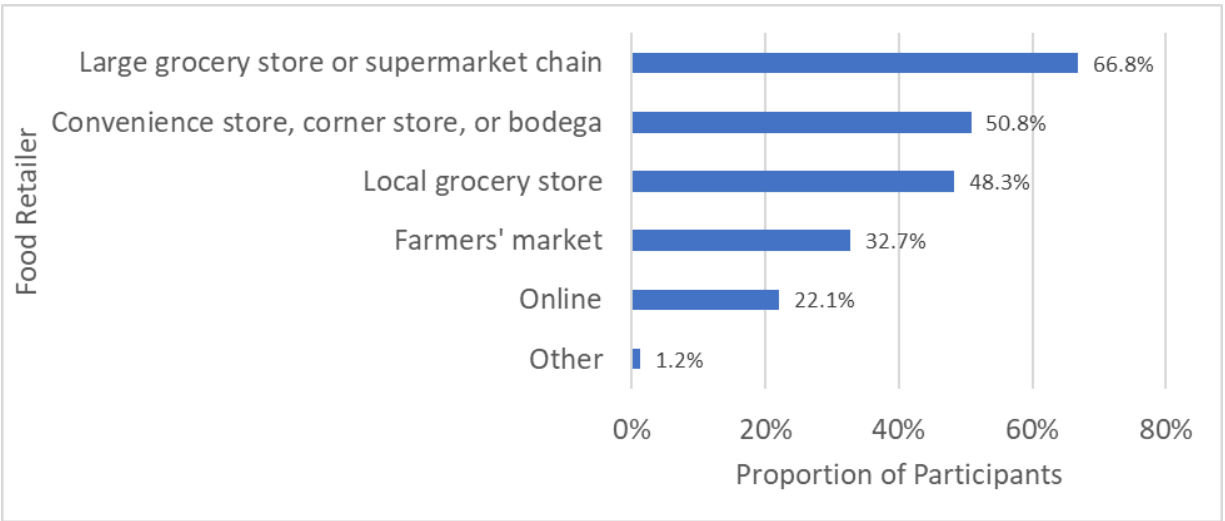
Figure 6. Proportion of Participants Reporting Purchasing Groceries from Various Food Retailers (n=3566)

Note: Participants were allowed to select multiple responses. The percent displayed refers to the proportion of total participants who selected that answer choice.

4.2.4 Vignette Survey

Mean scores for likelihood to purchase each food product are displayed in **Table 10.** When examining the relative influence of vignette attributes (i.e., coupon, healthy logo, and shopper rating) results differed by food type. The presence of the healthy logo and a 5-star shopper rating significantly increased intention to purchase all food items. A coupon, however, increased intention to purchase both yogurt and cereal, but did not influence intention to purchase beans. Complete results can be found in **Table 11** (Aim 2).

Table 10. Mean Overall Score for Likelihood to Purchase Yogurt, Cereal, and Beans

Food Type	Mean (SD)
Yogurt (n=3490)	68.83 (21.26)
Cereal (n=3458)	67.07 (21.36)
Beans (n=3439)	67.90 (21.86)

Note: Possible scores ranged from 0-100;

Table 11. Multiple Linear Regression Results for Base Vignette Attributes Only for All Food Types (n=3566)

Vignette Attribute[1]	Food Type		
	Yogurt	Cereal	Beans
Coupon	1.907 (0.733)**	2.549 (0.744)***	1.320 (0.757)
Healthy Logo	2.394 (0.733)**	2.286 (0.744)**	2.572 (0.757)***
Shopper Rating	6.969 (0.733)***	6.825 (0.744)***	7.575 (0.757)***
Intercept	64.347 (0.725)	62.399 (0.738)	63.216 (0.759)
R-squared	0.033	0.033	0.033

[1]Coupon 1=yes, 0=no; Healthy Logo 1=yes, 0=no; Shopper Rating 1=5-start, 0=3-star

Note: Standard errors in parentheses; significance is denoted by *, **, *** for 5%, 1% and less than 0.1% levels, respectively

Table 12 presents the results of the multiple linear regression analysis to examine whether response to the label attributes differed by key demographic characteristics (i.e., race/ethnicity, age, SNAP eligibility) (Aim 2b). Participants identifying as Hispanic, Latinx, or Spanish were more likely to purchase yogurt overall when compared to those who did not identify as Hispanic, Latinx, or Spanish. When considering the relative influence of the vignette attributes, only 5-star shopper ratings for cereal and beans increased intention to purchase in Hispanic, Latinx, or Spanish individuals. In the interest of decentralizing whiteness as the standard to which all other races are compared, the "Other/Mixed Race" category was selected as the reference group. Participants in all race categories (i.e., American Indian or Alaska Native, Asian, Native Hawaiian or Pacific Islander, Black or African American, and White) were more likely to purchase yogurt when compared to those in the Mixed Race/Other category. Differences emerged when examining the interaction effects between vignette attributes and race categories. For participants identifying as American Indian or Alaska Native, the presence of a healthy logo decreased intention to purchase yogurt, while a 5-star shopper rating increased intention to purchase cereal when compared to those identifying as Mixed Race or Other. Black or African American participants were also less likely to purchase yogurt when it displayed the healthy logo compared to the Mixed Race/Other group.

Participants 18-25 years of age and 26-55 years of age were more likely to purchase all food types compared to those over 55 years of age. The "55 years of age or older" category was selected as the reference group because it came last numerically in the age category. For both age groups, the healthy logo decreased intention to purchase cereal and beans and a 5-star shopper rating also decreased intention to purchase yogurt compared to their older adult counterparts.

