Testing Theories and Measures for Promoting Dietary Change

Shane A. Snyder

University of Texas at Arlington

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Supervising Professor: Dr. Angela Liegey Dougall

Abstract

Many Americans do not consume enough healthy food and overconsume sugar and meat products. As a prominent food desert, this trend is particularly rife in Arlington/Ft. Worth, TX especially among low-income individuals. To obtain an understanding of this dearth in healthy eating, this research sampled a low-income population for focus groups (Study 1) and a longitudinal experimental study (Study 2). The focus groups explored the prevalence of the social cognitive theory, the prototype willingness model, and the extended parallel processing model components to preliminarily examine health attitudes and opinions of this group. The longitudinal study tested four health topics (how to shop and eat healthy at low cost, recommended serving sizes of food groups, chronic disease and food preparation, and physical activity) over three time points through brief educational manipulations. This second study piloted behavior change topics that may be important for education and elucidated ways to improve health. It was predicted that behaviors, knowledge, and attitudes would improve after the manipulations, especially within the chronic disease and food preparation manipulation. Overall, the sample in Study 2 was 51.2% Black and 62.9% male, with a mean age of 46 years (SD = 13.19). Most reported high school completion or equivalent, but earned less than $10,000 a year ($N$ = 116, 73%). Study 1 showed participants distrusted large food companies, did not know what food to eat, and felt little control to be healthier, yet desired to be healthier. Aspects of the prototype willingness model also encouraged more change over the social cognitive theory or the extended parallel processing model. Contrary to expectations, Study 2 showed no significant change over time nor more improvements in the chronic disease manipulation over time. Exploratory moderators of sex, employment status, and eating schema were also found to primarily influence healthy food intentions and attitudes over time and between manipulations.

As expected, the chronic disease manipulation had more positive outcomes when these moderators were tested. For future research, a focus on chronic disease and feasible options with a low-income positive deviant example may provide the best avenue over other nutrition topics for effective health change in this population.

Keywords: low-income; focus groups; nutrition; education; longitudinal; behavior

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More than about 90% of adults do not consume enough fruits and vegetables (Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017). Foods consumed away from home have also steadily increased in the United States. Ethnic, traditional, and wholesome foods have been progressively displaced or modified with fast foods (e.g. meat or soft drink additions to a meal; Guthrie, Lin, & Frazao, 2002) as sugar and fat are more feasible ingredients (Drewnowski, 2000; Swinburn, Caterson, Seidell, & James, 2004). Research has resoundingly stated that overconsumption of a "westernized" diet (high fat and high sugar foods) and under consumption of nutrient dense food could lead to health risks such as increased vasoconstriction, high cholesterol, atherosclerosis, and hypertension (Getz & Reardon, 2007). Indeed, of the top ten most lethal chronic conditions, diet is implicated in four of them (i.e., ischemic heart disease, stroke, diabetes mellitus, and cancer; Kapany, Gray, Schwarz, 2015).

This emphasis on disease risk has called for more research with interventions and behavior change. It is well known the earlier in time desired behaviors are reinforced, the easier they are to maintain. Because of this reasoning, it was important to initiate behavior change interventions to allow individuals to lead healthy lives. To date, research on interventions has focused more on dietary intake, particularly of fruits and vegetables, and were only over a short period of time. More studies needed to address other measures such as competency in eating (Lohse, 2013) and eating schemas (Kendzierski et al., 2015). More qualitative data has also been called for, as there was a lack of qualitative research with low-income individuals (Mello et al., 2010). The purpose of the current study was to test activities and strategies in experimental manipulations that incorporated dietary intake, thoughts about eating healthy, food choice values, eating competency, dietary self-efficacy, perceived stress, threat, and eating schemas. To

examine this, a pilot survey and focus groups were implemented to provide initial insights to target for these experimental manipulations and measure change over time. In this study, we identified measures that influenced health behavior change and healthy eating for future interventions to mitigate health risks.

Diet and Disease Risk

Broadly**,** a diet that is high in processed foods, added sugars, saturated fats, cholesterol, and low in fruits and vegetables, fiber, and quality nutrients can be detrimental to an individual's long-term health. Improper nutrition has contributed to cardiovascular disease and other chronic diseases (Getz & Reardon, 2007) including some forms of cancer (Slattery, Boucher, Caan, Potter, & Ma, 1998). Not only has a poor diet influenced physical health, but it has influenced psychological health. A nutritionally poor diet has the potential to rewire the reward systems and increase the responsiveness of the HPA axis, which can lead to an over-reactive stress response (Stevenson, 2017). Moreover, dependency on high fat or high sugar diets has been shown to alter prefrontal cortex functioning that could impair inhibitory control, learning, and memory (Stevenson, 2017).

Indeed, a diet that meets recommendations and limits saturated fat and cholesterol is important for optimal health and functioning (World Health Organization [WHO], 2003). Fruits and vegetables are particularly important because not only do they contain fiber for controlling fat levels, but they also contain many other phytochemicals like flavonoids and phytosterols that mitigate inflammation and cancer growth, respectively (Anderson, Smith, & Gustafson, 1994; Van Duyn & Pivonka, 2000). Adequate consumption of fruit and vegetables can also decrease risk of cataracts, chronic obstruction pulmonary disease, and colon abnormalities (Van Duyn & Pivonka, 2000). However, researchers recognize a nutritionally adequate diet can be difficult as

diets may change as people develop, have a change in circumstances, or experience other impediments (Taylor, 2015).

Diets of Low-Income Individuals

While a healthy diet is important and should be held in high regard, not everyone has the economical means or knowledge to do so. When one cannot afford nutritionally adequate or safe foods, they are often labeled as food insecure (Seligman, Laraia, & Kushel, 2009) in which food insecurity has been associated with economic disadvantage (Sarlio-Lähteenkorva & Lahelma, 2001). Food insecurity is rife in food deserts, which generally are geographical areas that have an inadequate amount of full-service grocery stores or access to healthy foods like fruits and vegetables (Walker, Keane, & Burke, 2010). A recent review of food deserts has detailed the following conditions found in food deserts: (1) limited supermarket access, (2) ethnic disparities, (3) income/socioeconomic status, (4) differences in chain vs. non-chain stores, (5) cost of food, (6) availability of food items, and (7) store types (convenience stores vs. full supermarkets; Walker et al., 2010). Undoubtedly, food insecurity and food deserts highlighted socioeconomic differences in health (Furness, Simon, Wold, & Asarian-Anderson, 2004). Higher income individuals have greater access to foods and are less likely to be in a food desert compared to low-income individuals (Furness et al., 2004).

Because of this geographical dichotomy, low-income families often consume greater amounts of high sugar, salt, and fat foods compared to individuals with higher income. Specifically, it has been reported that low-income adults consumed fewer whole grains, fruit, vegetables, fish, and legumes and exceed recommendations for processed meats, sweets, and bakery goods (Leung et al., 2012). Lack of nutritious foods may also be from a lack of proper nutrition education (Mello et al., 2010) as complexity of food preparation has been positively

associated with income (McLaughlin, Tarasuk, & Kreiger, 2003). However, money is not something to be disregarded with diet quality, as it continues to be a major barrier to eating healthy (Dharod, Drewette-Card, & Crawford, 2011). Not only can low-income individuals have inadequate healthy foods (e.g., fewer whole grains, more fruit juice, and more red meat; Leung et al., 2012), food insecurity has been associated with increased hypertension, diabetes, (Champagne et al., 2007; Seligman et al., 2009) and obesity (Leung et al., 2012). Because of these risk factors, chronic disease has become more prevalent in this demographic compared to individuals with higher income. Thus, of great importance for health policy was to implement strategies, guidelines, or interventions to combat food insecurity to help individuals maintain health.

Interventions in low-income populations. Of the interventions for dietary change in this demographic, most have focused on women and were primarily in rural areas or specific geographical locations (Bowling, Moretti, Ringelheim, Tran, & Davison, 2016; Champagne et al., 2007; Dharod et al., 2011; Rustad & Smith, 2013; Tessaro, Rye, Parker, Mangone, & McCrone, 2007). This was presumably because women do most of the cooking and childcare. Previous research has also reported that nutrition interventions may not be as effective in this demographic because of higher dropout rates and other social or environmental factors (Michie, Jochelson, Markham, & Bridle, 2009). Additionally, much of this literature suffered from a lack of long-term follow up and additional information in this population such as assessment of eating competency, eating schemas, and how these measures influenced dietary outcomes like behaviors, knowledge, and attitudes (Oldroyd, Burns, Lucas, Haikerwal, & Waters, 2008). However, it has been shown that teaching nutrition knowledge and reinforcing behaviors with short education sessions in this group can improve short-term dietary choices and may be most

effective compared to long educational sessions with follow ups over multiple time points (Rustard & Smith, 2013). As additional framework for education sessions, provision of information, aids in goal setting, and barrier identification were helpful for low-income groups (Michie et al., 2009).

Although these intervention suggestions were important to consider, of pertinent interest is the location of this study. Tarrant County, TX has been documented as one of the most food insecure counties in the country with a food insecurity rate of about 16% (United States Department of Agriculture [USDA], 2017). Although conditions have improved slightly (Gundersen, Dewey, Crumbaugh, Kato & Engelhard, 2018), there was a need to intervene to assess the nutritional behavior, attitudes, knowledge, and other psychosocial variables of low-income groups. The current study addressed this need by assessment of nutrition attitudes, knowledge, and behaviors combined with stable personality constructs (eating competency and eating schema) and psychosocial variables (self-efficacy, perceived stress, and threat) and related these constructs to theories in short discussions to facilitate health behavior change.

Theories for Behavior Change

As a way to promote better habits, especially with regard to nutrition education and healthy eating, research has established theories to address health behavior change (Sheeran, Klein, & Rothman, 2017). Many of these theories have similar concepts, and a lack of clarity has been reported about which methods employed the best strategies (Cousineau, Franko, Ciccazzo, Goldstein, & Rosenthal, 2006). Although the theory components overlap (e.g., self-efficacy and attitudes), the differences have also been delineated (Sheeran et al., 2017).

Self-efficacy in particular is one of the most important predictors of health behavior change (Bandura, 2005) and was a large component of Bandura's social cognitive theory (SCT;

Bandura, 1991). Broadly speaking, self-efficacy is competence to perform a certain behavior (Bandura, 1977). Although dietary beliefs of younger age groups may be driven more by emotional factors like social influences and impulsivity (Louis, Davies, Smith, & Terry, 2007), research has shown that high self-efficacy can overcome these factors and explained eating behaviors and patterns across age groups (Ball et al., 2009; Kedem, Evans, & Chapman-Novakofski, 2014). Indeed, people with higher self-efficacy were more likely to translate desires into actions (Ochsner, Scholz, & Hornung, 2013). When self-efficacy has been combined with outcome expectations (setting a goal or intention), these two constructs together have been shown to be important for maintaining a healthy diet (Kedem et al., 2014; Tudoran, Scolderer, & Brunsø, 2012). Specifically, self-efficacy has consistently shown to be associated with fruit and vegetable consumption (Kreausukon, Gellert, Lippke, & Schwarzer, 2012). However, because self-efficacy can be somewhat general, research has further defined various phases of self-efficacy for more direct targeting of behavior change.

Self-efficacy could be further bifurcated into motivational and volitional components. Motivational self-efficacy has been defined as the ability to start a behavior and has been shown to be related to development of an intention to change (Ochsner et al., 2013). On the other hand, volitional self-efficacy has been defined as one's ability to keep a behavior over a long period of time if obstacles emerge, in which it has been shown the latter produced better outcomes than the former (Ochsner et al., 2013). Volitional self-efficacy was also partially based on motivational self-efficacy, and the association between volitional self-efficacy and behavior change was influenced by past behavior (Ochsner et al., 2013; Scholz, Sniehotta, & Schwarzer, 2005). Interventions to promote healthy behavior that have implemented these two aspects of self-efficacy have shown to be successful (Kreausukon et al., 2012; Lhakhang, Godinho, Knoll, &

Schwarzer, 2014). Therefore, the current study controlled for current dietary self-efficacy (the motivational component) and used self-efficacy on a long-term basis (the volitional component) as an outcome to measure success of behavior change.

Implementation intentions. It has been commonly known that despite multiple resources for individuals to follow a healthy diet, very few do so. For example, people make goals or resolutions for themselves, but do not develop specific plans and fall short. As a measure to gauge volitional self-efficacy and adherence, implementation intentions have been used to link goal projections to specific action plans (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). Goal-oriented intentions specify the *what* to change, and implementation intentions cover the *where*, *when,* and *how* (Adriaanse et al., 2011) similar to planning (Kreausukon et al., 2012).

When dietary self-efficacy and implementation intentions were included in health behavior change theories, they helped educate individuals and were feasible to promote change (Adriaanse et al., 2011; Armitage, 2006; DeBiasse et al., 2017). Participants in this study formed and wrote a specific health goal (something SMART; Doran, 1981) for themselves as a way to implement intentions to change following Study 2. Additionally, three different health behavior change theories (not including implementation intentions) for behavior change were tested; the social cognitive theory, the extended parallel processing model (EPPM), and the prototype willingness model (PWM). Although each theory offered slightly different methods to encourage behavior change, all three incorporated self-efficacy and intentions toward the desired behavior.

The social cognitive theory. The first theory was the social cognitive model/theory (SCT) developed by Bandura (1991) to further elucidate human motivation and action (Figure 1). Generally, SCT posited that behavior was determined reciprocally by individual, behavioral, and

environmental factors (Bandura, 1991; Glanz, n.d.). Within these three factors lie self-efficacy components. Sheeran and colleagues (2017) summarized these self-efficacy components respectively as 1) *individual* intention to change behavior, 2) development of a beneficial attitude or response towards the desired behavior, and 3) employment of self-efficacy to do that behavior consistently, which involved *environment* adaptation to improve self-efficacy. These self-efficacy components showed people learned through experience, through modelling others, through feedback from the environment, and by understanding the results of their actions.

Because of these preceding components, there have been multiple studies that utilized SCT to supplement better eating habits, but it has more often been used with young adults (Kelly, Mazzeo, & Bean, 2013). Specifically, SCT has helped with increasing consumption of whole grains (Ha & Caine-Bish, 2011), low-fat dairy intake (Ha, Caine-Bish, Holloman, & Lowry-Gordon, 2009) and increased fruit and vegetable intake (Ha & Caine-Bish, 2009). Additionally, it was suggested these previous studies be interpreted with some caution because not all of them included reliable or validated instruments (Kedem et al., 2014; Kelly et al., 2013). A review of intervention frameworks in low-income populations stated that only four studies in this population had utilized SCT, and not all of them focused on diet promotion (Michie, et al., 2009), which highlighted a need for more studies to use SCT in this population. In this research, participants were guided to brainstorm information about personal factors (i.e., how to set up accountability measures and how to identify environmental constraints that may impact behavior change) during the manipulations.

The prototype willingness model. The second model used in this study was the prototype willingness model (PWM). The PWM incorporated similar concepts as SCT and was originally developed to explain adolescents' health-related behaviors (Gibbons, Gerrard,

Ouellette, & Burzette, 1998). The PWM addressed 1) intentions to change, 2) willingness to change, 3) attitudes toward the desired behavior, 4) subjective norms of the desired behavior, 5) self-efficacy towards that behavior, and 6) social prototypes or examples (Sheeran et al., 2017; Figure 2). Within the PWM was a dual-process approach: one process was the rationalization of behavior, and the second process was a social reaction to the behavior. The rationalization/reasoned process was based on the theory of planned behavior developed by Ajzen (1985). The theory of planned behavior considered the attitude toward the behavior, the subjective norm (what others do), and thirdly, one's ability to change the behavior (Ajzen, 1985). These were the three precursors needed to form intentions, which ultimately lead to behavior change (Ajzen, 1985). However, the second process of the PWM incorporated willingness to engage in said behavior and incorporated social prototypes (Sheeran et al., 2017). Prototypes were defined in the PWM as the image of the typical adult who does a certain behavior (e.g., the typical healthy eater as it pertains to this study; Dohnke, Steinhilber, & Fuchs, 2015). This prototype served as an influence because the more someone positively viewed an unhealthy eater, the more likely he/she was to eat unhealthily (Dohnke et al., 2015).

So far, most studies have examined changes in risky behaviors like smoking or unprotected sex with the PWM (Gibbons et al., 1998), and few studies to date have examined change in dietary habits. For example, one study demonstrated that salient and distinct perceptions of the typical unhealthy and healthy eater exist, and the perception of the unhealthy eater related to single indicators of unhealthy eating (Gerrits, de Ridder, de Wit, & Kuijer, 2009). The authors delineated that unhealthy eaters were associated with increased consumption of unhealthy foods, fatty foods, and soft drinks whereas healthy eaters were not associated with these characteristics (Gerrits et al., 2009). The full PWM (both processes) was utilized and found

to be effective in only one study (Dohnke et al., 2015), but it was also stated that future research may want to confirm this work (Dohnke et al., 2015). Here, aspects of the PWM were tested in Study 1 and incorporated into Study 2 in the form of prototypes/examples. Participants were presented during the manipulations with either 1) a healthy shopper vs. procrastinating shopper, 2) someone who ate recommended servings sizes vs. someone who did not, or 3) a person who tried to prevent chronic disease and prepare healthy food vs. someone who did not, and 4) someone who regularly exercised vs. someone who did not. Following this, participants were asked about how helpful these prototypes were to facilitate change.

The extended parallel processing model. The last theory used in this study was the extended parallel processing model (EPPM), which incorporated, 1) risk perception, 2) fear or worry, 3) intentions toward the desired behavior, 4) attitudes toward the desired behavior, and 5) self-efficacy to engage in the desired behavior (Sheeran et al., 2017; Figure 3). The EPPM was built on older models, namely, the protection motivation theory (Rogers, 1975) and Leventhal's parallel processing model (1970). The EPPM started with a fear appeal (a message meant to show a concept as applicable, substantial, and intended to invoke a fear response; Witte, 1992, 1994). This fear appeal was followed by examples to handle or hamper the threat (Witte, 1992, 1994). With the fear appeal, the implication of threat (operationalized as perceived severity and perceived susceptibility), was also made salient. In response to the fear appeal, individuals either engaged in protection motivation and message acceptance (individuals moved toward the target behavior) or defensive motivation and message rejection (individuals moved away from target behavior). Hence, the parallel processing aspect of the model (Witte, 1992, 1994). To further break down this parallel approach, protection motivations were conceptualized as how individuals changed cognitions about the target behavior, and defense motivations were

conceptualized as how (or if) individuals focused on changes in the emotional response about the target behavior (Witte, 1994). The typical outcome to measure with this model was message acceptance, defined as attitude, intention, or behavior change (Witte, 1992).

Regarding the use of EPPM in nutrition-related studies, fear appeals were suggested to help change one's diet in response to an impending chronic disease like atherosclerosis (Witte, 1992). However, other research has shown that most people trust the safety of their food and the ability to cope was more related to the affective response compared to the perception of risk (Kuttschreuter, 2006). The EPPM has also been shown to be very predictive for the consumption of fruits and vegetables and consumption increased with a self-affirmation component (Napper, Harris, & Klein, 2014). In this study, participants were exposed to fear/threat appeals during the experimental manipulations. Their cognitions about the fear appeals were assessed with perceived threat, attitude change, and if participants moved to a higher stage of behavior change (i.e., they accepted the message and engaged in protection motivation following the study). They were also given a self-efficacy component in the form of alternative healthy foods at common restaurants or a physical activity plan to facilitate message acceptance. Of course, these theories would have little meaning if there were not important concepts or measures to assess theory success and more objectively measure healthier eating.

Important Considerations to Promote Healthier Eating

Food choice. One target in interventions was to help individuals select those foods that are nutritious and profitable for personal health. Admittedly, why and what individuals choose to eat has been considered an important avenue for health policy (Lyerly & Reeve, 2015; Steptoe, Pollard, & Wardle, 1995). For greater understanding of food selection, researchers created food choice values based on proximal factors (e.g., taste preferences, availability, beliefs, knowledge,

etc.) that influenced food choices (Lyerly & Reeve, 2015). Generally, food choice values were defined as factors individuals considered for foods they wanted to buy and/or consume (Lyerly & Reeve, 2015). It was noted by Connors, Bisogni, Sobal, and Devine (2001) that there were five key values that influenced what foods individuals purchased or consumed. These key values included health, taste, cost, convenience, and acceptance by others (Connors et al., 2001). To date, food choice scales have been used to assess consumption patterns in a variety of different populations including individuals of low income (Lyerly, & Reeve, 2015). Although Steptoe and colleagues (1995) created the first food choice questionnaire, it was later revised to add an additional factor (safety) and delineated other scale items such as time to cook/prepare and financial convenience (i.e., having enough money to buy something; Lyerly & Reeve, 2015). It was used in this study as an outcome to examine how this group ranked importance of food choices before a manipulation and after. Changes in food choices were expected to reflect changes in stage of behavior change, an endorsement of a healthy eater prototype, and message acceptance to protection motivation.

Stage of behavior change. The transtheoretical model of behavior change has been used in research to assess individuals' stage and willingness to engage in healthier behaviors (Prochaska & Diclemente, 1992). Briefly, it assessed the stage of behavior in which individuals were at the time to consume fruits and vegetables (Prochaska & Diclemente, 1992). These stages included precontemplation, contemplation, preparation, action, and maintenance. Precontemplation described individuals before they were made aware of the target behavior; contemplation described individuals who had thought about change a little, but had made no attempts; preparation described individuals who had made plans to engage in the target behavior, but have not acted; action described individuals who started to engage in means toward the

desired behavior; and maintenance described individuals who had engaged in means toward the desired behavior, and the new behavior was established (Prochaska & Diclemente, 1992). Stage of change at T1 was assessed as a moderator in Aim IV because individuals in higher stages could have had less improvements in outcomes compared to those in lower stages (Figure 4). Participants in higher stages of change have perceived efficacy and have engaged in protection motivation whereas participants in lower stages of change may not have been aware of certain messages to invoke healthier behavior. Additionally, implementation intention formation may have also prevented lapses or regression of those in higher stages (Armitage, 2006).

Eating competency. Closely tied to stage of behavior change was one's sense to capably eat well. Eating competence encouraged eating based on the "body's natural processes" (Satter, 2007). Research on eating competence in adults has shown that more competent eaters tend to eat healthier. Higher eating competency has also been associated with fewer health problems like high blood pressure, high cholesterol, and being overweight (Lohse, Satter, Horacek, Gebreselassie, & Oakland, 2007; Psota, Lohse, & West, 2007). Generally, competent eaters have positive emotions toward eating nutritious and enjoyable food (Lohse et al., 2007) and are able to manage their weight more (Krall & Lohse, 2009).

To date, there have been few studies on eating competency in low-income individuals (Krall & Lohse, 2009, 2011; Lohse, 2013), and these studies primarily covered one area (i.e., Pennsylvania). However, the eating competency measure can be delivered effectively via social media platforms (Lohse, 2013), and qualitative assessment of eating competency in low-income individuals helped explain eating behaviors in this population (Krall & Lohse, 2009). Additionally, because eating competency has not been assessed comprehensively, there has been a call for more intervention research to address it in other locations (Krall & Lohse, 2011).

Eating competency was used in this study as a covariate of dietary intake, nutrition attitudes, knowledge, and health behavior change as it has been shown to be positively associated with healthy eating (Krall & Lohse, 2011). Because of this, participants who were competent eaters may have endorsed fewer barriers to health and may have potentially engaged in target health behaviors prior. However, another marker of healthy eating may be explained by how one views themselves in terms of general health.

Eating schemas. Regarding relationships with food, previous interventions have highlighted the need for one's schema to be examined as it has been tied to the practice of health behaviors including healthy eating (Kendzierski & Costello, 2004; Kendzierski, Ritter, Stump, & Anglin, 2015; Noureddine & Stein, 2008). A self-schema has been defined as a domain-specific self-definition conceptualized as a cognitive structure built on past experience that was important to the individual (Markus, 1977). An identified self-schema has been proposed to make certain responses more accessible, as those with healthier eating schemas were more knowledgeable of healthier foods (Kendzierski et al., 2015). They have had greater self-efficacy to overcome constraints (SCT) and embodied the prototype of the PWM. Further, individuals that had initial healthy eating schemas who did not meet recommendations for fruit and vegetables (more prominently vegetables) were able to increase their consumption if they formed implementation intentions compared to those that did not form implementation intentions (Kendzierski et al., 2015). Participants in Study 2 were asked to respond to six statements that assessed how descriptive each statement was of them and how important it was to them. For the purposes of this research, eating schema was used as a moderator because it may have influenced nutrition behavior, knowledge, and attitudes (Kendzierski et al., 2015). Because healthy eaters presumably ate healthy, we expected non-healthy eaters and non-schematics to have greater improvements in

health because the latter two could improve more. Lastly, because of the potential circumstances of this study group, it was deemed important to consider stress.

Stress. A wide body of research has shown that stress can influence poor health behaviors such as food choices. For instance, stress has caused people to choose high-fat foods over low-fat foods (Zellner et al., 2006), particularly highly palatable snack foods (Oliver & Wardle, 1999). Essentially, individuals tended to eat foods they normally avoided for health reasons because they presumed the taste to make them feel better (a defense motivation reaction; Zellner et al., 2006) because that process could have been seen as easier (Figure 3). As it pertains to Study 2, it was used here as a covariate.

Demographics. Certain demographic factors — namely sex and employment — were tested as moderators because of their influence in health. For instance, it is well known females have better attitudes toward health than do males, which could have influenced greater willingness toward a healthier lifestyle (Dutta & Youn, 1999). Additionally, employed or individuals with income had more resources, flexibility, and fewer difficulties to eat healthier and engaged in healthier behaviors (Dibsdall, Lambert, Bobbin, & Frewer, 2003).

