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Health Prompts Affect Consideration of Health But Not Intertemporal Preferences While Promoting Healthier Food Choices

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Abstract: Diet-related diseases impact populations across the globe. While intertemporal preferences—a fundamental preference for the distribution of benefits across time—have been used to explain low-quality food choices, recent literature proposes another cause: inattention to future implications (or opportunity costs) of the options faced. Food choices tend to become habitual to conserve cognitive resources, rather than carefully modeling future health impacts. Both low discount rates for future benefits and attention to future health impacts predict healthier decisions. While intertemporal preferences are stable, attention may provide an opportunity to intervene in the decision process to promote healthier decisions. In this study, we test the impact of a simple message that highlights health during food choice on the healthiness of foods chosen and on health consideration and intertemporal preferences. Our results show that actively considering health outcomes and lower discount rates lead to healthier food choices. We find that messaging increases the consideration of health outcomes during food choice but does not affect intertemporal preferences, suggesting that simple prompts may be an effective way to promote decisions balancing short and long-term benefits by drawing attention to overlooked opportunity costs of choices.

Keywords: point-of-decision prompt; active health consideration; health promotion; intertemporal preferences; nutrition; food choice

1. Introduction

Numerous seemingly minor daily choices that people face can have important impacts on their lives. Decisions about diet and exercise, whether to spend money on a desired item of clothing rather than saving the money for future use, or studying versus watching an extra episode of a favorite show seem insignificant at first glance but making the same 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 future costs of their repeated decisions [1,2]. Nevertheless, these minor daily choices influence important, long-term outcomes. Unhealthy food choices, infrequent physical activity, and low savings levels have long-term consequences for individuals and society. In fact, poor outcomes in life expectancy in the US and globally are attributable in part to these types of decisions [3,4].

Decision-makers in economic models of intertemporal choice weigh current and future options based on their preferences for the distribution of utility over time and choose the option that maximizes their wellbeing. While behavioral models allow for time-inconsistent preferences, both neoclassical and behavioral models of intertemporal choice model the decision-maker as considering current and future impacts [5]. Other disciplines, such as psychology, take different approaches to studying decisions with time-varying impacts. For instance, psychologists have developed the consideration of future consequences scale (CFC) to study differences in decision outcomes [6]. The CFC was designed to capture differences in individuals' tendency to consider the future impacts of decisions when making choices. A systematic review and meta-analysis of research using tools such

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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 [7,8]. Future-oriented people are more likely to delay spending immediately and save for future expenditures [9,10]. Researchers have found that future orientation is causally related to healthy behaviors [11].

While the CFC was developed to measure an individual's stable tendency to take the future into account, there is evidence that external factors influence cognitive processes. In the realm of health, for instance, research documents influences of hunger [12] and choice timing [13] on the nutritional quality of foods selected. Simple e-mail reminders increase gym attendance, an effect that lasts beyond the end of the intervention [14,15], and health reminders increase the nutritional quality of purchased selected in brick-and-mortar stores [16,17] and in online settings [18,19]. In the financial domain, people exposed to questions about overdraft fees on surveys were less likely to accrue overdraft fees, an effect that persisted over multiple years [20]. Even in simple, acontextual research settings, explicitly highlighting the (delayed) opportunity cost of choosing a smaller, earlier monetary reward changes people's choices, making them appear to value the future relatively more [21]. Therefore, external factors that recruit attention to health-promoting elements of choices may provide a useful tool to promote future wellbeing.

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 [3,22], as well as significantly impacting health outcomes globally [4]. The food choice process is complex, yet it is a decision individuals make daily. Since the 1990s, policies have been implemented in the US that require nutrition information and calorie labeling, but the obesity rate continues to rise [23]. A review of environmental nutrition interventions at the point-of-purchase recommends using interventions beyond food labeling [24]. Individuals find healthy eating challenging to achieve because it requires time and cognitive effort to identify and sustain healthy eating habits [25], which has led to a call for interventions that target automatic decision processes [26].

