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The Role of Intertemporal Preferences, Active Consideration of Health Outcomes, and Simple Health Prompts on the Nutritional Quality of Food Choices

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THE ROLE OF INTERTEMPORAL PREFERENCES, ACTIVE CONSIDERATION OF HEALTH OUTCOMES, AND SIMPLE HEALTH PROMPTS ON THE NUTRITIONAL QUALITY OF FOOD CHOICES

by

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This thesis consists of three chapters. The first chapter introduces the thesis by highlighting a brief review of intertemporal preferences, active consideration of health outcomes, and health prompts during food choices. The introduction paves the way for the following two chapters, which are related, but stand-alone papers.

In the second chapter, we explore a novel question: how does actively considering health outcomes (both current and future) during decision-making affect the nutritional quality of food choices? We explore this question with an online experiment on food choices. Our findings show that active consideration of health outcomes leads to choosing products with high nutritional quality. The results of the second chapter motivate the third chapter, which studies an intervention during decision-making that may influence people's decision processes.

In the third chapter, we build on the findings of chapter 2 to examine whether a simple message that highlights health impacts of food options leads people to increase the healthiness of food choices. The contribution of this chapter is to examine pathways through which these types of messages act. Specifically, we examine whether the health message changes attention and/or intertemporal preferences. The results show that simple messages during choice increase the consideration of health outcomes but do not change intertemporal preferences. Our findings

show that health prompts lead to healthier food choices by increasing consideration of health during choice.

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CHAPTER 1. INTRODUCTION

People face many choices on a daily basis that contribute to their immediate and long-term wellbeing. For instance, decisions about what to eat, whether to spend time exercising or working, to take the stairs or the elevator, to go to bed early or stay up late to watch television, to spend money today or save it for future needs, etc. all have consequences for our future selves. In every choice, there is a tradeoff that is made. These tradeoffs are typically thought of in economics, as well as other fields dealing with choice, as the product of intertemporal preferences. Intertemporal preferences capture an individual's preferences for the distribution of utility across time, with delayed utility being discounted relative to immediate or proximal utility. Economists have widely examined intertemporal preferences to explain outcomes like BMI, exercise, and smoking (Borghans & Golsteyn, 2006; Chabris et al., 2008), as well as obesity (Barlow et al., 2016; Zhang & Rashad, 2008).

In the context of food, not only do people make multiple food purchase and/or consumption choices a day, they also face myriad food products to choose from. Foods, with varying taste and nutritional profiles, have different implications on people's well-being for today and in the long-term. The widespread availability of objective nutrition information and information about the importance of eating healthy diets has not slowed increase in the prevalence of diet-related diseases in the US (Elizabeth et al., 2020; Mehta et al., 2020; Murray, 2013; Preston et al., 2018). Using the lens of intertemporal preferences, the rise in obesity and diet-related diseases should reflect decisions that weighed the immediate pleasure of consumption of preferred foods against the possibility of future health problems (for those

individuals whose taste preferences tend towards foods that do not contribute to preferences for health outcomes).

However, an alternative explanation exists: research in psychology and neuroscience suggests that cognitive resources are used differently in different choice settings. One important determinant of cognitive resource use is familiarity of the decision. If people are making choices that they make regularly, they are more likely to use a habitual system that does not "model" the broader implications of their choice; if people face a new choice setting, they are more likely to think through, or model, the implications of the alternatives they face. Given the frequency of food choice, this suggests that many people may rely on habitual cognitive processes when choosing foods, which likely omits from consideration the delayed health implications of food alternatives faced during the decision process. Therefore, in chapter 1 of this thesis, we examine how the active consideration of health outcomes when making a choice and individuals' discount rates—representing intertemporal preferences—relate to the nutritional quality of food choice. We study this novel question of active consideration of health outcomes using a sample of 500 US residents in an online food choice task featuring products in cereals, bread, and cracker categories. We find that active consideration of health outcomes leads people to choose foods with higher nutrition value than those who do not consider the health implications of food choices (while controlling for discount rates). We also find that participants who discounted the future less chose foods with higher nutritional quality compared to impatient participants.

In a study by Read et al. (2017), the authors found that making someone aware of future opportunity costs of choosing immediate rewards during a decision led to more patient choices. Participants were more willing to wait for future rewards when the opportunity cost of smaller, sooner rewards (that is, that the participant would receive $0 in the future) was highlighted. On

the other hand, there was no effect on choices when the larger, later opportunity cost (that the participant would receive $0 now) was highlighted. Highlighting future opportunity costs increased consideration of the opportunity costs of both choices, hence increased patience. While Read et al. (2017) used data from a common, but abstract intertemporal choice experiment, research in real-world settings shows that interventions that recruit attention to a choice or action can have positive impacts. For instance, evidence shows that sending reminders via text messages increases gym attendance and has an effect that lasts post-intervention (Calzolari & Nardotto, 2017; Habla & Muller, 2021). People who were given questions in a survey regarding overdraft fees were less likely to accrue overdraft fees in the future (Stango & Zinman, 2014). Interventions during choice may be a tool to help individuals think through the implications of choices today and in the long run and hence better incorporate future impacts. Hence, we build on the findings of chapter 1 to evaluate how intervention such as health prompts during choice may increase the likelihood that participants actively consider health implications during choice.

In chapter 2, we investigate the impact of a prompt message that draws attention to health outcomes of an under-consumed nutrient of public health concern: dietary fiber. We examine the impact of exposure to this message on intertemporal preferences elicited by a standard intertemporal choice task and on active consideration of health impacts of food choices to identify pathways to promote healthier behaviors. We find that the health prompt message increased the consideration of health outcomes but did not affect intertemporal preferences; additionally, as in chapter 1, we found that active consideration of health outcomes led to healthier choices. Our findings suggests that health prompts help people to think through choices by drawing attention to opportunity costs of their choices.

CHAPTER 2. THE IMPACT OF ACTIVE CONSIDERATION OF HEALTH OUTCOMES AND INTERTEMPORAL PREFERENCES ON NUTRITIONAL QUALITY OF FOOD CHOICES

Abstract

Understanding individuals' food choices in the US (and, increasingly, worldwide) is critical to addressing the public health epidemic of obesity and other health problems related to low-quality diets. While a robust literature documents relationships between discount rates and BMI, we examine a novel question: how does active consideration of food choices' short- and long-term health impacts affect the nutritional quality of food choices? We jointly examine how the active consideration of health during choice and individuals' discount rates relate to the nutritional quality of food choice. People are faced with myriad product options when making food choices. The complexity of choice environments may crowd out consideration of opportunity costs such as immediate or long-term future health impacts of the foods being evaluated. In addition to the complexity of many options, food choices tend to become habitual, which reduces cognitive effort invested in considering the opportunity costs of their choices. Thus, even if people have clear intertemporal preferences, those preferences may not be expressed if individuals do not consider the outcomes occurring in the future. We study the novel question of active consideration of health impacts using a sample of 500 US residents. Participants made food choices in three categories—cereals, bread, and crackers. After completing the food choices, they answered questions about factors they had considered during food choice—including health, responded to a series of intertemporal choice questions, which were used to capture how they discount the future, and provided information about demographic characteristics. Our results show that participants who actively consider health outcomes choose products with higher

nutritional quality compared to those who do not consider the health impacts of choices, while controlling for discount rates. Additionally, we find that the more patient participants selected foods with higher nutritional quality compared to the least patient participants, in line with previous literature. These findings suggest that active consideration of the health consequences during food choice explains additional variation nutritional quality of choices beyond intertemporal preferences.

