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Economic preferences and fast food consumption in US adults: Insights from behavioral economics

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ABSTRACT

Objective. To examine the relationship between economic time preferences and frequency of fast food and full-service restaurant consumption among U.S. adults.

Methods. Participants included 5871 U.S. adults who responded to a survey conducted in 2011 pertaining to the lifestyle behaviors of families and the social context of these behaviors. The primary independent variable was a measure of time preferences, an intertemporal choice assessing delay discounting. This was elicited via responses to preferences for an immediate dollar amount or a larger sum in 30 (30-day time horizon) or 60 days (60-day time horizon). Outcomes were the frequency of fast food and full-service restaurant consumption. Ordered logistic regression was performed to examine the relationship between time preferences and food consumption while adjusting for covariates (e.g. socio-demographics).

Results. Multivariable analysis revealed that higher future time preferences were significantly related to less frequent fast food intake for both the 30- and 60-day time horizon variables (P for linear trend <0.05; both). Notably, participants with the highest future time preference were significantly less likely to consume fast food than those with very low future time preferences (30-day: OR = 0.74, 95%CI: 0.62–0.89; and 60-day: OR = 0.86, 95%CI: 0.74–1.00). In comparison, higher future time preferences were not significantly associated with full-service restaurant intake (30-day: p for linear trend = 0.73; 60-day: p for linear trend = 0.83).

Conclusions. Higher future time preferences were related to a lower frequency of fast food consumption. Utilizing concepts from behavioral economics (e.g. pre-commitment contracts) to facilitate more healthful eating is warranted using experimental studies.

1. Introduction

The high prevalence of obesity, 37.7% of adults in the United States (US), and chronic diseases (e.g. type 2 diabetes, various cancers, cardiovascular disease) nationwide is due, at least in part, to the overconsumption of available food of low dietary quality (Briefel and Johnson, 2004; Daviglus et al., 2012; Flegal et al., 2016; Popkin et al., 2012; Vucenik and Stains, 2012). Specifically, there has been a shift to increased consumption of away-from-home foods and beverages, which often consists of energy-dense nutrient-poor foods of lower overall dietary quality including less fiber and more total and saturated fat and sugar (Appelhans et al., 2012; Shuval et al., 2015b; Smith et al., 2013; United States Department of Agriculture). Indeed, analysis from time-use data reveals that the energy intake from home food sources declined by ~24% from 1965 to 2008, with most of the decline occurring until 1996 (Smith et al., 2013). Powell et al. found that 36% of American adults consumed fast food in 2007–2008, which resulted in the intake of 877 cal per day from fast food alone (Powell et al., 2012). Pereira et al. (2005), in a longitudinal study of young adults, observed that increased frequency (>2 times/week) of fast food consumption was directly related to increased body weight and insulin resistance (Pereira et al., 2005). However, evidence indicates that not only excessive fast food consumption, but also, potentially, dining out in full-service restaurants, can lead to detrimental health outcomes (An, 2016; Powell and Nguyen, 2013). A recent study found that frequenting both fast food and full-service restaurants was associated with a significant increase in daily caloric intake as well as higher intake of saturated fat, cholesterol and sodium (An, 2016). Thus, it is of public health importance to

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encourage the consumption of more healthful home-prepared meals for obesity and chronic disease prevention. But numerous factors prevent this practice, such as low self-efficacy and lack of cooking knowledge/skills, as well as costs and accessibility to healthful foods, proximity to fast food restaurants, and lack of time (Leonard et al., 2014; Shuval et al., 2015a; Yeh et al., 2008).