Our study examines the impact of an exogenous intervention that targets automatic decision processes by drawing attention to health outcomes during the food choice process. We examine the impact of this intervention on consideration of health when facing food choices and on overall nutrition quality. A few studies have examined interventions that prompt individuals to consider long-term health benefits in the face of frequent decisions, without imposing restrictions on the individuals' choices. For instance, the use of point-of-decision prompts to has been found to significantly increase the use of stairs rather than an escalator/elevator [27–29]. Examples of point-of-decision prompts placed near stairs/elevators include "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," with footprints guiding people to the stairs. In the case of food choice, research done in physical and online food retail settings of prime or prompt messages presented at the point of decision have been found to increase healthier choices, including in high-risk populations, such as individuals with high bodyweight and low-income minority populations [16–18,30].

Previous studies have found that actively considering the future implications of choices led to significantly healthier choices [1,31,32]. A study on the impact of exposure to health prompts during choice found an increased likelihood of considering health outcomes, though this study did not incorporate data on intertemporal preferences [32]. On the other hand, Tuyizere and Gustafson [2] found that both active consideration of health during choice and low discounting rates led to healthier choices, though this study was cross sectional and therefore could not attribute causality to these relationships.

In this study, we examine whether simple health prompts presented at the point of decision, which highlight health benefits—in this case, of dietary fiber—increase active consideration of health impacts of foods considered during the choice process. We examine the effect of the prompt in an online experiment on food choice along with an intertemporal financial choice task. The health prompt message focuses on dietary fiber, an under-consumed dietary component of public health concern, which may be driven by a lack of knowledge of the health benefits of fiber, leading people not to consider fiber during food choice [33–35]. Benefits of dietary fiber recognized by the FDA are 1) lowering blood glucose, 2) lowering cholesterol levels, 3) lowering blood pressure, 4) increasing

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frequency of bowel movements, 5) increasing mineral absorption in the intestinal tract, and 6) reducing energy intake [36]. If a simple health message increases the proportion of people who actively think about future implications during food choice, it provides a valuable intervention tool at the point of purchase to increase attention towards healthier options without imposing restrictions on people's options.

2. Materials and 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.com), an online survey recruitment platform. To participate in the experiment, individuals had to be at least 19 years of age and residents of 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 in one month, and reported demographic information. In the survey, participants were reminded to consider other, real-world uses of 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 is an effective way to reduce hypothetical bias [37].

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 availability (i.e., those that are widely available and are not private store brands), 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 [18]). 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 finished making 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 offered in a check-all-that-apply format. The data of interest were captured by participants' responses to the following items: "*the impact of the foods on your/your family's current health*," and "*the impact of the foods on your/your family's health in the future*." Other items were included as decoys to mask the true items of interest. We collected these data from people after they had made their choices to avoid influencing choices during the consideration process, reflecting an approach that has been used in

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other studies focused on capturing elements of the through process during decision-making [38]. Finally, participants answered questions about intertemporal preferences, and demographic variables. The intertemporal preference question featured a series of hypothetical choices between a sooner, smaller monetary amount and a larger, delayed amount, which has been used in previous studies [2]. The first choice featured an option between $1000 immediately or $1200 in one month. If the individual selected the delayed amount, they continued to the next question; otherwise, they were faced with a choice between $1000 immediately or $1300 in one month. If a participant again selected the smaller, earlier amount, they subsequently faced a choice between $1000 immediately or $1400 in one month. If they indicated preferring $1000 immediately in each of these three choices, they were then asked the amount they would need to receive in one month to make them select the delayed amount. Participants who selected $1200 in the first choice were categorized as having a low discount rate, those who selected $1300 in the second choice were categorized as having a medium-low discount rate, those choosing $1400 were categorized as having a medium-high discount rate, and those who selected the earlier amount in each of the first three questions were categorized as having a high discount rate. 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 [39]. We use logistic regression to examine the impact of prompt on active consideration of health and multinomial logistic regression for discount rate categories. In each case, the dependent variable (active consideration of health, discount rate) was regressed on exposure to the prompt message. We examine the impact of these independent variables alone and in a second version in which we include demographic variables: sex, age, income, and education. We incorporate cluster robust standard errors at the individual level using the lmtest package [40].