2.1. Introduction

Low-quality diet is one of the leading causes of overweight and obesity and an important contributor to recent decreases in life expectancy in the U.S (Mehta et al., 2020; Murray, 2013; Popkin & Ng, 2022; Preston et al., 2018). The availability of convenient unhealthy food has contributed to the epidemic of low-quality diets among Americans (Bodor et al., 2008, 2010; Chandon & Wansink, 2012; Maddock, 2004; Rose et al., 2010). Consumers face many highly processed, energy-dense foods (Farley et al., 2010; Popkin, 2006) resulting in Americans consuming more calories, sugar, saturated fat, sodium, refined grains, and animal proteins than the amounts recommended for a healthy diet while under-consuming critical nutrients such as dietary fiber, vitamin D, calcium, and potassium (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). Diet-related diseases, such as diabetes, cancer, cardiovascular diseases, respiratory disorders, mental disorders, and gastrointestinal diseases such as non-alcoholic fatty liver, inflammatory bowel syndrome, and gastric cancer, are widespread in the U.S (Camilleri et al., 2017; Centers for Disease Control and Prevention, 2020). These diseases impose enormous costs on individuals, healthcare systems, and society at large (Barlow et al., 2016; World Health Organization, 2022).

Given the well-established links between diet and health, it is somewhat of a puzzle that a large proportion of people continue to eat low-quality diets. One potential explanation is that eating poorly largely imposes costs in the future. A broad literature on intertemporal preferences examines how people trade off benefits and costs occurring at different times, resulting in estimates of how people discount the future. Individuals' discount rates influence decisions that have consequences at multiple time points. An individual who discounts the future heavily will be relatively less likely to make decisions that promote future wellbeing.

The discount rate has been used to predict behaviors that have implications for people's long-term health and wellbeing, such as saving habits or health decisions like food choices and exercise (Chabris et al., 2008; Rung et al., 2018). Empirical research shows that individuals who discount the future heavily are more likely to be obese than those who are more patient (Courtemanche et al., 2015; Dassen et al., 2015; de Oliveira et al., 2016; Garza et al., 2013; Zhang & Rashad, 2008). People who heavily discount the future are less likely to use label information and more likely to consume lower quality foods, more fast food, high sugar foods, and engage in overnight eating (Bickel et al., 2021). A study of women with overweight and obesity found that those who highly discounted the future had greater energy intake when eating away-from-home and ready-to-eat foods (Appelhans et al., 2012). In a systematic literature review on time discounting, obesity, and unhealthy diets, (Barlow et al., 2016) note that most studies find that individuals with higher discount rates are more likely to be overweight/obesity and consume unhealthy diets.

Models of intertemporal preferences assume that people weigh the (discounted) values of options occurring at different points in time. Increasing evidence, however, shows that limited attention is common in decision-making and extends to consideration of the consequences of choices. (Read et al., 2017) show that people pay less attention to future opportunity costs of choices than to current opportunity costs. In the domain of food choices, this may mean that future health implications of different foods that the individual is considering are more likely to be overlooked than immediate opportunity costs, such as the foregone satisfaction of not eating a favored food now.

For a consumer to make a food choice that balances current and future costs and benefits of food consumption, health outcomes must be considered during the choice process, which

requires cognitive effort (Dayan, 2009). In food choice, taste attributes appear to be more naturally and quickly integrated during decision-making than health attributes (Hare et al., 2011; Sullivan et al., 2015). The basic elements of the human decision-making process involve goal-oriented learning, habitual control, and, particularly important for food choice, Pavlovian learning—automatic responses by the body to a specific stimulus, such as initiating saliva production when exposed to foods (Rangel, 2013). Both habitual control and Pavlovian learning do not employ significant cognitive resources during choice, making them efficient when making choices in familiar settings; however, the habitual and Pavlovian choice systems disregard future outcomes (Rangel, 2013). A consumer must actively model expected future outcomes in order for the goal-oriented system to generate a value that balances both immediate and delayed outcomes. Cognitive effort is required to weigh tradeoffs between immediate rewards of food such as tastes and satisfaction against the immediate and delayed physiological impacts—both positive and negative—of food consumption (Rangel, 2013).

Habitual processes can come to yield healthy eating patterns if individuals tend to make decisions that reflect future consideration. Consideration of future consequences (CFC) scales have been widely used to study the likelihood that individuals consider the future when making intertemporal choices. In a meta-analysis of findings from studies that measure individuals' tendencies to consider the future and correlate those tendencies with a variety of health behaviors, (Kooij et al., 2018) document that individuals who tend to consider the future are significantly more likely to make choices that promote the long-term wellbeing of the individual in a variety of domains, including physical health and savings.

We are aware of only one paper that seeks to integrate intertemporal preferences with consideration of the future. Bartels & Urminsky (2015)investigated how both awareness and

discounting of the future interact to influence choices with intertemporal consequences. In a series of analyses, the authors examined the effect that tendencies to consider future consequences, using the CFC, has on participants' spending habits while also studying the influence that valuing immediate and future consequences has on spending. The findings show that awareness and valuation of future outcomes reduce spending.

In this paper, we study the contribution of active consideration of short and/or long-term health consequences during food choice and intertemporal preferences elicited via a standard intertemporal financial choice task to the nutritional quality of foods chosen in a hypothetical food choice experiment. We hypothesize that both actively considering health outcomes and being more patient lead to more nutritious food choices. If active consideration of health—beyond stable, inter-temporal preferences—is an important contributor to the nutritional quality of food choices, it may open new pathways for promoting healthier choices.

2.2. Methods

2.2.1. Data collection

We conducted an online survey with 500 US adults (≥19 years old) in August 2021. The survey was developed in Qualtrics (www.qualtrics.com) and distributed via Prolific (www.prolific.co), an online survey recruitment platform. The survey consisted of a hypothetical food choice task, some questions about information individuals used and broader considerations made during food choice, and standard demographic questions. The food choice task was developed to incorporate elements of real-world grocery shopping experiences, including large assortments of products and the opportunity for participants to choose to view all available products or to direct their attention to a subset of products during choice. Participants made choices among three product categories: cereals, bread, and crackers. Each product category

featured 33 distinct options. At the beginning of the survey, participants were exposed to a cheap talk script directing them to imagine they were making real choices that would result in spending real money. The use of cheap talk scripts has been shown to reduce hypothetical bias (Penn & Hu, 2018). Participants received $1.85 for their participation. Based on the amount of time it took participants to complete the survey, this payment yielded an hourly compensation rate of just under $19/hour. Participation criteria were that individuals had to be at least 19 years of age and residents of the US. The study was approved by the researchers' university's institutional review board. All participants provided informed consent before participating in the experiment and were given the option to terminate their participation at any time during the study.