Behavioral economics, the application of psychology to economics, has the potential to offer additional insights into eating behaviors (Price and Riis, 2012). Behavioral economics acknowledges that humans are often not forward-looking, that they have limited computational ability, and that individuals often utilize heuristics ('rules of thumb') to solve problems, which could lead to decision biases (Dellavigna, 2009; Thorgeirsson and Kawachi, 2013). In addition, impatient time preferences refer to a disproportionate focus on making decisions based on immediate gratification (e.g. satiety from fast-food) rather than future benefits (e.g. health benefits of avoiding fast-food) (Ariely and Wertenbroch, 2002; Loewenstein et al., 2007). This phenomenon is also known as delay discounting, where individuals tend to devalue future rewards (e.g. health, monetary) over present ones (Odum, 2011). A greater preference for smaller immediate rewards over larger delayed rewards (i.e., greater delay discounting) has been associated with lack of saving for retirement, physical inactivity, and a higher tendency towards addictive behaviors (e.g. alcohol use and smoking) (Cutler and Glaeser, 2005; Shuval et al., in press.; Soman et al., 2005; Thaler and Benartzi, 2004). Impatient time preferences have also been associated with less healthful eating, such as consumption of energy-dense nutrient-poor foods and beverages (Cutler and Glaeser, 2005; Shuval et al., 2015a). In addition, a cross-sectional study by Garza among a sample of 478 adults, observed that impatient individuals were more likely to consume fast food even while taking into account participants' age, income and level of education (Garza et al., 2016). In comparison, Appelhans, examined this study question in a smaller sample ($n = 78$) of overweight/obese women, and found that impatient time preferences were related to the quantity of away from home eating, but not the frequency of consumption (Appelhans et al., 2012). However, insufficient research has explored the relationship between time preferences and away-from-home eating in a large national sample of US adults. Subsequently, in the current study, we sought to assess the association between time preferences with both fast food and full-service eating behaviors among American adults.

2. Methods

2.1. Design and sample

We employed a cross-sectional analytic design to assess the association between time preferences (primary independent variable) and the frequency of consumption at fast food and full-service restaurants (dependent variables) among adult participants of the Family Health Habits Survey (FHHS) study. Information on the FHHS is elaborated elsewhere (Pachucki et al., 2014); however, briefly, the FHHS was a web based survey conducted in 2011, aimed at obtaining information on the lifestyle behaviors of families (e.g. eating habits, obesity) and the social context of these behaviors (Pachucki et al., 2014). A total of 14,400 participants in the Nielsen National Consumer Panel (which is comprised of a proportionate sample of the contiguous US) were asked to participate in the FHHS study. Of these, 6019 participants were adults ≥21 years who responded to the FHHS survey by providing complete information about themselves (i.e. individual level data) pertaining to time preferences, food consumption, socio-demographics, and height and weight necessary to compute body mass index (BMI). Of these, 148 observations were omitted due to extreme BMI values (18.5 kg/m^{2-} BMI > 51 kg/m^2), due to potential underlying medical conditions, resulting in an analytic sample of 5871. The current analysis received exempt status from the Institutional Review Board of Morehouse School of Medicine.

2.2. Measures

The primary independent variables consisted of measures of time-preferences elicited via two survey questions, focusing on 30- and 60-day time horizons (Pearce and Parks, 2011; Shuval et al., in press) Specifically, participants were asked to choose between a hypothetical monetary amount today or a higher sum in 30 days (first question), and a hypothetical dollar amount in 30 days or a higher sum in 60 days (second question). For the first question participants were asked to select one of the following two options for each scenario: (a) "I prefer to get $10 today, OR I prefer to get $12 thirty days from today; (b) I prefer to get $10 today, OR I prefer to get $15 thirty days from today; and (c) I prefer to get $10 today, OR I prefer to get $18 thirty days from today". Similarly, in question two, participants were asked to choose one scenario for in each of the following 3 statements: "(a) I prefer to get $10 thirty days from today, OR I prefer to get $12 sixty days from today; (b) I prefer to get $10 thirty days from today, OR I prefer to get $15 sixty days from today; and (c) I prefer to get $10 thirty days from today, OR I prefer to get $18 sixty days from today". Each response of '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1' (Shuval et al., in press). This resulted in a score ranging from 0 to 3, with a higher score indicative of a higher future time preference. This summation approach, where a higher score reflects a more future (or more patient) time preference, is consistent with previous studies in the literature (Leonard et al., 2013; Oliveira et al., 2015; Shuval et al., 2015c). It should be noted that these two time horizons are slightly different measures of time preference. Specifically, individuals tend to value money received in the future less than money received today (Angeletos et al., 2001). Thus individuals willing to forgo immediate monetary gains today for a higher reward in 30 days likely have more patient time preferences than individuals forgoing monetary gains in 30 days versus a larger sum in 60 days; assuming the tradeoffs between the two time horizons are the same.