Current Study

The purpose of this study was to examine various healthy eating intervention strategies in a low-income population with the above mentioned targets as well as fruit and vegetable, sugar sweetened beverage, and processed meat intake, and attitudes and knowledge. Most of the intervention literature has focused on fruit and vegetable intake, was typically self-report in nature, and occurred over a short period of time. Research with interventions has called for more studies to address eating competency, and eating schemas in individuals (Kendzierski et al.,

2015). There was also a need for more longitudinal studies with more comprehensive and measureable dietary changes, and to measure other psychosocial factors like perceived stress.

For this study, a pilot study and two additional preliminary studies were conducted. The pilot study collected survey data to ascertain what young adults considered as important for dietary change (Table 1). It provided initial direction for important teachable topics as low-income individuals may have had similar responses to young adults because they may have lacked awareness or proper education to eat healthy and purchase cheaper options. These interests may have translated to greater motivation and further explain similarities between this low-income demographic and individuals that self-selected into the pilot study.

To assess similarities, Study 1 used mixed-methods that incorporated focus groups and surveys to validate what was found in the pilot study and preliminarily understand how low-income individuals responded to various health theories and nutrition topics. Briefly, five focus groups were conducted with three to eight participants per group at Arlington Life Shelter. A shelter that not only provided food for residents, but that set out fruits and vegetables as snacks. The focus groups were conducted at the site and lasted about 1 to 1.5 hours.

Study 2 of this research tested four health topics (i.e., how to shop and eat healthy at low cost, recommended daily serving sizes of food groups, chronic disease and food preparation, and physical activity) in brief manipulations. The manipulation consisted of a brief lecture portion for 10 to 15 minutes, a discussion, and then an activity related to one of the topics for another ten minutes. Finally, each manipulation ended by having participants' complete questionnaires and statements to prompt implementation intentions. Each manipulation covered one topic, but all the same elements from the health behavior change theories (i.e., SCT, PWM, and EPPM). Although the theories were further assessed in Study 2, Study 1's focus group discussion questions were

used to assess how participants' preliminary reaction to potential theories to understand which topics and activities best predict dietary and health behavior changes.

Aims and hypotheses. With this purpose in mind, Aim I was to obtain a preliminary understanding of how a low-income population viewed eating healthy (eating more fruit and vegetables, consuming fewer sugar-sweetened beverages, and consuming fewer processed meats). Specifically, we expected individuals in the focus groups to have similar opinions and attitudes about healthy food choices to each other and between focus groups. Additionally, we expected this population to have similar opinions to participants in the pilot study, such as increased concern for how to shop and eat healthy at low cost, the importance of eating balanced meals, and understanding the important relationship between diet and chronic disease.

Aim II used the different theories of behavior change discussed above to see if there would be a positive change in the primary measures from before the manipulation to after the manipulation (Figure 4). These theories were explored in the manipulations in which strategies to overcome barriers (SCT), prototype descriptions (PWM), and message internalization (EPPM) were probed and discussed to give participants concrete health improvements to encourage greater outcome change. Specifically, we hypothesized that intentions to eat fruit and vegetables as well as actual intake would increase over time, and sugar-sweetened beverage and processed meat intentions and intake would decrease over time. Participants would also adopt more nutritious (increased) attitudes and knowledge and have fewer unhealthier behaviors and greater healthier behaviors. Few, if any, intervention research studies have focused on food choices, particularly in this demographic as well, so part of this study was to assess if there were differences in reported food choices following the manipulations. We hypothesized that food choices would improve over time (i.e., better food choices) and for the psychological outcome of

volitional self-efficacy, this measure would also increase over time. Dietary self-efficacy would also be used as a covariate to assess change in volitional efficacy as those with higher dietary self-efficacy would have higher volitional self-efficacy.

Aim III assessed the best nutrition topic and theory to teach this population for future studies based on what topic and theory taught in the manipulations had outcomes (see previous paragraph) with the greatest positive change overall (Figure 4). We expected participants in the chronic disease and food preparation manipulation would have the greatest overall outcomes compared to the other manipulations because of the saliency of threat and provision of a self-efficacy response in line with the EPPM inherent in the teaching materials.

Lastly, Aim IV was exploratory and assessed the impact of potential moderators (sex, employment, stage of behavior change, and eating schema) with change over time as well as how they contributed to manipulation outcomes over time for reasons discussed above. Participants were also predicted to move higher in their behavior change stage.

Pilot Study

Method: Pilot Study

Participants: Pilot Study. A pilot survey study was conducted (Snyder & Liegey-Dougall, 2018) on a sample of participants (N = 197) recruited voluntarily online via a research registry (i.e. researchmatch.org). Sample size pre-calculated through G*Power indicated a sample size of 187 participants was required for a chi-square test with a medium effect size and power set at .80. To be eligible, participants had to be aged 18-24 years. Volunteers (N = 386) stated they were interested in the study, but only 203 opened the survey study link. Of those 203, 197 participants aged 18-23 participated and the other 6 declined. Individuals that completed the survey were primarily white and female (75.26%, and 83.08%, respectively). They had a mean

age of 20.31 (*SD* = 1.36) years, in which most reported being in college/university (*N* = 105, 54.10%), with a mean family income range of $50,001 to $70,000. This age range was chosen because this group may have viewed their health more optimistically and could have been less aware of how to maintain health (Pollard, Miller, Woodman, Meng, & Binns, 2009). Furthermore, peers and fast/prepared foods on college campuses have been shown to influence poor eating behaviors (Louis, et al., 2007; Plotnikoff et al., 2015). Many college students also lacked personal funds and resources to engage in healthier behaviors, which strengthened associations between a college-aged sample and a low-income adult sample. Lastly, participants were not compensated, and this study was approved by the University of Texas at Arlington (UTA) Institutional Review Board (IRB).

Materials and Procedure: Pilot Study. This study was a quasi-experimental design in which individuals self-selected into the pilot study and were asked to respond to a series of measures in an online Qualtrics survey. Specifically, participants were asked to rate their interest for 11 nutrition topics (Table 1) from 1 (*not very interesting*) to five (*extremely interesting*). Participants were also asked to rank their, 1) interest and 2) importance in two separate rankings for the 11 nutrition topics and an "other" category if they had another option that was not one of the 11 pre-selected. These 11 topics were chosen because they were based on typical topics taught in nutrition education courses. Additionally, demographic information, religious affiliation, chronic health condition, and diets/food restrictions were assessed to provide insight as to how these demographic influences may impact choices.

For recruitment, an initial email providing an overview of the study was sent to those qualified volunteers (people aged 18-24) in the research registry. If a volunteer accepted the invitation, their contact information was given to the researcher. The researcher then followed up

via email and sent the Qualtrics survey link to the interested volunteer. Volunteers were recruited by opening the Qualtrics survey link, accepting the informed consent conditions, and completing the survey.

Results: Pilot Study

Because we did not have a firm understanding of what young adults considered as nutritionally important or interesting, the purpose of this study was to provide feedback for topics to discuss in Study 1 and Study 2 based on descriptive statistics and demographic associations for future health behavior change studies. We had three research questions: 1) obtain descriptives of rankings for important nutrition topics, 2) whether certain demographic backgrounds were associated with chronic health conditions or diets/restrictions, 3a) whether chronic health conditions, diets/restrictions, religiosity, were associated with the ranking of importance for nutrition topics, and 3b) whether demographic variables were associated with the ranking of importance for nutrition topics.

The results of the first research question are addressed in Table 1. For my second research question, chi-squares tests of independence showed there were not any significant associations between sex, employment, family income, ethnicity, or religious background with chronic health conditions or food restrictions/diet.

Correlations. For question 3a, exploratory Spearman's rho bivariate correlations were conducted on sex (male or female), food restrictions/diets (had a food restriction/diet or did not), and whether or not one had a chronic health condition (no or yes) with the importance ranking of the 11 nutrition topics (lower numbers rated as more important).

These results showed there was an association for those who had chronic health conditions and ranking how to shop and eat healthy at low cost as more important. For those with

a diet/food restriction, there was an association with ranking the importance of chronic disease(s) as more important. For question 3b, Kendall's tau bivariate correlations were also conducted on age, income, and education with the importance ranking of the 11 nutrition topics. We found a relationship of increasing age to ranking tricks to make cooking easier and healthier as more important. Higher family income was also associated with ranking recommended daily serving sizes as more important. Lastly, greater education was associated with ranking food processes and how food gets to supermarkets as less important.

Discussion: Pilot Study

The Pilot Study goals were met as we obtained a preliminary understanding of important nutrition topics for young adults (Table 1). In particular, individuals in this 18-24 year old age group rated the following topics as the most important: 1) how diet relates to chronic disease, 2) recommended daily servings of food groups, and 3) how to shop and eat at low cost. These topics were then incorporated into subsequent experimental manipulations (Study 2). Moreover, to address the second question, there were not any significant associations between any demographic characteristics with chronic health conditions or food restrictions/diet. These lack of associations suggested that certain health conditions or food restrictions/diet were not driven by one demographic. Many individuals of different backgrounds could have various health conditions or food restrictions/diets and these conditions or food restrictions/diets may not have been more represented in one demographic over another. To address the third question, the results from the correlations suggested that those who had food restrictions/diets or conditions may have been more concerned about their health, health costs, and place more value in their diet to maintain good health. Furthermore, these associations may have been found because young adults often have limited access to necessary cooking items. Moreover, young adults in college

often relied on meal plans and purchased food, so cooking was not of high concern. Additionally, the associations of income and education with serving sizes and how food gets to supermarkets, respectively, may have been an artifact of increased awareness with education of healthy eating and developed desire or means for health with greater monetary resources. Those with less income and less education may have been more concerned about the obtainment of food over specific health recommendations. Indeed, these findings helped lay the foundation for Aim I, which was to validate nutrition opinions and implications for addressing proper nutrition in other populations.

Study 1: Focus Groups

Method

Participants: Focus Groups. Participants (N = 31) were recruited via flyers to participate in mixed-method research consisting of a short survey and focus groups at Arlington Life Shelter. Participants tended to be Black and male (48.4% Black and 54.8% male). They had a mean age of 37.6 years (SD = 13.7), and about half (N = 16, 53.3%) reported having earned at most a high school diploma or GED, earned $10,000 or less per year, and were employed (Table 2). The focus groups were advertised as a class in which individuals could participate, and five focus groups were conducted with a range of three to eight participants per group. Participants had to be >18 years of age, and Spanish speakers were excluded because researchers were not fluent in Spanish. All participants received $5 Walmart gift cards following the focus group, and these procedures were approved by the UTA IRB.

Measures: Focus Groups. The measures for focus groups included a series of questions implemented via surveys that assessed demographic information, questions to receive feedback to conduct the experimental manipulations, stage of behavior change, and nutrition attitudes

(Table 4). Additionally, focus group discussion questions ascertained participants' thoughts and feelings about healthy eating (Prochaska & DiClemente, 1992; Table 3; Table A1).

Demographic information. Prior to the focus groups, participants were asked about their age, sex, employment (yes or no, and if yes, how many hours they worked), family income, ethnicity, and education (highest degree completed; Table 2).

Stage of behavior change. To assess behavior change, participants were asked questions numbered 3, 4, 5 and 6 of the experimental feedback questions similarly assessed by Nitzke et al. (2007; Table 4). Here behavior change was only for fruit and vegetable consumption because the scale used here and in a previous study were designed for fruit and vegetables, and the scale was more appropriate for increasing as opposed to decreasing behaviors (Nitzke et al., 2007). Based on their response(s), participants were coded as precontemplation if they responded no to #4 and the following questions; contemplation if they responded yes to #4, but no to #5; preparation if they responded yes to #4, yes to #5, and no to #6; action if they responded yes to #4 and #5 and no to #6, but had reported consuming 5 or more servings of fruits and vegetables a day (#4); or maintenance phase if they responded yes to #4, #5, and #6 and consumed 5 or more servings of fruits and vegetables a day. All participants were asked #6. Although not discussed in previous research, if participants reported yes to #4, #5, and #6 and consumed less than 5 servings of fruits and vegetables a day, they were also coded as action.

Nutrition attitudes. Participants also responded to statements in which they dictated their opinion from not at all to very much on a scale from 1-5 (Table 4). Attitudes were assessed because research has shown that in addition to nutritional status, it was important to understand personal factors that related to dietary habits (Macías & Glasauer, 2014). Thus, the attitude questions assessed self-efficacy within the SCT. Indeed, attitude change can be seen as increased

confidence, belief, preference, or willingness towards the desired behavior (Macías & Glasauer 2014). As a note, these scale items were created for this research, but shown to have acceptable reliability with the omission of item #2 ($\alpha = .73$).

Procedure: Focus Groups. Researchers conducted the focus groups at Arlington Life Shelter around 7:30 pm as a class that individuals could join because that was when most individuals were available. Participants consented in person on the day of each focus group to minimize attrition (Krueger & Casey, 2002). Those that participated were escorted to a classroom on the shelter premises. At the start of each focus group, participants were given a brief survey that assessed demographic data (i.e., age, sex, income, education, ethnicity, and employment), a few questions to assess feedback for the experimental manipulations, stage of behavior change, and attitudes. Following this, the focus group started. I lead the focus group discussion and two to three other research assistants assisted by audio recording the group discussion and made notes about body language or other non-verbal gestures as previously suggested (Krueger & Casey, 2002). The questions asked focused around the intervention theories, such as favorite foods and motivations to eat healthy (Table 3). For each of the focus groups, names of participants were not recorded with the data and, instead, participants were assigned subject numbers to link survey data to individual focus group responses.

Data Analysis: Focus Groups. Discussions were transcribed verbatim twice by four raters with the aid of notes on nonverbal behaviors taken during the focus groups. Four researchers read through each transcript multiple times to assess major themes and identify common words or phrases from each of the discussions. Codes were then created for common themes and frequently-said words and analyzed via constant comparison analysis in which two raters coded at least one focus group. For this analysis, raters read through the transcripts then

responses to questions were rearranged so answers were together for each question (Rabiee, 2004). Next, the main ideas and common phrases were noted in each of the responses (Rabiee, 2004) by matching similar responses between focus groups with letters (Eliot & Associates, 2005). Fourth, some critical thinking was used to relate the main ideas and similarities to larger themes (Rabiee, 2004). Following the establishment of larger themes, certain quotations from the responses were identified (Rabiee, 2004) and used in the results. NVivo software (QSR International, 2002) was then used for corroboration of frequently-said text and to identify additional frequent text through queries.

Survey/Quantitative Results: Focus Groups

Before each focus group, participants completed a brief survey that assessed demographic information, nutrition attitudes, and their stage of behavior change to consume more fruits and vegetables (Table 4). For these survey data, we developed an attitudes questionnaire with 10 scale items (Table 4), and this study served as a pilot for examining its reliability. Most of the items had moderate means (i.e., items that were between 2 and 4 on the 5-point scale) which suggested no ceiling or floor effects. Additionally, as an adequate marker of variability in responses, most of the *SD*s were greater than 1. Only one item (#5) had a *SD* lower than 1. A mean of all the items in the attitudes scale was taken. Cronbach's alpha revealed reliability to be .61(M = 3.63, SD = 0.56), but one question (#2) was omitted because the reliability without it increased, $\alpha = .73$ (M = 3.73, SD = 0.68).

This research also assessed the stage of behavior change of participants for fruit and vegetable intake. From coding the individual stages of behavior change (precontemplation, contemplation, preparation, action, or maintenance), six individuals were in the precontemplation stage, five were in the contemplation stage, twelve were in the preparation stage, four were in the

action phase, and four were in the maintenance phase. Therefore, the sample was representative of all stages of behavior change and responses were not limited to people who were already engaging in behavior change.

As part of Aim I, we also assessed how similar the views of participants in the focus groups would be to individuals in the pilot study. Based on feedback from the survey, individuals in both studies were most interested in how to shop and eat healthy at low cost followed by chronic disease and food preparation similar to the pilot study (Tables 1 & 2). These attitudes and opinions were further probed in the focus group discussions.

Qualitative Results: Focus Groups

The focus group discussions provided preliminary opinions about health attitudes and behaviors of individuals residing at a shelter that intended to establish residence and job stability for its residents in the next four months. Here, the effectiveness of health behavior change theories was screened and participant interest in nutrition topics was assessed. To further examine Aim I, we used constant comparison analysis and developed themes based on participant responses to assess similarity of responses between focus groups.

To reflect on these focus group responses, individuals commonly reported they were limited to what the shelter provided. They could not bring other food in, and they had limited resources which surfaced in responses across all questions. The 1st, 3rd, and 5th focus groups tended to be more health oriented and some participants had more health knowledge than expected in which they stated they wanted to visit farmers' markets for wholesome food or do dietary fasts. Individuals in these focus groups also seemed to be acquainted with each other. Indeed, participants ended the discussion feeling empowered, closer together, and glad they participated. There was also little conflict throughout each of the discussions. For instance, Focus

Group 5 had only 3 individuals with different backgrounds, yet they all seemed to respect each other. Focus Group 2 was an odd exception being shorter than the others. It also had more males who did not participate as much, so discussion was not as fruitful in comparison to other groups.

Despite some variation in length of focus groups, individuals spoke on average 39 times per focus group with females having spoken more often (56 times, *SD* = 32.87) than males (27 times, *SD* = 20.01). Two participants were particularly vocal and were both in the first focus group. When those two participants were omitted, females spoke about 45 times (*SD* = 19.16). Overall, 238 statements were made on average per focus group. Of these 238 statements, the frequently-said words across all focus groups were also examined. Here, text was only counted once per statement if it was said by the same participant (e.g., I like oranges, oranges are healthy… was only counted as stating oranges once). The most recurring words that were somewhat consistent across each focus group were steak or types of red meat (stated 47 times), vegetables or some derivative like veggies (stated 42 times), fruits (stated 33 times), money or synonyms such as cost/finances/pay/income/price/rich (stated 31 times), chicken (stated 26 times), living circumstances or similar phrasing mentioned about 24 times, salad (stated 19 times) and greasy or fried food (stated about 17 times). Sugar or sweets came up in every single focus group (13 times total) and junk food was stated about 10 times. Fast food was voiced, but not as commonly as other unhealthy nomenclature. Some participants even brought up individual unhealthy items they often ate (e.g. donuts, burgers, fries, etc…). Preservatives or chemical additives were only mentioned twice when participants were asked about what they considered unhealthy food across all focus groups. Personal stories were brought up 55 times of which 26 related to personal health, and, across all focus groups, there were about 30 instances of change talk in which participants stated they wanted to, desired, or felt like they needed to change.

Theme Analysis. Beyond the descriptive information from these focus groups, the exploration questions (Table 3) guided responses and the development of themes. The major themes that emerged from these five focus group discussions included 1) distrust of government or food companies/excuses, with an ancillary theme of a small to moderate belief in external motivators to facilitate healthy eating, 2) wanting to obtain the right information and not knowing what to eat, 3) being confined in a shelter environment in which one can only consume what is provided (lack of money and control), and 4) consistent thoughts about eating healthier and ability to eat healthier outside of shelter environment.

Theme 1: Distrust of government or food companies/Excuses. Although more prominent in focus groups 1 and 4, a negative and skeptical view of health and food emerged. Both groups thought government and large corporations had a strong influence in food consumption and operated to support their needs because certain food additives have been linked to health risks (e.g., cancer). For example, as one participant said, *"the FDA has everybody confused…"* Indeed, another said these businesses were just *"trying to make money off of you*." Focus Group 1 also discussed that companies were *"stuffing the pockets"* of those in charge of dictating health claims, and *"I don't really look at the labels as much anymore because they're just so difficult to read and I don't trust them."* Others in Focus Group 4 said, *"I think if the labels were just simpler and straight forward…more truthful… I would take them."* Rather than hear something from a corporation or government, participants preferred to see videos or personal stories as evidence. This may be from lack of trust or because residents tried to explain their behaviors. Water was brought up in four of the groups as one of the few foods without any risk involved, and participants often cited it as a justification for eating healthy. Every focus group brought up the analogy of cigarettes regarding unhealthy food. Although there were

warning labels on cigarettes, people still "*smoke them anyway*." This mentality that people would do what they desire and the additive effect of skepticism toward health claims led to an ancillary theme of a small to moderate belief in external motivations for health behavior.

When examining the focus groups for the effectiveness of warning messages to tie into the EPPM (which examines message appeal strength and response to messages), Focus Group 1 had no agreements that warning messages were effective. In Focus Group 2, 4 participants initially disagreed, but later 1 agreed and 2 became indifferent. Focus Group 3 had 3 verbal agreements that warning messages were effective. Focus Group 4 had 3 verbal agreements, and Focus Group 5 had 1 agreement and 1 indifferent. In total, 8 people (or about a quarter of participants) verbally agreed and 6 verbally disagreed that warning messages were effective. The others did not respond or did not have an opinion. When participants stated whether they thought warning messages were effective, Focus Group 1 generally said they would usually choose the cheaper option or something familiar over heeding recommendations. Participants in Focus Group 2 thought warning messages were something to think about and could help to "*persuade your mind"* and encourage healthier eating. Focus Groups 3, 4, and 5 generally thought it was helpful to have those messages because *"there's a lot of people that are not educate*d," but there was some hesitancy because people may have felt *"we're conditioned to not care"* which suggested that people wanted something more relatable or personal.

When asked about the effectiveness of accountability partners, Focus Group 1 had no one agree it would help and 4 said it would not help. They reasoned even if they looked fit it was not always the best indication of health (i.e., *"how thin or how many ripped 6 packs he has…that don't mean he's healthy*.)*"* Focus Group 2 had 2 people agree and 2 state indifference, Focus Group 3 had 3 verbal agreements, Focus Group 4 had 3 verbal agreements and 4 maybes, and

Focus Group 5 had 2 agreements. In total, 10 people verbally agreed and 6 people verbally said having an accountability partner would help to some degree. If participants did not agree or disagreed on whether warning messages or role models/prototypes were effective for health change, participants said people would still do what they wanted to do (brought up about 16 times during these questions across all focus groups). Many agreed *"what we crave is what we crave, and we go for what we crave,"* largely indicating willpower, motivation, or focus was the main driver behind whether or not external motivations helped to change behavior. Individual willpower coupled with the multitude of food options and the obscurity of how our food was sourced and produced may have been overwhelming and individuals may not have known the best food to consume.

Theme 2: Not sure what to eat/Do not have the right information. With participants' pronounced distrust or excuses, participants stated there were too many options when choosing foods. Participants stated they did not want to eat certain foods like carbs, red meat, and canned vegetables because of the negative reception these food items have garnered. Indeed, *"what they put in the vegetables these days, it's just not appetizing to me."* One participant commented about not knowing what good carbs (e.g., whole grains or vegetables) were. Most individuals responded with general answers (i.e., sugar/sweets, fried food, and fast food) with little detail about certain kinds of food or why certain foods were unhealthy. *"A lot of people are not educated"* and *"A lot of time people don't think actually they just eat."* Participants in Focus Group 3 stated there was so much information and on *"the internet….they don't make it easy for people that don't know how to get on different computers"* and *"some of us just don't know how…how with our diet."* Access may have also impeded obtainment of the right information as participants in Focus Groups 1 and 4 brought up information related to getting nutrition

information from videos or social media like YouTube or Instagram. The main concern with not having the right information was that, *"if you can't afford the certain type of lifestyle then you may…die sooner."*

Theme 3: Limited resources/Circumstance. This theme was prominent in responses from questions 4 (what do you typically eat?) and 5 (what obstacles or barriers make it difficult to eat healthy?). There was consistency across focus groups that they could only eat what was given to them and because of limited resources, many had a survival mentality. As one participant said, *"if I don't eat this, I don't have nothing else."* Many reported eating similar foods (i.e., oatmeal/cereal for breakfast, sandwiches or PB&J for lunch, and a larger dinner that was often chicken or pasta, with a basic salad). For the first engagement question (what are your favorite foods/meals?) participants tended to say familiar southern foods (high fat or fried foods). These responses were also more protein and carbohydrate-based (pasta, spaghetti). Condiments also "*sat out*" unrefrigerated, which left a feeling of disgust with participants. Indeed, it was hard for many to eat healthy in the shelter because of limited variety and *"beggars can't be choosers."* Because of the lack of variety of foods and resources, participants may have skipped lunch and just ate dinner. However, a few participants noted that, *"they [shelter workers] try to feed us [residents] a healthy diet"* as fruits were laid out throughout the day to facilitate balanced eating and help alleviate any perceived barriers to healthy options.

When asked about barriers or obstacles, money or finances was the most common and usually the first response (verbally mentioned by 13 different participants across all focus groups for this particular question). Another frequently voiced response was that others or situations control what residents consume. Seven participants verbally stated they did not have control over what they ate at least some of the time. One participant brought up the concept of living in a food

desert and another in Focus Group 3 stated, *"non-access… fruits are more expensive."* Despite participants noting barriers, many said it was in their control to eat healthier.

Theme 4: Desire to change behavior. The stage of behavior change theory (SBC) was captured and assessed with question 6 (have you thought about eating healthier?) and question 7 (how capable are you to change your diet habits to consume more fruits and vegetables if you need to?). Out of all the focus groups, 20 of 31 participants verbally agreed they thought about eating healthier and often. Participants mentioned intending to meal prep, grow own fruits and vegetables, fast as a diet strategy, and visit healthier markets. They also described what they ate prior to the shelter environment and were eager to be on their own and move on from the shelter constraints. One participant even wanted to cook more and said, "*cooking is a ritual.*" When asked about capability to eat fruits and vegetables if they need to, participants had an average rating of 8.2 (*SD* = 1.79) out of 10. What was offered as to why some participants were not giving themselves higher scores was just the available options and lack of control in the shelter. One participant noted, *"if I was in my own environment, I would be eating healthy*" to tie in with the previous theme. These two questions also prompted more anecdotes related to family or personal health to describe why they wanted to change.