For the design of the experiment, participants viewed cereal, bread, and cracker product categories sequentially. In each product category, there were 33 products to choose from. As in real-world physical and online retail settings, participants could direct their attention to subsets of products. In this experiment, participants could choose to view subsets of the products or all the available products. The products constituted a range of less healthy to healthy options and the subsets used this structure to group products into three sets of 11 items. While not displayed to participants, we use the Guiding Stars (GS) nutritional rating system (*Guiding Stars*, 2022), which rates products based on nutrient content from 0 (low nutritional quality) to 3 (high nutritional quality) stars, as a measure of overall nutritional quality of the choices participants made. The GS system was also used to determine the cutoff points for assigning products to the subsets. One subset had products that received 0 GS, a second had 1 GS, and the third had products with 2 or 3 GS. The system of GS calculates a product's score based on food attributes such as vitamins, minerals, fiber, whole grains, omega-3 fatty acids, saturated fat, trans fat, added sodium, added sugars, and artificial colors present in a product (*Guiding Stars*, 2022). For

instance, in the bread category, one category contained predominantly white breads, while whole-grain bread with moderate dietary fiber content was in a second set, and high fiber whole-grain bread was in a third set (though, again, the subsets were determined by GS ratings). After choosing the set of products they wanted to view in a product category, the participant then made a product selection. Participants could also indicate that they would not choose any of the available products.

The cereal, cracker, and bread products in the experiment are widely available in grocery stores across the US. All the products had a selection of per-serving nutrition information that is provided on nutrition facts panels in the US displayed below them. Figure 1 provides a screenshot of the experiment showing the way products and nutrition information were presented.

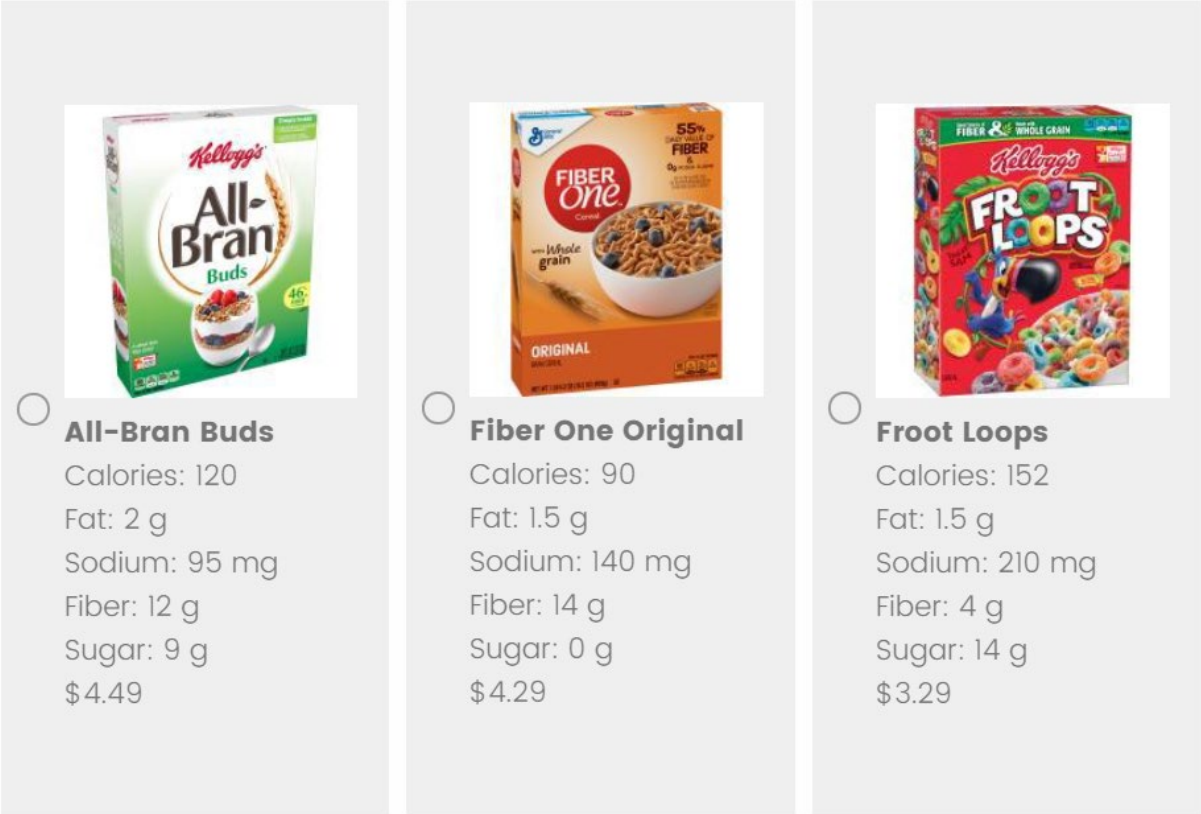

Figure 1: A screenshot of the presentation of ready-to-eat cereal products in the food choice experiment.

After choosing products, participants answered a series of questions about choice considerations, intertemporal choice questions, and demographic questions. We take a different approach than Bartels & Urminsky (2015)'s use of the CFC to document consideration of the future because the CFC may overlook fine-grained temporal variation in future consideration. Rather than use a scale about tendencies, we directly asked about broader considerations that participants had actively thought about during the choice process. We do this because evidence shows that cognitive processes can be influenced by external forces. For instance, hunger has been found to influence food choices for both immediate and future consumption (Lozano et al., 1999). Consideration of the opportunity costs of immediate rewards can be prompted by a simple change in the presentation of the choice, making participants more likely to choose larger, delayed rewards (Read et al., 2017). The choice consideration question was, "*In general, which of the following did you consider when making food choices today*?" A variety of options were presented, including taste and price, among others, but the considerations of interest were: "*The impact the foods might have on your/your family's health in the future" and "The impact of the foods on your/your family's current health.*" We chose to elicit information about what participants considered during the choice process directly after they had made all of their choices to avoid influencing the food choice process (Morris et al., 2021). We then created a categorical variable that captured whether a participant reported considering 1) current, 2) future, 3) current and future health implications, or 4) did not consider health.

To create a measure of how individuals trade off immediate versus future benefits, participants answered four intertemporal choice questions. Participants were asked to imagine choosing to receive an immediate payment of $1000 or $1200 in one month. If they chose the immediate payment of $1000, they were then asked to choose between a payment of $1000 today

or $1300 in a month. If they again chose $1000 immediately, they next chose between $1000 immediately or $1400 in one month. If they still chose $1000 immediately, the final intertemporal choice question asked them to indicate the amount they would need to receive to wait for a month rather than receive a payment of $1000 today. In those choices, they had an option of choosing "I don't know." For the discount rates responses, we categorized participants based on their relative degree of patience. Participants who chose $1200 in one month were classified as "patient," $1300 as "somewhat patient," $1400 as "somewhat impatient," and those who required an amount greater than $1400 to wait a month for a larger amount as "impatient."

2.2. Data analysis

We conducted the analysis using R Studio (R Core Team, 2021). We created a panel dataset of the choices that every participant made in each of the three food categories. The panel dataset of choices included 1500 observations from 500 participants. The outcome variable of interest is the GS rating of the products that individuals chose. We use GS as the dependent variable in a linear regression. The independent variables were 1) current health consideration, future health consideration, or both current and future health consideration, and 2) discount rates. We examine the impact of these target independent variables on GS separately and together, resulting in three sets of regressions. We additionally performed a robustness check on our results by repeating these regressions with the inclusion of demographic questions: sex, age, income, and education. We conducted cluster robust standard errors at the individual level using the lmtest package (Zeileis & Hothorn, 2002).

The simple version of the regression model (not including demographic characteristics) is as follows:

$$GS_{ij} = \beta_0 + \beta_1 (Ch_i) + \beta_2(fh_i) + \beta_3 (Ch_i)x (fh_i) + \beta_4(D_i) + \in_{ij},$$

Where GS_{ij} is the number of Guiding Stars chosen by individual i for product j, (fh_i) is future health consideration by individual i, (Ch_i) is current health consideration by individual i, (D_i) is the discount rate category for individual i, and $\in_{ij}$ is the error term. For the analyses, we consider p-values < 0.05 to be statistically significant.