In addition, the two primary dependent variables pertained to the frequency of consuming fast food and full-service restaurant food. Specifically, participants were asked to indicate the number of times per week they personally purchased food at a fast food establishment (including both take-out and seated meals) and the number of times they ate out at a restaurant with sit-down service. The categories were: 0, 1, 2–3, 4–6, 7–10, and > 10 times per week. For analysis, the frequency of food consumption was divided into 3 categories: (a) 0–1; (b) 2–3; and (c) ≥4 times per week to enhance interpretation of the results. However, using the original categories in multivariable analysis did not change results materially. In addition, it should be noted that higher frequency of fast food consumption was significantly associated with obesity ($\chi^2 = 79.97$, $p < 0.001$) in this analytic sample.

Additional covariates taken into account in the analyses included: age (21–29, 30–39, 40–49, 50–59, ≥60 years), college graduate (yes/no), household annual income (<$30,000, $30,000–44,999, $45,000–69,999, ≥$70,000), race/ethnicity (non-Hispanic white and black, Hispanic, Asian, other), self-rated health status (low, medium, high), and obesity status. Obesity was defined at having a body mass index (BMI) ≥30, which was computed using standard formula (kg/m^2) based on self-reported weight and height (World Health Organization). The gender variable was missing for 74% of survey respondents since the survey targeted heads of households; therefore this variable was estimated using multiple imputations (Schafer and Graham, 2002). To impute gender, we utilized all covariates from the multivariable models as well as participants' height. Using the imputed gender variable or omitting it entirely yielded similar results. We opted for including the imputed gender variable to use as much available information as possible.

2.3. Statistical analysis

Cross tabulations were performed to examine the association between participants' characteristics and the frequency of fast food consumption, and a Pearson's chi-squared test was utilized to determine statistical significance. The relationships between the primary independent variables to the frequency of fast food and full-service food consumption were determined via two separate multivariable models. Ordered logistic regression was performed due to the ordering of the restaurant food consumption variables (Leonard et al., 2013), that is, a higher category is indicative of more frequent restaurant food consumption. Specifically, the odds ratios (OR) and 95% confidence interval (CI) depict moving from one category of fast food or full-service restaurant to a higher one versus remaining in the same category (Leonard et al., 2013). It should be noted that for each dependent variable (i.e. fast food and full-service restaurant consumption), an ordered logistic regression model was separately constructed for the 30-day and 60-day time horizons. We also examined the linear trend of the time preferences-fast food frequency and time preference-full- service frequency relationships by entering the 4-category time preference variables into respective regression models as an ordinal term (Shuval et al., 2012). We additionally re-estimated the main models (i.e. time preferences and food frequency) using multinomial logistic regression to provide an OR and 95% CI for frequenting restaurants 2–3 times and ≥4 times per week in comparison to the reference group (0–1 times weekly); please see Appendix. All multivariable models adjusted for age, imputed gender, race/ethnicity, marital status, obesity, education, income, and self-rated health status. In addition, the relationship between the primary independent variables and fast food or full-service restaurant frequency was examined using ordered logistic regression, stratifying by obesity status and income levels, while adjusting for the other covariates. Furthermore, the interaction between time preferences*obesity and time preferences*income in relation to the dependent variables was examined by adding these interaction terms into the multivariable models. These interactions were not statistically significant (time preference*obesity: p-values: 0.065–0.976; time preference*income: p-values: 0.180–0.956).

3. Results

Participants' characteristics stratified by the frequency of fast food consumption are presented in Table 1. Briefly, participants' frequency of fast food consumption differed significantly by age, race/ethnicity, obesity, marital and health status, as well as time preferences. The relationship between participants' time preferences and fast food and full-service restaurant frequency are depicted in Tables 2, 3 (stratified by obesity status), and Table 4 (stratified by income). Multivariable analysis revealed that participants with higher future time preferences consumed fast food less frequently for both the 30 and 60-day time horizon variables than the reference group (very low future time preferences) (P for linear trend <0.05; both). Notably, in comparison to the reference group, participants with the highest future time preferences consumed fast food less often (30-day: OR = 0.74, 95%CI: 0.62–0.89; 60-day: and OR = 0.86, 95%CI: 0.74–1.00). In comparison, higher future time preferences were not significantly related to the frequency of full-service restaurant intake (30-day: p for linear trend = 0.73; 60-day: p for linear trend = 0.83). In addition, multinomial logistic regression models (see Appendix) revealed that high future time preferences (30-day) were associated with a 45% lower likelihood of consuming fast food ≥4 times a week with statistical significance (OR = 0.55; 95%CI: 0.39–0.77), and a 16% lower likelihood of consuming fast food 2–3 times weekly without statistical significance (OR = 0.84; 95%CI = 0.68–1.02), in comparison to the reference group of consuming fast food 0–1 times weekly. These associations for the 60-day time preference variable did not reach statistical significance, and no significant associations were observed for future time preferences and full-service restaurant consumption.