Discussion: Focus Groups

Findings from Study 1 theme analysis revealed thoughts about healthy eating were defined similarly across the focus groups. Additionally, both this population and a student population from a pilot study had similar interest in food topics, in support of Aim I. Moreover, despite being in a transient situation, two-thirds of participants stated they were in the preparation stage or better when it came to fruit and vegetable consumption. This may have been because residents resided at the location for at most a few months and some fruit and vegetables

were accessible throughout the day. Many participants even liked the same foods and had similar opinions about unhealthy foods. However, unhealthy foods tended to cover broad categories, (i.e., junk food, processed food, fried food, and fast food), which suggested a lack of knowledge as previously reported in this population (Davis, Befort, Steiger, Simpson, & Mijares, 2013). When describing healthy food, vegetables were more often stated than fruits (although both were frequently cited), which aligned with health initiatives to increase servings of vegetables per day (Lee-Kwan et al., 2017; Treiman et al., 1996).

Although participants wanted to make healthier choices, theme analysis in Themes' One and Two showed individuals thought current health information was contrived and wrongly manipulated. While food companies may use sophisticated campaigns that can be confusing and ill-founded (Lake & Townshend, 2006), there are multiple government organizations, in addition to the FDA, aimed at providing individuals with proper information. While the internet served as a portal for this evidence-based information, it also has allowed more misguided health claims to propagate. If individuals lacked knowledge, they may turn to convenient sources, such as social media, instead of more reputable sources for health knowledge (Davis et al., 2013; Slusser et al., 2011). Theme One also addressed if warning messages and prototypes were effective for health behavior change to address components of the EPPM and PWM. Researchers have stated these two behavior change strategies could be used for increasing healthier behaviors as they were initially targeted to decrease risky behavior in youth (Gerrard, Gibbons, Stock, Vande Lune, & Cleveland, 2005; Gibbons, et al., 1998). Here, a quarter of participants said warning messages helped. Without prompting, participants brought up these warning messages, related them to cigarettes, and described the same desensitization and misperceptions about health threats as cigarette packs (Guillaumier, Bonevski, & Paul, 2015).

While messages may have provided some benefit, we also indirectly addressed the PWM in these focus group discussions and asked participants about the effectiveness of a role model or prototype as a person/role model could create accountability and set a precedent (Treiman et al., 1996). Overall, participants expressed greater effectiveness to eat healthier with having a model than just receiving a message. This may have also explained Theme Four: participants had strong intentions towards healthy eating yet did not have the social reinforcement to achieve the desired behavior of eating healthier.

Due to the controlled environment where food was prepared for them, Theme Three saw consistent responses from participants in what they typically ate each day. The food served at the shelter was also very similar, so it was easy for participants to recall specific items (e.g., sandwiches, salad, and pasta). Although, participants often voiced it was difficult to know what else to eat to stay healthy because of the plethora of food choices in our food system (Caballero, 2007; Fine & Leopold, 1993) and the multitude of factors that influence food choices (Lyerly & Reeve, 2015; Steptoe et al., 1995). As expected, finances and lack of control were the most common barriers to consuming healthier foods (Hendrickson, Smith, & Eikenberry, 2006), despite this population being more socially functional than typical low-income shelter residents. Other barriers cited in these discussions included living circumstances, companions, and self-discipline. Although taste and food appeal have been previously reported, they were not cited in these discussions (Pollard, Kirk, & Cade, 2002). It may be that environmental and social barriers were more salient as this population tended to be older, more independent, and in the same shelter environment suggesting stronger social influence. This shelter was also located in a county considered to have more prominent food insecurity (Gundersen et al., 2018; USDA,

2017), which could have also contributed to the lack of food variety and prominence of environmental barriers.

Even with the presence of barriers, two-thirds of participants desired to eat healthier and a few even had good intentions for the future such as a desire to grow a garden or meal prep, which was found previously with low-income women (Treiman et al., 1996). One participant noted, "*healthy nutrition starts at home from infancy for training your kids,"* which is often neglected by many individuals because of an optimistic bias toward personal health (people perceive themselves to be healthier than they may be). For instance, many participants were mothers or had some stake in childcare, and, when prompted, most individuals perceived themselves to be "*in control*" of their own health (Aldoory, Braun, Maring, Duggal, & Briones, 2015), which suggested most people recognized it as a personal choice.

Study 2: Testing Intervention Theories and Strategies

Method

Participants: Testing Intervention Theories and Strategies. Participants (N = 181) consented to participate in one of 4 manipulations and were recruited via flyers from Arlington Life Shelter in Arlington, TX and True Worth Place in Ft. Worth, TX from November 2018 to February 2019. However, recruitment halted for the week of Thanksgiving and Christmas for risk of bias in health attitudes. Sample size calculated through G*Power indicated a sample size of 72 to examine within and between effects for repeated measures ANOVAs so adequate power was achieved for T1 to T2 analyses. Manipulations were taught roughly twice a week at both locations where participants completed questionnaires at three time points. They completed the questionnaire right before the manipulation (Time 1/T1), immediately after (Time 2/T2), and two weeks following the end of their respective manipulation (Time 3/T3). Two weeks was chosen to

account for variability in length of stay. To be eligible to participate, participants had to be 18 or older, not on staff at either location, be available the shelter/facility was open and two weeks later, be a fluent English speaker, and have not participated in Study 1 of this research. For a demographic description of participants, most were Black and male (51.2% Black and 62.9% male). They had a mean age of 46 years (*SD* = 13.19), and most reported having completed high school or equivalent and earned less than $10,000 a year (*N* = 116, 73%). Additional characteristics can be found in Table 5. Participants also received $5 gift cards after the manipulation and at the two-week follow up (to earn $10 total), and these procedures were approved by the UTA IRB.

Measures: Testing Intervention Theories and Strategies. Participants completed the following measures before the manipulation, immediately after, and two weeks following. The primary outcomes were dietary intentions and intake, behavior, attitudes, knowledge, food choices, and volitional self-efficacy. Covariates included perceived stress, education, if the participant took a previous health class or not, eating competency, perceived threat T1, and dietary self-efficacy T1 (Figure 4). In total, these measures took about 20-25 minutes to complete.

Demographic information. Participants were asked about age, sex, employment (yes or no and if yes how many hours they worked), family income, ethnicity, and education (highest degree completed). Employment was dummy-coded such that 0 = employed and 1 = unemployed. Sex was also dummy-coded such that 0 = female and 1 = male.

Fruit and vegetable intake. To assess fruit and vegetable servings, and because participants may not have had access to an internet-enabled device, participants self-reported how many fruit and vegetables they consumed on average per day as well as how many they

intended to consume as similarly used by Nitzke and colleagues (2007) and in Study 1 after they were given a handout that detailed proper serving sizes of fruit and vegetables. This was assessed before each experimental manipulation, right after the experimental manipulation (but framed as how many fruit and vegetables individuals *intended* to consume per day instead), and two weeks later as how many fruits and vegetable servings they consumed on average per day the previous two weeks and how many they intended to consume going forward. Intentions and intake were two single-item open-ended measures.

Sugar-sweetened beverage intake. Participants also recorded their sugar-sweetened beverage intake similar to fruit and vegetable intake as used by Nitzke et al. (2007) — how much they intended to consume and how much they consumed per day on average. Some examples of sugar-sweetened beverages included regular/non-diet soda, fruit drinks (e.g., juices and smoothies, because they could include added sugars), sports drinks, energy drinks, sweetened waters, and coffee or tea beverages with added sugars (McGuire, 2011). A handout of common sugar-sweetened beverages was given to participants to help them answer the question correctly. This was assessed before each experimental manipulation, right after the experimental manipulation (but only framed as how many individuals *intended* to consume per day), and two weeks later as how many sugar-sweetened beverages they intended to consume going forward and how many they consumed on average per day the previous two weeks. Intentions and intake were two single-item open-ended measures.

Processed meat intake. Recent research has also shown that processed meat consumption was associated with increased all-cause mortality (Larsson & Orsini, 2013). Processed meats were those preserved by smoke, salt, curation, or by additional additives (Larsson & Orsini, 2013). Common examples of processed meat included, but were not limited to, corn dogs, bacon,

hot dogs, salami, and bologna (Sinha et al., 2005). Participants also recorded their processed meat intake similar to fruit and vegetable intake after given a complete list. Processed meat intake was assessed before each experimental manipulation, right after the experimental manipulation (but instead framed as how many individuals *intended* to consume per day), and two weeks later as how many processed meats they intended to consume going forward and how many they consumed on average per day the previous two weeks like the previous two measures. Intentions and intake were two single-item open-ended measures.

Stage of behavior change. Similar to Study 1, participants were asked questions, that is, numbers 3, 4, 5, and 6 of the Experimental Feedback Questions (Table 4) as assessed by Nitzke et al. (2007) for fruit and vegetable intake. Based on their response(s), they would be coded as precontemplation if they responded no to #4 and the following questions; contemplation if they responded yes to #5, but no to #6; preparation if they respond yes to #4, yes to #5, and no to #6; action if they responded yes to #4 and #5 and no to #6, but had reported consuming 5 or more servings of fruits and vegetables a day (#3); or maintenance phase if they responded yes to #4, #5, and #6 and consumed 5 or more servings of fruits and vegetables a day. Although not discussed in previous research, if participants reported yes to #4, #5, and #6 and consumed less than 5 servings of fruits and vegetables a day, they were also coded as action. Participants answered some derivative of these questions for fruit and vegetable intake at T1 and T3. In Study 2 it was used to describe participant movement across stages.

Nutrition knowledge. Knowledge quantitatively asked how much participants agreed with various statements (Table 6) from -2 (*strongly disagree*) to 2 (*strongly agree*) as assessed by Rustad and Smith (2013). An increase in knowledge was defined as an increase in understanding or awareness of the target behavior (Macías & Glasauer 2014). Knowledge sums

were created at all three time points for the nutrition knowledge items (items 1-12; Table 6) and total knowledge that included the nutrition knowledge questions plus two questions about physical activity (Table 6).

Nutrition attitudes. Participants stated their opinion from not at all to very much on a scale from 1-5 (Macías & Glasauer, 2014; Table 4) for piloted nutrition attitudes. Research has shown it was important to understand personal factors related to dietary habits over just nutrition knowledge (Macías & Glasauer, 2014). Attitude change has been seen as increased confidence, belief, preference, or willingness towards the desired behavior (Macías & Glasauer 2014). For this research, these questions were piloted in Study 1 and shown to be reliable (see above). In Study 2, a mean of attitudes was created at all 3 time points omitting question 2 and were shown to be reliable (α =.80-.87).

Behavior. Participants responded with a single number (e.g., 1 = once, 2 = twice, etc…) to pre-selected health statements (Table 6). The first four questions were used by Rustad and Smith (2013), which were piloted in a previous study by Brown and Hermann (2005). In the current study, the first four items were used and analyzed individually as outcomes and the latter two were included in a descriptive table (Table 5).

Food choice. Steptoe and colleagues (1995) had originally created a food choice questionnaire that addressed what foods individuals chose and what factors influenced them. Since then, it has been updated with more questions to reflect food choice values by Lyerly and Reeve (2015). This updated food choice questionnaire consisted of 25 items in which respondents reported importance of each item on a scale from 1 (*not at all*) to 5 (*very*; Lyerly & Reeve, 2015). Examples of these items included 1) how it tastes, 2) the amount of calories in it,

and 3) how easy or difficult it is to compare (Appendix B). Scores on this scale were computed by averaging the ratings for each item and internal consistency was strong (α =.90-.92).

Eating competency. This measure developed by Satter (2007) encompassed hunger and need to survive, the need for pleasure, the social reward of sharing food, and the tendency to maintain a certain and stable body weight. Eating competency consisted of 16 statements in which respondents reported how frequent (always, often, sometimes, rarely, or never; scored as 3, 2, 1, 0, or 0, respectively (Lohse et al., 2007) they engaged in the behavior that captured four dimensions: 1) attitudes toward eating and internal regulation (the experiences and processes of hunger, appetite, and satiety), 2) acceptance of food, 3) external influences and attitudes to like new food, and, 4) contextual skills that reflect cognitive and external behaviors to manage food consumption (Lohse et al., 2007; Appendix C). Items were then summed for a total score for each participant. Cronbach's alpha at T1 was reported to be .86.

Dietary self-efficacy. Self-efficacy was measured with a dietary self-efficacy questionnaire as used in a previous study (Lhakhang et al., 2014). It used three items with the stem, "I am confident that I can eat fruit and vegetables …." followed by, 1) "even when I cannot see any positive changes immediately", 2) "even when it costs some extra money", and 3) "even when it takes a long time to become part of my daily routine". Responses were formatted on a scale from 1 (*completely disagree*) to 6 (*completely agree*) in which an average of the items was computed (Scholz et al., 2005). Internal consistency of this measure was also sufficient at T1 α = .79.

Volitional self-efficacy. Research has also shown the importance of how to *maintain* a sense of self-efficacy (Scholz et al., 2005). This measure was adapted here to assess a " healthy diet" instead of a low-fat diet (Scholz et al., 2005), and drew upon volitional self-efficacy using

four items that were operationalized for this study: 1) I am confident I can maintain a healthy diet *on a long term basis* even if I cannot see any positive change immediately, 2) I am confident that I can maintain a healthy diet *on a long term basis* with friends and relatives who do not keep a healthy diet, 3) I am confident that I can maintain a healthy diet *on a long-term basis* even if I feel like eating something else, and 4) I am confident that I can maintain a healthy diet *on a long-term basis* even if I do not feel well (Ochsner et al., 2013; Scholz et al., 2005). These items were scored on a scale from 1 (*completely disagree*) to 6 (*completely agree*), and an average of the items was computed similar to dietary self-efficacy. Cronbach's alpha for internal consistencies were reported to be .87-.88. Additionally, physical activity volitional self-efficacy was computed with the same questions stems, but instead of "healthy diet," exercise was used instead as a manipulation check between conditions. Cronbach's alpha were also found to be consistent for this measure (α = .88-.93).

Perceived threat/susceptibility. Participants were queried about the magnitude of the health threat from the manipulations and their own risk to the threat. The magnitude of the health threat was conceptualized as how serious the health consequences of not consuming what was recommended each day measured on a scale from 1 (*not at all serious*) to 7 (*very serious*; Napper et al., 2014). To measure susceptibility, two questions were used: 1) my chances of experiencing some form of chronic disease in the future if I (the participant) do not eat what is recommended is 1(*very low*) to 7(*very high*), and 2) "How likely is it that I will experience poor health in the future if I do not eat what is recommended?" from 1(*not at all likely*) to 7 (*very likely*; Napper et al., 2014). Total threat/susceptibility was calculated by taking the mean of these three questions (α = .76).

Implementation intention. Participants were to write and carry out a specific health goal following each manipulation. They were told to pick something SMART or specific, measurable, achievable, relevant, and time-bound (Doran, 1981). Typically, implementation intentions were either completed or not completed. However, a continuous coding scheme was piloted here in which four coders subjectively assessed how specific and targeted the formed intentions were on a continuous scale from 1 (*not very detailed*) to 4 (*very detailed*). Two and three on this scale were somewhat detailed and detailed, respectively. Implementation intentions were used as a manipulation check to describe effectiveness of each manipulation for desire to change.

Eating schema. A healthy eater was someone who ate in a nutritious manner, and someone who was careful about what they ate. To assess eating schema, participants responded on an 11-point scale from 1 (*does not describe me*) to 11(*describes me*) to three prototypes: 1) healthy eater, 2) someone who eats in a nutritious manner, and 3) someone who is careful about what they eat. They also rated the importance of the phrases with the stem "to the image you have of yourself regardless of whether or not you are a…." 1) healthy eater, 2) someone who eats in a nutritious manner, and 3) someone who is careful about what I eat on an 11-point scale from 1 (*not at all important*) to 11(*very important*). As shown by Kendzierski and Costello (2004) and Markus (1977), participants have healthy eating schemas if they rated at least two of the three prototypes as very self-descriptive (8-11 on the 11-point scale), and rated at least two of the three phrases as very important to their self-image (8-11 on the 11-point scale). Conversely, participants who rated at least two of the three prototypes as not very self-descriptive (1-4 on the 11-point scale), and rated at least two of the three phrases as very important (8-11 on the 11-point scale) to their self-image were considered non-healthy eaters Kendzierski et al., 2015).

Others not categorized as having a healthy or non-healthy eating schema were coded as non-schematics. For this research, eating schema was used as a moderator.

Perceived stress. The perceived stress scale (PSS) has been the most widely used measure for the perception of stress (Cohen, Kamarck, & Mermelstein, 1994) and was important to consider for this study as a large body of research has implicated stress in unhealthy food choices. Sample items for the PSS included "in the last month, how often have you felt that you were unable to control the important things in your life?" or "in the last month have you felt confident in your ability to handle problems?**"** The 4-item scale was used, where a total score for the PSS was calculated by summing the four items after reverse coding items 2 and 3 (Appendix D). It was shown to be acceptable and feasible for short questionnaires ($\alpha = .58$) and was used here as a covariate and assessed at T1.

Food Log. Participants were also asked to fill out a food log by hand from an online template to track their food intake for the two weeks in between T2 and T3 assessments. However, very few participants completed this ($n = 3$), so they were not used in the analyses.

Participants were asked some feedback questions, three of which were used in analyses as manipulation checks. The first was if they had taken a previous health or nutrition class before the manipulation (yes/no), and it was used as a covariate in the analyses. The other two occurred post-manipulation (T2) and were as follows: 1) how helpful the experimental manipulation was from 1(*not at all*) to 5(*very*), and how beneficial the manipulation was from 1(*not at all*) to 5(*very*). Enjoyment of the manipulation was created from the sum response to these latter questions (creating a rating scale from 1-10) because they were both highly correlated, $r(157) = .76$, $p < .001$, and used as a manipulation check to describe how participants responded to the manipulations.

Procedure: Testing Intervention Theories and Strategies. Study 2 used data from the pilot survey and focus groups to implement experimental manipulations. For these manipulations, participants were recruited from Arlington Life Shelter in Arlington, TX and True Worth Place in Ft. Worth, TX. These manipulations also covered portions of the SCT, the EPPM, and the PWM because each addressed intention, attitudes, and self-efficacy, but individually covered other aspects of behavior change that were not just captured with one theory (Sheeran et al., 2017; Table A2). In particular, the manipulations used the interpersonal and environmental interactions of behavior change (SCT), a fear component and a measure of perceived severity/susceptibility (EPPM), and finally, used examples to follow and not follow (PWM) during the discussion portion (Table A2).

Forty to fifty participants per manipulation group were targeted for enrollment. Participants were not randomly assigned to manipulations because of potential contamination with different individuals that may show up each week. Because of this, the manipulations were conducted in a counterbalanced Latin square design to account for week to week variability and effects of practice. Additionally, this research was also meant to be a pilot study because there have been few diet interventions that utilized a community-based participatory recruitment approach (Harmon et al., 2014). However, each manipulation was announced in advance via flyers as an hour and a half-long class (to account for time) to occur on different dates. Each manipulation also focused on one topic, either how to shop and eat healthy at low cost, recommended daily serving sizes of food groups, chronic disease and food preparation, or physical activity. The three nutrition manipulations had material that was examined and verified by a registered dietician, and the physical activity manipulation used approved materials (*materials available upon request*) from the American Heart Association (AHA, 2015).

For each manipulation, participants provided their consent, filled out a baseline questionnaire, and listened to a lecture for about 10 minutes with complementary educational videos in which participants received handouts of the educational slides to follow along and take notes. Following this lecture portion, there was a brief discussion portion during in which I talked about the three health theories (SCT, PWM and EPPM, respectively). First, participants were taught environmental and personal factors related to behavior change (e.g., set up accountability measures and identify environmental constraints in a brainstorm fashion related to the manipulation topic). Second, participants were provided examples (i.e., healthy shopper vs. procrastinating shopper, someone who ate recommended servings sizes of food groups vs. someone who did not, a person who tried to prevent chronic disease and prepare healthy food vs. someone who did not, or someone who regularly exercised vs. someone who did not). Third, participants were exposed to a fear appeal to incorporate aspects of the EPPM (i.e., dangers of consuming certain fast foods or dangers of inactivity in the physical activity group), and told healthier options to consume at restaurants or other fast food eateries instead because fast foods were more familiar to them and to evoke a sense of self-efficacy and behavior change. The physical activity group was given an exercise plan handout instead.

Next, participants completed an activity (in groups of three or four) related to the topic of the manipulation for which they applied what they learned for about 10 minutes. For the activity on how to shop at low cost, participants were given a handout with common grocery commodities and prices and were asked to choose items they could form meals with for a week. They were given a set budget and challenged to shoot under $40, which was about what individuals on the thrifty food plan could spend per week (USDA, 2018). The goal was to have participants choose from more wholesome food options to try and get under this upper limit. For

the manipulation on chronic disease and food preparation, participants were first given three recipes. Duplicates of each recipe (for a total of 6) were given to participants in which one would have healthier ingredients and one used less healthy ingredients. With these recipe differences, they were then tasked to brainstorm and write down other recipes with which they could swap healthier ingredients. For the manipulation on recommended servings sizes of food groups, participants attempted to estimate the serving sizes of common foods (e.g., 1/8 cup, 1/4 cup, ½ cup) prior to the lecture portion and data collection at T1. Following the lecture portion, participants then compared their estimated serving sizes to the actual serving sizes. In the physical activity group, participants were told to write an exercise plan for themselves. All these activities were completed on paper.

After the activity, participants completed measures at T2 and were told to write an implementation intention. The T2 questionnaire was similar to the one at T1, but included some additional feedback questions. Food competency, behavior, perceived stress, and healthy eating schema were omitted at T2 because they asked about more stable traits and were redundant since they were measured at T1. Additionally, because there was little opportunity for them to change within the manipulation time, fruit and vegetable intake, sugar-sweetened beverage intake, and processed meat intake were not measured at T2. Implementation intentions were measured only at T2, because they were derived from course materials. In total, the manipulation lasted about 90 minutes. Following completion of the measures, participants were told to come back to the shelter\facility two weeks later, complete a food log in between, and complete the same measures assessed at T1 via paper print-outs to obtain a third time point (T3). At T3, participants recorded their intake of fruit and vegetables, sugar-sweetened beverages, and processed meats as an average per day for the two weeks prior. The follow-up time was kept reasonably short to reduce

participant dropout, but attrition still occurred. Four T3 questionnaires were provided online to participants who could not attend in person.

The survey measures at each time point were similar, however, the survey to be completed after the manipulation ended (T2) included the questions, if the participant had taken a previous health class before and how much the participant benefited from the experimental manipulation and how helpful they found it rated on a scale from 1 (*not at all*) to 5 (*very*). As noted previously, measures of dietary intake were also framed as how much individuals planned to consume fruit and vegetables, sugar-sweetened beverages, and processed meats, respectively.

Recruitment: Testing Intervention Theories and Strategies. Of the 181 participants who consented to participate in this research, 173 had useable T1 data (eight consented but had to leave before completing the study procedures). From the 173 that had useable data, 13 more participants were excluded from analyses. Of these 13, 7 individuals were excluded because they did not finish completing the T1 data until the T2 assessment point; therefore, they did not have true T1 data. Two participants were discharged because of difficulty comprehending the questionnaire. Additionally, two participants slept during the class; therefore, they were excluded. One participant completed less than 50% of one questionnaire before leaving the study, and one participant did not have useable T1 data, so they were also excluded from analyses because they did not have a baseline. Thus, 160 had T1 data. Of the 160 that had useable T1 data, 8 participants left before the class ended (had to leave in order to make another appointment or from disinterest), and we could not acquire T2 data, thus 152 had T1 and T2 data. Time 3 data were acquired two weeks after the class ended. A total of 44 participants had at least half of T3 data. One participant completed just over half of the T3 survey so was included. Loss in data from T2 to T3 was due to attrition (lack of interest or forgetting to return). The same

participant that did not have T1 data was excluded at T3. Between recruitment locations, five manipulations were taught for how to shop and eat healthy at low cost, seven for recommended daily serving sizes, six for chronic disease and food preparation, and seven for physical activity (Table 5 for sample sizes). Chi-square tests of independence were conducted on sex, ethnicity, income, employment, education, stage of behavior change for fruits and vegetables, and eating schema with location to assess differences in recruitment site. Results showed significant differences by site on sex, $\chi^2(1, N = 159) = 4.19$, $p = .04$, income, $\chi^2(4, N = 152) = 20.34$, $p < .001$, and employment $\chi^2(1, N = 151) = 33.37$, $p < .001$. From examining column proportions between locations, more males (67.2% to 48.6%), more individuals that made 30,000 or less (95.7% to 88.6%), and more unemployed individuals (86.8% to 40.5%) were recruited from True Worth Place compared to Arlington Life Shelter, $p < .05$.

Data Screening: Testing Intervention Theories and Strategies. Data were then screened for missing values at each time point (T1, T2, and T3) following exclusion of cases. Values may have been unreported or uninterpretable and were coded as missing to be conservative. Missing data ranges for variables relevant to analyses for those that had complete data at each time point were as follows: T1 (0 to 12.5%), T2 (0 to 11.2%), and T3 (0 to 13.6%). Next, data from T1, T2, and T3 were examined for normality via histograms, boxplots, and skewness and kurtosis values from descriptive statistics. The variables that required a log transformation included the following: fruit and vegetable intake T1 and T3, fruit and vegetable intentions T1, T2, and T3, sugar-sweetened beverage intentions T1, T2, and T3, sugar-sweetened beverage intake T1 and T3, processed meat intentions T1, T2, and T3, processed meat intake T1 and T3, combined sugar-sweetened beverage and processed meat intake T1 and T3, times consumed fast food in the last week T1 and T3, times read nutrition label in the last week T1 and

T3, times added salt, sugar, or butter to foods in the last week T1 and T3, and times cooked a nutritious dinner in the last week T1 and T3. Variables that required a square transformation included dietary self-efficacy T1, dietary volitional self-efficacy T1, T2, and T3, physical activity volitional self-efficacy T1, T2, and T3, and perceived susceptibility/threat T1. Finally, enjoyment ratings at the end of the manipulations were negatively skewed and required a cube transformation.