2.3. Results

Table 1 summarizes the demographic characteristics we used in our regression. The average household income of participants was just over 74,000 dollars. Over 70% of participants identified as female and about 56% had completed bachelor's degrees. The average of participants was about 29 years old. About 30% of participants actively considered future health outcomes and 77% exhibited patient behavior during intertemporal monetary preferences task.

Table 1. Summary statistics (N=500)

Variables	Mean	SD
Female (%)	72.90	0.44
Age (years)	29.00	8.97
Education (%):		
Advanced degree (Master's level or higher)	27.00	0.45
Bachelor's degree	29.00	0.45
Associate degree or some college	27.00	0.44
High school/G.E.D.	16.00	0.37
Less than high school	1.00	0.09
Income ($)	74080.00	52364.00
Current health consideration (%)	17.40	
Future health consideration (%)	8.00	
Both heath consideration (%)	21.80	
Patient (%)	77.00	
Somewhat patient (%)	5.40	
Somewhat impatient (%)	6.00	
Impatient (%)	11.60	

Notes: Data from Prolific survey. N=500.

Table 2 presents the results of four regression models examining the influence of consideration of current and future health outcomes and discounting behaviors on the nutritional quality of food choices.

Table 2. Linear regression model for the nutritional content measured in Guiding stars (GS)

	Guiding stars			
	(1)	(2)	(3)	(4)
Both health consideration	0.596***	0.604***	0.559***	0.559***
	(0.061)	(0.061)	(0.063)	(0.062)
Current health consideration	0.438***	0.468***	0.375***	0.396***
	(0.065)	(0.065)	(0.066)	(0.066)
Future health consideration	0.455***	0.480***	0.355***	0.365***
	(0.091)	(0.091)	(0.094)	(0.093)
Patient		0.195***		0.291***
		(0.072)		(0.077)
Somewhat Patient		-0.114		-0.008
		(0.107)		(0.122)
Somewhat Impatient		-0.076		-0.025
		(0.109)		(0.112
Age			0.007**	0.010***
			(0.003)	(0.003)
Female			0.062	0.015
			(0.059)	(0.058)
Income			0.031**	0.026*
			(0.014)	(0.014)
Advanced degree (Master's level or higher)			0.319*	0.327*
			(0.182)	(0.180)
Bachelor's degree			0.244	0.247
			(0.179)	(0.177)
Associate degree/some college			0.283	0.266
			(0.181)	(0.178)
High school/G.E.D.			0.114	0.126
			(0.181)	(0.178)
Constant	0.633***	0.486***	0.064	-0.197
	(0.030)	(0.071)	(0.200)	(0.218)
Observations	1,437	1,437	1,418	1,418
R2	0.083	0.096	0.099	0.114
Adjusted R2	0.081	0.092	0.092	0.106

Notes: ***=<0.001; **=<0.01; *=<0.05. Data from Prolific survey.

The first regression only includes consideration of current health, future health, and both current and future health. Consideration of future health, current health, and both current and future health are all statistically significant. Participants who considered current health outcomes, future health outcomes, and both current and future health outcomes selected products with 0.438, 0.455, and 0.596 more GS per product, respectively, than those who did not consider health outcomes. Estimates of consideration of health outcomes change little and remain significant when we control for demographic characteristics (column 3).

Analyses reported in column (2) and (4) incorporate both health consideration and discounting rates with and without demographic controls. Without demographic control variables (column 3), current health consideration, future health consideration, both current and future consideration and patient individuals chose significantly more GS. Those who considered current health outcomes, future health outcomes, and both current and future health outcomes selected products with 0.468, 0.480, and 0.604 more GS per product, respectively, than those who did not consider health outcomes during food choice. Patient individuals chose nearly 0.2 additional GS per product than impatient individuals. When controlling for demographic characteristics, future health consideration, current health consideration, and both current and future consideration were statistically significant with estimated coefficients of 0.396, 0.365, and 0.559. Additionally, individuals who were patient chose products with significantly more GS (0.283).

Age was significant across all three regressions that include demographic characteristics. With an additional year of age, participants chose more GS per product. In addition, income was significant, consistent, and positively related to GS. Participants with an advanced degree (master's level or higher) consistently selected products with more GS compared to participants with less than high school.

2.4. Discussion

The results of this study show that people who actively consider short or long-term health implications during food choice select more nutritious foods compared to those who do not, even while controlling for intertemporal preferences and demographic characteristics. Our findings show that intertemporal preferences alone do not sufficiently explain behaviors that have effects occurring at multiple time points. In fact, actively considering health outcomes led to a larger increase in GS of chosen products than being patient in intertemporal choice tasks, relative to being impatient.

Evaluating the impact of actively considering health consequences and discounting of future outcomes on food choices has relevance for health promotion interventions and policy formation. Despite the implementation of multiple policies meant to promote more nutritious food choices over the past thirty years in the US—such as the nutrition facts panel and restaurant calorie labeling, evidence suggests that these policies have had little impact on food choices. Studies show that nutrition information on food packages and calorie labeling in restaurants do not markedly change the nutritional quality of foods chosen on average (Berry et al., 2019; Dumanovsky et al., 2011; Krukowski et al., 2006; Swartz et al., 2011; Variyam, 2008), though there are individual differences in the use of nutrition information (Christoph et al., 2018; Grunert et al., 2010). Christoph et al. (2018) found that nutritional use of information was higher among participants who were concerned with their weight, those with higher education and income, and women. They most frequently looked at total calories, sugars, and serving size. Those who used nutrition facts reported healthier dietary behaviors such as higher vegetable intake, fewer added sugars, and less frequent fast-food consumption. Individuals motivated by health concerns are more likely to use nutrition information. However, most of the evidence

focuses on differences in behavior explained by stable traits, such as health motivation and consideration of future consequences, which are difficult to change via simple interventions.

The CFC has been found measure traits that are stable across time that may be complex to change in order to shift individuals' choices (Strathman et al., 1994). Our results suggest a promising approach that does permit influencing intertemporal food preferences through instantaneous health consideration. Choice-scenario specific consideration of health outcomes is subject to influence by external factors. People may be prompted to actively incorporate health consideration in instantaneous decision making through episodic future thinking and health prompts at the point of purchase (Daniel et al., 2013b; Gustafson & Rose, 2022).

Some studies suggest that episodic future thinking can help individuals consider future outcomes during decision-making. Daniel et al., (2013a) found that episodic future thinking helped reduce how much people discount their future. They analyzed 26 overweight or obese participants' episodic thinking to evaluate the anticipation of future events during a delay-discounting task and an *ad libitum* eating task to stimulate impulsive eating. Episodic future thinking influenced participants to reduce their discounting and to choose healthier foods during the experiment compared to the control group. This research supports our findings that thinking about health outcomes could promote healthier eating patterns. However, our findings show that more patient individuals and consideration of health outcomes contribute to more nutritious choices, suggesting that the healthier choices they make may result from a combination of increased patience and consideration of the future. Daniel et al. (2013b) also found a similar effect of episodic future thinking to reduce impulsive eating patterns in a study of obese and lean (average weight) individuals resulting in less calorie consumption in both groups.

