2015

Understanding Everyday Decisions: An Examination Of Biases In Decision-Making, Educational Attainment, And Use Of Tobacco And Nicotine Delivery Products Among Women Of Reproductive Age

Laura L. Chivers
University of Vermont

UNDERSTANDING EVERYDAY DECISIONS: AN EXAMINATION OF BIASES IN DECISION-MAKING, EDUCATIONAL ATTAINMENT, AND USE OF TOBACCO AND NICOTINE DELIVERY PRODUCTS AMONG WOMEN OF REPRODUCTIVE AGE

A Dissertation Presented

by

Laura L. Chivers

to

The Faculty of the Graduate College

of

The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
Specializing in Psychology

May, 2015

Defense Date: March 26, 2015
Dissertation Examination Committee:

Stephen T. Higgins, Ph.D., Advisor
Kelley C. McLean, M.D., Chairperson
Mark E. Bouton, Ph.D.
Diann E. Gaalema, Ph. D.
Stacey C. Sigmon, Ph.D.
Cynthia J. Forehand, Ph.D., Dean of the Graduate College

Abstract

The aim of this study was to examine associations between biases in decision-making (delay discounting [DD], opportunity cost neglect [OCN], status quo bias [SQB]), educational attainment, and use of cigarettes and other tobacco and nicotine delivery products among women of reproductive age. Women of reproductive age are of special interest because of the additional risks that cigarette smoking or use of these other products represents should they become pregnant. Data were collected anonymously online in survey format using Amazon Mechanical Turk [AMT]. Participants were 800 women of reproductive age (24-44 years) from across the US. Half (n = 400) were smokers who reported current, daily smoking and half (n = 400) were never smokers who reported smoking less than 100 cigarettes in their lifetime. Participants reported smoking characteristics, plans to quit smoking, use of nicotine replacement therapies, use of other tobacco and nicotine delivery products, alcohol and drug use histories, and the Fagerström Test for Nicotine Dependence. Participants completed two measures for each of the three biases in decision-making, the Barratt Impulsiveness Scale [BIS-11], and two scales measuring short- and long-term propensity to plan for money expenditures [PPMS and PPML]. Educational attainment analyses compared three education groups: high school or less vs. some college (e.g. some college/A.A.) vs. B.A. or higher. DD was steeper among current vs. never smokers and for women with lower vs. higher levels of education, with no significant interaction between smoking and education. Modifying the instructions of the DD measure to make the zero option explicit reduced DD similarly across levels of smoking status and education. OCN was worse at lower vs. higher educational attainment on one OCN measure, with no significant effect of smoking status or interaction between opportunity cost neglect and educational attainment on either measure. No evidence was found for stronger SQB by smoking status or education. Smoking status was related to BIS Total, BIS Motor and Nonplanning subscales and to PPML in initial models but remained significant after adjusting for baseline differences in participant characteristics only for BIS Motor subscale and educational attainment was related only to BIS Nonplanning subscale. Preliminary comparisons of e-cigarette users to non-users suggest smokers using e-cigarettes only differ from smokers not using e-cigarettes on measures related to quitting smoking whereas within never smokers e-cigarette users demonstrated a pattern of riskier decision-making compared to non-users. Results confirm that DD and education are important to understanding the use of tobacco and nicotine products in women of reproductive age, and suggest that smoking and educational attainment are independently related to discounting rates. The observed explicit-zero framing effect suggests making alternatives more explicit when presenting choices may help reduce DD and lead to better decision-making, which has possible treatment implications. Results identify OCN as an additional decision-making bias to consider in understanding how low educational attainment might relate to smoking vulnerabilities. The preliminary examination of e-cigarette use suggests for women of reproductive age above age 24 years, e-cigarette use among current smokers may reflect desire or attempts to quit or cut back on smoking whereas e-cigarette use among non-smokers may be a marker of a more impulsive, riskier repertoire, although additional study of this question is needed.

Dedication

In loving memory of my grandmother Julia Marek Chivers, who inspired in me a love of learning and a curiosity about the world's unanswered questions

Acknowledgements

This research was supported by a developmental project funded by the Tobacco Centers of Regulatory Science award P50DA036114 from the National Institutes of Health / National Institute on Drug Abuse.

I believe it takes a village to complete a dissertation, with each person contributing in different but meaningful ways. My deepest thanks to my adviser Stephen Higgins for his advice and guidance and for supporting me though I took an unconventional path. I would like to express my appreciation to my dissertation committee members Kelley McLean, Mark Bouton, Diann Gaalema, and Stacey Sigmon for their support. I thank Eran Magen and Stephen Spiller for consulting on their decision-making measures.

Others in my University of Vermont "village" include my collaborators Dennis Hand and Jeffrey Priest. Dennis was instrumental in framing the research questions, providing guidance on online data collection, assisting with study design, and providing input on IRB and grant submission. Jeff provided extensive guidance on statistical procedures and presentation of research findings. I also thank Jacob O'Connor and Peter Rippberger for serving as blind coders and Melinda Rouille, Diana Cain, Susan Delisle and Marissa Wells for providing stellar administrative support to our laboratory. Thanks to the faculty and staff of the Psychology Department and the Graduate College, especially Mark Bouton, John Green, and Ida Russin, for helping me forge this path.