Data Analysis: Testing Intervention Theories and Strategies. Study 2 had three aims (Aim II-IV). Each aim used mixed analyses of covariance (ANCOVAs) to examine how health outcomes changed over time in this population (T1 to T2 and T1 to T3). Aim III examined manipulation topic and time to examine which topic had the greatest positive change overall. Aim IV investigated how moderators (i.e., sex, employment, stage of behavior change for fruits and vegetables, and eating schema) influenced manipulation and changes over time. The analyses including the T3 outcomes were exploratory because the sample was small (n = 44), so data should be interpreted with caution.

In Aim II, the main effects of time were examined within 2(time) X 4(manipulation) or 3(time) X 4(manipulation) mixed ANCOVAs to determine whether intentions, intake, behavior, attitudes, knowledge, food choices, and volitional self-efficacy improved from before to after the manipulation. It was hypothesized there would be increases in fruit and vegetable intake from T1 to T3 and intentions to consume more fruit and vegetables T1 to T2 to T3. Further, participants would decrease intentions to consume sugar-sweetened beverages from T1 to T2 and T1 to T3 and decrease sugar-sweetened beverage intake from T1 to T3. Similarly, participants would have decreased intentions to consume processed meats T1 to T2 and T1 to T3 and decreased processed meat intake from T1 to T3. Regarding behavior, participants would decrease fast food

consumption and times added salt, sugar, or butter to foods from T1 to T3, but there would be increases in reading nutrition labels and times cooked nutritious dinners from T1 to T3. Nutrition knowledge and attitudes from T1 to T2 and T1 to T3 would also increase. Further, it was hypothesized participants would have more positive food choice values from T1 to T2 and T1 to T3 and increased volitional self-efficacy from T1 to T2 and T1 to T3.

For Aim III, the class X time interaction effects from the mixed-measures ANCOVAs were used to assess the best nutrition topic and theory to teach this population for future studies. Here, manipulation topic and time were used as independent variables and outcome change from T1 to T2 and from T1 to T3 was examined to assess which topic provided the most positive change. The outcomes were the same as in Aim II. It was hypothesized that individuals in the chronic disease manipulation would have improved health outcomes from (T1 to T2 and T1 to T3) over those in other manipulations. There would also be greater increases in physical activity volitional self-efficacy in the physical activity manipulation compared to other manipulations.

Aim IV explored the influence of sex, employment, stage of behavior change for fruits and vegetables, and eating schema as potential moderating factors in the ANCOVA models and was an extension of Aim III. Sex and income differed by recruitment site, which influenced their consideration for inclusion in the ANCOVA models, but employment was used in place of income because the dichotomous nature made it more amenable to analyze in the ANCOVAs particularly with the reduced power. Additionally, individuals with healthy-eating schemas have been shown to increase fruit and vegetable intake over individuals with non-healthy eating schemas (Kendzierski et al., 2015), which may have contributed to better health outcomes. Additionally, stage of behavior change reflected readiness to change. If individuals were in the contemplation or preparation stage they were more apt to experience greater health behavior

change outcomes than individuals in other stages. Indeed, individuals in the action or maintenance phase may not have seen increases in health outcomes because they already engaged in healthy behaviors (Prochaska & Diclemente, 1992).

In addition to measuring the effect of the moderators above, covariates for Aims II-IV were also included in the models. These covariates were perceived stress T1, if the participant took a previous health class, education, eating competency T1, perceived threat T1, and dietary self-efficacy T1. Education has been shown to be theoretically important to consider regarding health outcomes (Adler, Boyce, Chesney, Folkman, & Syme, 1993). Perceived stress and eating competency have also been shown to influence eating behaviors (Satter, 2007; Zellner et al., 2006). Lastly, greater perceived threat from lack of recommended health adherence and greater baseline confidence to engage in healthier behaviors may have influenced greater positive change.

Results: Testing Intervention Theories and Strategies

Manipulation checks. First, assessments of enjoyment (rated from 1 to 10) for the manipulation and implementation intentions at the end of the manipulation were examined to ensure the manipulations were effective enough to be enjoyable and could facilitate development of specific plans to change eating behaviors. Overall, the majority of participants enjoyed the manipulation. The medians within each manipulation were as follows: how to shop at low cost, median = 8.00, recommended daily serving sizes of food groups, median = 9.00, chronic disease and food preparation, median = 10.00, and physical activity, median = 8.00. Additionally, an ANCOVA showed that participants in the chronic disease and food preparation manipulation (M = 745.88 SE = 46.63) had significantly more enjoyment than did those in the how to shop and eat healthy at low cost manipulation (M = 537.41, SE = 47.00), $F(3, 139) = 3.59$, $p = .015$, $\eta_p^2 = .07$.

Implementation intentions were also examined post-manipulation via an additional ANCOVA to verify the manipulations were successful in helping participants form intentions to eat healthy and to preliminarily determine if any of the manipulations led to greater intention formation. Overall, the means were roughly equivalent for each manipulation: how to shop at lost cost (M = 2.17, SE = 0.15), recommended serving sizes of food groups (M = 2.02, SE = 0.16), chronic disease and food preparation, (M = 2.08, SE = 0.14), and physical activity (M = 1.94, SE = 0.14). Approximately 17% of the sample (n = 23) participants had implementation intentions > 3 (out of 4), but because the means were similar to the median (i.e., 2.00) and because intentions were only measured after the manipulation, no conclusion could be drawn as to whether the manipulations helped participants improve intentions. Additionally, all of the manipulations were equally effective in helping people establish implementation intentions, $F(3, 123) = 0.44$, $p = .72$, $\eta_p^2 = .01$.

Aim II. The primary focus of Aim II was to assess changes in the outcome variables over time (i.e., the main effect of time in ANCOVA models) from pre to post-manipulation. Specifically, Aim II examined the effect of time in which it was hypothesized that participants would have improvements in outcomes over time, such that outcomes at T3 would be better than outcomes at T2 and outcomes at T2 would be better than at T1 (Figure 4). The Ms and SEs over time and between manipulations can be found in Tables 7 through 9, respectively. As stated above, covariates included the following: if you have taken a previous health class before, education, eating competency T1, perceived stress T1, perceived susceptibility/threat T1, and dietary self-efficacy T1.

Contrary to expectations, there were no changes over time in specific healthy eating behaviors (intentions or actual performance), nutrition knowledge and attitudes, food choice

values, and desire to engage in these behaviors long-term (Table 7). Overall, Aim II was not supported.

Aim III. This aim was assessed by examining the interaction of manipulation and time from the ANCOVAs conducted in Aim II to see what manipulation led to the best overall outcomes. Additionally, the main effect of manipulation was examined to determine if groups differed even if changes were not found over time. It was hypothesized that participants in the chronic disease and food preparation manipulation would have greater improvements in outcomes compared to the other manipulations. Individual intentions and behaviors were presented in the same order as in Aim II (Tables 8 & 9).

With regard to healthy eating behavior, there were only significant main effects of manipulation for processed meat consumption intentions, such that when considering aggregate intentions T1 to T2, participants in the chronic disease manipulation had lower intentions to consume processed meats than did participants in the serving sizes manipulation ($p = .01$; Table 9), but these differences were not seen over time. Similarly, when considering intentions at all three assessments, participants in the how to shop manipulation had lower intentions to consume processed meats than did those in the serving sizes manipulation ($p = .03$; Table 9). Lastly, participants in the physical activity manipulation had read the nutrition label more in the last week compared to participants in the how to shop manipulation ($p = .02$; Table 9). There were no other main effects of manipulation nor time X manipulation interaction effects for the other healthy behavior intentions or actual intake behaviors (Tables 8 & 9).

Contrary to expectations, no support was found for increased performance of additional nutritional behaviors between manipulations. There were no manipulation X time interaction effects and no other manipulation main effects observed (Tables 8 & 9). Therefore, no

manipulation led to better nutrition behavior over time. Similarly, no effects involving the manipulations were observed within the less stable constructs of nutrition knowledge and attitudes nor within the more stable food choices and volitional self-efficacy constructs (Tables 8 & 9). Overall, Aim III was not supported and the manipulation groups appeared to be equally effective.

Aim IV. Aim IV consisted of moderation analyses that were an extension of Aims II and III. Sex, employment, stage of behavior change for fruits and vegetables, and eating schema were used as potential moderators entered as factors into the ANCOVA models with the same covariates. Because sample size was low, descriptives and chi-square cross tabulations were examined for stage of behavior change to provide an overviews of how many moved between stages and assess if change was significant. Here, we wanted to assess how these moderators influenced the above outcome measures over time and if they influenced any manipulation more than another over time. Multivariate *F* statistics were reported because of potential power issues and to account for any violations of sphericity or variance-covariance matrices. Reported below are only those outcomes that had significant moderating variables.

Stage of behavior change was not a significant moderator, but for descriptive purposes, at T1 (for those with both T1 and T3 data), 4 people were in the precontemplation stage, 7 in the contemplation stage, 5 in the preparation stage, 15 in the action stage, and 0 in the maintenance stage. At T3, there was 1 participant in the precontemplation stage, 5 in the contemplation stage, 7 in the preparation stage, 9 in the action stage, and 5 in maintenance stage. From examination of eating schema with stage of behavior change at both T1 and T3, unhealthy eaters and non-schematics were not more than expected to be in the precontemplation or contemplation stage compared to healthy eaters at either time point.

Moderation of sex. With sex coded dichotomously, there was a significant time X sex effect for fruit and vegetable intentions from T1 to T2, $F(1, 124) = 4.75$, $p = .03$, $\eta_p^2 = .04$. Although Box's M was violated $F(21, 22690.50) = 3.17$, $p < .001$, males were trending to have improved intentions at T2 compared to T1, $p = .05$ (Figure 5). for fruit and vegetable intentions from T1 to T3, a significant time X sex X manipulation effect was observed, $F(6, 42) = 3.29$, $p = .01$, $\eta_p^2 = .32$. Specifically, within the chronic disease manipulation at T1, males had greater intentions to consume fruits and vegetables than did females, $p = .03$. In the physical activity manipulation at T1, females had greater intentions to consume fruits and vegetables than did males, $p = .01$ (Figure 6). This same significant trend was found at T3 in the physical activity manipulation, but males had improved intentions over females, $p = .02$. Additionally within the physical activity manipulation, females had lower intentions at T3 compared to T1, $p = .02$, but males had higher intentions at T3 compared to T1, $p < .001$ (Figure 6).

Additionally, for nutrition attitudes from T1 to T2, there was a significant time X sex effect, $F(1, 132) = 4.81$, $p = .03$, $\eta_p^2 = .04$, such that within females, attitudes were significantly improved at T2 compared to females' attitudes at T1, $p = .001$. Additionally, females had significantly improved attitudes at T2 compared to males at T2, $p = .008$ (Figure 12). These differences in healthy eating based on sex were expected based on previous literature. However, despite participants coming from a low-income environment with only 23% of the sample employed ($n = 37$), employment status had more prominent moderation effects.

Moderation of employment. Participants in this study were either coded as employed or unemployed. Interestingly, employment was only a significant moderator for sugar-sweetened beverage intentions, where there was an interaction of time, employment, and manipulation for sugar-sweetened beverage intentions from T1 to T2, $F(3, 113) = 2.85$, $p = .04$, $\eta_p^2 = .07$. For

those that were employed, within T2, the physical activity manipulation had greater intentions to consume sugar-sweetened beverages than did the chronic disease manipulation, $p = .004$. At T2, within the physical activity manipulation, those that were employed had greater intentions to consume sugar-sweetened beverages than did those that were unemployed, $p = .006$. Furthermore, participants in the physical activity manipulation at T2 who were employed had greater intentions to consume sugar-sweetened beverages compared to T1, $p = .008$, but those who were unemployed had reduced intentions, $p = .04$, respectively (Figure 9).

For sugar-sweetened beverage intentions from T1 to T3 there was a significant time X employment X manipulation interaction, $F(6, 38) = 3.15$, $p = .01$, $\eta_p^2 = .33$. Participants in the serving sizes manipulation who were employed had reduced intentions to consume sugar-sweetened beverages at T3 compared to T1, $p = .03$. (Figure 10).

When considering performance of behavior, the only moderating effects with nutrition behavior were in times read the nutrition label in the last week with employment, in which a significant time X employment X manipulation interaction was observed, $F(3, 23) = 6.80$, $p = .002$, $\eta_p^2 = .47$. Within T1, participants in the how to shop manipulation who were employed had read the nutrition label more last week compared to unemployed participants, $p = .018$. This same significant trend was also found in the physical activity manipulation at T1, $p = .02$, and within T3 in the chronic disease manipulation, $p = .02$. Additionally, within those in the chronic disease manipulation, those who were employed at T3 had read the nutrition label in the last week more than at T1, $p = .001$. Moreover, within T1, for participants in the physical activity manipulation who were employed, they had read the nutrition label more times in the last week compared to the chronic disease manipulation, $p = .007$. Finally, at T3 within those who were employed, the chronic disease manipulation had read the nutrition label more than did those in

the how to shop manipulation, $p = .04$ (Figure 11). This change in behavior could have been due to participants' change in attitudes when considering employment status.

In fact, employment also moderated nutrition attitudes T1 to T3, as a significant time X employment X manipulation interaction was observed, $F(6, 50) = 2.41$, $p = .04$, $\eta_p^2 = .23$. Within the how to shop manipulation, within those unemployed, participants at T3 had improved attitudes than at T1, $p = .002$, and improved attitudes than at T2, $p = .01$. This same significant trend was also found within the chronic disease manipulation except within those that were employed at T3 compared to T1, $p = .006$, and T2, $p = .008$, respectively. Within the how to shop manipulation, within T1, those that were employed had improved attitudes than did unemployed participants, $p = .04$. This was also the case at T2, $p = .003$. Interestingly, within unemployed participants at T2 in the chronic disease manipulation, they had improved attitudes over those in the how to shop manipulation, $p = .02$ (Figure 14). Indeed, there has been minimal research on employment in a low-income population, so it was thought employment would have minimal to no moderation effects (at a minimum less influence than eating schema) given the sample.

Moderation of eating schema. Eating schema in this study was coded thrichotomously in which participants were categorized into healthy eaters (participants who considered healthy eating as part of their image and important), unhealthy eaters (participants who considered eating healthy as not descriptive of them, but who thought healthy eating was important), or non-schematics (participants who did not fall into either schema category). From examination of outcomes, a significant time X eating schema interaction was found for fruit and vegetable intentions from T1 to T3, $F(4, 34) = 3.24$, $p = .02$, $\eta_p^2 = .28$. Here, non-schematics had improved

intentions to consume fruits and vegetables at T3 than at T1, $p = .04$. Moreover, within T2, non-schematics had significantly improved intentions than did unhealthy eaters, $p = .03$ (Figure 7).

Additionally, a time X eating schema X manipulation interaction was observed for fruit and vegetable intentions from T1 to T3, $F(12, 34) = 2.07$, $p = .05$, $\eta_p^2 = .42$. Within the physical activity manipulation, non-schematics had improved intentions from T3 compared to T1, $p = .001$. Within the serving sizes manipulation at T2, participants that were non-schematics had improved intentions than did unhealthy eaters, $p = .05$, which was also found in the physical activity manipulation at T3, $p = .04$ (Figure 8).

For nutrition attitudes from T1 to T2, there was also a significant time X eating schema X manipulation effect, $F(6, 128) = 2.98$, $p = .009$, $\eta_p^2 = .12$. Here, within unhealthy eaters in the how to shop manipulation, T2 nutrition attitudes were improved compared to T1, $p = .003$. This same significant trend within unhealthy eaters was also found in the chronic disease manipulation from T2 to T1, $p = .03$, within non-schematics in the serving sizes manipulation from T2 to T1, $p = .05$, and within healthy eaters in the physical activity manipulation from T2 to T1, $p = .02$. Additionally, within T1 in the serving sizes manipulation, healthy eaters had improved attitudes than did non-schematics, $p = .004$. This same significant trend within T1, was also found in the chronic disease manipulation, $p < .001$ (Figure 13).

Within T2, in the how to shop manipulation, serving sizes manipulation, chronic disease manipulation, and physical activity manipulation, healthy eaters had improved nutrition attitudes compared to non-schematics, $p = .03$, $p = .02$, $p < .001$, and $p < .001$, respectively. Similarly, in the serving sizes manipulation and physical activity manipulation, healthy eaters had improved attitudes compared to unhealthy eaters, $p = .05$, and $p = .02$, respectively. Finally, within T2 in

the chronic disease manipulation unhealthy eaters had improved attitudes compared to non-schematics, $p = .002$. (Figure 13).

While eating schema influenced less stable perceptions, eating schema also influenced more enduring aspects of behavior change. Specifically, a significant time X eating schema X manipulation interaction for dietary volitional self-efficacy was observed from T1 to T3, $F(12, 38) = 2.37$, $p = .02$, $\eta_p^2 = .43$. Within the how to shop manipulation, healthy eaters at T3 had significantly improved volitional self-efficacy than at T1, $p < .001$, and when compared to T2, $p = .004$. Contrary to expectations, at T1, within the how to shop manipulation, healthy eaters had significantly lower self-efficacy than did non-schematics, $p = .002$, and unhealthy eaters, $p = .005$. This same pattern was also found at T2, between healthy eaters and non-schematics, $p = .03$, and unhealthy eaters, $p = .03$ (Figure 15). Oddly, at T1, healthy eaters in the how to shop manipulation had lower volitional self-efficacy than did healthy eaters in the serving sizes manipulation, $p = .006$, chronic disease manipulation, $p = .03$, and the physical activity manipulation, $p = .03$. At T2, healthy eaters in the chronic disease manipulation had greater improvements in volitional self-efficacy than did healthy eaters in the how to shop manipulation as expected, $p = .006$ (Figure 15).

Although it was noted previously that eating schema would be a moderator of manipulation for behavior change, employment had a strong influence with the outcome variables and interestingly more so than sex, which was unexpected. Sex was a significant moderator for fruit and vegetable intentions and nutrition attitudes. Employment was a significant moderator for sugar-sweetened beverage intentions, times read the nutrition label in the last week, and nutrition attitudes. Thirdly, eating schema was a significant moderator for fruit and vegetable intentions, nutrition attitudes, and volitional self-efficacy. Here, there were only

four outcomes that changed over time with moderators, but there were eight significant three-way interactions. As expected, the most positive change considering the influence of these moderators occurred in those participants in the chronic disease manipulation. Specifically, from the findings and trends discussed above, about 14 effects from the moderation analyses favored the chronic disease manipulation, 12 favored the physical activity manipulation, 9 favored the how to shop manipulation, and 6 favored the serving sizes manipulation.

Discussion: Testing Intervention Theories and Strategies

Despite numerous studies examining health behavior change, it has remained an ongoing issue. Adults have not achieved adequate fruit and vegetable intake per day (Lee-Kwan et al., 2017), and our westernized diet has also introduced more soft drinks, meat, and processed commercialized options (Drewnowski, 2000; Swinburn et al., 2004). This was particularly relevant to individuals who have limited resources to consume nutritious food and lead healthier lives. To our knowledge, there has not been any health behavior intervention research in Arlington/Ft. Worth, TX that targeted the effectiveness of specific nutrition education topics, so Study 2 was to extend previous findings in a low-income population (Rustad & Smith, 2013) in this location and to fill the gaps of what topic(s) may lead to the most change based on previous interest (Snyder & Liegey-Dougall, 2018). Despite intentions, the manipulations revealed no significant changes over time nor over time between manipulations. Nonetheless, sex, employment, and eating schema were the primary significant moderators in which moderation analyses benefited the chronic disease manipulation more compared to other manipulations as predicted.

Food intentions and intake over time. First, this study assessed fruit and vegetable, sugar-sweetened beverage, and processed meat consumption intentions and intake. It was

hypothesized fruit and vegetable consumption intentions and intake would increase over time and sugar-sweetened beverage, and processed meat intentions and intake would decrease over time. Contrary to expectations, fruit and vegetable intentions and intake did not increase over time. There were also no significant differences in sugar-sweetened beverage, and processed meat intentions and intake over time.

Unfortunately, while the EPPM has been shown to increase fruit and vegetable consumption, that was not the case here (Napper et al., 2014), and it was difficult to assess how well this and other health theories influenced outcomes as many participants reflected upon their situation and rejected the health messages. Even though reported increases in intentions and intake for fruit and vegetable consumption was encouraging, intentions did not always lead to significant changes (DeBiasse, 2016; DeBiasse et al., 2017).

This was the case with unhealthy food as both sugar-sweetened beverages and processed meat intentions and intake did not significantly decrease over time. Currently, half of all Americans consume one sugar-sweetened beverage per day and about 14% consume 2 or more per day (Rosinger, Herrick, Gahche, & Park, 2017). The average consumption of sugar-sweetened beverages in this sample ranged from 1.5 to 2 per day, which put this population at even greater risk for weight gain, type 2 diabetes, and the metabolic syndrome (Malik et al., 2010). Indeed, many participants frequently described food from fast food companies that they typically ate so access to a healthy food pantry, kitchen, or cooking utensils could benefit many low-income residents and help spur or reinforce better eating behavior.

Nutrition behavior over time. With regard to nutrition behavior, this study examined four behaviors: fast food consumption, reading the nutrition label, adding salt, sugar, or butter to foods, and times prepared a nutritious dinner in the last week. These questions were found

previously to support increases in healthy eating behavior in low-income women (Rustad & Smith, 2013), which were further tested here. In contrast to expectations, there were no changes over time for any of the behaviors. The follow up time was short, and participants may have not had time, desire, or the proper food preparation materials to cultivate and engage in these behaviors.

Nutrition attitudes and knowledge over time. To see behavior change, a shift in attitudes must occur because attitudes convey one's evaluation of a particular practice (Li, Figg, & Schüz, 2019). In this study, attitudes about nutrition-behavior marginally improved over time, but they were not significant, contrary to expectations. Previous researchers have targeted specific attitudes and how they influence a specific outcome (e.g., attitudes toward fruit and vegetable intake). The nutrition attitudes studied here covered multiple domains of nutrition, which have been found to be less effective for change (Dittus, Hillers, & Beerman, 1995). Attitude formation has also been reported to rely on multiple internal and external variables (Stevenson, 2017). For instance, gains in knowledge may invoke a change in attitudes and greater willingness toward the target behavior.

Even though attitude change was often used for health education assessment (Macías & Clasauer, 2014), knowledge has been reported to be significantly reduced in low-income populations (Hardcastle & Blake, 2016) and has usually been the most compliant to change (Thomas, 1991). In this study, we adapted a few statements about knowledge that were previously assessed in a low-income population (Rustad & Smith, 2013). Contrary to expectations, there were no short-term gains in nutrition knowledge nor total knowledge over time.

Even though heightened awareness can lead to more healthful food choices (Variyam, Blaylock, Smallwood, & Basiotis, 1998), the lack of differences could have been due to the low reliability between the knowledge scale items. It has been reported knowledge scales can be less reliable if participants were not familiar with material (or material was too difficult), if comparisons between products were assessed (Obayashi, Bianchi, & Song, 2003), if they consisted of too few questions, or if they covered multiple domains (Axelson & Brinberg, 1992). The way the items were coded could have also contributed to the low reliability, and insufficient change in attitudes and knowledge may have indicated limited effectiveness of health theories to see change in food choices.

Food choices and behavior maintenance over time. In this study, there were no changes in food choices over time. Again, environmental factors may have overridden other factors like health, tradition, sensory appeal, or comfort (Dammann & Smith, 2009; Lyerly & Reeve, 2015). Habit has been suggested to be a strong influence in eating patterns (Hardcastle & Blake, 2016), which may explain why little change was seen in food choice values. Of course, habit could also stem from lack of or immutable motivation to change, important for regular health maintenance.

With regard to volitional self-efficacy to maintain a healthy diet, there were no improvements over time. This population may not have started these behaviors (Ochsner et al., 2013; Scholz et al., 2005) or they felt they already did them well (Dibsdall et al., 2003). Previous findings regarding volitional self-efficacy for maintaining a healthy diet have not been as predictive as well (Ochsner et al., 2013). However, volitional self-efficacy has been effective in predicting physical activity behaviors (Renner, Spivak, Kwon, & Schwarzer, 2007), contrary to

what was found here. The fact that little change in volitional self-efficacy was found over time also decreased the likelihood of the EPPM or SCT instilling change.

Food intentions and intake over time between manipulations. It was thought nutrition classes may support willingness to decrease unhealthy food. It was hypothesized intentions to consume and intake of fruit and vegetables would increase and sugar-sweetened beverages and processed meats would decrease over time and that these differences would be more pronounced in the chronic disease manipulation. However, these claims were not supported. Moreover, this desire to decrease sugar-sweetened beverages and processed meats did not translate into actual decreases in intake either. While we did see lower intention means over time for unhealthy food (particularly sugar-sweetened beverages and processed meats) in the chronic disease manipulation, they were not significant.

While focusing on chronic disease has been helpful to increasing fruit and vegetable consumption in a student population (Ha & Caine-Bish, 2009), these results did not hold up here. To relate to the EPPM, fear appeals of chronic disease did not result in actual change as previously suggested (Witte, 1992). While the dangers of overconsumption of sugar-sweetened beverages and processed meats were discussed (Malik et al., 2010; Slattery et al., 1998) and more so in the chronic disease manipulation, there was little intent to change. Nonetheless, these messages may not have been strong enough to engender a sense of efficacy or message acceptance to engage in better nutrition behaviors.

Nutrition behavior over time between manipulations. Contrary to what was expected, there were no significant changes between manipulations over time for performance of nutrition behaviors. These behaviors were not entirely tied to the manipulations, so that could have explained the lack of differences over time. While reduction of fast food and healthier ways to

prepare food were more salient in the chronic disease manipulation, all manipulations only offered more information and did not teach skills or provide cooking equipment/resources for participants to use. Indeed, behavior was more difficult to change because it was multifaceted.