SNAP eligible participants expressed lower levels of intention to purchase beans compared to non-SNAP eligible participants. The presence of a coupon, however, significantly increased intention to purchase beans in this group. Complete results from the multiple linear regression model to assess Aim 2b can be found in **Table 12.**

When asked what factors influenced their intention to purchase a given food item, the largest proportion of participants selected "Food preference" across all food types (yogurt: 51.1%, cereal: 49.7%, beans: 49.6%). This was followed by the healthy logo and price of the food item. Shopper rating ranked the lowest among the options provided although a substantial proportion of participants still selected it (yogurt: 39.6%, cereal: 39.1%, beans: 38.8%). A full ranking of the factors influencing intention to purchase the food types can be found in **Figure 7**.

Table 12. Multiple Linear Regression Results for Base Vignette Attributes, Demographic Characteristics, and Vignette Attribute*Demographic Characteristic Interactions for All Food Types (n=3566)

	Food Type		
Vignette Attribute[1]	Yogurt	Cereal	Beans
Coupon	-2.487 (6.045)	13.118 (6.270)*	-4.963 (6.392)
Healthy Logo	9.851 (6.126)	13.143 (6.278)*	21.518 (6.450) ***
Shopper Rating	33.380 (6.141)***	6.365 (6.225)	13.342 (6.432)*
Hispanic/Latinx/Spanish[2]	3.190 (1.514)*	2.741 (1.572)	-1.793 (1.610)
Hispanic/Latinx/Spanish*Coupon	0.804 (1.543)	-1.451 (1.560)	-0.469 (1.603)
Hispanic/Latinx/Spanish*Healthy Logo	0.746 (1.543)	0.129 (1.562)	2.864 (1.602)

Hispanic/Latinx/Spanish*Shopper Rating	1.412 (1.546)	3.758 (1.562)*	3.488 (1.604)*
Race[3]			
American Indian or Alaska Native	17.193 (5.359)**	-3.963 (5.366)	4.059 (5.358)
American Indian or Alaska Native*Coupon	-8.981 (5.276)	-1.043 (5.200)	1.248 (5.413)
American Indian or Alaska Native*Healthy Logo	-10.832 (5.147)*	-0.911 (5.216)	-8.075 (5.350)
American Indian or Alaska Native*Shopper Rating	0.909 (5.119)	10.574 (5.205)*	2.354 (5.335)
Asian	15.907 (6.121)**	2.542 (6.133)	3.375 (5.917)
Asian*Coupon	-7.227 (6.028)	-7.569 (5.940)	3.472 (6.134)
Asian*Healthy Logo	-7.776 (5.884)	3.705 (5.978)	-5.879 (6.106)
Asian*Shopper Rating	-3.795 (5.874)	0.149 (5.949)	-2.422 (6.084)
Native Hawaiian or Pacific Islander	14.910 (6.103)*	-1.860 (6.189)	7.805 (6.034)
Native Hawaiian or Pacific Islander*Coupon	-4.946 (5.875)	1.519 (5.803)	2.727 (6.000)
Native Hawaiian or Pacific Islander*Healthy Logo	-10.875 (5.816)	1.599 (5.835)	-9.932 (6.009)
Native Hawaiian or Pacific Islander*Shopper Rating	-4.594 (5.753)	4.316 (5.828)	-1.821 (6.005)
Black or African American	16.346 (4.941)***	8.376 (4.959)	8.154 (4.718)
Black or African American*Coupon	-1.161 (4.854)	-4.695 (4.746)	2.011 (4.938)
Black or African American*Healthy Logo	-9.280 (4.709)*	0.152 (4.774)	-4.991 (4.905)
Black or African American*Shopper Rating	-6.946 (4.681)	1.520 (4.749)	-6.011 (4.877)
White	15.830 (4.619)***	2.909 (4.618)	7.089 (4.353)
White*Coupon	-3.820 (4.527)	-3.787 (4.403)	3.196 (4.582)
White*Healthy Logo	-6.897 (4.369)	1.583 (4.426)	-8.720 (4.547)
White*Shopper Rating	-4.601 (4.336)	5.171 (4.401)	-1.941 (4.517)
Age[4]			
18-25 years	21.033 (4.373)***	26.865 (4.833)***	13.858 (4.583)**
18-25 years*Coupon	6.248 (4.788)	-5.861 (4.949)	1.575 (5.005)
18-25 years*Healthy Logo	-1.817 (4.775)	-12.540 (4.938)*	-14.502 (5.044)**
18-25 years*Shopper Rating	-24.376 (4.832)***	-4.833 (4.907)	-3.628 (5.069)

26-54 years	20.312 (4.178)***	31.509 (4.622)***	18.488 (4.365)***
26-54 years*Coupon	8.153 (4.575)	-7.048 (4.748)	3.471 (4.784)
26-54 years*Healthy Logo	0.204 (4.564)	-11.953 (4.733)*	-12.305 (4.831)*
26-54 years*Shopper Rating	-22.736 (4.623)***	-5.482 (4.702)	-6.105 (4.856)
SNAP Eligible[5]	-2.294 (2.075)	2.791 (2.128)	-7.055 (2.283)**
SNAP Eligible*Coupon	4.040 (2.172)	-0.013 (2.195)	5.463 (2.248)*
SNAP Eligible*Healthy Logo	-0.900 (2.167)	-0.379 (2.195)	1.970 (2.255)
SNAP Eligible*Shopper Rating	-2.380 (2.161)	-3.500 (2.192)	3.229 (2.256)
Intercept	28.292 (6.045)	28.378 (6.401)	41.165 (5.915)
R-squared	0.080	0.081	0.069