Table 1
Characteristics of study participants by frequency of fast food consumption ($n = 5871$).

Characteristics N (row percentage)	Fast food frequency, Number of times per week: 0–1	2–3	≥4	P-value[*]
Age (years)				
21–39	552 (70.1)	191 (24.3)	44 (5.6)	<0.001
40–59	2455 (72.1)	773 (22.7)	177 (5.2)	
≥60	1342 (79.9)	278 (16.6)	59 (3.5)	
Gender[a]				
Male	338 (74.1)	93 (20.4)	25 (5.5)	0.874
Female	798 (74.0)	214 (19.9)	66 (6.1)	
Race/ethnicity				
Hispanic	212 (68.8)	78 (25.3)	18 (5.8)	<0.001
Non-Hispanic Black	250 (58.7)	136 (31.9)	40 (9.4)	
Non-Hispanic White	3643 (76.0)	947 (19.8)	203 (4.2)	
Asian	169 (72.5)	52 (22.3)	12 (5.2)	
Other	75 (67.6)	29 (26.1)	7 (6.3)	
College graduate				
No	2370 (74.2)	676 (21.2)	147 (4.6)	0.809
Yes	1979 (73.9)	566 (21.1)	133 (5.0)	
Annual household income				
<$30,000	837 (76.8)	210 (19.3)	43 (3.9)	0.335
$30,000–44,999	750 (72.6)	227 (22.0)	56 (5.4)	
$45,000–69,999	1160 (74.3)	327 (21.0)	74 (4.7)	
≥$70,000	1602 (73.3)	478 (21.9)	107 (4.9)	
Obese[b]				
No	3023 (77.6)	729 (18.7)	144 (3.7)	<0.001
Yes	1326 (67.1)	513 (26.0)	136 (6.9)	
Married				
No	1297 (74.0)	359 (20.5)	98 (5.6)	0.130
Yes	3052 (74.1)	883 (21.5)	182 (4.4)	
Self-rated health				
Low	252 (75.9)	67 (20.2)	13 (3.9)	<0.001
Medium	933 (68.7)	330 (24.3)	95 (7.0)	
High	3164 (75.7)	845 (20.2)	172 (4.1)	
Future time preference (30-day time horizon)[c]				
Very low	506 (69.5)	168 (23.1)	54 (7.4)	<0.001
Low	334 (70.3)	120 (25.3)	21 (4.4)	
Medium	1113 (73.7)	323 (21.4)	74 (4.9)	
High	2396 (75.9)	631 (20.0)	131 (4.2)	
Future time preference (60-day time horizon)[c]				
Very low	1140 (71.5)	368 (23.1)	86 (5.4)	0.112
Low	519 (73.4)	154 (21.8)	34 (4.8)	
Medium	864 (74.0)	248 (21.3)	55 (4.7)	
High	1826 (76.0)	472 (19.6)	105 (4.4)	

[*] P-value was computed using Pearson χ^2.
[a] Only 1534 participants provided information pertaining to their gender. In multivariable analysis multiple imputation was utilized to estimate missing responses.
[b] Obesity was determined based on a body mass index (BMI) ≥30 kg/m^2.
[c] Time-preferences were elicited via the following two questions: (1) preferred $10 today or $12, $15, or $18 in 30 days (30 day horizon); and (2) preferred $10 in 30 days or $12, $15, or $18 in 60 days (60 day horizon). A response '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1'. This resulted in a score ranging from 0 ('very low') to 3 ('high'), with a higher score indicative of a higher future time preference.

When examining the relationship between time preferences and fast food frequency stratified by obesity status, the associations did not differ substantially (see Table 3). For example, obese and non-obese participants with high future time preferences (30-day time horizon) were 32% and 22% (respectively) less likely to frequent fast food establishments than their counterparts in the same weight status who have very low future time preferences (Obese: OR = 0.68, 95%CI: 0.52–0.91; non-obese: OR = 0.78; 95%CI: 0.61–0.99; Table 3). When examining these associations stratified by annual income, only

Table 2
Time preferences and eating in fast food and full-service restaurants: ordered logistic regression,[a] ($n = 5871$).