Nutrition attitudes and knowledge over time between manipulations. A few of those facets (i.e., attitudes and knowledge) may contribute to behavior change. Contrary to expectations, there was no significant interaction with manipulation and time for nutrition attitudes even with the coupling effect of the EPPM and the chronic disease material. Message processing and attitude change were required to see message acceptance and beneficial behavior change (Figure 3; Witte, 1994). Indeed, attitudes comprised a large component of each of the health theories tested, suggesting no or little adoption of attitudes indicative of limited to no health behavior change.

While knowledge was also a component of the SCT, and somewhat indirectly associated with the other health theories tested here, there was no significant time by manipulation effects for nutrition or total knowledge. Not one manipulation addressed all of the knowledge statements, but they were spread throughout each of the manipulations, to not bias one manipulation over another. Although participants may have acquired new knowledge, aggregately they did not improve and there was very little change in knowledge regardless of manipulation. Because of little behavior change particularly in the more amenable factors of attitudes and knowledge, food choice values or capability to maintain behaviors (volitional self-efficacy) may not have had time to change.

Food choices and behavior maintenance over time between manipulations. It was anticipated that heightened awareness from the manipulations would lead to healthier food choices (Variyam et al., 1998). As evidenced by the time effects, food choices did not

significantly improve in one manipulation over another, contrary to expectations. As discussed, food choices could have been stable and predicated by habit. This made them less likely to change over the manipulation timespan. Even though the chronic disease manipulation discussed better foods to eat, participants also lacked a variety of food choices given environmental disadvantages, which may have hindered change (Hendrickson et al., 2006).

For volitional self-efficacy, there were no differences in time outcomes by manipulation taught, contrary to what was expected. Means for volitional self-efficacy were relatively high (4-5 out of 6) at each time point, indicating participants had an optimistic bias or they felt confident they could do these behaviors leaving little room for improvement. Means were also highest in the chronic disease manipulation, but they were not significantly different than other manipulations. Indeed, despite a multiplicative effect with the EPPM discussion and the teachings of chronic disease, there was little improvement. Participants may not have acknowledged a threat to them even though they understood the same threat may have been faced by others according to the precaution adoption process model (Weinstein & Sandman, 1992). Surprisingly, no interaction effect of physical activity volitional self-efficacy in the physical activity manipulation over time was observed. Participants even stated minimal barriers to physical activity when discussing aspects of the SCT. Yet, there was no change in physical activity volitional self-efficacy or nutrition volitional physical activity despite evidence that volitional physical activity self-efficacy could improve (Renner et al., 2007).

Moderation effects. For the exploratory analyses, sex, employment, eating schema, and stage of behavior change were used to assess potential moderation. Stage of behavior change did not contribute much as a moderator. However, sex, employment, and eating schema did contribute more to the ANCOVA models.

In this study, sex was a significant moderator for fruit and vegetable intentions and nutrition attitudes. As for fruit and vegetable intentions, intentions were greater within males compared to females, particularly within the chronic disease manipulation. This finding was perplexing, but it may have been the chronic disease manipulation warned participants about limiting certain foods, so participants may have misinterpreted to also limit fruits and vegetables. However, in the physical activity manipulation, females had increased intentions at T1 compared to males as expected as females do have more positive attitudes toward fruits and vegetables than males (Dutta & Youn, 1999), but these did not last over time and men improved. Physical activity also relies on healthy eating to improve performance, women may have had fewer desires to exercise because these shelter facilities were located in potentially unsafe locations (Bengoechea, Spence, & McGannon, 2005), and the integration of exercise and diet considerations could have spurred greater desire to eat healthier. These effects with fruit and vegetable intentions may have also been observed between sexes partially because of differences by sex in reported nutrition attitudes.

Additionally, sex was a significant moderator for nutrition attitudes in which females had more positive attitudes than did males and females saw more improvement from T1 to T2. Females tended to have more positive attitudes and were more receptive to health claims even in low-income groups (Dibsdall et al., 2003). Historically, healthier food items like salad or vegetables were seen as a woman's food and not "manly" enough for men's appetite (Pollard et al., 2002), which may have contributed to why men did not view healthy eating in the same light.

While sex contributed some influence to the models, employment was also a significant moderator for sugar-sweetened beverage intentions (T1 to T2 and T1 to T3), times read the nutrition label, and nutrition attitudes. For the former, unemployed participants had fewer

intentions to consume sugar-sweetened beverages than did employed participants. These differences were also found primarily within the physical activity group in which employed participants increased intentions and unemployed participants had fewer intentions to consume sugar-sweetened beverages from T1 to T2, but not from T1 to T3. As expected, means were lower (though not significantly) in the chronic disease manipulation compared to others. These differences in intentions to consume sugar-sweetened beverages from T1 to T2 with employment may have arisen because unemployed participants have less resources or even excuses to buy sugar-infused drinks, so they do not intend to buy any. Although, participants on nutrition assistance have been shown to consume considerably more sugar-sweetened beverages than higher income participants (Leung et al., 2012). However, sugar-sweetened beverages are under the guise of discretionary calories as well, in which consumption of discretionary calories may be more similar across income levels (Kirkpatrick, Dodd, Reedy, & Krebs-Smith, 2012).

Understanding how calories and nutrients contribute to one's daily intake may also be a factor of employment as employment was a significant moderator with times read the nutrition label and more so in the chronic disease manipulation, as anticipated. In the chronic disease manipulation, employed participants had read the nutrition label more in the last week compared to T1 and compared to unemployed participants. While use of nutrition labels may be independent of demographic factors (McArthur, Chamberlain, & Howard, 2001), it has been well documented that individuals with more income have more means to engage in healthier behavior (Dutta & Youn, 1999). Employed individuals may also be more likely to purchase their own food increasing occurrences where they examine nutrition labels whereas shelter residents were provided with food and were not in the position to choose and examine health labels for themselves.

Increasing resources could also positively influence nutrition attitudes with greater access to health information (Dutta & Youn, 1999). Indeed, employment was also a significant moderator and interacted with manipulation for attitudes from T1 to T3. Here, more differences were observed in the how to shop manipulation, followed by the chronic disease manipulation. Within the how to shop manipulation, employed participants had better attitudes than did unemployed participants and unemployed participants improved in attitudes over time. Attitudes for employed participants also became more positive over time in the chronic disease manipulation in support of expectations.

Currently, there is little research on how employment in a low-income population influences health attitudes, but one study did find improved attitudes in employed compared to unemployed low-income individuals (Dibsdall et al., 2003). This was likely due to the increase in resources such as additional income, transportation, and access allowing for greater perceived control. Employment may also have pushed individuals out of a fixed mindset to allow for more opportunities as unemployed individuals dealt with more uncertainty, which more negatively impacted diets in those of low-income (Laraia, Leak, Tester, & Leung, 2017).

While sex and employment were both external factors that may have influenced health behavior change, a more intrinsic factor of how one views themselves in relation to healthy eating (eating schema) was also a significant moderator. Although this has been reported previously as a moderator for healthy food intake (Kendzierski et al., 2015), eating schema influenced fruit and vegetable intentions, nutrition attitudes, and volitional self-efficacy. Concerning fruit and vegetable intentions, non-schematics tended to have greater intentions to consume fruits and vegetables than did unhealthy eaters. Surprisingly, no differences occurred between healthy eating schematics and non-healthy eating schematics for fruit and vegetable

intentions. However, non-schematics also made up a large proportion, so this sample difference could have contributed to findings.

Although individuals who were healthy eaters tended to eat in a more nutritious manner (Kendzierski, 2007), this was not supported here. It was recently stated that intentions or attitudes do not always predict healthier behavior, especially in a low-income population (DeBiasse, 2016; DeBiasse et al., 2017). Shelters may not have provided consistently enough fruits and vegetables as fruits and vegetables spoil quickly. Healthier foods can also be more costly and not the most filling for individuals with a survival mentality (Baumann, Szabo, & Johnston, 2017). However, the fact that there were improved intentions in non-schematics was encouraging and potentially indicative of them shifting attitudes or reducing less healthy behaviors.

With eating schema as a significant moderator for attitudes from T1 to T2, there were general improvements over time with healthy eaters having more positive nutrition attitudes than did non-schematics. Healthy eaters by definition have healthier eating attitudes as they consider healthy eating important to their self-image (Kendzierski, 2007, Kendzierski et al., 2015, Markus, 1977), so this finding was anticipated. There were also more differences in the chronic disease manipulation than the other manipulations with unhealthy eaters improving, and more so than non-schematics. Additionally, there were few differences between healthy eaters and unhealthy eaters. This suggests unhealthy eaters may be translating their intentions into new behaviors or exposure to attitudes may be empowering them to view their current state as less stable, increasing their expectancy of success (Kendzierski, 2007; Weiner, 1985). The chronic disease manipulation also incorporated aspects of the EPPM in which participants were exposed

to threatening health messages and given ways to eat or be healthier for an additive effect to increase their response self-efficacy to help them encode and maintain these behaviors over time.

In fact, dietary volitional self-efficacy from T1 to T3 was significantly moderated by eating schema. Moreover, there was also an interaction with manipulation in which differences were primarily in the how to shop manipulation. In contrast to what was found previously, healthy eaters in the how to shop manipulation had lower volitional self-efficacy than did non-schematics or unhealthy eaters at T1 and to a large degree at T2, but T3 differences did not differ by manipulation. Although this finding was likely in error, it may be that maintaining a diet over a long period of time may be redundant to how healthy eaters view themselves (Kendzierski et al., 2015). Healthy eaters may have recognized they may not eat well consistently and were more fluid to situational constraints. They could have more readily and confidently re-aligned their intentions and behavior and maintained that behavior more consistently following a lapse (Kendzierski, 2007).

Nonetheless, these influences within and between each of the manipulations could have largely been spurious from unequal sample and cell sizes. Sex cell sizes in the moderation effects happened to be more male where females made up at most half to two-thirds of the male sample in those cells. Sample sizes for those employed in time X employment and three-way interactions were also small and were at most half the size of the unemployed cells within each time point and manipulation. Thirdly, cell sizes for eating schemas more heavily favored non-schematics. Healthy eaters and unhealthy eaters were at most half to a quarter of non-schematics within each time point and manipulation. Finally, any moderation effects from T1 to T3 had very small sample sizes ($n < 10$).

Behavior change theories discussion. Three theories of behavior change were also used for Study 2. They primarily supplemented the education portion of the manipulations to influence outcomes, but a few measures had theory components. For example, the social cognitive theory was used in a brief discussion of barriers and identification of tactics to overcome those barriers following the manipulation but was also indirectly measured via dietary self-efficacy (a covariate) and volitional self-efficacy. The PWM, which incorporated a reasoned and a social process, was also used. The reasoned process was captured in participant's attitudes, behavior norms (through discussion of barriers and living environment) and through the outcome of volitional self-efficacy. The social process was utilized in these discussions to help participants identify with prototypes and descriptions (e.g., healthy shopper vs. unhealthy shopper) to gauge willingness to adopt these prototypes and descriptions. Finally, the EPPM incorporated 1) risk perception with health warning messages, 2) fear assessed with perceived susceptibility (used as a covariate), 3) intentions toward the desired behavior measured with the formation of implementation intentions, 4) attitudes toward the desired behavior (measured with attitudes), and 5) self-efficacy to engage in the desired behavior measured with volitional self-efficacy while controlling for baseline or dietary self-efficacy. To move participants toward message acceptance, they were given a handout of healthier foods to eat at popular common eateries or an activity plan if they were in the physical activity manipulation.

All three theories were incorporated into each manipulation, and participants thought each discussion portion was beneficial, despite overall non-significant changes in attitudes and average implementation intention formation. However, participants responded best to the EPPM. They discussed the health messages presented to them more than when other theories were conferred. Many commented the most surprising messages were that high fat or high sugar diets

could lead to worse memory and learning (Stevenson, 2017) and that a very limited portion of the population consumed the recommended amount of fruits and vegetables (Lee-Kwan et al., 2017). Means for perceived susceptibility were also significantly higher post-manipulation compared to pre-manipulation suggesting participants did perceive some threat, but there were no differences between manipulations, and they did not hold until T3. There were also no changes over time for perceived susceptibility when covariates were accounted for. As discussed above, volitional self-efficacy did not improve over time nor between manipulations.

Self-efficacy and most of the situational barriers were primarily discussed during the SCT portion of the manipulation. Participants cited barriers such as finances, knowledge, getting around, opportunities, and eating to feel full as recent research found (Baumann et al., 2017). While how to overcome barriers were addressed, many participants thought they already knew how to overcome them or barriers did not apply to them. Interestingly, the physical activity manipulation brought up minimal barriers to exercise. Many said they did not have any means of transportation, so they defaulted to walking. Because participants walked to pass the time, they mentioned exercising all day or all the time. Consequently, they felt they did not need to change or have a plan, description, or model as a reference to be healthier.

Lastly, the PWM had the least response. This may have been because participants were provided with just descriptors of what a model would do. Although they thought it was helpful to have a descriptive points of the manipulation they attended in a model, few if any internalized the model prototypes. Participants typically brought up either examples they reported seeing or hearing about with little elaboration. A more impactful model or provision of a low-income individual who engages in healthier behaviors (a positive deviant; Wishik & Vynckt, 1976) may invoke stronger internalization.

General Discussion

The purpose of these studies was to pilot and examine how specific health topics (how to shop at low cost, understanding recommended portion sizes, chronic disease and food preparation, and physical activity) based on previous interest influenced health behavior in a low-income population through brief manipulations. First, we piloted nutrition topics, theories, and attitudes for descriptives in Study 1. Briefly, we found the attitude statements were reliable, and that most participants thought the aspects of the PWM would be most effective for healthier behavior change.

Next, we wanted to extend previous research (Rustad & Smith, 2013) by examining if brief manipulations resulted in greater health outcomes over time. For these particular outcomes, we found it important to assess fruit and vegetable, sugar-sweetened beverage, and processed meat consumption patterns given topical importance (Larsson & Orsini, 2013; Rosinger et al., 2017), nutrition behavior, nutrition attitudes and knowledge, food choices, and individual self-efficacy over a long-term basis. Third, it was hypothesized differences in these outcomes based on the manipulation topic taught, in which there would be greater improvements in health outcomes in the chronic disease manipulation compared to other manipulations. Fourth, we explored potential moderators that may have influenced outcomes over time and between manipulations.

Overall, participants enjoyed the manipulations and felt they were beneficial, particularly in the chronic disease manipulation as anticipated. Implementation intentions, however, were difficult to make specific in this demographic as less than 20% of the sample had specific health intentions following the manipulations and most were of average strength. Although we briefly assessed food consumption patterns, attitudes, and knowledge in this demographic, there was not

much predictive change for these outcomes. Furthermore, behaviors and food choices were found to be more stable, and self-efficacy may be driven by motivation as opposed to knowledge of health information.

Study 1

This study employed a mixed-method design to examine nutritional attitudes and behavior change theories in a sample of low-income individuals to confirm previous studies and assess what may be useful in an intervention. To my knowledge, this was one of the first studies to qualitatively examine the effectiveness of specific behavior change strategies (i.e., primarily stage of behavior change, EPPM, and PWM). Generally, there was support for Aim I. Participants had similar opinions to the pilot study and between focus groups. Four themes also arose and were summarized as follows: 1) distrust of food companies, 2) insufficient information, 3) lack of control/flexibility, and 4) desire to eat healthier. Theories tested in these focus groups showed role models as more effective for older or experienced individuals (Davis et al., 2013). Moreover, as part of the PWM, models pertained more to social reaction behaviors (willingness to eat or buy fruits and vegetables when presented or avoidance of fast food when prompted by friends or family) while messages pertained more to reason-based behaviors (attitudes and intentions), in which the former may override intentions and lead to the desired behavior (Gibbons et al., 1998). We also assessed if people would heed food label warnings, but it was reported messages could often be missed, particularly if one was ignorant of the danger the message conveyed. The strength of the message and message relevancy were other factors that should be probed in the future (Davis, Morgan, & Mobley, 2015; O'Keefe, 2008).

Study 2

While participants found the manipulations helpful and beneficial, outcomes did not change over time nor did they change over time between the manipulations, which did not support Aims II and III. When moderators were considered, however, participants in the chronic disease manipulation benefited the most over time compared to the other manipulations.

As it pertains to diet or diet intentions, participants did not have any change over time nor between conditions over time. Intentions were important to consider here because according to the prototype willingness model, intentions were a proximal determinant of future behavior (Dohnke et al., 2015). Despite this, Individuals residing in shelters lack control in their food environment and researchers have argued that low-income individuals were driven by "tastes of necessity" and corporate brands (Baumann et al., 2017). Tastes of necessity encompassed on-the-go items that were cheap, abundant, calorically dense, and fast (Baumann et al., 2017), like many sugar-sweetened beverages and processed meats. Participants may have just had a routine in which they would not or could not consume more fruits and vegetables and fewer beverages or meat products. In fact, even though fruits and vegetables (typically apples, bananas, and oranges) were provided throughout the day for residents to consume at Arlington Life Shelter, they did not always choose to eat them.

A routine provision of food may also have contributed to improper food preparation skills or knowledge to engage in behaviors such as cooking a nutritious meal or reading nutrition labels. Participants may have also had limited means to add things to food, because they were not in the position to exercise choice with healthier foods, despite potentially having healthy intentions and attitudes.

Both attitudes and knowledge have been used as short-term outcomes to assess effectiveness of interventions and have been broadly described as components of social,

psychological, and behavioral outcomes. This was evidenced by knowledge and attitudes' inclusion in the social cognitive model of behavior change and attitudes in the prototype willingness model and extended parallel processing model of behavior change (Bandura, 1991; Gibbons, et al., 1998; Sheeran et al., 2017; Witte, 1992, 1994). Thus, both help gauged the impact of nutrition and health education and whether individuals followed through on behavior.

While attitudes largely depend on preexisting constructs (Stevenson, 2017; a potential reason for the lack of change found here), change in knowledge was often used to gauge awareness of prevailing truths. However, knowledge in Study 2 was meant to assess general nutrition information that may have been somewhat subjective (Macías & Clasauer, 2014). Additionally, some individuals could have particular knowledge in one area, but not enough knowledge in another. However, it was unclear to what extent education, food costs, or access influenced nutrition behaviors (Baumann et al., 2017). The little change in attitudes and knowledge may also have indicated limited effectiveness of the health theories listed above and tested in this research to choose healthier foods and maintain behavior.

What people ate was important for their health, but the decisions, thoughts, and motivations in food consideration are still quite complex. Habit or routine may have also explained the minimal change with volitional self-efficacy (Hardcastle & Blake, 2016). Participants may have thought that they already engaged in healthier behaviors or had a false sense of it, so they felt little encouragement to change (Dibsdall et al., 2003).

Underlying why many of these changes were not seen over time could be that circumstance (lack of availability of healthy food and resources to obtain healthy food) was an overwhelming influence. Even though this population has reported multiple barriers, the most frequent were typically related to time, cost, lack of willpower (Eikenberry & Smith, 2004), and

taste (Treiman et al., 1996), which could arguably have applied to individuals from different income brackets. Less nutrition knowledge may have also kept individuals in a fixed mindset and blunted awareness to see the more minute improvements (e.g., single attitudes or intentions). As discussed, intentions have been shown to be predictive of future behavior and serve to some degree to assess potential changes in attitudes (Dohnke et al., 2015). This sentiment was particularly relevant for residents at Arlington Life shelter because many of them were within a few months of achieving a more stable life situation. Even if participants were not able to change their behavior, intentions could have provided a better indication of how receptive they were to change irrespective of psychosocial or environmental challenges (Aggarwal, Rehm, Monsivais, & Drewnowski, 2016) as the manipulations addressed ways to overcome the more commonly cited barriers. As was the case in this study, when moderators were considered, influences of change with intentions and attitudes were more prominent.

Sex, employment, and eating schema were each significant moderators that primarily influenced healthy eating intentions and attitudes. As expected, females tended to have more positive eating intentions and better attitudes. However, employed individuals tended to have less positive eating intentions than did unemployed participants from T1 to T2, but not from T1 to T3. Employed participants also had more positive behaviors. Interestingly, employed participants tended to have more positive attitudes at baseline, but both unemployed and employed participants had more improvements in attitudes following the manipulations, particularly those in the how to shop and chronic disease manipulation. For eating schema as a moderator, non-schematics had more positive improvements in eating intentions particularly in the serving sizes and physical activity manipulations compared to unhealthy or healthy eaters. With regard to attitudes, the moderators showed improvements in nutrition attitudes over time

regardless of manipulation. Although, eating schema was a significant moderator for dietary volitional self-efficacy, results may have been spurious given low numbers in the how to shop and eat healthy at low cost manipulation. To add support to Aim III, the moderation results revealed more positive influences in the chronic disease manipulation compared to others. Generally, these moderation effects should be interpreted with caution, but could provide avenues for health behavior change with larger samples.

Limitations & Strengths

While Study 1 contributed to knowledge about more socially functional low-income shelter residents, there were some limitations. Participants were self-selected, so individuals with more healthful eating attitudes were more likely to enroll in these discussions. Also, because all focus groups were conducted at the same location, participants had similar conditions and restrictions. Indeed, participants ate what was provided, so there was similarity and agreement in what they typically consumed. As with other research in groups, group polarization could have occurred allowing for stronger opinions of participants to form, which could have explained why participants felt closer together. Lastly, although compensation was minimal, participants may have been motivated by the monetary incentive and just wanted to do or say enough. Despite these limitations, the self-selection of participants in the focus groups allowed for stronger opinions to be voiced and more constructive discussion. The similarity in conditions likely reduced error variance and provided insight for future health behavior avenues to pursue.

As study 1 did help establish reliability for some measures and acted as a confirmation of topics to teach, there were some limitations in Study 2 as well. First, this study relied solely on self-reported data, so there was a lack of objectivity for specific foods consumed. Food logs were attempted, but lack of monitoring and trouble with reminders and follow ups made acquiring

food logs difficult as only 3 participants completed them. Second, there were no measures of social desirability as a manipulation check for desirable reporting bias. Indeed, negatively valenced items (e.g., consumption of sugar-sweetened beverages and processed meats) were positively skewed and positively valenced items (e.g., self-efficacy questions) were negatively skewed as shown by the transformations (see data screening). Third, because T1 and T2 points were assessed so close together (within 2 hours), participants may not have seen large improvements. Fourth, from a design perspective, even though some questions were assessed in a previous study, they may not be as appropriate for this population (e.g., asking about times individuals cooked a nutritious dinner). The question that assessed times added salt, sugar, or butter to foods may have focused on different outcomes as well. For example, adding butter to foods may not have the same impact on health as adding salt or sugar. As discussed above, the knowledge questions used here were too general and if tailored to the manipulations may have revealed improvements in knowledge. Fifth, retention has been well documented as an issue among low-income and minority participants and that was no exception here with about 25% of the sample retained at T3. However, the sample size between T1 and T2 was large and roughly similar between manipulations. The same instructor also taught all of the manipulations, and the information used in each of the nutrition-based manipulations was verified by a registered dietician. Although the sample was recruited from two locations, they both reported similar findings on outcomes, which made them more comparable. Finally, we measured and controlled for multiple covariates which made the ANCOVA models more robust and able to depict a more accurate sense of behavior change. The data were also collected longitudinally over three time points, bolstering the amount of low-income health behavior longitudinal intervention studies.

Conclusion & Future Directions

These two pilot studies were designed to obtain preliminary interests in nutrition topics, assess how these topics could lead to better health outcomes in a low-income population, and conclude what could be improved for health education. Study 1 was designed to obtain preliminary data to gauge general thoughts about health and barriers to health for future research. This sample was more socially functional, which sheds light on food and nutrition behavior of low-income shelter residents who were in the process of establishing stability in employment and housing. Despite this, residents reported lack of 1) finances, 2) healthy support network from friends or family, 3) flexibility in eating healthy (i.e., confined to shelter food), and 4) knowledge of what to consume like other research in low-income samples. Moreover, there was small to moderate support for having role models over specific health messages in promoting better health behavior. For future studies, this population of shelter residents who are close to achieving a more stable life may be providential for interventions as these individuals may be more receptive to health messages and more likely to improve healthy behaviors. Additionally, more focus groups or studies should be conducted to address the specifics of these health theories (e.g., the EPPM, PWM, or stage of behavior change) or focus on one individually to elucidate what specific theory mechanisms may drive some theories over others and health change.

While the health theories were utilized in Study 2, there was generally limited support that these manipulations and materials helped individuals improve healthy eating intentions, consumption, behavior, attitudes, knowledge, food choices, and self-efficacy over time even with their aid. However, from examination of moderating factors, there was some support for one manipulation over others. Those participants in the chronic disease and food preparation manipulation had more significant outcomes compared to the other manipulations, notably for

improved fruit and vegetable intentions, decreased sugar-sweetened beverage intentions, and more positive attitudes. While knowledge of serving sizes and portions was important, serving sizes were difficult to track. Many participants lacked interest or motivation to count or know how many servings of a particular food item they should consume which limited the serving sizes manipulation's effectiveness. Additionally, here we further examined the SCT, the PWM, and the EPPM to assess which theory or theories would support change in this population the most. Although participants seemed to endorse a role model as more effective than health messages in the focus groups, messages created more discussion in the manipulations. Based on these findings, to have a combination of messages and a model or framework (i.e., the EPPM and PWM) to follow may be the most beneficial for health outcomes for teaching individuals about health.

With regard to materials, food logs and handouts had minimal completion in this population, and we suggest other researchers have more regular reminders or a more monitored approach for logging diet. Although these findings demonstrated some of the predictive value of certain measures over time, future studies should further investigate these health topics particularly with a more reliable sample, diet questionnaires, and objective food consumption to establish reliability. More regular or longer education sessions may contribute to better health outcomes as well.