[1]Coupon 1=yes, 0=no; Healthy Logo 1=yes, 0=no; Shopper Rating 1=5-start, 0=3-star

[2]Relative to those not identifying as Hispanic/Latinx/Spanish

[3]Relative to Mixed Race/Other

[4]Relative to those 55 years or older

[5]Relative to non-SNAP Eligible participants

Note: Standard errors in parentheses; significance is denoted by *, **, *** for 5%, 1% and less than 0.1% levels, respectively
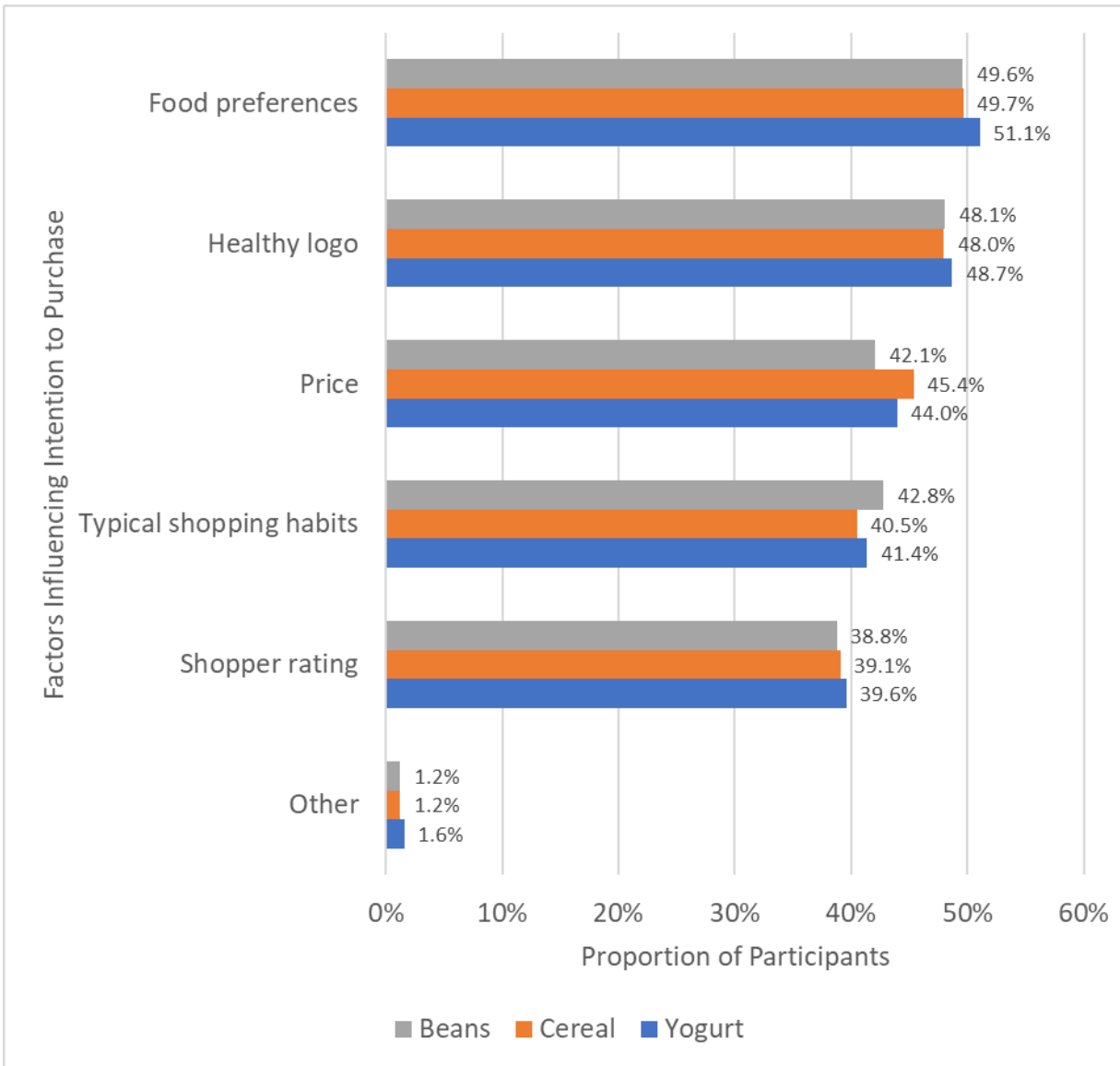
Figure 7. Proportion of Participants Reporting Stated Factors Influencing Intention to Purchase Food

Products (n=3566)

Note: Participants were allowed to select multiple responses. The percent displayed refers to the proportion of total participants who selected that answer choice.

5.0 Discussion

The present study aimed to assess the usefulness of food messaging techniques in influencing intention to purchase healthy food items and determine their relative importance. Further, it endeavored to determine if differences in the importance of the messaging techniques exist based on key participant demographic characteristics (i.e. race/ethnicity, age, SNAP eligibility). Phase 1 interviews confirmed the hypothesis that a vignette survey is a valid and appropriate way of assessing intention to purchase healthy foods and provided valuable insights into participant decision making, informing the final draft of the vignette survey. Phase 2 analyses revealed a significant influence of the vignette attributes (i.e., coupon, healthy logo, and shopper rating) on intention to purchase the food items presented (i.e., yogurt, cereal, and beans); however, this influence differed by food type. A healthy logo and 5-star shopper rating increased intention to purchase all food items, but a coupon only increased intention to purchase yogurt and cereal, not beans. This finding ran counter to the hypothesis that economic incentives would be the most important factor in increasing intention. Rather, a 5-star shopper rating, a theorized proxy for social norms, appeared to have the largest positive effect on purchasing intention.