To examine the nutrition quality of foods chosen, we created a panel dataset of the food choices that every participant made, resulting in three rows per participant—one row for each food category. We conducted a linear regression to examine the impact of active consideration of health, discounting (low, medium-low, or medium-high, relative to an omitted "high discount rate" category), and prompt exposure on Guiding Stars rating of foods chosen in experiment with and without demographic controls. We hypothesized that exposure to health message would lead to healthier choices (measured in GS ratings), while also identifying significant impacts of active consideration of health and discount rates.

The simple version of the linear regression model of GS on consideration of health impacts, discounting, and prompt (excluding demographic characteristics) is as follows:

$$GS_{ij} = \beta_0 + \beta_1(H_i) + \beta_2(D_i) + \beta_3 P_i + \in_{ij}. \quad (1)$$

Here, GS_{ij} is the number of Guiding Stars chosen by individual i for product j, H_i is active consideration of health impacts (current and/or future) 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 with coefficient estimates at ($p<0.05$) as statistically significant. The study protocol was approved by the University of Nebraska-Lincoln's institutional review board (#20201020721EX). All participants provided electronic consent before participating in the study.

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 US dollars.

Table 1. Demographic characteristics of study participants (N=1005).

Variables	Mean	SD
Female (%)	72.9	
Age (years)	29.1	26.0
Education (%):		

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Advanced degree (Master's degree 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

We report the results of a logistic regression to examine the impact of prompt on active consideration of health in Table 2. The results show a significant impact of exposure to the health message on active consideration of health both with and without the inclusion of demographic variables as controls. This result corresponds to our hypothesis that simple messages can recruit attention to attributes of choice alternatives.

Table 2. Logistic regression of the effect of health prompt message on active consideration of health.

	(1) **Coef.** **(SE)**	**(2)** **Coef.** **(SE)**
Health prompt	0.245*** (0.074)	0.252** (0.079)
Constant	-0.137** (0.053)	-13.271 (309.1)
Demographic Variables	No	Yes

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

In the second analysis, 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 3). There was no significant impact of the prompt message on discounting rates among participants in our research.

Table 3. Multinomial logistic regression for the effect of health prompt message on discount rate categories (reference: High Discount Rate Category).

	Med-high Discount	**Med-Low Discount**	**Low Discount**	**Med-high Discount**	**Med-Low Discount**	**Low Discount**
Health prompt	-0.342 (0.190)	0.185 (0.182)	-0.103 (0.115)	-0.270 (0.201)	0.143 (0.193)	-0.128 (0.134)
Constant	-0.602*** (0.130)	-0.742*** (0.136)	1.884*** (0.083)	-2.458** (0.772)	-2.350** (0.774)	10.954*** (0.615)
Demographic Variables		No			Yes	

Notes: Reported values are the estimated coefficient, with standard errors in parentheses; *=p<0.05; **=p<0.01; ***=p<0.001.

The third analysis was a linear regression of Guiding Stars rating of foods selected by participants (the dependent variable) on active consideration of health, discount rate categories, and prompt exposure to evaluate impacts on the healthiness of participants' product choices. We

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conducted this analysis in the simple form initially and then added demographic variables as a robustness check.

Table 4. Linear regression of active consideration impact, discount rates, and prompt exposure on Guiding Stars rating of foods chosen.

	Coef. (SE) (1)	**Coef. (SE) (2)**
Consideration of Health	0.524*** (0.033)	0.476*** (0.034)
Low discount rate	0.178*** (0.051)	0.236*** (0.057)
Med-low discount rate	-0.045 (0.079)	0.013 (0.081)
Med-high discount rate	0.005 (0.083)	0.045 (0.086)
Prompt	0.133*** (0.033)	0.136*** (0.033)
Constant	0.497*** (0.055)	0.220 (0.541)
Demographic Variables	No	Yes
Observations	2905	2905
R2	0.091	0.108
Adjusted R2	0.089	0.100

Notes: Data were collected in the experiment/survey. *=p<0.05; **=p<0.01; ***=p<0.001.