In terms of content, education that focuses on both chronic disease, low-cost healthy options, and incorporates the EPPM may provide the most benefit to this population as the former suggestions utilized aspects of the EPPM. Undeniably, fear invocation about health or disease followed by an amenable solution was more or less what the EPPM described and what participants responded to the most from these manipulations. A hands-on source receptive to

different contexts (like a cooking or tasting demonstration that prepares cheap, healthy foods or providing a low-income positive deviant example) that supports a sustainable environment as a means to combat government and food company distrust could help develop skills to change behavior more effectively and provide the best avenue for better health.

To incorporate these measures into future studies could effectively shape health in this population with multiple perceived barriers. Theories that invoke stronger message internalization, but also incorporate low-income social norm identification and suggest improvements may also spur change in this low-income population. This combination along with detailed but feasible diet tracking and a focused emphasis on personal health to mitigate disease risk and clean eating to combat authoritative distrust could alter health attitudes and engender healthier conduct.

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Table 1

Pilot Study Frequencies of Rankings of Importance and Interest for Nutrition Topics

Topic Importance	**Percent ranked at #1**	**Frequency**
How diet relates to chronic disease(s)	23.43	41
Recommended serving sizes and daily servings of food groups	14.86	26
How to shop and eat healthy at low cost	14.86	26
Food safety (proper storage of food, common pathogens related to food not properly sanitized, cooking techniques to lessen infection)	12.00	21
Calories from beverages	11.43	20
Food Sustainability (organic vs. non organic foods, genetically modified organisms, sustainable eating practices)	6.86	12
Carbohydrates, proteins, and fats (their function in the body, and how they relate to overall health)	6.29	11
Vitamins and Minerals (their function in the body, and how they relate to overall health)	4.00	7
Food production and process food goes through to get to supermarkets	3.43	6
Healthy Recipe Food Swaps	1.71	3
Cooking tricks to make cooking easier and healthier	0.57	1
Other?	0.57	1

Topic Interest	**Percent ranked at #1**	**Count**
How to shop and eat healthy at low cost	34.86	61
How diet relates to chronic disease(s)	12.57	22

Table 1 cont'd

Vitamins and minerals (their function in the body, and how they relate to overall health)	9.14	16
Food sustainability (organic vs. nonorganic foods, genetically modified organisms, sustainable eating practices)	8.00	14
Calories from beverages	7.43	13
Carbohydrates, proteins, and fats (their function in the body, and how they relate to overall health)	6.86	12
Cooking tricks to make cooking easier and healthier	6.29	11
Recommended serving sizes and daily servings of food groups	5.71	10
Healthy recipe food swaps	4.00	7
Food production and process food goes through to get to supermarkets	2.86	5
Food safety (proper storage of food, common pathogens related to food not properly sanitized, cooking techniques to lessen infection)	1.71	3
Other?	0.57	1

Table 2

Study 1/Focus Group Demographic Characteristics

Categorical Variables		*Valid Percent*	*Frequency*
Sex			
Male		54.8	17
Female		45.2	14
Employment			
Employed		53.3	16
Unemployed		46.7	14
Education			
Some High School		23.3	7
GED/High School Diploma		30.0	9
Some College		26.7	8
Bachelor's Degree		16.7	5
Masters or equivalent Degree		3.3	1
Income			
No income		46.7	14
< $10,000		6.7	2
$10,000-$20,000		33.3	10
$20,001-$30,000		10.0	3
$30,001-$40,000		3.3	1
Ethnicity			
American Indian/Alaska Native		3.2	1
Black		48.4	15
Hispanic		3.2	1
White		29.0	9
Native Hawaiian		3.2	1
Other		12.9	4
What nutrition topic are you most interested in?			
How to Shop and Eat Healthy at Low Cost		45.2	14
Diet, Chronic Disease, and Food Preparation		25.8	8
Recommended Daily Serving Sizes of Food Groups		22.6	7
Other?		6.5	2
Continuous Variables	*N*	*M*	*SD*
Age (years)	31	37.6	13.7
Servings of Fruits and Vegetables	31	2.5	1.3
If employed avg. hours per week	15	39	9.6

Table 3

Focus Group Discussion Questions

Engagement Questions:
1. What is your favorite food/meal
2. What is unhealthy food/diet?
Exploration Questions:
3. What does a healthy meal look like to you (PWM)?
4. What do you typically eat?
5. What obstacles/barriers make it difficult to eat healthy (SCT; II)?
6. Have you thought about eating healthier (SBC)?
7. How capable are you to change your diet habits to consume more fruits and vegetables if you need/like to (SCT; EPPM; II; SBC)?
8. How effective will health warning messages be to facilitate healthy eating (EPPM)?
9. How effective will having a model be to facilitate healthy eating (PWM)?
10. What would make a nutrition education session most enjoyable for you if you could participate in one?
Summary Questions:
11. Anything else you would like to say regarding eating healthy?
12. What were some key points that were brought up?

Note. SCT = Social Cognitive Theory, EPPM = Extended Parallel Processing Model, PWM = Prototype Willingness Model, II = Implementation Intentions, SBC = Stage of Behavior Change

Table 4

Focus Group Survey Questions

Demographic Questions

1. What is your age?
2. What is your gender?
3. What is your annual family income in dollars (per year)?
   a. under 10,000
   b. 10,000 to 20,000
   c. 20,001 to 30,000
   d. 30,001 to 40,000
   e. 40,001 to 50,000

4. What is the highest degree or level of school you have completed? If you are currently enrolled, indicate your highest degree received.
   a. Some High School
   b. GED/High School Diploma
   c. Some College
   d. Associates degree (e.g. AA, AS)
   e. Bachelor's Degree (e.g. BA, BS)
   f. Some Graduate Work
   g. Masters or equivalent degree (e.g. MA, MS, Med)
   h. Doctorate or equivalent degree (e.g. Ph.D, EdD)
   i. Professional Degree (e.g. MD, DDS, DVM)
   j. Technical/Trade school

5. What is your ethnicity?
   a. American Indian/Alaska Native
   b. Asian
   c. Black or African American
   d. Hispanic, Latino, or Spanish Origin
   e. White or European descent
   f. Native Hawaiian or Pacific Islander
   g. Other (Please Specify)

6. Are you currently employed?
   a. Yes (If yes, how many hours do you work per week?)
   b. No

Nutrition Attitude Questions

1. It is important to have a variety of foods in my diet
2. I eat the same foods week to week
3. I like to eat healthy
4. I like the taste of vegetables
5. I like the taste of fruits

Table 4 cont'd

6. I make sure I eat some sort of fruit or vegetable with each meal in a day
7. I care about where my food comes from
8. I care if my food is in my opinion "highly processed or not"
9. I avoid foods made with ingredients I do not understand
10. I check food labels when I buy foods

Experimental Manipulation Feedback Questions

1. What nutrition topic are you most interested in (select one):
   a. How diet relates to chronic disease
   b. Low Cost Food Options
   c. How diet relates to serving sizes and daily recommendations?
   d. Other? (specify)

2. If you were to participate in a nutrition education session, how long would you prefer it to be?
   a. 15 minutes
   b. 30 minutes
   c. 1 hour
   d. Other (specify)

3. How many servings of fruits and vegetables do you eat per day on average?
   (Open ended)

4. In the next 6 months, do you intend to eat 5 or more servings of fruits and vegetables a day?
   a. No
   b. Yes

5. In the next 30 days, do you intend to eat 5 or more servings of fruits and vegetables a day?
   a. No
   b. Yes

6. In the past 6 months, have you been eating 5 or more servings of fruits and vegetables a day?
   a. No
   b. Yes

Table 5

Study 2 Baseline Demographic Characteristics

Categorical Variables	*Valid Percent*	*Frequency*
Sex		
Male	62.9	100
Female	37.1	59
Employment		
Employed	24.5	37
Unemployed	75.5	114
Education		
No High School	0.6	1
Some High School	26.9	43
GED/High School Diploma	26.3	42
Some College	26.3	42
Associate's Degree	5.6	9
Bachelor's Degree	6.9	11
Some Graduate Work	1.3	2
Masters or equivalent Degree	0.6	1
Technical/Trade School	5.6	9
Income		
< $10,000	76.3	116
$10,000-$20,000	12.5	19
$20,001-$30,000	5.3	8
$30,001-$40,000	1.3	2
$40,001-$50,000	4.6	7
Ethnicity		
Black	51.2	82
White	25.0	40
Other(mixed)	11.9	19
Hispanic	8.8	14
American Indian/Alaska Native	1.9	3
Asian	0.6	1
Middle Eastern or North African	0.6	1
Class/Manipulation		
How to Shop and Eat Healthy at Low Cost	25.6	43
Chronic Disease, and Food Preparation	23.8	40
Recommended Daily Serving Sizes of Food Groups	22.6	34
Physical Activity	28.0	43
Location		
Arlington Life Shelter	23.1	37
True Worth Place	76.9	123

Table 5 cont'd

Continuous Variables	***N***	***M***	***SD***
Age (years)	158	46.02	13.19
Current intake of fruits and vegetables	147	2.16	1.61
Current intake of sugar-sweetened beverages	147	2.35	3.06
Current intake of processed meats	149	2.01	1.78
If avg. hours reported working per week	43	29.62	12.82
How much money did you spend on meals per week?	149	35.29	62.10
How long have you been at this facility?[a]	145	7.76	13.69
How much longer do you plan to stay at this facility? [a]	86	2.95	3.46

[a]Expressed in number of months

Table 6

Health Knowledge and Behavior Questions

Knowledge Statements
1. It is expensive to eat healthy
2. Processed foods have more sodium than fresh foods
3. Frozen foods are not as healthy as fresh foods
4. When shopping, it is better to look at the unit price compared to the total price
5. The food pyramid is still recognized as the standard for knowing how many servings to eat per day
6. Adults should get 5 servings of fruits and vegetables per day
7. It is advised to eat more vegetables than fruit
8. Fat is important in one's diet
9. Honey is considered added sugar
10. Diet sodas are equally healthy as water
11. Sugar-sweetened beverages contribute strongly to the development of diabetes
12. People learn lifelong eating habits as children
13. Most people report inconvenience as a greater barrier to physical activity over self-discipline
14. It is better to get more moderate than vigorous physical activity.
Behavior Questions
1. How many times last week did you read the nutrition label?
2. How many times last week did you add salt, sugar or butter to foods?
3. How many times last week did you cook a nutritious dinner?
4. How many times a month do you attend this facility?
5. How many times a month do you plan to attend this facility?

Table 7

Main Effects of Time (Aim II)

DV\Time	T1		T2		T3					
	M	***SE***	***M***	***SE***	***M***	***SE***	df_1	df_2	**Multi. *F***	η_p^2
Fruit and Vegetable Intentions T1-T2	0.62	0.02	0.63	0.02	-	-	1	128	1.05	.008
Fruit and Vegetable Intentions T1-T3	0.63	0.02	0.62	0.03	0.66	0.03	2	24	0.38	.03
Fruit and Vegetable Intake T1-T3	0.46	0.04	-	-	0.60	0.04	1	27	0.98	.04
Sugar-Sweetened Beverage Intentions T1-T2	0.36	0.02	0.33	0.02	-	-	1	124	0.44	.004
Sugar-Sweetened Beverage Intentions T1-T3	0.33	0.05	0.28	0.04	0.19	0.04	2	22	1.09	.09
Sugar-Sweetened Beverage Intake T1-T3	0.40	0.03	-	-	0.49	0.07	1	29	2.28	.07
Processed Meat Intentions T1-T2	0.40	0.02	0.37	0.03	-	-	1	128	0.11	.001

Table 7 cont'd

Processed Meat Intentions T1-T3	0.40	0.03	0.37	0.04	0.28	0.04	2	25	0.24	.02
Processed Meat Intake T1-T3	0.43	0.03	-	-	0.51	0.06	1	28	2.90	.09
Combined Sugar-Sweetened Beverage and Processed Meat Intake T1-T3	0.63	0.04	-	-	0.75	0.07	1	27	2.01	.07
Times Eaten Fast Food Last Week T1-T3	0.42	0.06	-	-	0.50	0.06	1	31	0.09	.003
Times Read the Nutrition Label Last Week T1-T3	0.28	0.07	-	-	0.37	0.06	1	27	.005	<.001
Times Added Salt, Sugar, or Butter to Foods Last Week T1-T3	0.59	0.06	-	-	0.60	0.08	1	27	0.007	<.001
Times Cooked a Nutritious Dinner Last Week T1-T3	0.12	0.05	-	-	0.14	0.05	1	28	0.003	<.001
Nutrition Attitudes T1-T2	13.73	0.41	14.66	0.44	-	-	1	136	0.05	<.001
Nutrition Attitudes T1-T3	13.21	0.71	14.08	0.63	15.22	0.57	2	28	2.11	.13
Nutrition Knowledge T1-T2	4.23	0.34	5.48	0.33	-	-	1	136	0.11	.001
Nutrition Knowledge T1-T3	5.53	0.71	6.24	0.72	6.17	0.69	2	28	2.89^{+}	.17

Table 7 cont'd

Total Knowledge T1-T2	4.44	0.37	5.63	0.36	-	-	1	136	0.29	.002
Total Knowledge T1-T3	5.72	0.80	6.24	0.74	6.54	0.69	2	28	3.11^{+}	.18
Food Choices T1-T2	3.21	0.06	3.34	0.06	-	-	1	140	0.28	.002
Food Choices T1-T3	3.12	0.11	3.16	0.10	3.25	0.12	2	29	0.64	.04
Dietary Volitional Self-Efficacy T1-T2	19.31	0.61	20.85	0.70	-	-	1	140	3.33^{+}	.02
Dietary Volitional Self-Efficacy T1-T3	19.17	1.35	21.90	1.28	22.66	0.98	2	26	0.08	.01
Physical Activity Volitional Self-Efficacy T1-T2	19.46	0.63	20.66	0.70	-	-	1	139	0.37	.003
Physical Activity Volitional Self-Efficacy T1-T3	18.85	1.38	21.23	1.51	22.45	1.24	2	26	0.09	.01

Note. $p < .10^{+}$

Table 8

Class X Time Interaction Effects (Aim III)

DV	df_1	df_2	**Multi. *F***	η_p^2
Fruit and Vegetable Intentions T1-T2	3	128	1.53	.04
Fruit and Vegetable Intentions T1-T3	6	50	0.14	.02
Fruit and Vegetable Intake T1-T3	3	27	0.29	.03
Sugar-Sweetened Beverage Intentions T1-T2	3	124	1.11	.03
Sugar-Sweetened Beverage Intentions T1-T3	6	46	0.42	.05
Sugar-Sweetened Beverage Intake T1-T3	3	29	0.99	.09
Processed Meat Intentions T1-T2	3	128	0.54	.01
Processed Meat Intentions T1-T3	6	52	1.03	.11
Processed Meat Intake T1-T3	3	28	1.31	.12
Combined Sugar-Sweetened Beverage and Processed Meat Intake T1-T3	3	27	0.54	.06
Times Eaten Fast Food Last Week T1-T3	3	31	0.38	.04
Times Read the Nutrition Label Last Week T1-T3	3	27	0.74	.08
Times Added Salt, Sugar, or Butter to Foods Last Week T1-T3	3	27	0.93	.09
Times Cooked a Nutritious Dinner Last Week T1-T3	3	28	0.37	.04
Nutrition Attitudes T1-T2	3	136	0.70	.02
Nutrition Attitudes T1-T3	6	58	0.55	.05
Nutrition Knowledge T1-T2	3	136	1.63	.04
Nutrition Knowledge T1-T3	6	58	1.04	.10
Total Knowledge T1-T2	3	136	1.42	.03
Total Knowledge T1-T3	6	58	0.86	.08
Food Choices T1-T2	3	140	0.44	.01
Food Choices T1-T3	6	60	0.54	.05
Dietary Volitional Self-Efficacy T1-T2	3	140	1.56	.03
Dietary Volitional Self-Efficacy T1-T3	6	54	1.51	.14
Physical Activity Volitional Self-Efficacy T1-T2	3	139	1.31	.03
Physical Activity Volitional Self-Efficacy T1-T3	6	54	1.06	.11

Table 9

Main Effects of Manipulation

DV\Manipulation	**How to Shop at low cost**		**Recommended Serving Sizes**		**Chronic Disease and Food Preparation**		**Physical Activity**					
	M	***SE***	***M***	***SE***	***M***	***SE***	***M***	***SE***	df_1	df_2	**Multi. *F***	η_p^2
Fruit and Vegetable Intentions T1-T2	0.59	0.03	0.58	0.04	0.66	0.03	0.65	0.03	3	128	1.80	.04
Fruit and Vegetable Intentions T1-T3	0.63	0.03	0.60	0.04	0.65	0.04	0.66	0.04	3	25	0.34	.04
Fruit and Vegetable Intake T1-T3	0.52	0.06	0.53	0.07	0.50	0.06	0.58	0.05	3	27	0.37	.04
Sugar-Sweetened Beverage Intentions T1-T2	0.31	0.05	0.38	0.05	0.26	0.04	0.41	0.04	3	124	2.56+	.06
Sugar-Sweetened Beverage Intentions T1-T3	0.26	0.07	0.33	0.09	0.21	0.09	0.27	0.08	3	23	0.29	.04
Sugar-Sweetened Beverage Intake T1-T3	0.43	0.07	0.57	0.10	0.45	0.09	0.34	0.08	3	29	1.02	.10
Processed Meat Intentions T1-T2	0.38	0.05	0.44	0.05	0.23	0.05	0.48	0.04	3	128	5.82**	.12

Table 9 cont'd

Processed Meat Intentions T1-T3	0.26	0.05	0.57	0.07	0.18	0.06	0.39	0.06	3	26	7.14**	.45
Processed Meat Intake T1-T3	0.40	0.06	0.49	0.10	0.50	0.08	0.48	0.07	3	28	0.46	.05
Combined Sugar-Sweetened Beverage and Processed Meat Intake T1-T3	0.63	0.07	0.80	0.11	0.71	0.09	0.63	0.09	3	27	0.60	.06
Times Eaten Fast Food Last Week T1-T3	0.38	0.08	0.50	0.13	0.55	0.11	0.42	0.10	3	31	0.54	.05
Times Read the Nutrition Label Last Week T1-T3	0.18	0.08	0.29	0.12	0.29	0.10	0.55	0.09	3	27	3.51*	.28
Times Added Salt, Sugar, or Butter to Foods Last Week T1-T3	0.53	0.10	0.66	0.14	0.55	0.13	0.66	0.11	3	27	0.34	.04
Times Cooked a Nutritious Dinner Last Week T1-T3	0.09	0.06	0.05	0.09	0.07	0.07	0.30	0.07	3	28	2.69+	.22
Nutrition Attitudes T1-T2	13.93	0.75	13.98	0.87	15.05	0.76	13.81	0.72	3	136	0.57	.01
Nutrition Attitudes T1-T3	13.11	0.89	12.90	1.32	15.99	1.21	14.70	1.02	3	29	1.75	.15

Table 9 cont'd

Nutrition Knowledge T1-T2	5.96	0.59	4.83	0.66	4.92	0.56	3.80	0.54	3	136	2.49^{+}	.05
Nutrition Knowledge T1-T3	7.57	1.01	3.20	1.38	7.57	1.27	5.57	1.21	3	29	2.37^{+}	.20
Total Knowledge T1-T2	6.03	0.64	4.99	0.71	5.08	0.60	4.05	0.59	3	136	1.77	.04
Total Knowledge T1-T3	7.52	1.02	3.26	1.49	7.98	1.28	5.91	1.22	3	29	2.37^{+}	.20
Food Choices T1-T2	3.21	0.11	3.33	0.12	3.34	0.10	3.22	0.10	3	140	0.46	.01
Food Choices T1-T3	3.00	0.17	3.30	0.25	3.47	0.22	2.93	0.19	3	30	1.43	.13
Dietary Volitional Self-Efficacy T1-T2	19.57	1.14	18.57	1.30	21.22	1.11	20.96	1.09	3	140	1.07	.02
Dietary Volitional Self-Efficacy T1-T3	18.14	1.84	18.90	2.59	25.09	2.24	22.85	2.17	3	27	2.54^{+}	.22
Physical Activity Volitional Self-Efficacy T1-T2	19.35	1.13	19.21	1.29	21.41	1.12	20.26	1.08	3	139	0.77	.02
Physical Activity Volitional Self-Efficacy T1-T3	18.52	1.97	17.53	2.77	25.29	2.40	22.02	2.32	3	27	2.34^{+}	.21

Note. $p < .10^{+}$, $p < .05^{*}$, $p < .01^{**}$

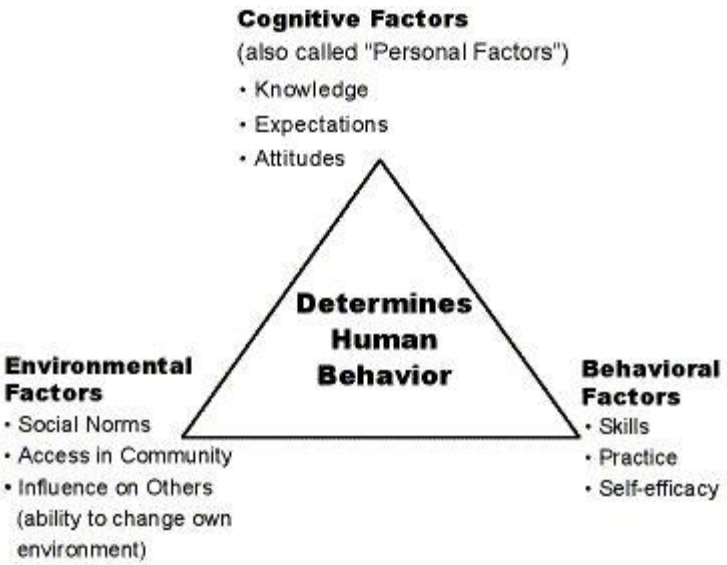

Figure 1. SCT diagram adapted from Bandura, 1986

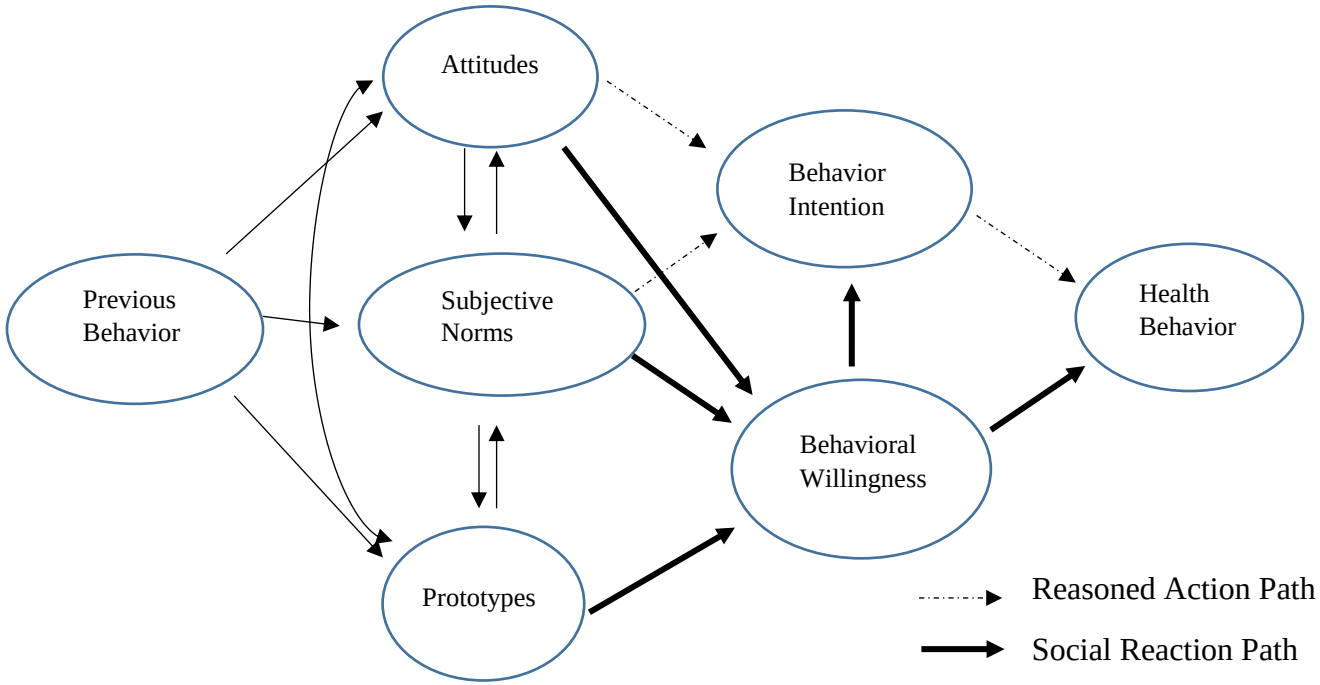

Figure 2. PWM diagram adapted from Gibbons et al., 1998.