Of particular interest to the present study was the influence of the vignette attributes on intention to purchase for key population subgroups. When demographic characteristics of interest and the interactions between those characteristics and the vignette attributes were included in the model, the overall influence of the vignette attributes was muted. For yogurt, only a positive shopper rating was effective in increasing intention to purchase. For cereal, both a coupon and the presence of the healthy logo significantly increased intention to purchase with little difference between the two. For beans, both the healthy logo and a positive shopper rating were influential

with the healthy logo being the more impactful of the two. There were few significant interaction effects observed, largely confirming the hypothesis that the relative importance of the vignette attributes would not differ by participant demographics.

5.1 Validation of the Vignette Survey

Previous research has demonstrated the usefulness of vignette methodology in assessing food and nutrition related behaviors (Ellison & Lusk, 2018; Hartman et al., 2018; Kellershohn et al., 2021; Lydecker et al., 2020). Phase 1 cognitive interviews confirmed the previous understanding that a label vignette would be easily understood, well received by participants, and result in low participant burden. This is in line with previous findings that have determined vignettes to be valid and reliable measures of respondent opinions (Alexander & Becker, 1978). These interviews allowed for an in-depth analysis of the participants' comprehension of each question in the survey, the past experiences they relied upon to contextualize the questions, how they weighed the options presented to them, and how they ultimately decided upon a response.

These interviews were essential for the revision of the final vignette survey, particularly the creation of a drop-down menu to replace the open-ended responses assessing motivations for intention to purchase. In Phase 1, this question was identified as a key point of confusion and difficulty for participants, with many unsure what to write or the level of detail they should provide. In addition to the vignette attributes, two commonly stated motivations (i.e., food preference and typical shopping habits) were identified and included in a multiple-select list for the finalized survey. Similar factors, such as familiarity of food, convenience, and sensory appeal, have emerged in previous research assessing motivations for food choice (Konttinen et al., 2021).

Additionally, a third question was added to the assessment of TPB constructs in order to provide a more comprehensive assessment of perceived behavioral control. Based on participant feedback regarding their interpretation of the question, it became clear that only asking to what extent they agreed with the statement 'I am confident in my ability to purchase healthy foods' was not sufficient to fully capture both the self-efficacy and sense of personal control that define perceived behavioral control. As a result, the statement 'My ability to purchase healthy foods is under my control' was added to the survey. This distinction between capacity and controllability and the importance of their combined effect is made evident by Ajzen (2002). The new survey item was created based on previously developed questionnaires assessing perceived behavioral control for physical activity behaviors (Ajzen, 2019).

The interviews provided a framework for improved interpretation of the Phase 2 survey results as well as illuminating additional themes and novel insights. Of note were the diverse definitions for the term 'healthy' that participants shared. Many participants associated 'healthy' with the nutrient content of the food, specifically identifying sugar, sodium, and fat as nutrients of concern. Additionally, other characteristics of the food, such as how it was prepared, level of processing, and freshness, contributed to the perception of healthfulness. Lusk (2019) found similar consumer sentiments; sugar content, fat content, and use of preservatives were among the most commonly cited factors effecting the perception of a food's healthfulness. Further, phase 1 participants shared they were motivated to purchase and consume healthy foods because of the perceived health benefits associated with eating a nutritious diet. This finding is consistent with previous cross-sectional surveys assessing motivations for food choice in adults which have identified the health effects of food as a key factor in influencing food choice (Konttinen et al., 2021).

5.2 Influence of Vignette Attributes

5.2.1 Coupon

Previous research has highlighted the importance of economic incentives for driving purchasing behavior (Hartman-Boyce et al., 2018). It was hypothesized that the economic incentive would be the most salient factor in determining the likelihood of purchasing the food product; however, that was not the case. In the present study, the 25% off coupon did not appear to be as influential as expected, and in some cases (i.e., beans) having no effect at all on intention to purchase. This may be due to the fact that canned beans are generally perceived to be an inexpensive food, thus making the influence of the coupon less important. This sentiment was expressed in the Phase 1 cognitive interviews; beans were generally perceived to be a low-cost food item and therefore the coupon may not have been influential. When demographic characteristics and interaction effects were taken into account, the influence of a coupon was further diminished, and the only significant effect observed was an increase in intention to purchase cereal. Dairy, grain products, and beans/legumes have a lower energy cost (i.e., dollar amount per calorie) compared to other healthy grocery items (e.g., fruits, vegetables, meat/poultry/fish) (Drewnowski, 2010). It is possible that all foods selected for the study, not only beans, are already perceived to be low-cost, and therefore, a coupon does little to increase their appeal.

Additionally, presenting the coupon in terms of a percentage rather than a dollar amount may have been difficult for participants to interpret. Previous research suggests that discounts that require mathematical calculations may result in greater error in consumers' estimations of the final cost of the product (Chen & Rao, 2007). Alternatively, the coupon may not have been large enough

to influence purchasing intention; offering a coupon for 50% or 75% off the cost of the product may have resulted in a greater intention to purchase.

5.2.2 Healthy Logo

When evaluating the impact of the vignette attributes alone, the presence of the healthy logo on the food labels was effective in increasing intention to purchase across all food types. This was aligned with previous findings that suggest the use of commonly understood symbols help to address the barrier of bounded rationality, the idea that humans may lack the necessary resources to make the best decision in a given situation (Liu et al., 2014; Matjasko et al., 2016). In the present study, the use of the healthy logo was theorized to act as a 'short-cut' for participants, allowing them to identify the food product as 'healthy' without having to interpret extensive and complex nutrition information. This hypothesis corresponds to the expected impact of the proposed FDA healthy logo currently under evaluation (DPC, 2022).