When demographic variables were not included in the model, consideration of health outcomes led participants to choose products with 0.524 more GS per product, respectively, than those who did not consider health outcomes (Table 4). Individuals with low discount rates chose products with 0.178 more GS per product than impatient participants. Participants who received a health prompt message chose more nutritious products, equivalent to 0.133 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.

4. Discussion

Our findings show that exposure to health prompts increased the likelihood that people actively considered health outcomes during food choice and led them to select foods with higher nutritional quality. Studies have found that people who discount the future heavily are more likely to eat lower-quality diets and engage in other behaviors that put them at risk for obesity and other poor health outcomes [41–47]. A smaller body of evidence suggests that asymmetric attention to immediate vs. future opportunity costs of choices may play an important role in determining choices with intertemporal components [1,2,21,32]. This evidence suggests that attention is more naturally paid to immediate opportunity costs, yielding decisions that appear to represent preferences that heavily discount the future but that may instead represent blindness to future opportunity costs. In our study, the evidence of the impact of the prompt on consideration of health and discounting choices suggests that health prompts work by recruiting attention to attributes of the products faced, 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 changing 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 [48] or shifts in one's beliefs about their connection to their future self [49,50]. 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 also

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concur with a recent study showing that attention to a health prompt message increases the consideration of future health during food choice [32].

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 [51,52]. EFT helps a person to pre-experience events so that they conceptualize 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 [53]. In the absence of EFT (or other interventions), future rewards tend to be devalued, while immediate rewards are likely to be overestimated, leading to shortsighted choices [54]. EFT encourages positive health practices in intertemporal choice scenarios [55], such as limiting snacking [56], reducing impulsive eating and calorie intake in overweight or obese individuals and among individuals with varying overweight status [57,58], and reducing cheating by inducing future orientation with a focus on one's ideal self [59]. Evidence from the literature on EFT supports our findings that decisions incorporating 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 lose weight by vividly imagining their desired future (EFT), providing motivation to take action, paired with targeted prompts that make this imagined future salient in food choice settings.

Our study found that participants exposed to health prompt messages considered health impacts more and chose more nutritious food products than those not exposed to prompts. The increasing sophistication and power of technology 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. A podcast-based educational intervention during grocery shopping led shoppers to buy more ω-3-rich seafood items when given podcasts about the types, food sources, and health benefits of ω-3 fatty acids at the point of purchase throughout the 6-month intervention and 6-month post-intervention [60,61]. This study shows 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. Studies on prompts have found that exposure to prompts during food choice increases healthy behaviors [62,63]. Related research on physical activity found that sending reminders to gym members increases attendance and has effects that last beyond end of the intervention [14,15]. While previous research has documented that prompts change multiple choice process behaviors—such as the use of nutrition information and the sets of products considered during choice [64]—impacts on cognition had not been studied in complex choice environments. In an fMRI study, participants made healthier decisions in a food choice task when they were exposed to prompts directing their attention to health [65], resulting in neural and behavioral patterns that resembled successful dieters [66].

Our study has limitations that need to be addressed in further work. The food choice task in this study was hypothetical. Participants did not pay for and receive their food selections as they would in a real-world food retail outlet. 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 directed participants to approach the choice task as if they would make an actual transaction [37], observing real, binding choices would provide a stronger evidence about the effect of consideration, discounting, and prompts.

A second limitation is potential exclusion of people who have made such a regular habit of making healthy food selections that they no longer actively consider health during choice but rather

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habitually choose from a small subset of products that meet previously establish health criteria. We asked participants about factors they actively considered during the choice process to capture those who had actively considered health, and—even more importantly—to allow us to detect changes in active consideration of health. Participants who habitually make healthy choices may have not reported actively considering health during choice because healthy choices have become habitual for them. In this case, our finding that those who actively considered health outcomes made significantly healthier choices may underestimate the value of establishing healthy habits because the no-consideration group would include anyone who habitually made healthy choices.

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 other intervention approaches, such as EFT, 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 engender active consideration of future impacts during the decision process. This approach may help align choices with long term preferences in other domains in which people face tradeoffs between short and long-term benefits, such as promoting savings for the future, making environmentally sustainable choices, and others.

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