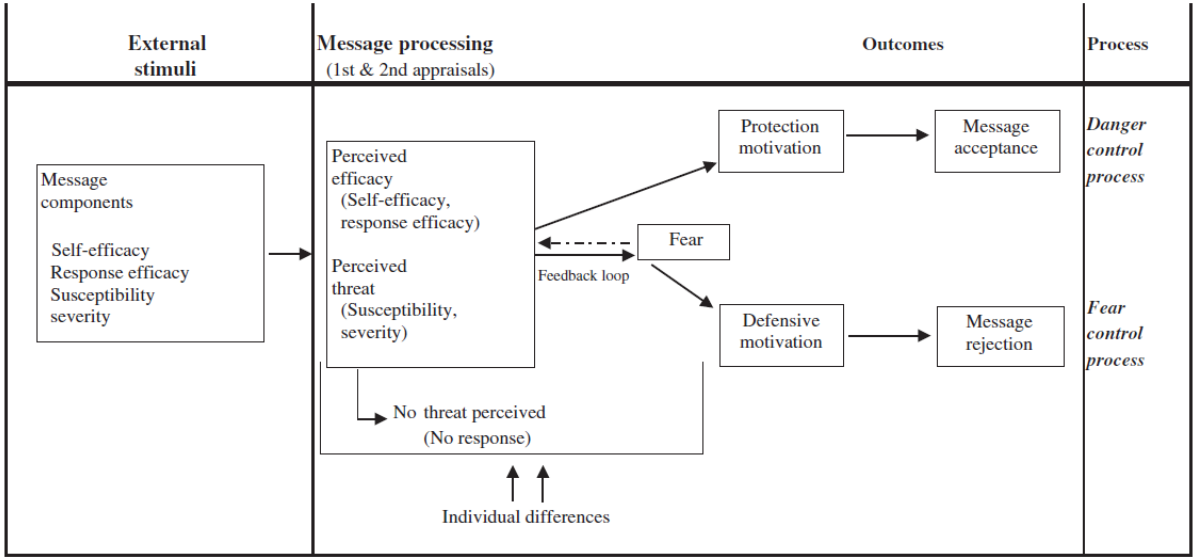

Figure 3. EPPM diagram adapted from Witte, 1994.

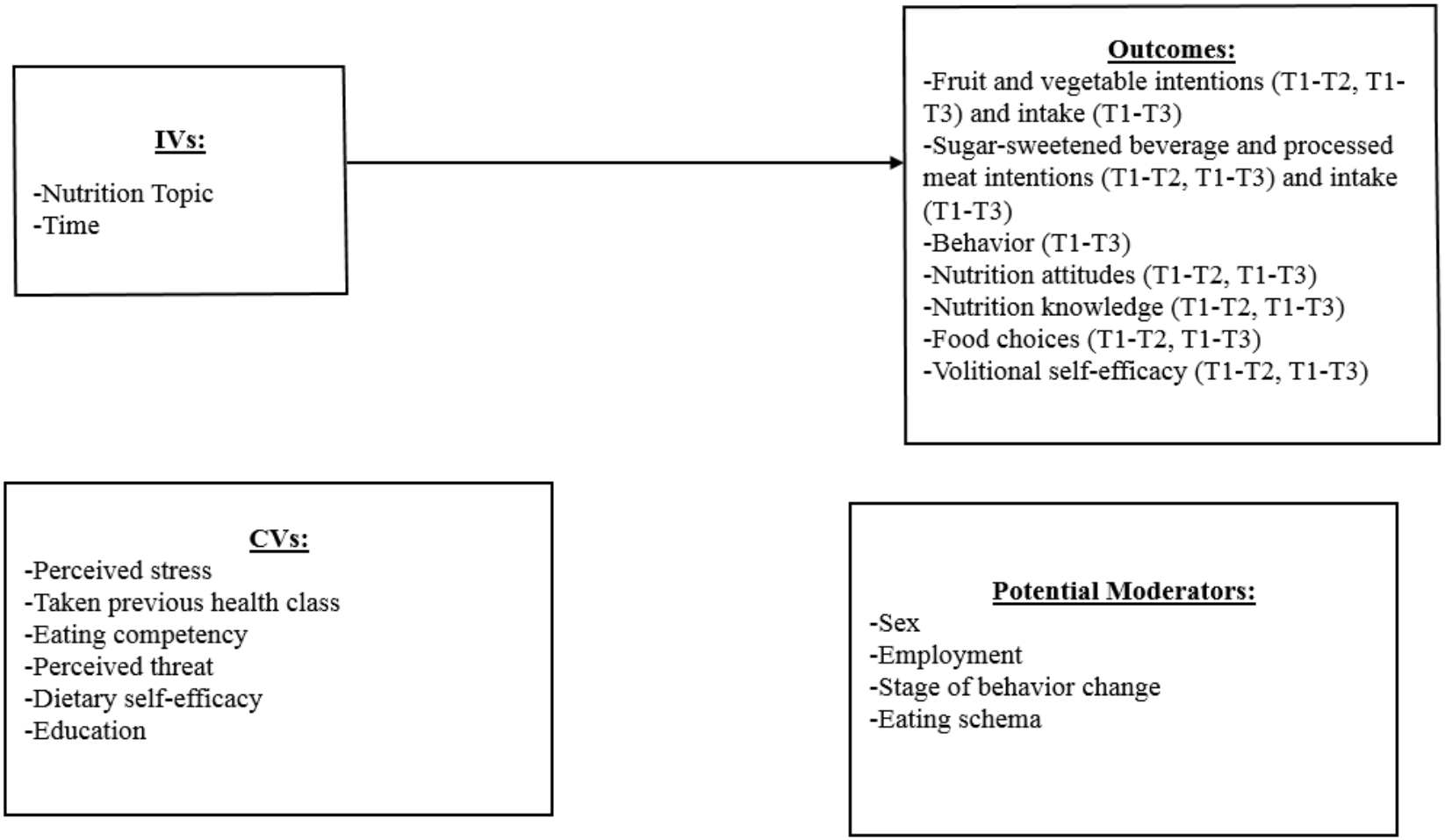

Figure 4. Model for Aims.

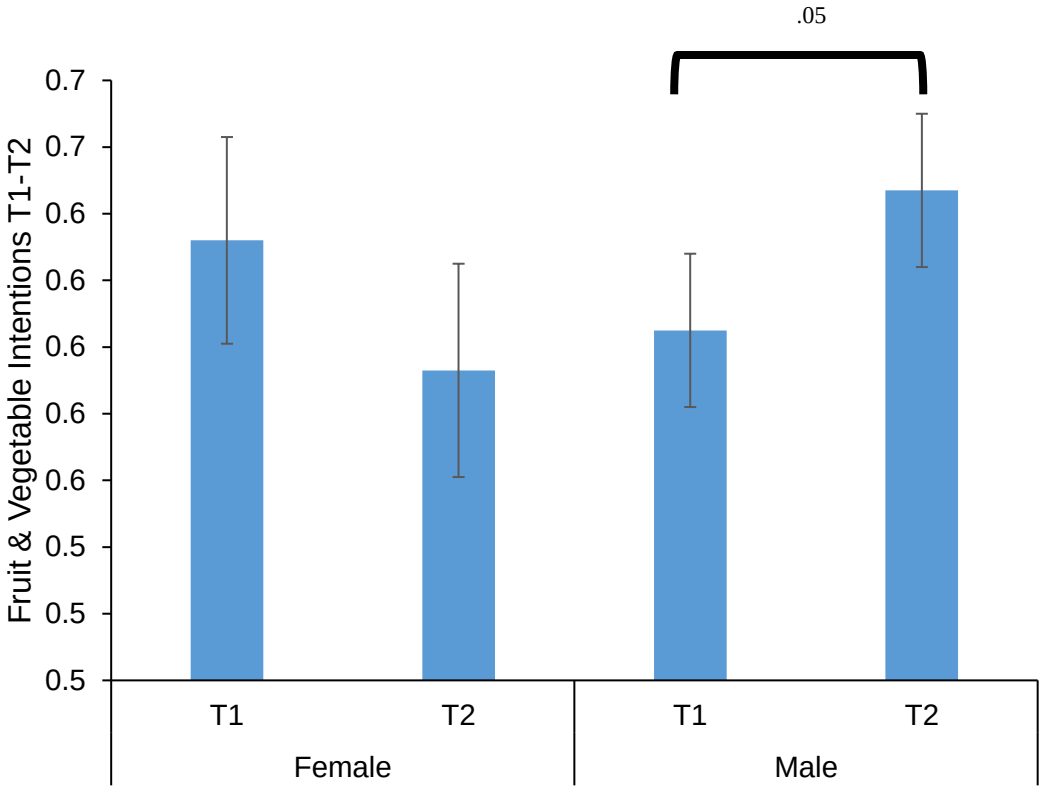

Figure 5. Interaction *M*s and *SE*s of time and sex for fruit & vegetable intentions T1-T2. Bar denotes trending comparison.

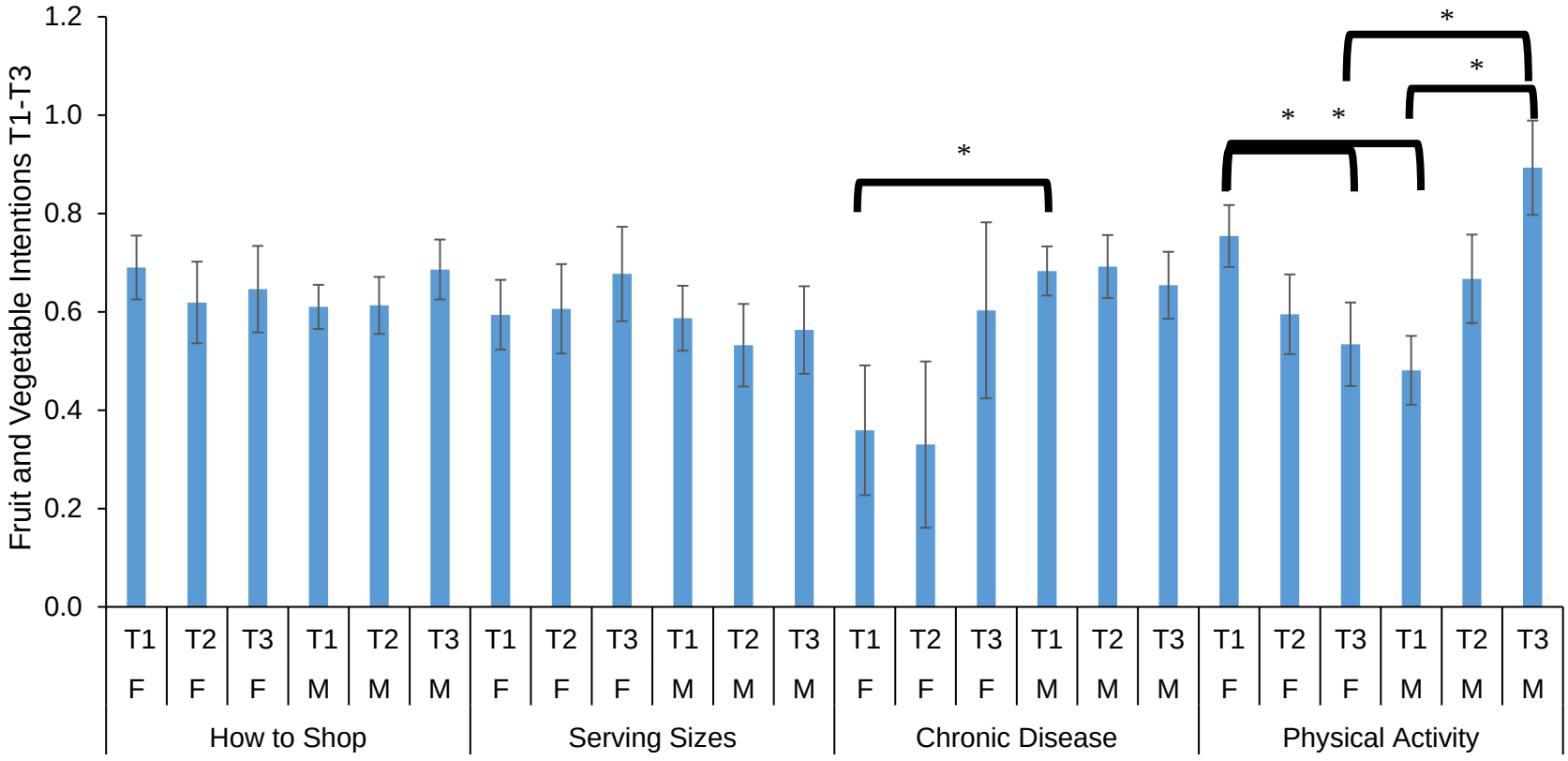

Figure 6. Interaction *M*s and *SE*s of time, sex (F: female, M: male), and manipulation for fruit & vegetable intentions T1-T3. Bars and asterisks denote significant comparisons.

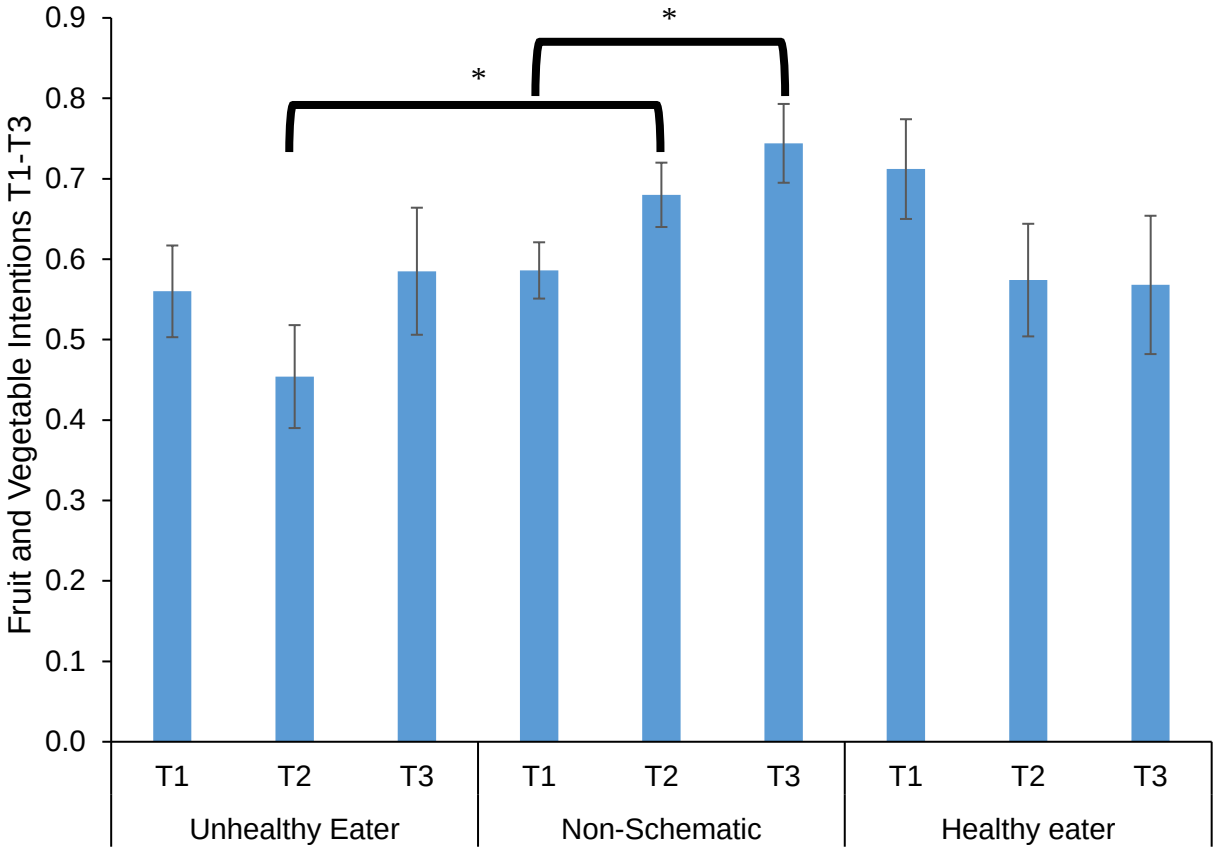

Figure 7. Interaction *M*s and *SE*s of time and eating schema for fruit & vegetable intentions T1-T3. Bars and asterisks denote significant comparisons.

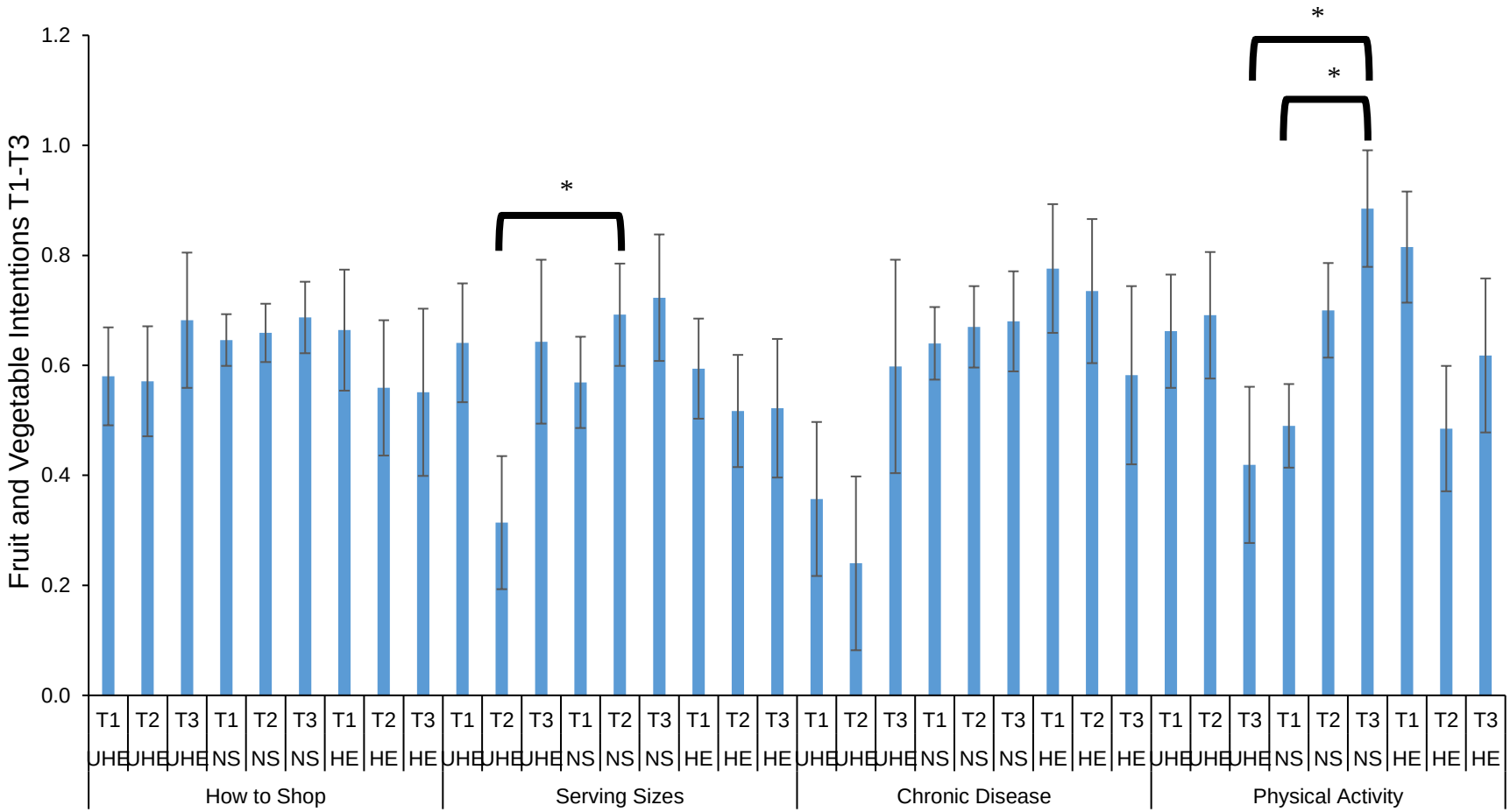

Figure 8. Interaction *M*s and *SE*s of time, eating schema (UHE: unhealthy eater, NS: non-schematic, HE: healthy eater), and manipulation for fruit & vegetable intentions T1-T3. Bars and asterisks denote significant comparisons.

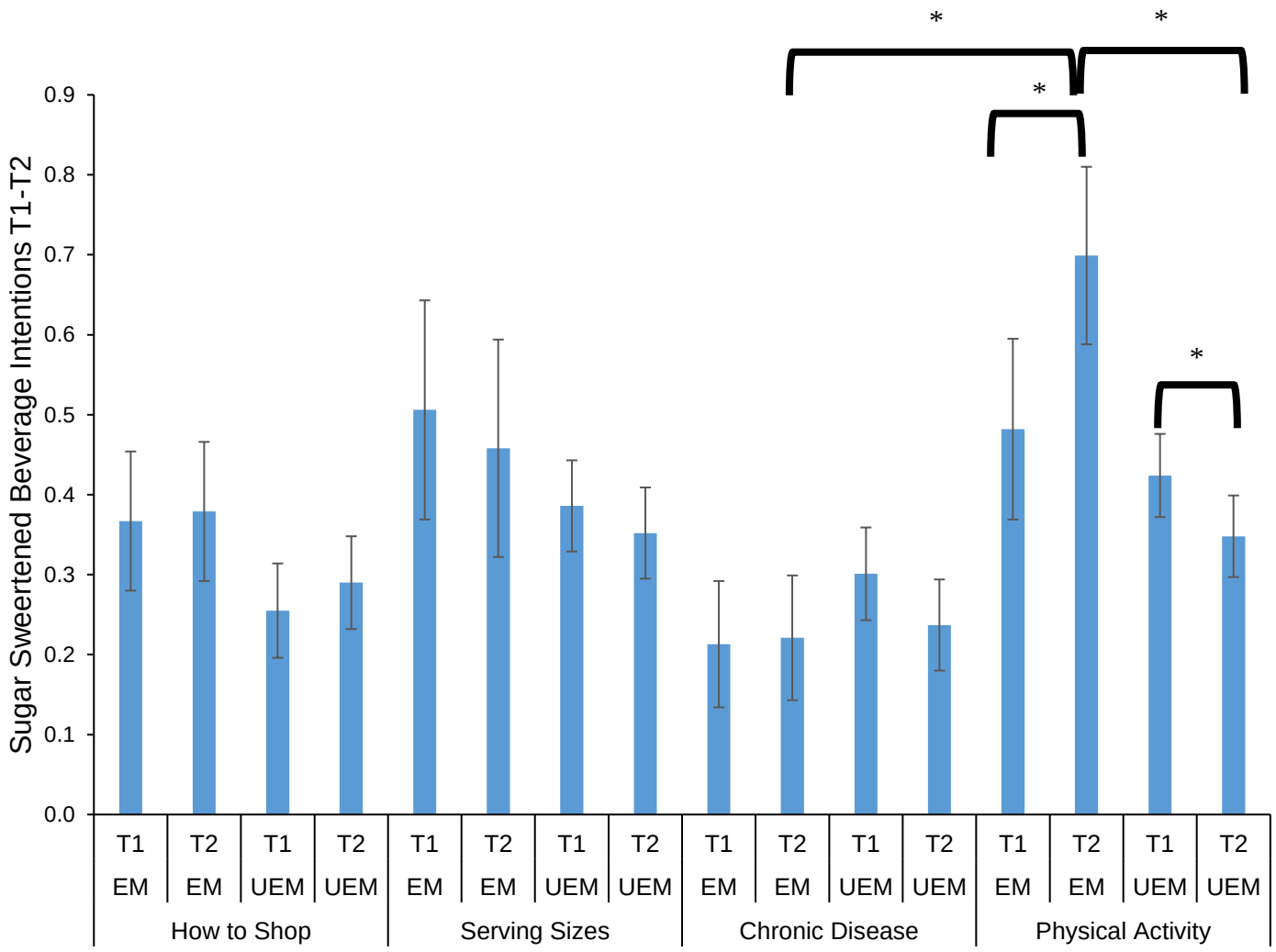

Figure 9. Interaction *M*s and *SE*s of time, employment (EM: employed, UEM: unemployed), and manipulation for sugar-sweetened beverage intentions T1-T2. Bars and asterisks denote significant comparisons.

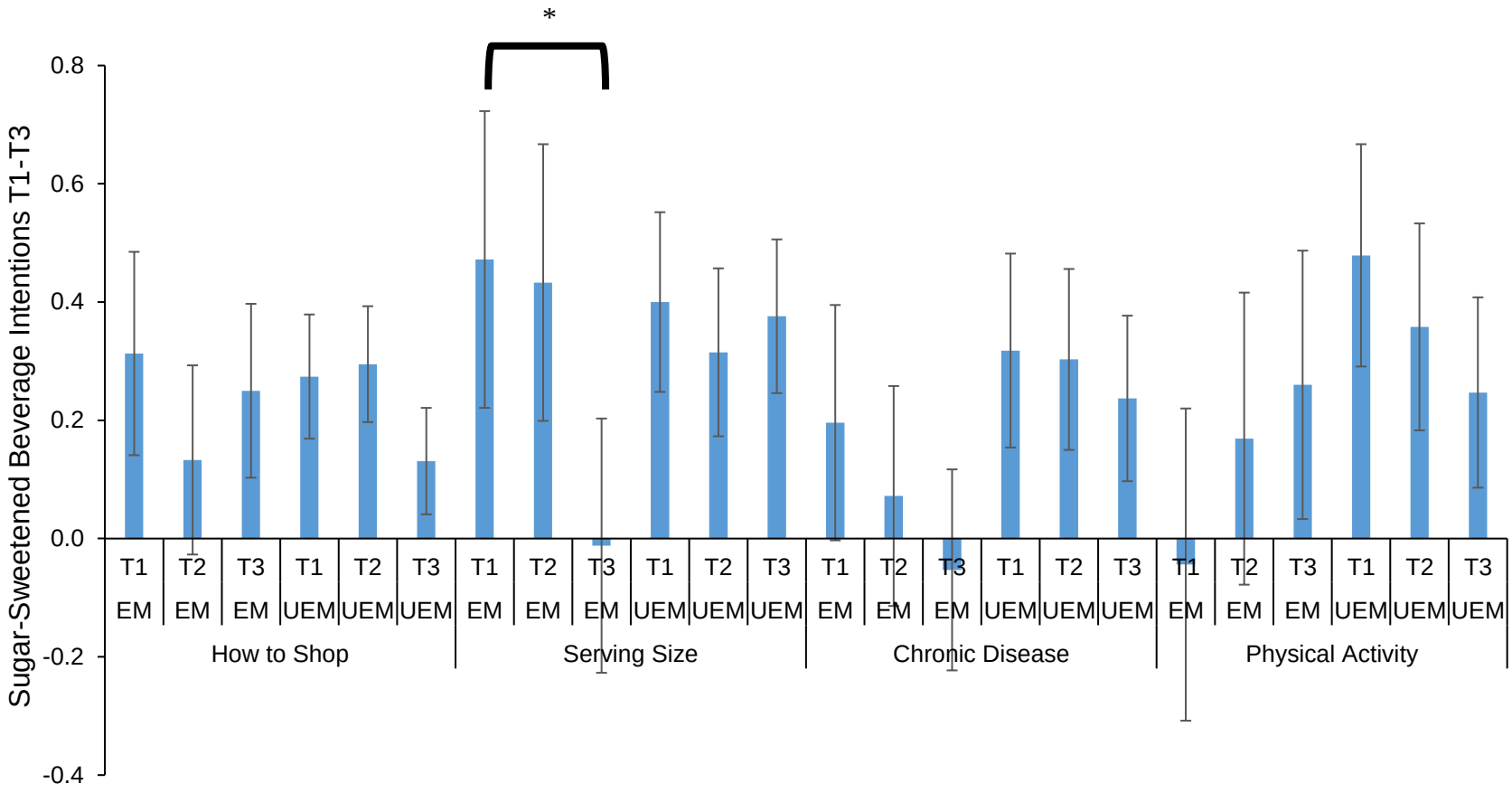

Figure 10. Interaction *M*s and *SE*s of time, employment (EM: employed, UEM: unemployed), and manipulation for sugar-sweetened beverage intentions T1-T3. Bar and asterisk denotes significant comparison.