	Fast food restaurants[c] OR (95%CI)	Full-service restaurants[c] OR (95%CI)
Future time preference (30-day time horizon),[b]		
'Very low' (reference)		
Low	0.85 (0.66–1.10)	1.25 (0.97–1.62)
Medium	0.81 (0.66–0.98)	1.00 (0.82–1.22)
High	0.74 (0.62–0.89)	1.03 (0.85–1.24)
P for linear trend	0.001	0.726
Future time preference (60-day time horizon),[b]		
'Very low' (reference)		
Low	0.93 (0.76–1.14)	1.04 (0.85–1.27)
Medium	0.94 (0.79–1.11)	1.04 (0.88–1.24)
High	0.86 (0.74–1.00)	1.02 (0.88–1.18)
P for linear trend	0.049	0.826

Abbreviation: OR, odds ratio; CI, confidence interval.

[a] Model adjusted for age, gender (multiple imputation), race/ethnicity, marital status, obesity status, education, income, and self-rated health status.

[b] Time-preferences were elicited via the following two questions: (1) preferred $10 today or $12, $15, or $18 in 30 days (30 day horizon); and (2) preferred $10 in 30 days or $12, $15, or $18 in 60 days (60 day horizon). A response '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1'. This resulted in a score ranging from 0 ('very low') to 3 ('high'), with a higher score indicative of a higher future time preference.

[c] Participants were asked to indicate the number of times per week they personally purchased food at a fast food establishment and full service restaurant. The categories were: 0–1, 2–3, and ≥4 times per week.

participants in the third income stratum (i.e. $45,000- < $70,000 annually) with higher future preferences consumed fast food less frequently than the reference group for both 30-day and 60-day time horizons (p for linear trend, <0.01 for both). No significant associations were observed between time preferences and the frequency of full-service restaurant consumption when stratified by income.

4. Discussion

Few studies to date have examined the relationship between time preferences and restaurant (fast food and sit down) frequency among national samples in the US. Identifying factors that affect away-from-home eating is paramount to public health, since food consumed in restaurants often consists of energy-dense nutrient-poor foods and beverages of poor dietary quality, which, in turn, increases the risk for chronic disease (Pereira et al., 2005; Powell and Nguyen, 2013). Current study findings suggest that a willingness to delay immediate gratification for future gains is related to reduced frequency of fast food consumption. In categorical analysis, this finding is primarily evident among participants with high levels of future orientation. Thus, a high degree of future orientation appears to be protective against eating frequently at fast food establishments. In comparison, future orientation was not related to frequenting full-service restaurants. These results are consistent with a smaller scale study by Garza et al. (2016) among university employees finding that less patient time preferences were associated with greater frequency of fast food consumption (Garza et al., 2016). However, Appelhans observed that delay discounting was not related to the frequency of away-from-home eating (Appelhans et al., 2012).

The economic literature differentiates between individuals who are 'naïve' and 'sophisticated' regarding their time preferences (Nuscheler and Roeder, in press; O'Donoghue and Rabin, 1999). Thus, 'sophisticated' individuals, who are cognizant of their impatience, might find ways to prevent themselves from engaging in behaviors that could affect their health. For example, packing more healthful snacks and/or meals to bring to work daily could potentially prevent lunch trips to adjacent fast food establishments for individuals who are aware of having impatient time preferences and know they will be tempted to frequent these establishments, particularly when hungry (Liu et al., 2014). Thus, there might be merit in screening individuals for time preferences, informing them of this tendency, and designing pertinent targeted interventions. For example, pre-commitment contracts, which are self-imposed constraints aimed at overcoming impatient time preferences, have been applied with some success in smoking cessation interventions and could potentially be utilized in modifying eating behaviors (Halpern et al., 2012, 2015). With respect to fast food consumption, a sum of money is deposited initially by the individual, and would be lost (or given to a designated charity), if the person does not meet their goal, such as to eat less frequently at fast food restaurants (Shuval et al., 2015c). While this concept holds promise, its efficacy in this context needs to be substantiated.

This strategy, however, might not be sufficient to reduce the intake of fast food, since these establishments are abundant, highly accessible, relatively inexpensive, and provide sensory pleasure (Appelhans et al., 2012; Devoe et al., 2013; Just and Payne, 2009). Furthermore, the fact that the food can be prepared and consumed within minutes either via take-away or sit-down is particularly conducive to persons who have impatient time preferences. Indeed, this assumption is consistent

Table 3
Time preferences and fast food and full-service restaurant eating by Obesity[a]: Ordered Logistic Regression[b] ($n = 5871$).