When demographic characteristics and interaction effects were included in the analysis, the healthy logo only appeared to be influential for intention to purchase cereal and beans. Results from the Phase 1 cognitive interviews suggested that participants' interpretation of the healthy logo was mixed. Some saw it as validating the healthfulness of the product, while others remained skeptical of the criteria used by the FDA to define the term 'healthy.' This conflicting sentiment among consumers may have driven the mixed results seen when evaluating the influence of the healthy logo on purchasing decisions. It may be that a healthy logo on its own may not be enough to convince all consumers of the healthfulness of the product; additional education and/or marketing may be needed. Similar conclusions have been drawn by Lusk (2019). An individual's definition of 'healthy' is often multifaceted and may not be fully represented by one logo. The

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development of a national education campaign to inform consumers about the criteria for and interpretation of the proposed healthy logo may be warranted. Further, it is possible that the proposed FDA healthy logo cannot yet be considered a 'commonly understood symbol,' such as traffic lights or stop signs cited in the literature, and thus may not be as readily interpretable by consumers (Liu et al., 2014).

5.2.3 Shopper Rating

Surprisingly, shopper ratings appeared to be the most influential of all the vignette attributes when examining their influence overall. Previous research has established the importance of social norms in health decision making, including food purchasing behavior (Ajzen, 1991; CDC, 2022; Hayden, 2014; Liu et al., 2014). The presence of a shopper rating was theorized to influence the consumer's perception of social norms and thus result in the participant understanding the food to be appraised positively (5-stars) or moderately (3-stars) by other shoppers. The substantial influence of the shopper rating on intention to purchase a food item suggests that positive social appraisal may be a more influential tool than previously realized.

When demographic characteristics and interaction effects were included in the model, the influence of shopper ratings was dampened. Similar to what was observed with the healthy logo, participants were divided in their perception of the shopper ratings. Results from the Phase 1 interviews indicated that many participants did not trust shopper ratings as a reliable tool in evaluation the quality of a food product. Additionally, when asked to identify which factors contributed to their decision making, less than half of participants cited the shopper rating as a primary influence. However, despite the relatively low subjective ratings, shopper ratings significantly increased intention to purchase yogurt and beans. This illustrates a disconnect

between what individuals may believe is influencing their decision to purchase a food item and what may actually be driving their intention.

5.3 Differences among Participant Demographics

Few differences were observed in the relative importance of the vignette attributes among key demographic subgroups of the sample. The differences that did exist, however, provide valuable insight into how response to food label messaging vary by race/ethnicity, age, and SNAP eligibility, occasionally in unexpected ways.

5.3.1 Race/Ethnicity

The relative importance of the vignette attributes remained consistent across most race/ethnicity groups with a few notable exceptions. A 5-star shopper rating increased intention to purchase both cereal and beans among participants identifying as Hispanic, Latinx, or Spanish compared to those not identifying as Hispanic, Latinx, or Spanish. Previous research has established the substantial social influence and importance of family and community in this ethnic subgroup (Callender et al., 2020; Conlon et al., 2015; Kong et al., 2018; Lindsay et al., 2018; Mena et al., 2015; NIMHD, 2017; Ochoa & Berge, 2017; Reifsnider et al., 2020). It may be that the presence of a 5-star rating communicating a positive social appraisal of the food product was particularly meaningful for those identifying as Hispanic, Latinx, or Spanish.

Of particular note is the significant decline in likelihood to purchase yogurt when a healthy logo is present observed in both American Indian/Alaska Natives and Black/African Americans

compared to those identifying as Mixed Race or Other. The intention of the healthy logo is to make discerning the healthfulness of a product quick and easy for consumers and reduce barriers to interpreting nutrition information on labels. For these two racial subgroups in the current study, however, it had the opposite effect. It is possible this finding could be attributable to a lack of trust among these communities in institutions such as the U.S. government (Braveman et al. 2010; Satia, 2009; Coleman-Jensen, Rabbitt, Gregory, et al., 2021). Presently, this association is speculative, and further research is needed to determine if trust and/or other factors not directly assessed in the current study influenced the observed interaction between race and the healthy logo.

5.3.2 Age

Those in the 18-25 years and 26-54 years age categories followed similar patterns of behavior when compared to those over 55 years of age. Participants in both of the younger age categories exhibited significantly lower levels of intention to purchase both cereal and beans when a healthy logo was present on the product compared to older adults. Previous research, as well as findings from the Phase 1 interviews, indicate that the healthfulness of a food product becomes more important as an individual ages (Konttinen et al., 2021). This indicates that a healthy logo may be more effective for those over 55 years of age and may prove to be less motivating for those under 55 years of age. This finding typifies the concept of time inconsistent preferences, a common behavioral bias known to influence food choice (Loewenstein et al., 2003; Matjasko et al., 2016). It is common for individuals to make decisions that favor immediate gratification at the expense of long-term wellbeing. This is often seen with young adults being less concerned about their health than older adults who may be experiencing more direct, negative consequences of poor health related-decisions as they age (Liu et al., 2014).

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A 5-star shopper rating also decreased intention to purchase yogurt for those 18-25 years of age and 26-54 years of age compared to those over 55 years of age. This may be related to the lack of trust in shopper ratings expressed by some participants in the Phase 1 interviews. There is a perception that shopper ratings may be falsified or only reflect extreme opinions from shoppers. This mistrust may be more pronounced in younger participants who have grown up with high levels of digital engagement (Schroth, 2019). They may be more accustomed to seeing a shopper rating scale for online purchases and be more attuned to the pitfalls of the system compared to older adults.