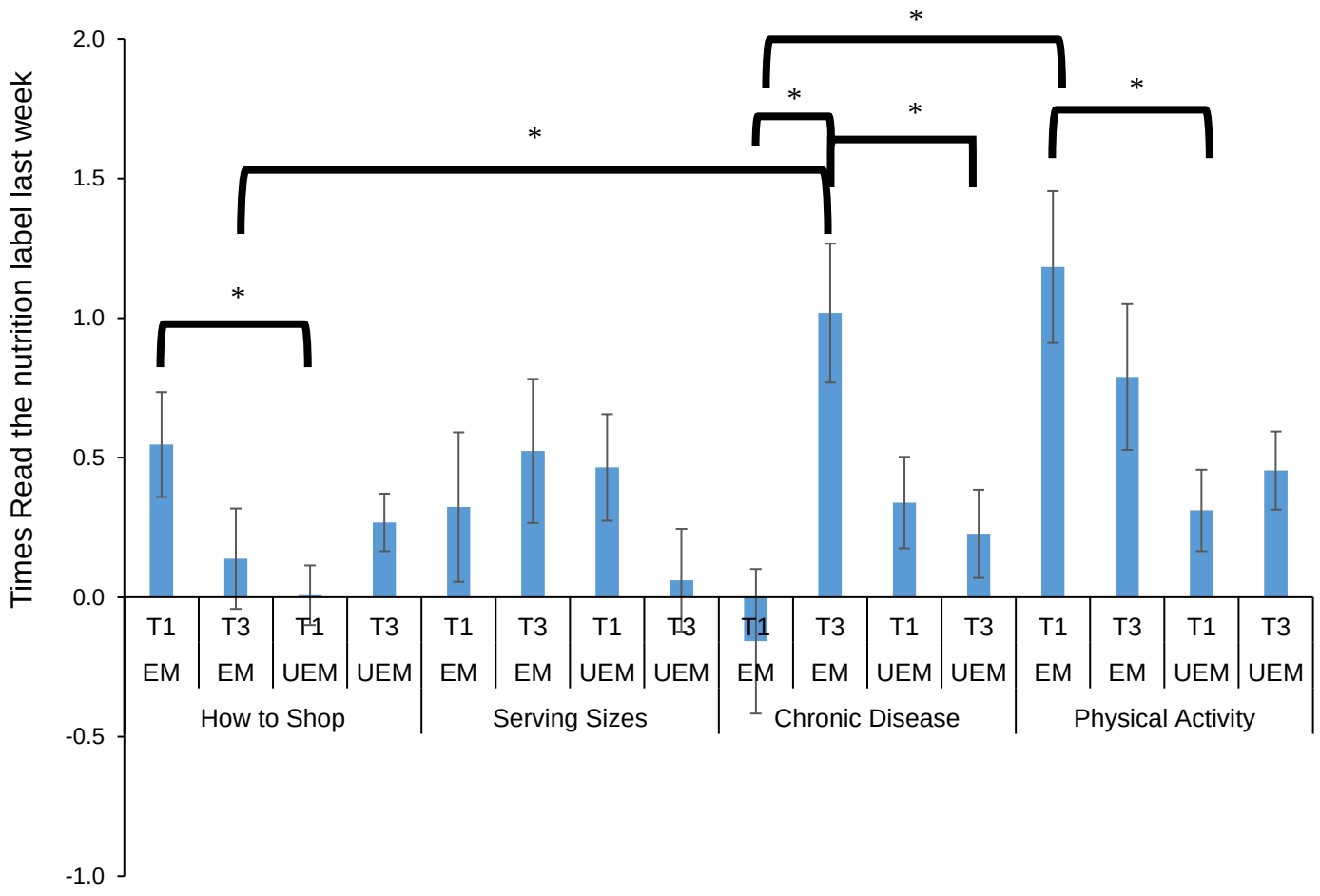

Figure 11. Interaction *M*s and *SE*s of time, employment (EM: employed, UEM: unemployed), and manipulation for times read the nutrition label last week. Bars and asterisks denote significant comparisons.

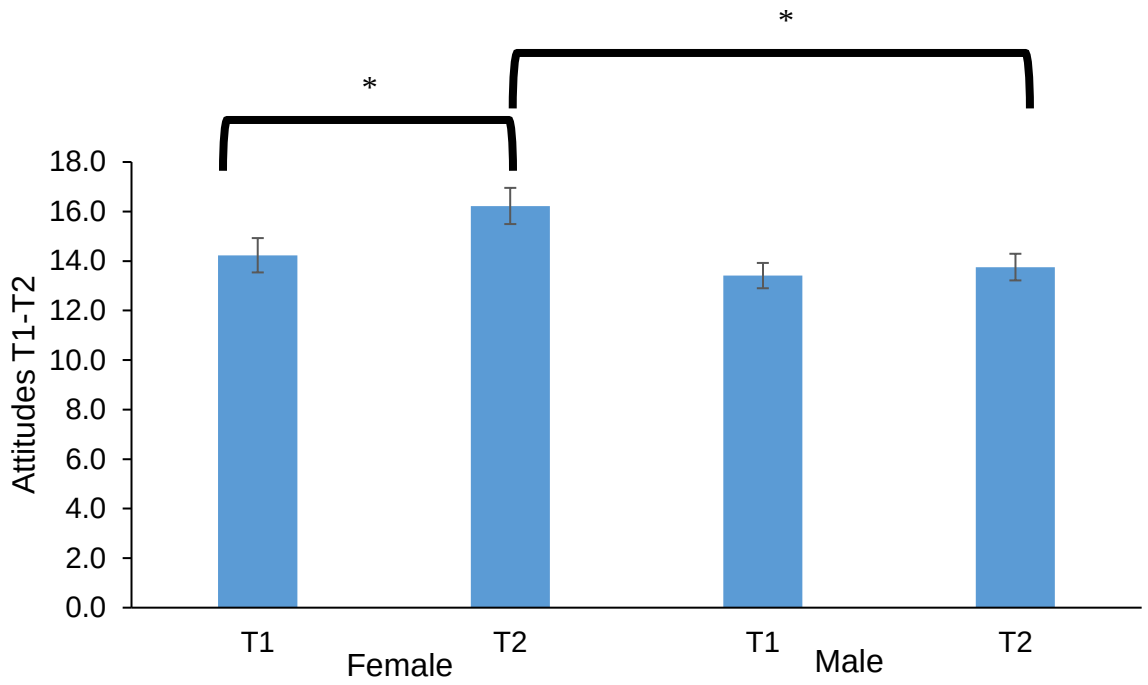

Figure 12. Interaction *M*s and *SE*s of time and sex for attitudes T1-T2. Bars and asterisks denote significant comparisons.

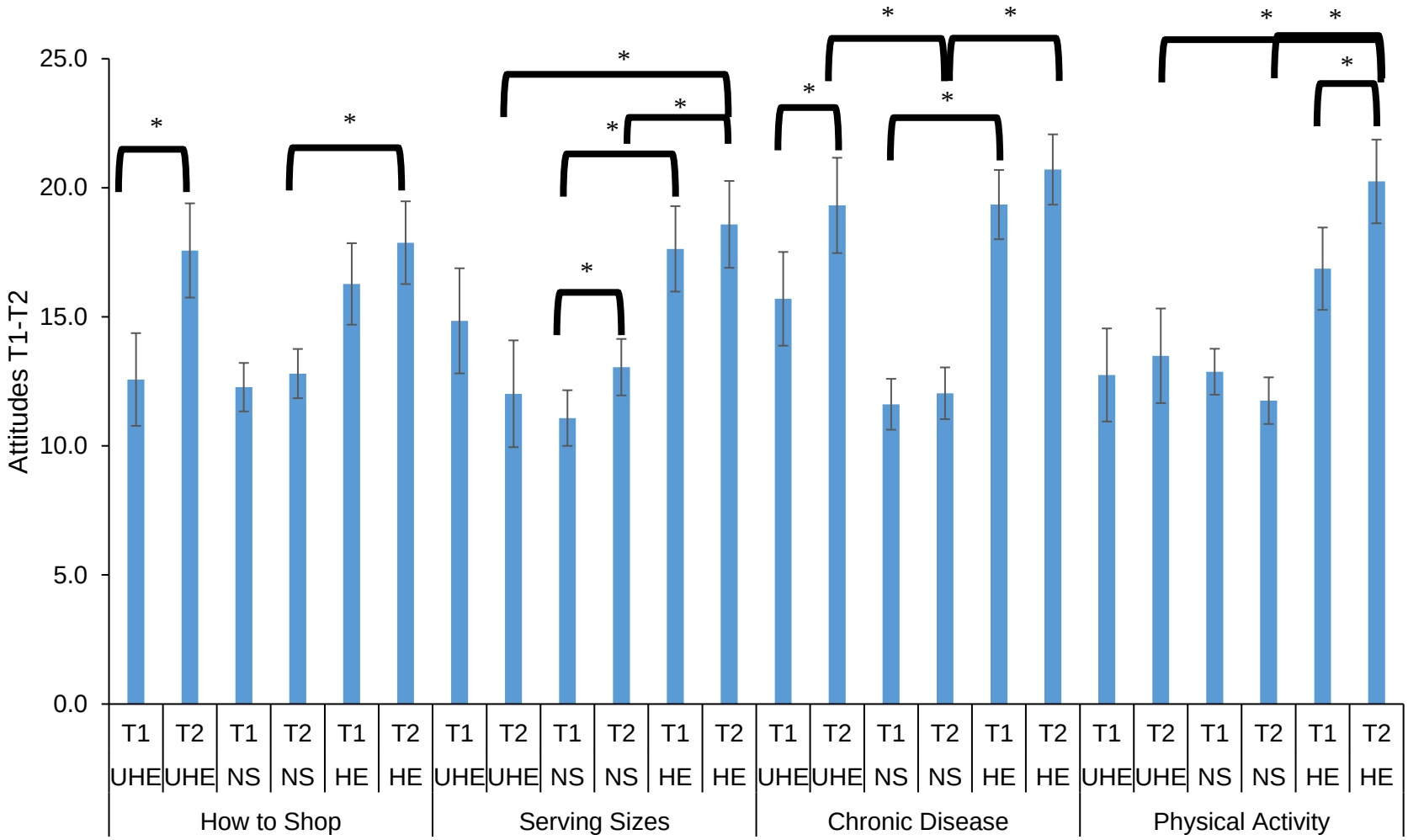

Figure 13. Interaction *M*s and *SE*s of time, eating schema (UHE: unhealthy eater, NS: non-schematic, HE: healthy eater), and manipulation for attitudes T1-T2. Bars and asterisks denote significant comparisons.

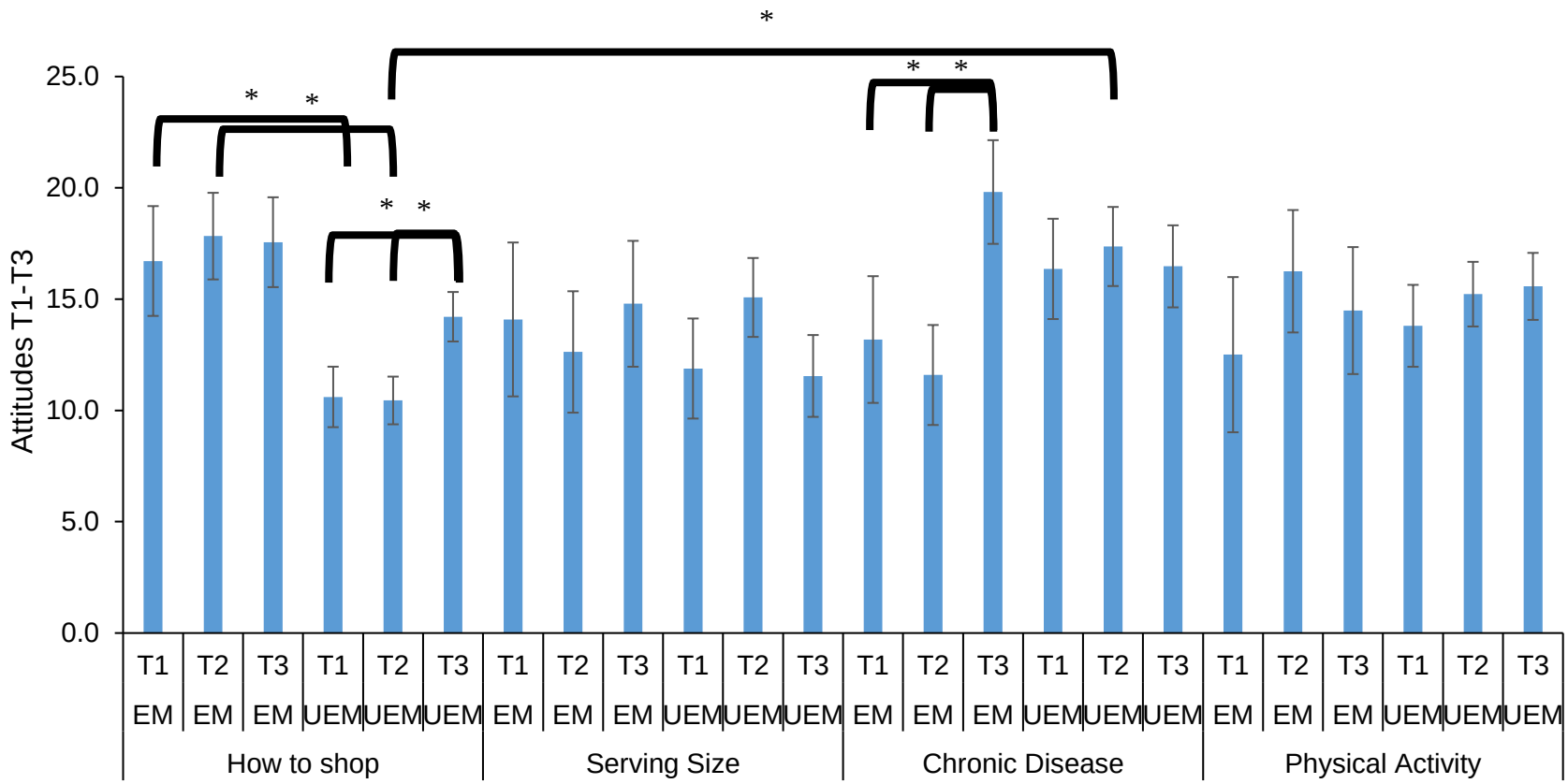

Figure 14. Interaction *M*s and *SE*s of time, employment (EM: employed, UEM: unemployed), and manipulation for attitudes T1-T3. Bars and asterisks denote significant comparisons.

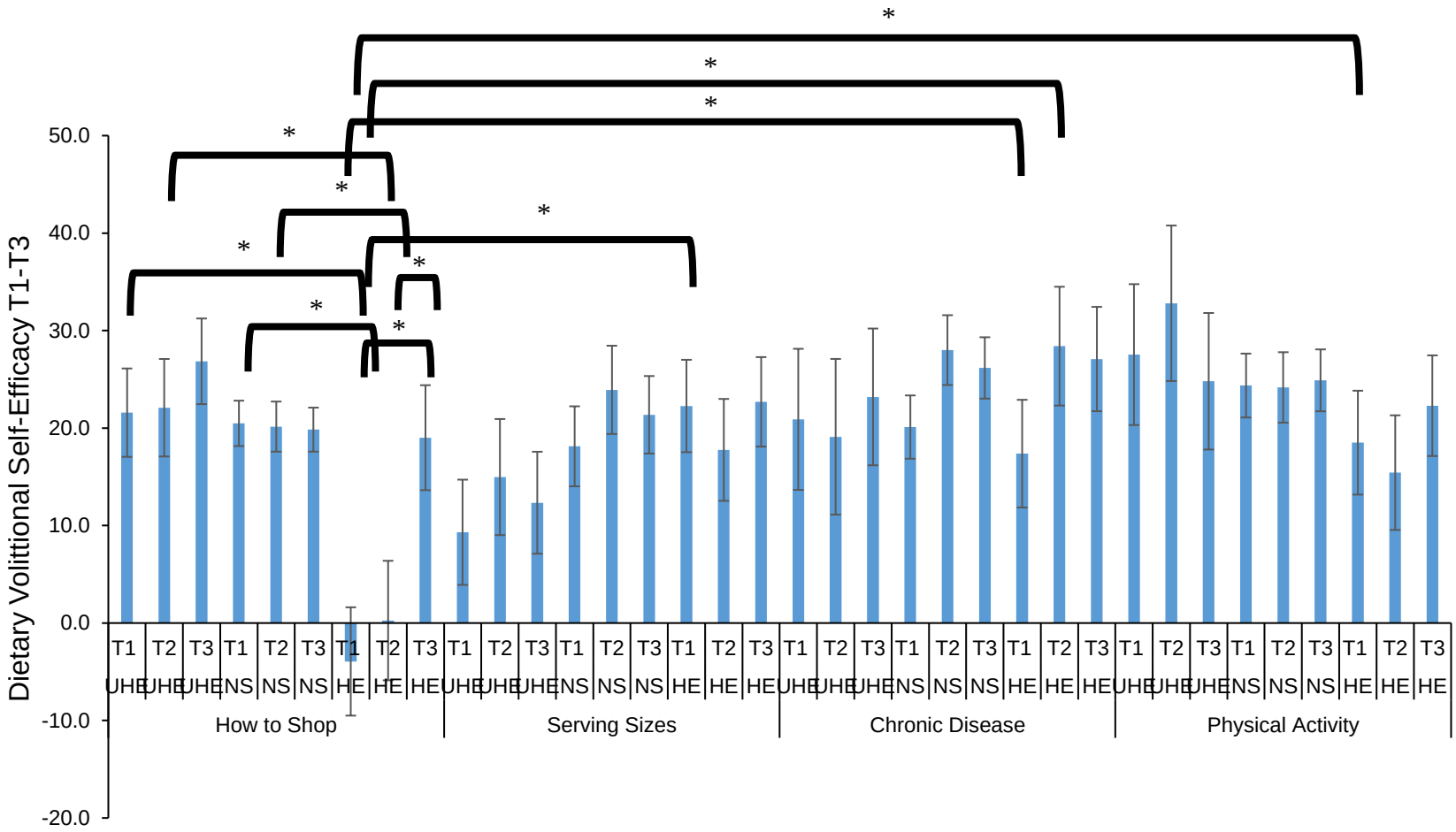

Figure 15. Interaction *M*s and *SE*s of time, eating schema (UHE: unhealthy eater, NS: non-schematic, HE: healthy eater), and manipulation for dietary volitional self-efficacy T1-T3. Bars and asterisks denote significant comparisons.

Appendix A

Table A1

Theories used	Components in this Study	How measured	Outcomes for use of theory in Study 2 (all listed would be preferred)
Implementation Intentions	Participants were asked questions on goal planning or capability to change diet	Focus group Discussion Questions below followed by thematic coding. Question #5 What obstacles make it difficult to eat healthy? Question #7 How capable are you to change your diet habits to consume more fruits and vegetables if you need/like to?	• Low number of participants forming implementation intentions • Low nutrition attitudes
Social Cognitive Theory	Participants were asked questions on environmental constraints and self-efficacy.	Focus group Discussion Questions below followed by thematic coding. Question #5 What obstacles make it difficult to eat healthy? Question #7 How capable are you to change your diet habits to consume more fruits and vegetables if you need/like to? Some of the attitude questions address this too	• Most participants in precontemplation or contemplation stage of behavior change • Low nutrition attitudes • Identification of multiple environmental barriers/need for accountability • Low self-efficacy established from question #7
Prototype Willingness Model	Participants were asked questions on models or examples to follow	Focus group Discussion Questions below followed by thematic coding. Question #3 what does a healthy meal look like to you? Question #9 How effective would having a model be to facilitate healthy eating? Probe more or detail	• Most participants in precontemplation or contemplation stage of behavior change • Low nutrition attitudes • Discussion that having model or example to follow would help facilitate healthier eating

			Table A1 cont'd
Extended Parallel Processing Model	Participants were asked a question about effectiveness of strong health messages	Focus group Discussion Questions below followed by thematic coding. Question #7 How capable are you to change your diet habits to consume more fruits and vegetables if you need/like to? Question #8 How effective would health warning messages be to facilitate healthy eating? Probe for more detail	• Discussion of needing more motivation • Low nutrition attitudes • Discussion that health warning messages about specifically what to eat or avoid would help
Stage of Behavior Change	Participants were asked questions on stage of behavior change to assess where they stand.	Focus group Discussion Questions below followed by thematic coding. Question #6 Have you thought about eating healthier? Question #7 How capable are you to change your diet habits to consume more fruits and vegetables if you need/like to? Additional Questions 4-7 (see table 3)	• Low nutrition attitudes • Having most people in precontemplation or contemplation stage or just a general need for improvement

Table A2

Theories Used	Components in this study	How theory measured/incorporated
Implementation Intentions	Participants formed intentions intended to be SMART, that is, specific and details when, where, and how to engage in a healthier behavior. It was used as a manipulation check.	Implementation intentions were in all manipulations. Raters then coded the intentions for specificity from 1-4. One being not very detailed and four being very detailed.
Social Cognitive Theory	Participants were taught environmental and personal factors related to behavior change (e.g., setting up accountability measures, identifying environmental constraints, which were discussion based)	It was incorporated into each manipulation. Ideas/constraints/impeding motivational factors were queried and openly discussed. Thoughts were listed on paper with the moderating researcher's aid.
Prototype Willingness Model	Participants were provided with prototypes (e.g., healthy shopper vs. procrastinating shopper) and told to think about an example prototype they could follow for the corresponding topic for effectiveness.	It was incorporated into each manipulation. Participants were shown and asked to brainstorm a visual image with descriptions of how to and how not to behave depending on the topic that seemed to be most important or interesting from focus group feedback questions (with the moderating researcher's aid).
Extended Parallel Processing Model	Participants were exposed to a fear appeal to incorporate aspects of the EPPM (i.e., a series of negative health statements about fast food/inactivity). Participants were then exposed to healthier fast food recipes/activity plan to engender a sense of self-efficacy.	It was incorporated into each manipulation. Participants were presented with a high threat message on paper printouts that said (for example) that processed meats may increase risk of cancer. To engender a sense of efficacy, participants were then presented with response messages about healthier fast food options to consume or presented with an activity plan.
Stage of Behavior Change	Used as a moderator and outcome	Series of questions 4-7(see Table 4)

Appendix B

Food Choice Value Questionnaire

1. How it tastes
2. Whether it is considered a traditional food
3. How it smells
4. Whether it is easily available in shops and supermarkets
5. Degree to which it is a good value for money
6. Whether I think it will help me cope with stress
7. Degree to which it will help me cope with life events
8. How likely it is to help me control my weight
9. Degree to which it reflects my cultural or ethnic traditions
10. Degree to which I can be sure it is not associated with food-borne illness
11. Whether it is grown or produced in an environmentally friendly way
12. The amount of calories in it
13. How easy or difficult it is to prepare
14. Degree to which it contains natural ingredients
15. Degree to which it has been prepared with extreme care and safety
16. Degree to which it will help me lose weight
17. Degree to which it looks good
18. The amount of vitamins and minerals in it
19. Whether it can be cooked very simply
20. How long it takes to prepare
21. How similar it is to the food I ate when I was a child

22. How much it will help me relax

23. Whether I am certain it does not contain harmful bacteria or viruses

24. How many artificial additives it contains

25. Whether it can be bought in shops close to where I live

Appendix C

ecSatter Inventory Scale and Subscale Items

Eating Attitudes

I am relaxed about eating.

I am comfortable about eating enough.

I enjoy food and eating.

I am comfortable with my enjoyment of food and eating.

I feel it is okay to eat food that I like.

Food Acceptance

I experiment with new food and learn to like it.

If the situation demands, I can "make do" by eating food I don't much care for.

I eat a wide variety of food.

Internal Regulation

I assume I will get enough to eat.

I eat as much as I am hungry for.

I eat until I feel satisfied.

Contextual Skills

I tune in to food and pay attention to myself when I eat.

I make time to eat.

I have regular meals.

I think about nutrition when I choose what I eat.

I generally plan for feeding myself. I don't just grab food when I get hungry.

Appendix D

4-item Perceived Stress Scale

1. In the last month, how often have you felt that you were unable to control the important things in your life?

2. In the last month, how often have you felt confident about your ability to handle your personal problems?

3. In the last month, how often have you felt that things were going your way?

4. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?