	Fast food restaurants[c] Non-obese OR (95%CI)	Obese OR (95%CI)	**Full-service restaurants[c]** Non-obese OR (95%CI)	Obese OR (95%CI)
Future time preference (30-day time horizon),[b]				
'Very low' (reference)				
Low	0.90 (0.64–1.28)	0.79 (0.54–1.16)	1.22 (0.87–1.71)	1.31 (0.88–1.95)
Medium	0.82 (0.63–1.07)	0.77 (0.57–1.05)	1.02 (0.79–1.32)	0.96 (0.69–1.33)
High	0.78 (0.61–0.99)	0.68 (0.52–0.91)	1.02 (0.80–1.29)	1.06 (0.79–1.43)
P for linear trend	0.037	0.012	0.709	0.951
Future time preference (60-day time horizon),[d]				
'Very low' (reference)				
Low	0.83 (0.64–1.09)	1.07 (0.78–1.46)	0.92 (0.71–1.17)	1.31 (0.95–1.81)
Medium	0.85 (0.68–1.07)	1.07 (0.81–1.40)	0.96 (0.78–1.19)	1.22 (0.92–1.61)
High	0.85 (0.70–1.03)	0.86 (0.68–1.08)	0.92 (0.77–1.10)	1.22 (0.96–1.55)
P for linear trend	0.128	0.237	0.423	0.138

Abbreviation: OR, odds ratio; CI, confidence interval.

[a] Participants were asked to indicate the number of times per week they personally purchased food at a fast food establishment and full service restaurant. The categories were: 0–1, 2–3, and ≥4 times per week.

[b] Time-preferences were elicited via the following two questions: (1) preferred $10 today or $12, $15, or $18 in 30 days (30 day horizon); and (2) preferred $10 in 30 days or $12, $15, or $18 in 60 days (60 day horizon). A response '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1'. This resulted in a score ranging from 0 ('very low') to 3 ('high'), with a higher score indicative of a higher future time preference.

[c] Obesity was determined based on a body mass index (BMI) ≥30 kg/m^2.

[d] Model adjusted for age, gender (multiple imputation), race/ethnicity, marital status, income, education, and self-rated health status.

Table 4
Time preferences and fast food and full-service restaurant eating by **household annual income:** Ordered Logistic Regression[a] ($n = 5871$).

	Fast food restaurants[b]				Full-service restaurants[b]			
	<$30,000 OR (95%CI)	$30,000–$44,999 OR (95%CI)	$45,000–$69,999 OR (95%CI)	≥$70,000 OR (95%CI)	<$30,000 OR (95%CI)	$30,000–$44,999 OR (95%CI)	$45,000–$69,999 OR (95%CI)	≥$70,000 OR (95%CI)
Future time preference (30-day time horizon),[c]								
'Very low' (reference)								
Low	0.90 (0.52–1.58)	0.91 (0.54–1.56)	0.87 (0.52–1.44)	0.80 (0.49–1.29)	0.82 (0.51–1.31)	1.22 (0.71–2.12)	1.23 (0.73–2.06)	1.41 (0.90–2.20)
Medium	0.84 (0.54–1.31)	0.66 (0.43–1.03)	0.78 (0.54–1.14)	0.9 (0.62–1.31)	1.09 (0.73–1.64)	0.82 (0.52–1.31)	1.07 (0.73–1.57)	1.19 (0.84–1.71)
High	0.84 (0.57–1.25)	0.74 (0.50–1.08)	0.55 (0.38–0.78)	0.91 (0.64–1.29)	1.10 (0.62–1.95)	0.78 (0.52–1.18)	1.04 (0.72–1.49)	1.21 (0.86–1.69)
P for linear trend	0.396	0.104	<0.001	0.891	0.690	0.101	0.899	0.597
Future time preference (60-day time horizon),[c]								
'Very low' (reference)								
Low	1.37 (0.86–2.18)	0.74 (0.45–1.20)	0.86 (0.58–1.28)	0.97 (0.69–1.36)	1.12 (0.67–1.88)	1.06 (0.65–1.71)	0.87 (0.59–1.29)	1.14 (0.84–1.55)
Medium	0.96 (0.63–1.46)	0.77 (0.51–1.17)	0.87 (0.63–1.21)	1.10 (0.82–1.47)	1.00 (0.64–1.56)	0.70 (0.44–1.11)	1.21 (0.88–1.66)	1.08 (0.83–1.41)
High	0.85 (0.60–1.21)	0.98 (0.71–1.36)	0.64 (0.48–0.86)	1.02 (0.79–1.32)	1.28 (0.9–1.82)	1.10 (0.78–1.55)	0.86 (0.65–1.14)	1.02 (0.81–1.29)
P for linear trend	0.250	0.921	0.003	0.761	0.203	0.779	0.456	0.977