Literature on attention-targeting interventions suggest a role for scenario-specific influences on choice. In an fMRI study, Hare et al. (2011) found that simple cues directing attention toward health during food choice changed neural activation patterns—suggesting choice scenario-specific variation in the processing of food attributes—and led to healthier decisions. Research in physical and online retail settings on prime or prompt messages delivered at the point of decision find that these interventions promote healthier choices (Arslain et al., 2020; Gustafson et al., 2018; Papies et al., 2014). Evidence suggests that these point-of-decision interventions change the sets of products that people consider and increase the likelihood that they use nutrition information during choice (Arslain et al., 2021a). These studies have not directly examined whether prompts or primes increase attention to health impacts of food choices, though increased attention to nutrition information suggests that it likely does. In a recent paper, Gustafson (2022) finds that consideration of future health impacts leads people to choose significantly healthier foods. The results also show that a simple health message increased the likelihood that participants considered long-term health impacts of foods, suggesting that attention can be influenced to promote healthy decisions (Gustafson 2022).

We additionally find relationships between demographic characteristics and choices that reflect patterns found in previous studies. First, we find that people with higher incomes choose foods with greater nutritional quality. These findings are consistent with the work of Robinson et al. (2022) found that high earners are more likely to consume healthy foods than people with low income, which may reflect beliefs that eating healthy is expensive and time consuming (Andajani-Sutjahjo et al., 2004; Lappalainen et al., 1997; Ross & Melzer, 2016)discouraging low-income earners from considering healthy foods. Education levels also consistently relate to

choices. Lower education levels (high school/GED and less) are negatively related to GS. Robinson et al. (2022) found that people with low education levels are more likely to consume low-quality diets and live with obesity.

Our study has some limitations we plan to address in future research. First, the study featured hypothetical choices—participants did not receive what they chose or spend real money. We used a cheap-talk script to address concerns about biases resulting from hypothetical decisions. The cheap-talk script has been found to minimize hypothetical bias in a meta-analysis of techniques to address hypothetical biases in consumer studies (Penn & Hu, 2018). Second, we directly elicited participants' responses about active consideration of various elements during the choice process—with consideration of current and future health as the elements of interest—potentially making a main independent variable subject to social desirability bias (Grimm, 2010). While prior research has used the CFC scale to measure tendencies to consider the future, these scales are intended to be a stable measure. Given our desire to examine choice-specific consideration, we chose to use retrospective reporting of consideration, which has been used in other setting in which researchers need to avoid influencing subsequent choices (Gustafson & Rose, 2022; Morris et al., 2021). While we envisioned our approach as measuring choice-scenario specific consideration, we do not directly compare our approach with the measure we would have obtained with the CFC, preventing a comparison of the two approaches.

Finally, policies intended to prompt or prime consumers to actively consider future outcomes may help consumers consider the health implications of their food choices. However, the results in this paper are merely cross-sectional. It may be that individuals who care more about their health are more likely to consider the impact of choices on health. Gustafson (2022) found that a health education prompt increased the likelihood that participants considered future

health and made healthier choices, though that study did not account for time preferences. Additional research is needed to examine whether interventions can successfully promote consideration of health outcomes.

Our results suggest that active consideration of the opportunity costs of decisions is an essential driver of healthy choices. A growing body of evidence shows that prompting or priming individuals to consider health during food choices leads people to purchase significantly more nutritional food products (Arslain et al., 2020, 2021b; Gustafson et al., 2018; Papies et al., 2014). (Gustafson, 2022) finds that people exposed to a fiber health prompt were significantly more likely to consider future health impacts during food choices. Our results suggest that recruiting attention to health impacts of food choices is likely an important driver of the health impacts of prompts. However, further research is needed to study how health prompts can most effectively orient people to think about health implications at the point of purchase to improve the nutritional quality of food choices. Health information at the point of purchase could help consumers to use a goal-directed system over the Pavlovian and habitual systems that disregard future outcomes (Rangel, 2013). Our findings suggest that active consideration of health outcomes is an important pathway for choosing higher-quality diets and may provide an opportunity for targeted interventions to promote healthier consumption, even when accounting for individuals' intertemporal preferences, showing that there are two important elements to decisions that promote long-term wellbeing. First, individuals must value the future. Second—and more importantly in our results—individuals must actively consider the impacts that their choices will have in the future.

CHAPTER 3. PREFERENCE OR ATTENTION? HOW HEALTH PROMPTS AFFECT DECISION-MAKING DURING FOOD CHOICE

Abstract

A host of problems beset many in modern societies—from poor health stemming from decisions related to diet, exercise, and smoking, to insufficient savings for retirement. While intertemporal preferences—fundamental, reasoned decisions to trade-off benefits at different points in time—have been used to explain these choices, a recent literature proposes a separate driver: inattention to implications, or opportunity costs, of the options faced. Frequently repeated decisions, such as choosing what to eat, may lead people to conserve cognitive decision-making resources by relying on habit rather than careful deliberation about alternative options. This literature finds that both preferences that do not discount future benefits greatly and attention to opportunity costs predict decisions that provide for a healthier future. Attention, in particular, may provide an opportunity to intervene in the decision process to promote healthier decisions. However, the current evidence has not examined this question in depth. In this study, we test whether a simple message that highlights a health-related opportunity cost of food options increases the healthiness of food choices and examine whether the message changes attention or intertemporal preferences. Corroborating previous findings, results show that actively considering health outcomes and having more patient intertemporal preferences lead to healthier food choices. Second, we find that the simple messaging increases the consideration of health outcomes during food choice but do not affect intertemporal preferences, suggesting that simple prompts may be an effective way to promote decisions that balance short and long-term preferences by drawing attention to potentially overlooked opportunity costs of choices.

3.1. Introduction

Numerous frequent, seemingly minor choices can have important impacts on our lives. Choices about diet and exercise, whether to spend money on a desired item of clothing, or studying versus watching an extra episode of a favorite show seem insignificant on the surface, but making the same "insignificant" decision repeatedly may determine whether we are healthy later in life, have enough money for retirement, or achieve the academic degree that we desire. Individuals may fail to weigh the immediate and future costs and benefits of their repetitive seemingly trivial choices (Read et al., 2017). People are likely to pay less attention to small, daily decisions compared to choices we make a few times, such as buying a house or a car. Nevertheless, these small, daily choices influence important, long-term outcomes. For instance, an individual who chooses to binge watch and eat fast foods may enjoy those choices but regret those decisions if they experience being obese and hence become susceptible to high bodyweight-related diseases in the long run. Unhealthy food choices, infrequent physical activity, and low savings levels have consequences today and in the long term for individuals.

Although people are aware of the benefits of eating healthy, exercising, and saving for the future, individuals continue to save less, eat poor diets, and exercise less on average. One reason for this behavior may be the failure to weigh the benefits and costs of the various options the individual faces because consideration requires additional cognitive resources to model the future impacts of the options (Rangel, 2013). In an experimental study that manipulated the opportunity cost of a choice, the authors found that participants paid less attention to decision-making and hence failed to consider the implication of those decisions (Read et al., 2017).

In context-rich settings, psychologists have developed and employed the consideration of future consequences scale (CFC) to study differences in decision outcomes. The CFC has been

widely used to study people's tendency to consider the future impacts of decisions when making choices. A systematic review and meta-analysis of research using tools such as the CFC found that future-oriented individuals are more likely to make decisions that are beneficial in the long run, such as exercising, saving more for retirement, and obtaining higher levels of education (Kooij et al., 2018). Future orientation is causally related to healthy behaviors such as physical activity (Hall & Fong, 2003). The CFC was designed to test a stable trait within an individual across time (Strathman et al., 1995). A longitudinal study found CFC scores to be stable over the medium term—such as a year—but variable over longer time periods (Toepoel, 2010).