5.3.3 SNAP Eligibility

Prior to the Aim 2b exploratory analyses, a new SNAP eligible variable needed to be created. There were concerns about the validity of the data and overreporting because nearly 47% of participants reported they received SNAP benefits, greatly exceeding the national SNAP participation rate of 12.6%. A new variable, SNAP Eligibility, was created using participant reported household income and household size. Those participants that were within 130% of the federal poverty level were categorized as 'SNAP eligible' and those above 130% of the federal poverty level were categorized as 'non-SNAP eligible' (USDA, 2021b; HHS, 2023). This resulted in 13.9% of the sample being considered SNAP eligible, a figure that more closely reflected the national rate of participation, and thus the variable used for the subsequent analyses.

SNAP eligible participants did not differ from non-SNAP eligible participants in the relative importance of the vignette attributes, with one exception. SNAP eligible participants were more likely to purchase beans when presented with a 25% off coupon compared to non-SNAP eligible participants. This finding aligns with the previous understanding that this population tends

to be more cost sensitive (Food and Nutrition Service, 2021a, 2021b). The influence of the healthy logo was not significantly different among SNAP eligible participants compared to those who were not SNAP eligible. Previous research has examined the differential effects of front-of-package food labels on the purchasing behavior of low-income individuals and found a slightly greater benefit for those with higher incomes (Ni Mhurchu et al., 2017; Ducrot et al., 2016). Although still effective, Ducrot et al. (2016) found the influence of front-of-package labels on the purchasing behavior of low-income individuals to be less than the influence on their higher income counterparts. Ni Mhurchu et al. (2017) observed that front-of-package labels were less effective for low-income participants relative to high-income participants. This indicates the need for a deeper examination of the influence and potential role labels may have on intention to purchase food items in SNAP eligible participants.

5.4 Attitudes Toward Healthy Foods and Shopping Habits

Results from both Phase 1 and Phase 2 suggest that purchasing healthy food is a high priority for the vast majority of participants. They also felt that they were confident in their abilities and had the resources necessary to be able to purchase healthy foods. This suggests high levels of perceived behavioral control over the behavior (Ajzen, 2002, 2019). Participants' high level of perceived behavioral control for purchasing healthy foods may help to explain why coupons and the healthy logo were less effective than a 5-star shopper rating in increasing intention to purchase a food item. It was theorized that the inclusion of an economic incentive and/or a commonly understood symbol of healthfulness would improve perceived behavioral control by reducing the barrier of bounded rationality (i.e., providing individuals with the resources necessary to make the

best decision). Since perceived behavioral control for purchasing healthy foods appeared to be quite high prior to the intervention, it may be that the attempt to increase it was negligible.

Data from the present study aligned with findings from national surveys assessing where and how often individuals shop for groceries. The vignette survey results indicated that nearly 67% of participants shop for groceries at a large grocery or supermarket chain. This is reflective of the USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) which indicated that about 65% of calories purchased for a household come from large supermarkets (USDA, 2019). Further, results indicated that nearly 77% of participants purchase groceries at least once per week. This mirrors findings from FoodAPS suggesting that over 75% of households visit the grocery store once per week or more (Todd & Scharadin, 2016). These findings emphasize the importance of the food retail environment in food acquisition and thus its importance for nutrition interventions.

5.5 Strengths and Limitations

A primary strength of the study was the large and diverse sample of participants. The present study was able to provide preliminary insights into the purchasing behavior of key demographic subgroups. In Phase 2, the total sample size greatly exceeded what was needed to observe the desired effect size. Additionally, the sample size in each demographic of interest (i.e., race/ethnicity, age, SNAP eligibility) was large enough to perform subgroup analyses and examine interaction effects between vignette attributes and demographic characteristics. This was particularly important for the evaluation of racial and ethnic minorities, such as American Indian/Alaska Natives and Native Hawaiian/Pacific Islanders, who are often not reported as

separate racial groups in the literature. Additionally, findings contributed to the growing body of literature on young adults (18-25 years). As this group ages and continues to gain economic spending power, it is increasingly important to understand their motivations and habits.

The inclusion of cognitive interviews served two primary purposes: 1) to finalize the vignette survey and 2) provide context to Phase 2 quantitative results. The interviews provided a means of validating the survey for use in assessing intention to purchase selected food items. The survey was able to be modified in response to participant feedback to ensure greater interpretability by participants and thus higher quality outputs in Phase 2. Additionally, the interviews provided an in-depth understanding of the quantitative findings of the vignette survey. Themes and categories that emerged during the qualitative analysis of the interview transcripts were essential in informing interpretation of the Phase 2 findings. As suggested in previous literature, the combination of both qualitative and quantitative methods served to produce higher quality data and a more nuanced interpretation of the findings (Almalki, 2016). Complementary, mixed methods approaches should be prioritized in future research endeavors.

In addition, the use of vignette methodology and randomization of the questionnaire allowed for an assessment of the relative importance of the vignette attributes (Hainmueller et al., 2015). Previous research has identified messaging components that are influential for purchasing behavior, but few have been able to rank those components in order to determine which is most effective and for whom (Hartman-Boyce et al., 2018; Just & Gabrielyan, 2018; Payne & Niculescu, 2018). The present study provides visibility into the influence of each attribute and how that may, or may not, vary by race/ethnicity, age, and SNAP eligibility.