Abbreviation: OR, odds ratio; CI, confidence interval.
[a] Participants were asked to indicate the number of times per week they personally purchased food at a fast food establishment and full service restaurant. The categories were: 0–1, 2–3, and ≥4 times per week.
[b] Time-preferences were elicited via the following two questions: (1) preferred $10 today or $12, $15, or $18 in 30 days (30 day horizon); and (2) preferred $10 in 30 days or $12, $15, or $18 in 60 days (60 day horizon). A response '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1'. This resulted in a score ranging from 0 ('very low') to 3 ('high'), with a higher score indicative of a higher future time preference.
[c] Model adjusted for age, gender (multiple imputation), race/ethnicity, marital status, obesity status, education, and self-rated health status.

with our findings indicating an inverse relationship between future orientation and fast food intake. In comparison, one might expect those who are more patient to eat more frequently in full-service restaurants, where the food preparation and the whole dining experience usually take longer. However, this was not observed in the current study where a null linear relationship was found between time preferences and frequenting full-service establishments. This finding might be due to the fact that patient individuals might consume more healthful foods at home rather than away-from-home. This supposition, however, cannot be substantiated in the current study since information on home food consumption was not available in the dataset.

It is important to note that consumption of fast food could be regarded as the 'path of least resistance' (also known as status quo bias) that many follow (Loewenstein et al., 2007), particularly the impatient, unless the default options are healthful foods (e.g., carrot sticks versus French fries). Fast food consumption has also been associated with being younger, male, possessing insufficient cooking skills, not allocating enough time for eating, increased exposure to advertisements, and easy access to fast food establishments in the neighborhood (Mohr et al., 2007; Ravensbergen et al., 2016; van der Horst et al., 2011). In addition, while the US has generally supported an obesogenic environment (Ard, 2007), more recent efforts have been made to improve nutrition-related environments and policies. For example, the New York City Council proposed a bill to enhance the nutrition quality of 'Happy Meals' in fast food establishments where the default would be meals of higher nutritional quality for meals that offer toys for children (Elbel et al., 2015; Otten et al., 2012). Furthermore, in 2006, New York City followed by the state of California (in 2008) banned partially hydrogenated oils (PHOs) from restaurant food, since PHOs increase the risk for coronary heart disease (Baur et al., 2012; Brownell and Pomeranz, 2014). In 2015, the U.S. Food and Drug Administration (FDA) made a final determination that PHOs are unsafe and that food manufacturers have up to three years to cease from selling foods containing PHO (U.S. Food and Drug Administration). As noted by Brownell and Pomeranz (2014), this type of policy approach is an important step in changing the food environment, which might serve as a precedent to addressing other detrimental constituents of foods (e.g. added sugar) (Brownell and Pomeranz, 2014). Moreover, in recent years, some fast food chains have attempted to offer more healthful food choices (and default options such as apples instead of French fries) and items that contain fewer calories (Baur et al., 2012). Yet despite these experiences, adhering to dietary guidelines that suggest consuming whole grains, more fruits and vegetables and less red meat, as well as reduced total fat and sodium (Kushi et al., 2012), may be challenging to actually implement in these restaurants.