While the CFC was developed to measure individuals' stable tendencies to take the future into account, there is evidence that external factors influence cognitive processes. In the realm of health, for instance, research shows that hunger influences food choices for immediate and future consumption (Lozano et al., 1999; Read & van Leeuwen, 1998). Simple reminders increase gym attendance, an effect that lasts beyond the end of the intervention (Calzolari & Nardotto, 2017; Habla & Muller, 2021). In financial decisions, people who were exposed to questions about overdraft fees on surveys were found to be less likely to accrue overdraft fees over multiple years (Stango & Zinman, 2014). Future-oriented people are more likely to delay spending immediately and save for future expenditures (Gärling et al., 2009; Frederick & Loewenstein, 2002). Therefore, external factors that recruit attention towards specific elements of choices may provide a tool to use in various choices domains with implications for wellbeing across time.

Food choice is a critical determinant of long-term outcomes. Diet-related diseases are a primary contributing factor to the decrease in life expectancy and quality of life in the US in recent years (Elizabeth et al., 2020; Mehta et al., 2020; Murray, 2013; Preston et al., 2018), and significantly impact health globally (The GBD 2015 Obesity Collaborators, 2017). The food

choice process is complex, yet it is a daily decision individuals make. Over the past decades, there has been an increase in nutrition information and calorie labeling, but the obesity rate continues to rise. Studies find that nutrition information is ineffective in changing people's choices towards healthier choices. In a review of environmental nutrition interventions at the point-of-purchase, Seymour (2004) recommends using interventions beyond food labeling. Individuals find healthy eating challenging to achieve because it requires time and psychological effort to sustain healthy eating habits (Lappalainen et al., 1997). Studies recommend that health promotion campaigns should not only focus on providing nutrition information but also show that healthy eating is achievable, not time-consuming, and does not exclude eating favorite foods (Andajani-Sutjahjo et al., 2004; Lappalainen et al., 1997; Ross & Melzer, 2016). That is why interventions at the point of purchase beyond calorie labeling may help to stimulate thinking through choices during decision making (Zepeda & Deal, 2008).

In a systematic review of factors influencing consumers' perception and decision-making process on the choice of healthier foods, Ogundijo et al. (2022) found healthiness of the food, experience, price, socio-economic position, emotion, availability, and promotion information or messages play a role in influencing food choices. Our study focuses on the ability of exogenous interventions to recruit attention to health outcomes, hence improving overall nutrition quality. A few studies examine interventions that nudge consumers to cognitively think through their choices amidst alternatives without imposing restrictions. For instance, in a systemic review by Soler et al. (2010), the use of point-of-decision prompts in a choice between taking the stairs and using an elevator/escalator was found to significantly increase the use of stairs. The point-of-decision prompts placed near stairs/elevators were "walking upstairs burns almost five times more calories than riding an elevator. Take the stairs", "improve your waistline, use the stairs,"

and "your heart needs exercise, use the stairs" and footprints. In the case of food choice, research done in online and physical food retail settings of prime or prompt messages presented at the point of decision was found to increase healthier choices (Arslain et al., 2020; Gustafson et al., 2018; Papies et al., 2014).

Previous studies found that actively considering the health implications of food choices lead to significantly healthier choices (Gustafson, 2022; Tuyizere and Gustafson, 2022). Also, Gustafson (2022) found that exposure to health prompts during choice increases the likelihood of considering health outcomes. However, the study did not examine intertemporal preferences during choice. On the other hand, Tuyizere and Gustafson (2022) found that both active consideration of health during choice and discounting the future less led to healthier choices. This study, though, was cross sectional and therefore could not attribute causality to these relationships. Thus, in this study, we examine whether simple health prompts presented at the point of decision, which highlight health benefits—in this case, of fiber—may increase active consideration of health impacts of foods considered during the choice process. We examine the effect of the prompt in an online food choice experiment along with an intertemporal financial choice task. The health prompt message is for an under-consumed dietary component of public health concern, dietary fiber, which is also not considered by a significant proportion of the population during food choice (Gustafson and Rose, 2022). Benefits of dietary fiber recognized by the FDA are 1) lowering blood glucose, 2) lowering cholesterol levels, 3) lowering blood pressure, 4) increasing frequency of bowel movements, 5) increasing mineral absorption in the intestinal tract, and 6) reducing energy intake (FDA, 2021). If a simple health message increases the proportion of people who actively think about future implications during food choice, it provides a valuable tool for intervention at the point of purchase to increase attention towards

healthier options without imposing restrictions on the unhealthy choice alternatives or altering their discount rates.

3.2. Methods

We conducted an online food choice experiment of 1005 U.S adults (≥19 years old) in August 2021. We developed the survey in Qualtrics (www.qualtrics.com) and distributed it via Prolific (www.prolific.co), an online survey recruitment platform. To participate in the experiment, individuals had to be 19 years of age and living in the U.S. The food choice task included hypothetical food choices in three common food categories: breads, ready-to-eat breakfast cereals, and crackers. Participants also answered questions about attention and cognition during the shopping experience, completed an intertemporal preferences task, in which they made choices among different amounts of money that would be received either immediately or delayed one month, and reported demographic information. In the survey, participants were reminded to consider other, real-world demands on their money when considering the products in the experiment to reduce biases from hypothetical decisions. This is called a cheap talk script, which a meta-analysis has shown to reduce hypothetical bias (Penn & Hu, 2018).

To evaluate the effect of a health prompt on cognitive processes and preferences that promote healthier choices, participants were randomly assigned to one of two conditions: a control condition or a prompt condition. In the control condition, participants did not receive a health prompt message; however, all other instructions and questions were identical between the conditions. The health message displayed to participants in the prompt condition was: *"How can dietary fiber help you reach your health goals? While some benefits of fiber consumption are well known, dietary fiber has a number of surprising benefits. Benefits that are not widely known include that dietary fiber: (1) Reduces energy intake (by, for example, promoting feelings of*

fullness), which helps with weight loss (2) Lowers blood pressure (3) Increases absorption of important minerals (4) Lowers blood glucose (5) Lowers cholesterol levels. Choosing products with higher dietary fiber can help you meet your health goals!"

Participants viewed cereal, bread, and cracker product categories sequentially. Participants faced 33 product alternatives in each product category. Just as in real-world retail settings—both in-store and online—participants had the ability to direct their attention to products, potentially resulting in incomplete consideration of the full set of available products. In each product category, participants could view all available products, or they could choose to view one of three product subsets, each containing 11 items.

Products were selected for inclusion in the experiment based on being broadly available, well-known products, as well as to provide products representing the breadth of nutritional quality available in the market. Subsets were inspired by sets observed in real-world retail settings (see figure 2 in Arslain et al. (2020)). In each product category, the three sets of 11 items were categorized based on the Guiding Stars (GS) nutrition rating system. The GS rating system calculates a score for each product based on dietary components such as added sugars, added sodium, saturated fat, trans fat, vitamins, minerals, fiber, whole grains, omega-3, vitamins, and artificial colors contained in a product (see more information about the calculation of product scores at www.guidingstars.com). The GS system rates products from 0 (low nutritional quality) to 3 (high nutritional quality) stars. The three subsets in each product category separated products into those with 1) zero GS, 2) one GS, and 3) two or three GS. The GS rating was not displayed to participants in the experiment; it was only used to represent the nutritional quality of the products.