The present study is not without its limitations. Although the study design was strong, it still only represents a simulation of real-world events. Individuals may behave differently when

actually faced with the decision of whether or not to purchase a food item in the grocery store. While every attempt was made to include the most common motivations for food choice in the assessment following each vignette, it would be impossible to represent all potential factors that may influence food choice. Even though participants had the option to write in a response, it is possible that the survey did not capture all motivations for food choice. There are potentially unconscious or situation-specific factors that could not be accounted for in a survey format. Additionally, a smaller number of adults over the age of 55 years participated in the Phase 2 vignette survey (n=89) compared with the other age groups. This may indicate that recruitment methods (e.g., social media, listservs) were not as effective for recruiting this age group into the study. Finally, it is possible that the foods presented in the survey were too inexpensive to test the coupon effect. The relatively small effect of the economic incentive on intention to purchase the food items observed in this study was not in line with previous findings and may have been related to the types of foods selected, rather than the actual influence of the coupon.

5.6 Future Directions

5.6.1 Implications for Future Research

The present study provided robust, preliminary insights into the relative influence of messaging techniques to increase intention to purchase foods in the food retail environment. It was, however, a simulation of real-world behavior and therefore does not fully encompass all of the complex influences on purchasing decisions made in the food retail environment. Future research should aim to test these hypotheses in a real-world, in-store setting to compare the results.

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Additionally, targeted approaches should be taken to recruit older adults to ensure a balanced study sample. Future studies should examine the influence of the vignette attributes on the intention to purchase a variety food items, particularly those that are perceived to be higher cost, as a means to more effectively test the influence of a coupon. Additional exploration into the influence of demographic characteristics on the TPB constructs is also warranted. Finally, the influence of front-of-package labeling on SNAP eligible participants remains unclear. This is of particular concern because of the reduced access to healthy food and poor diet quality in this population (Coleman-Jensen, Rabbitt, Gregory, et al., 2021; Coleman-Jensen, Rabbitt, Hales, et al., 2021; Crowe et al., 2018). In order to effectively improve the food purchasing behavior of low-income individuals, future research should explore interventions that more directly target the specific needs and motivations of this community.

Future studies should also aim to evaluate alternative known motives for food choice in the retail environment (e.g., time inconsistent preferences, visceral cues, status quo bias) and their relative importance on intention to purchase healthy foods (Loewenstein et al., 2003; Liu et al., 2014; Matjasko et al., 2016). Studies should continue to explore the use of qualitative and mixed method designs, as they can offer more detailed and nuanced insights into the decision making process that cannot be assessed through quantitative methods alone.

5.6.2 Implications for Practice and Policy

As the FDA continues to evaluate the criteria for and usefulness of the healthy logo, care should be taken to ensure that the population is properly informed and educated on the meaning of the logo. As demonstrated in the present study, simply placing the healthy logo on a food item may not increase intention to purchase it. In some cases, it may actually deter individuals from

purchasing, as was seen with American Indian/Alaska Native, Black/African Americans, and adults under 55 years of age. It was speculated that the influence of the healthy logo was diminished due to a lack of trust in government and health systems, particularly for racial and ethnic minorities. This could be further examined through focus groups to co-create food labels with communities, including racial/ethnic minorities and SNAP eligible individuals, to better understand their interpretations and opinions of the proposed healthy logo. Dissemination and awareness campaigns should be led by members of these communities in order to effectively communicate the relevance and importance of the new food labels.

In addition to physical food retail environments, online grocery shopping has risen in popularity in the last decade and presents unique opportunities and challenges for consumers (Pitts et al., 2018). The presentation of the 5-star shopper rating in the present study likely provides more insight into how this type of messaging may be used to increase intention to purchase healthy foods in a digital environment, where star ratings are commonly used. Previous research has been mixed on the influence of social norm messaging in the digital food retail environment, indicating a need for further exploration into the best ways to utilize this technique (Jansen et al., 2021).

The present study contributed to the growing body of evidence indicating the importance of the food retail environment in nutrition and health. Public health officials and policy makers should carefully consider the influence of this space and look to structure the environment in a way that encourages healthy food purchasing. Findings from this study suggest that the inclusion of economic incentives, a healthy logo, and/or a positive shopper rating are plausible interventions that may help to increase the purchase, and potentially consumption, of healthy foods.

5.7 Conclusions

The results of this study supported the hypothesis that the investigator designed vignette survey would be valid, well received by participants, and result in low participant burden. Results from Phase 2 supported the hypothesis that the presence of a coupon, healthy logo, and 5-star shopper rating would increase intention to purchase food items. However, they did not support the hypothesis that a coupon would be the most influential of the three attributes. Rather, a 5-star shopper rating was observed to have the greatest impact on intention. Finally, the hypothesis that no differences would be observed across demographics was only partially supported by these findings. While there were no significant interaction effects for most demographic characteristics and vignette attributes, the influence of the label attributes may vary by race/ethnicity and age. Additional research is needed to explore these relationships further to inform future nutrition interventions and develop effective food labels and messaging techniques that work for all subgroups of the U.S. population.

In sum, the present study highlights the complexity of food choice. There is not a singular way to encourage healthy purchasing behavior. Appropriate and effective techniques likely vary across demographics and food type. In order to effectively address the needs and preferences of the diverse U.S. population, a variety of messaging techniques will need to be utilized.

Appendix A

Cognitive Interview Guide

At the start of the interview, participants were provided with the vignette survey and open-ended reflection question. Participants were given as much time as they need to read through and respond to the questionnaire. The interviewer then probed with the following questions for each of the questions in the survey. Questions have been adapted from Collins (2003).

1. How did you go about answering that question? Tell me what you were thinking.

2. How easy or difficult did you find this question to answer? Why do you say that?

3. What does the term "healthy" mean to you? What did you understand by the FDA Healthy logo?

4. Were you able to find your first answer to the question from the response option shown?

Appendix B

Phase 1 Eligibility Screener

Responses of "no" to one or more questions disqualified the individual from participating.