Results from the present study emphasize that those who have impatient time preferences are more prone to fast food eating, however, stratified analysis indicates that these relationships differ by income. Notably, the significant relationship between time preferences and fast food consumption was observed only among those in the middle-income category ($45,000- < $70,000) but not in the low- and high-income strata. Thus, in this sample, fast food intake might be impacted by factors other than time preferences among these subgroups. Recent qualitative research by Daniel (2016) on food choices among low-income families documents how complex food decisions can be, and that inexpensive, energy-dense nutrient-poor foods are not always the default (Daniel, 2016). Current findings indicate that African Americans and Hispanics were more likely than whites to frequent fast food establishments. While these findings warrant further exploration, it is possible that social norms and the physical environment play a larger role than income with regard to selection of fast food. In an earlier study among a predominately African American sample, we observed that healthful food intake was affected by social norms and access to food (Leonard et al., 2014). In contrast, a study by Anderson et al. (2011), examining fast food consumption among >4000 adults from Michigan, did not find that fast food consumption differed according to income, race/ethnicity or education (Anderson et al., 2011).

The current study has strengths and limitations. A substantial strength stems from the study question and the unique data that focuses on the nexus of behavioral economics and restaurant food intake in a national sample of adults in the US. The study design, however, is cross-sectional, which limits the ability to determine a temporal relationship. Furthermore, the survey sampled households and many did not report their gender on the survey. In an attempt to overcome this inherent limitation of the dataset, we performed multiple imputation to statistically compute the missing information based on available data. Further, although we were able to determine the frequency of fast food and full-service restaurant consumption, this information was based on self-report, which is subject to recall bias. Finally, information on the quantity and quality of food consumed both away-from-home and at home was not available in the dataset and therefore not included in the analysis.

Nonetheless, the current study meaningfully contributes to the literature examining the intersection between behavioral economics and eating behavior. Study findings from a national sample of US adults emphasize that persons who have impatient time preferences are significantly more likely to frequent fast food establishments than future-oriented individuals. Since away-from-home eating, and fast food consumption especially contribute to the obesogenic society in the US, it is of public health significance to screen for time preferences, and potentially tailor interventions based on these tendencies. Utilizing concepts from behavioral economics to facilitate more healthful eating both away from and at home should be further investigated in experimental studies.

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Conflicts of interest

None.

Appendix

Time preferences and eating in fast food and full-service restaurants: Multinomial logistic regression,[a] (n = 5871).

	Fast food frequency[c]		Full-service restaurants frequency[c]	
	2–3 time per week[d] OR[e] (95%CI)	≥4 times per week[d] OR[e] (95%CI)	2–3 time per week[d] OR[e] (95%CI)	≥4 times per week[d] OR[e] (95%CI)
Future time preference (30-day time horizon),[b]				
'Very low' (reference)				
Low	1.02 (0.77–1.35)	0.52 (0.31–0.89)	1.20 (0.90–1.59)	1.40 (0.87–2.27)
Medium	0.89 (0.72–1.11)	0.64 (0.44–0.93)	0.97 (0.78–1.22)	1.07 (0.72–1.58)
High	0.84 (0.68–1.02)	0.55 (0.39–0.77)	1.03 (0.84–1.26)	1.02 (0.71–1.47)
P for linear trend	0.033	0.004	0.896	0.812
Future time preference (60-day time horizon),[b]				
'Very low' (reference)				
Low	0.94 (0.75–1.17)	0.89 (0.59–1.36)	1.01 (0.81–1.25)	1.11 (0.76–1.61)
Medium	0.94 (0.78–1.14)	0.92 (0.65–1.32)	1.10 (0.92–1.32)	0.91 (0.64–1.27)
High	0.86 (0.73–1.01)	0.85 (0.63–1.15)	0.97 (0.83–1.14)	1.12 (0.85–1.47)
P for linear trend	0.066	0.311	0.572	0.535

Abbreviation: OR, odds ratio; CI, confidence interval.

[a] Participants were asked to indicate the number of times per week they personally purchased food at a fast food establishment and full service restaurant. The categories were: 0–1, 2–3, and ≥4 times per week.

[b] Frequenting fast food or full-service restaurants 0–1 times per week is the reference category.

[c] Time-preferences were elicited via the following two questions: (1) preferred $10 today or $12, $15, or $18 in 30 days (30 day horizon); and (2) preferred $10 in 30 days or $12, $15, or $18 in 60 days (60 day horizon). A response '$10' was coded as '0' since it indicated the lowest future time preference, whereas responses indicating a higher future dollar amount were each coded as '1'. This resulted in a score ranging from 0 ('very low') to 3 ('high'), with a higher score indicative of a higher future time preference.

[d] Model adjusted for age, gender (multiple imputation), race/ethnicity, marital status, obesity status, education, income, and self-rated health status.

[e] The odds ratios were obtained by exponentiating the multinomial logit coefficients.

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