To collect data on factors that participants actively considered during the choice process, they answered a question after they had made all food choices. This question was, "*In general, which of the following did you consider when making food choices today*?" Responses to this question were a check-all-that-apply format. The data of interest were captured by participants' responses to the following items: "*the impact the foods might have on your/your family's health in the future"* and *"the impact of the foods on your/your family's current health."* Other items were included as decoys to mask the true items of interest. Finally, participants answered questions about intertemporal preferences, and demographic variables. To make sure that participants were paying attention, we asked a question in which participants were asked to mark "Added Sugar" from a list of six options. Five participants who did not mark "Added sugar" were excluded from the analysis.

We conducted the analysis using R Studio (R Core Team, 2021). We created a panel dataset of the choices that every participant made, resulting in three rows per participant—one row for each food category. To examine the impact of prompt to bring attention to active consideration of health outcomes, we conducted two multinomial logistic regressions to examine the impact of prompt on active consideration of health and discount rate categories with and without demographic variables. These models (not including demographic characteristics) are as follows:

$$AC_i = \beta_0 + \beta_1 (P_i) + \in_{ij},$$

$$D_i = \beta_0 + \beta_1 (P_i) + \in_{ij}$$

Where AC_i is active consideration of health outcomes by individual i, D_i is the discount rate category for individual i, P_i is health prompt exposure by individual i and $\in_{ij}$ is the error term

Next, we conducted linear regression model of GS on consideration of health impacts, discounting, and prompts with and without demographic variables (sex, age, income, and education). We incorporate cluster robust standard errors at the individual level using the lmtest package

The simple version of the linear regression model of GS on consideration of health impacts, discounting, and prompt (not including demographic characteristics) is as follows:

$$GS_{ij} = \beta_0 + \beta_1(Ch_i) + \beta_2(Fh_i) + \beta_3(Ch_i)x(Fh_i) + \beta_4(D_i) + \beta_5 P_i + \in_{ij},$$

Where GS_{ij} is the number of Guiding Stars chosen by individual i for product j, Ch_i is current health consideration by individual i, Fh_i is future health consideration variable by individual i, D_i is the discount rate category for individual i, P_i is health prompt exposure by individual i and $\in_{ij}$ is the error term. We report variables at ($P<0.05$) as statistically significant. The study protocol was approved by the university's institutional review board.

3.3. Results

We report summary statistics of the participant sample in Table 1. Over 70% of participants were female. The mean age of participants was just over 29 years. Approximately 56% had completed a bachelor's degree or higher, and the average household income of participants was just over 75,000 dollars.

Table 1. Demographic characteristics of study participants (N=1000).

Variables	Mean	SD
Female (%)	72.9	
Age (years)	29.1	26.0
Education (%):		
Advanced degree (Master's level or higher)	26.1	
Bachelor's degree	30.0	
Associate degree or some college	27.2	
High school/G.E.D.	15.5	
Less than high school	0.7	
Income ($1000s)	75.5	70.0

Notes: data from Prolific survey.

We additionally report summary statistics for the distribution of participants' responses to the survey questions about their consideration of health outcomes and intertemporal preferences in Table 2. Participants who considered only current, only future, or both current and future health outcomes comprised 18.8%, 8.9% and 22.4% of the sample, respectively, while half (49.9%) reported not considering health outcomes. About 76% were always willing to wait one month to receive a higher amount of money, placing them in the patient category, while relatively small percentages of the participants required higher amounts of money to be willing to wait one month to receive the payout.

Table 2. Distribution of participants' responses for consideration of health outcomes and intertemporal monetary preference choice task

Variables	Proportion
Consideration of health outcomes:	
Current	0.188
Future	0.089
Both	0.224
Neither	0.499
Discounting:	
Impatient	0.121
Somewhat impatient	0.054
Somewhat patient	0.063
Patient	0.762

Notes: data from Prolific survey.

We conducted a multinomial logistic regression to examine the impact of the health prompt on consideration of health outcomes (Table 3). The results indicated that the prompt message significantly increased the likelihood that participants actively considered both, current, or future health outcomes compared to none of the health outcomes. This result was consistent with or without the inclusion of demographic control variables.

Table 3: Multinomial regression for the effect of health prompt message on health consideration (reference: Do not consider health outcomes when making food choices).

	Dependent variable:		
	Both	Current	Future
	(1)	(2)	(3)
Health prompt	0.162*	0.258***	0.311**
	(0.093)	(0.099)	(0.133)
Constant	-0.881***	-1.106***	-1.883***
	(0.066)	(0.071)	(0.098)

Note: *=p<0.05; **=p<0.01; ***=p<0.001.

Next, we evaluated whether exposure to the health prompt affected individuals' discount rates. We conducted a multinomial logistic regression of discount rates on the prompt (Table 4).

There was no significant impact of the prompt on the distribution of participants among discounting categories.

Table 4: Multinomial logistic regression for the effect of health prompt message on discount rate categories (reference: Impatient).

	Dependent variable:		
	Somewhat impatient	Somewhat patient	Patient
	(1)	(2)	(3)
Health prompt	-0.306	0.205	-0.101
	(0.190)	(0.181)	(0.113)
Constant	-0.659***	-0.765***	1.893***
	(0.130)	(0.135)	(0.081)

Note: *=p<0.05; **=p<0.01; ***=p<0.001.

Lastly, linear regression was used to determine how consideration of health (both, current, and future), patience level, and health prompt were related to the healthiness of participants' product choices, measured in GS ratings (Table 5). When demographic variables were not included in the model, considering current, future, and both health outcomes led participants to choose products with 0.425, 0.461, and 0.603 more GS per product, respectively, than those who did not consider health outcomes. Patient individuals (those who discount the future less) chose products with 0.133 more GS per product than impatient participants. Participants who received a health prompt message chose more nutritious products, equivalent to 0.142 GS per product, compared to those who were not exposed to the message. Similar results were found when demographic variables were included in the model.

Table 5. Linear regression model for the nutritional content measured in Guiding stars (GS) (5)

	Coef. (SE) (1)	Coef. (SE) (2)
Constant	0.539***	1.040*
	(0.050)	(0.128)
Both health consideration	0.603***	0.565***
	(0.042)	(0.043)
Current health consideration	0.425***	0.381***
	(0.044)	(0.045)
Future health consideration	0.461***	0.398***
	(0.062)	(0.065)
Somewhat impatient	-0.030	0.061
	(0.080)	(0.083)
Somewhat patient	-0.092	-0.038
	(0.075)	(0.079)
Patient	0.133***	0.223***
	(0.048)	(0.053)
Health prompt message	0.142***	0.134***
	(0.033)	(0.033)
Demographic controls	No	Yes
Observations	2,894	2,854
R2	0.092	0.109
Adjusted R2	0.090	0.101

Note: (1) Model does not include demographic controls; (2) Model includes demographic controls; *=p<0.05; **=p<0.01; ***=p<0.001.