1. Are you 18 years of age or older? (Yes/No)
2. Have you purchased food from a food retailer within the last 6 months? A food retailer includes grocery stores, conveniences or corner stores, farmers' markets, etc. This excludes food purchased from a restaurant. (Yes/No)
3. Do you have internet access via a computer, smartphone, or tablet? (Yes/No)
4. Are you able to speak, read, and write in English? (Yes/No)

The following questions were used for stratification.

5. What is your age in years? (Enter numeric responses only)
6. Are you of Hispanic, Latinx, or Spanish origin? (Yes/No)
7. How would you describe yourself? (Select all that apply)
   a. American Indian or Alaskan Native
   b. Asian
   c. Native Hawaiian or Other Pacific Islander
   d. Black or African American
   e. White
   f. Other:_____

8. Do you receive SNAP (EBT) benefits? (Yes/No/I don't know)

Phase 2 Eligibility Screener

Responses of "no" to one or more questions disqualified the individual from participating.

1. Are you 18 years of age or older? (Yes/No)
2. Have you purchased food from a food retailer within the last 6 months? A food retailer includes grocery stores, conveniences or corner stores, farmers' markets, etc. This excludes food purchased from a restaurant. (Yes/No)
3. Are you able to speak, read, and write in English? (Yes/No)

Assessment of TPB Constructs

To what extent do you agree with the following statements:

1. It is important to me to purchase healthy foods.
   1. Never
   2. Rarely
   3. Sometimes
   4. Most of the time
   5. Always

2. I am confident in my ability to purchase healthy foods.
   1. Never
   2. Rarely
   3. Sometimes
   4. Most of the time
   5. Always

3. My ability to purchase healthy foods is under my control.
   1. Never
   2. Rarely
   3. Sometimes
   4. Most of the time
   5. Always

Vignette Survey

Label Preparation:

You will be shown a series of food labels. After each label, you will be asked how likely you are to purchase the product.

Label Vignettes:

Participants will randomly receive one label from each category (yogurt, cereal, and beans) and be asked how likely they are to purchase the product. Responses will be recorded using a slidable 100-point scale from 0 (definitely would not purchase) to 100 (definitely would purchase).

Yogurt:

You see the following item while shopping for groceries. How likely are you to purchase this product?

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★★★

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:
★★★★★

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★☆☆

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:
★★★☆☆

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★★★

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:
★★★★★

Cereal:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★☆☆

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:
★★★☆☆

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★★★

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★★★

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:
★★★★★

Beans:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:
★★★☆☆

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. How likely are you to purchase this product?

Shopper rating:

You see the following item while shopping for groceries. You have a coupon for 25% off that you are able to use today. How likely are you to purchase this product?

Shopper rating:

Reflection:

Following each label vignette, participants will be asked to provide additional insight into their

decision making:

- What factors did you consider when selecting that number? (Select all that apply.)
  a. Food preferences
  b. Typical shopping habits
  c. Healthy logo
  d. Price
  e. Shopper rating
  f. Other:_____

Sociodemographic Questionnaire

1. What is your age in years? (Enter numeric responses only)
2. Which most closely describes your gender?
   a. Male
   b. Female
   c. Transgender Male
   d. Transgender Female
   e. Non-binary
   f. Agender/I do not identify with a gender
   g. Other: _____

3. Are you of Hispanic, Latinx, or Spanish origin? (Yes/No)

4. How would you describe yourself? (Select all that apply)
    a. American Indian or Alaskan Native
    b. Asian
    c. Native Hawaiian or Other Pacific Islander
    d. Black or African American
    e. White
    f. Other:_____

5. What is the highest level of school you have completed?
    a. Finished primary school or did not finish high school
    b. Finished high school
    c. Technical school
    d. Associate's degree
    e. Some college
    f. Finished college
    g. Graduate degree

6. Which of the following best describes your current work situation?
    a. Employed for wages
    b. Self-employed
    c. Currently unemployed but actively seeking work
    d. Currently unemployed, but not seeking work
    e. Stay home parent or caregiver
    f. Student
    g. Retired
    h. Unable to work

7. What was the total income of your household before taxes in the past year?
    a. Less than $20,000 (less than $385 weekly)
    b. $20,000 - $34,999 (approx.. between $385 - $673 weekly)
    c. $35,000 - $49,999 (approx.. between $674 - $961 weekly)
    d. $50,000 - $74,999 (approx.. between $962 - $1,442 weekly)
    e. $75,000 - $99,999 (approx.. between $1,443 - $1,923 weekly)
    f. $100,000 or more ($1,924 or more weekly)
    g. I do not know

8. How many other people, excluding yourself, live in your household? (Enter numeric responses only.)

9. Of the people who live in your household, excluding yourself, how many are adults? How many are children? (Enter numeric responses only.)

10. Do you currently receive SNAP (EBT) benefits? (Yes/No/I don't know)

11. What is your zip code? (Enter numeric responses only.)

12. Are you the primary food shopper for your household (e.g., buy most of the groceries)?
(Yes/No/Shopping is shared equally/I don't know)

13. How often do you purchase groceries?
   a. More than once per week
   b. Once per week
   c. Three times per month
   d. Twice per month
   e. Once per month
   f. Less than one time per month

14. Where do you typically purchase your groceries? Select all that apply.
   a. Large grocery store or supermarket chain
   b. Local grocery store
   c. Convenience store, corner store, or bodega
   d. Farmer's market
   e. Online
   f. Other:_____

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