3.4. Discussion

Our findings show that exposure to health prompts increased the likelihood that people actively considered health outcomes during food choice, leading them to select foods with higher nutritional quality. Studies have found that people who discount the future more are more likely to eat lower-quality diets and engage in other behaviors that put them at risk for obesity (Appelhans et al., 2012; Barlow et al., 2016; Bickel et al., 2021). We find no direct impact of discounting the future less when exposed to health prompts, which suggests that health prompt messages work by bringing attention to the decision being made, but do not change people's preferences for the temporal distribution of costs and benefits. The finding that simple prompts

do not change intertemporal preferences is consistent with research showing that decreasing an individual's discount rate—so that they are more patient and thus more likely to make choices that provide greater long-term benefits—requires intensive educational interventions (Rung et al., 2018). Therefore, our results reveal that simple efforts that prompt active consideration of health impacts during food choice may be an effective complement to more intensive interventions that aim to alter discount rates. These findings corroborate a recent study showing that attention to a health prompt message increases the consideration of future health impacts (Gustafson, 2022).

Episodic future thinking (EFT) is a concept that has been used in psychology, cognitive development, and child development research to help individuals envision future events so that they actively think through possible future outcomes of choices they face, helping them to establish pathways to attain those outcomes (Atance & O'Neill, 2001; Terrett et al., 2019). EFT helps a person to pre-experience events so that an individual conceptualizes feelings and actions to be taken to achieve their future self's goals. Evidence shows that EFT decreases the tendency to discount delayed gratification in intertemporal choice tasks (Rung & Madden, 2018). Future rewards tend to be devalued, while immediate rewards are likely to be overestimated, leading to shortsighted choices (Schacter et al., 2017). EFT encourages positive health practices in intertemporal choice scenarios (Peters & Büchel, 2010), such as limiting snacking (Dassen et al., 2016), reducing impulsive eating and calorie intake in overweight or obese individuals (Daniel et al., 2013a) and among individuals with varying overweight status (Daniel et al., 2013b), and reducing delinquency by inducing future orientation with a focus on one's ideal self (Wu et al., 2017). Evidence from the literature on EFT support our findings that making decisions that include active consideration of the future impacts of choice alternatives faced now leads to better

choices. While our results suggest that brief, targeted messaging improves the quality of choices, future research may investigate whether EFT combined with interventions prompting active consideration of health outcomes may be even more effective. Combined interventions may help people with obesity or overweight status lose weight by vividly imagining their desired future (EFT) paired with targeted prompts that make this imagined future salient when making their food choices.

Our study found that participants exposed to health prompt messages considered future health impacts more and chose more nutritious food products than those not exposed to prompts. With the rise of technology, it may be used to help people think more about the future implications of their food choices by using health prompt messages about the benefits of food—for instance, sending a message that reminds them of the benefits of fiber or under-consumed nutrients during a time when they are making choices in the store or online. Health professionals may use this concept to send health message reminders to their clients about future impacts or health benefits of foods that may significantly increase their quality eating habits. One study has done educational intervention at the point of purchase using podcasts while grocery shopping (Bangia et al., 2017). The authors found that 173 participants bought more Omega-3-rich seafood items when given podcasts about Omega-3 fatty acids' health benefits, types, and food sources at the point of purchase throughout the 6-month intervention and 6-month post-intervention. Bangia et al. (2017) show that interventions as messages or other interventions highlighting health benefits at the point of purchase may help individuals make healthier choices.

The findings of our study have some broader implications. Identifying active consideration of health outcomes during food choice—and showing that a simple educational prompt can increase active consideration of health—provides further insights into the impact of exogenous

cues in the choice environment. Our interest is in the use of prompts to recruit attention to the health implications of their choices for research and policy practices to tackle obesity-related problems. Studies on prompts have found that exposure to prompts during food choice and physical activity settings increases healthy behaviors (Arslain et al., 2020, 2021, 2021; Gustafson et al., 2018; Milliron et al., 2012; Papies et al., 2014). Related research found that sending reminders to gym members increases attendance and has effects that last beyond end of the intervention (Calzolari & Nardotto, 2017; Habla & Muller, 2021). While previous research has documented the impact of prompts, and Arslain et al. (2021) showed that prompts change multiple choice process behaviors—such as the use of nutrition information and the sets of products considered during choice, impacts on cognition had not been studied in complex choice environments. In a study on the brain activation in the face of messages prompting consideration, Hare et al. (2021) found that participants made healthier decisions as a result of changes in neural activation patterns in food choice scenario when they were exposed to prompts to direction their attention to health. Our paper helps fill that gap in the literature.

Our study has limitations that need to be addressed in further work. The food choice task in this study was hypothetical. Participants did not receive their food selections as they would in a real-world food choice setting. Our experiment task was hypothetical so that we could collect a large set of data from participants across the US. While we used established methods to minimize the risk of hypothetical bias by including a cheap-talk script that requested that participants approach the choice task as if they would make an actual transaction (Penn & Hu, 2018), observing real, binding choices would provide a more solid evidence base about the effect of prompts. In addition, as online grocery shopping is increasingly becoming popular, the choice interface mimics similar grocery shopping experiences many consumers have when they order

their groceries online. The second limitation is potential exclusion of people who have established the habit of health consideration when making food choices. We asked participants to answer the question about factors they actively considered during the choice process. Our goal was to find people who actively considered health outcomes during choice. Some participants may have not thought they actively considered health during choice because it has become their habit from their previous shopping experience of food in general or these three food items we used in the experiment. Our findings of those considered health outcomes during choice may be underestimated if this case is true.

This study contributes to a growing body of research that active consideration of health outcomes and exposure to health prompt messages promote healthier food choices. These methods may provide a simple, low-cost approach to stimulate consideration of often-overlooked health impacts of food choices. While additional research is necessary, these methods may complement episodic future thinking so that an individual has both established a desired future outcome and actively considers the implications of the choices they face for that desired future outcome. Our findings show that exogenous factors such as simple messages intended to bring attention to consideration of future opportunity costs during choice are an important tool to actively consider future impacts during decision process. Therefore, these effects of consideration of future impacts could be applied to other intertemporal preferences with the use of simple messages to bring attention of thinking through future impacts during choices. For instance, promoting savings for retirement and emergency in young generation, and promoting good relationship with the environment to sustain the planet for future generation such as recycling, conscious use of natural resources like water uses and other behaviors that promote

environmental sustainability. This study shows that exogeneous factors such as simple messages may be a tool to draw attention consideration of future opportunity costs during choices.

Supplemental table

Table A. Linear regression model for the nutritional content measured in Guiding stars (GS)

	(1)	(2)
Both health consideration	0.603***	0.565***
	(0.042)	(0.043)
Current health consideration	0.425***	0.381***
	(0.044)	(0.045)
Future health consideration	0.461***	0.398***
	(0.062)	(0.065)
Somewhat impatient	-0.030	0.061
	(0.080)	(0.083)
Somewhat patient	-0.092	-0.038
	(0.075)	(0.079)
Patient	0.133***	0.223***
	(0.048)	(0.053)
Prompt message	0.142***	0.134***
	(0.033)	(0.033)
age		0.005**
		(0.002)
Sex		0.015
		(0.044)
Associate's degree /some college		-0.136**
		(0.054)
Bachelor's degree		-0.025
		(0.051)
High school/G.E.D.		-0.223***
		(0.060)
Less than high school		-0.195
		(0.166)
Prefer not to answer		-0.003
		(0.220)
Income		0.00000
		(0.00000)
Constant	0.539***	0.389***
	(0.050)	(0.109)

Note: (1) Model does not include demographic controls; (2) Model includes demographic controls; *=p<0.05; **=p<0.01; ***=p<0.001.

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