My “village” at Harvard includes first and foremost Mahzarin Banaji. Completing my doctorate while simultaneously working for her would not have been possible without her mentorship and her faith in me, and I am forever grateful to her. Rebecca Stoodley, Shelley Carson, Jeff Perrotti, Liz Lambert, Ken Nakayama and Susan Carey encouraged me to begin tackling the PhD, and Melissa Dias, Celia Raia, John Nannas, Danielle Truxaw, Nicole Noll, Julia Galindo and Mark Gerstel supported me on many occasions to keep the psychology undergraduate program thriving. Amitai Shenhav consulted on and provided the MATLAB script for delay discounting scoring and Josiah Nunziato provided critical advice about Amazon Mechanical Turk research practices. Thanks to Ellsworth Fersch, Irene Pepperberg, Shawn Harriman, and the 2nd floor staff for many research discussions and pep talks and to the Life Science advising team, my cohort at Careers Plus, and Angela Lifsey for being role models for my work and research.

The rest of my “village” is composed of my family and friends who help me both to enjoy life and to persevere. My parents Jeanne and Jim Chivers are always there for me, and my sister, grampy, aunts, uncles and cousins are wonderfully understanding. Jessica Drawe and my cat Lily make home a comforting place no matter how crazy things get. Jonathan Matsui gives me great advice and keeps me honest about sticking to my plans. Greg, Jenn, Tom, Ethan, Robin, Mike, Bryan, Elissa, Corey, MJ, Maria, Tony, Maggie, Spike, Paula, and Peter have all been shoulders to lean on and friends to unwind with.

Many more friends and colleagues than I can name have meant so much to me in this process, and I hope each and every one of them knows how much I appreciate them.

Table of Contents

List of Tables

List of Figures

Background

Smoking in Women of Reproductive Age and Relation to Educational Attainment

Smoking prevalence in the U.S. has declined substantially over the past approximately 50 years. Unfortunately, this progress has not been evenly distributed across sub-populations of smokers, with smoking rates among women, and especially among women from economically-disadvantaged populations, showing a slower decline (e.g., Graham, Inskip, Francis, & Harman, 2006; Higgins & Chilcoat, 2009; Kandel, Griesler, & Schaffran, 2009). Socioeconomic status (SES) is a strong predictor of various aspects of smoking, with lower SES being associated with higher smoking initiation rates, heavier smoking, and lower quit rates in women (e.g., Chilcoat, 2009). Moreover, smoking during pregnancy is the leading preventable cause of poor pregnancy outcomes in the US, and SES is inversely related to smoking during pregnancy, such that women with lower SES continue smoking at much higher rates during pregnancy compared to women with higher SES (Ershoff, Ashford, & Goldenberg, 2004; Higgins et al., 2009; Kandel et al., 2009; Lumley et al., 2009).

Educational attainment is one marker of SES that is an especially reliable predictor of tobacco use and smoking characteristics in women, including likelihood of having started smoking at an early age, being a current smoker, smoking daily, smoking heavily, being nicotine dependent, and having higher blood levels of cotinine (a nicotine metabolite) even after adjusting for number of cigarettes smoked per day (Chilcoat, 2009; Higgins et al., 2009; Kandel et al., 2009). The nearly linear relationship typically observed between educational attainment and smoking status becomes even more pronounced in pregnancy, when the majority of women with lower educational

attainment (e.g. less than high school degree) continue to smoke through pregnancy and early postpartum (Chilcoat, 2009; Ershoff et al., 2004; Higgins et al., 2009; Kandel et al., 2009; Lumley et al., 2009) despite serious potential consequences to themselves and their unborn fetus including pregnancy complications, stillbirth, and sudden infant death syndrome (Bonnie, Stratton, & Wallace, 2007; Cnattingius, 2004; Pauly & Slotkin, 2008). By contrast, the vast majority of women at higher levels of education (e.g. college graduates), are able to quit smoking during pregnancy. The increased prevalence of smoking among disadvantaged women more generally and the consequences of becoming pregnant and continuing to smoke or raising children in a smoking environment suggest that women of reproductive age represent an important population to target for study to try to understand vulnerabilities that may contribute to smoking. The previously discussed relationships between smoking and education level in women generally and during pregnancy specifically underscore the importance of educational attainment to smoking vulnerability.

Association of Educational Attainment and Smoking Status with Biases in Decision-Making

Much remains to be learned about the influence of educational attainment on risk for engaging in unhealthy behaviors such as smoking and other nicotine product use. For example, higher educational attainment may lead to differences in several important factors, including increased knowledge of the negative effects of smoking and of effective treatments and routes to access them (Link & Phelan, 2009). Another pathway may be that education enhances critical thinking and decision-making skills that provide people with the tools to make more optimal choices (Galobardes, Shaw, Lawlor, Lynch,

& Davey Smith, 2006). Suboptimal decision-making is one of the hallmarks of unhealthy behavior patterns such as smoking. That is, smoking represents persistence in an unhealthy behavior pattern despite well-known negative consequences as well as the forfeiture of other available, more beneficial choice options (i.e., alternative uses of the money spent on purchasing cigarettes). While all humans exhibit such biases in decision-making, they are often more pronounced in populations with lower SES and may contribute to the overrepresentation of unhealthy behavior patterns in populations with lower levels of educational attainment.

For example, one of the more common of these biases is one that is referred to as a bias for the present wherein people prefer the more immediate of the available options even when doing so means forgoing a larger but more delayed gain (Bickel & Marsch, 2001; O'Donoghue & Rabin, 1999). This bias for the present is evident in laboratory studies of delay discounting, in which people are given a series of hypothetical choices between a smaller but immediate reward (typically money) or a reward of a larger amount available at varying delays (e.g., Bickel & Marsch, 2001; Frederick, Loewenstein, & O'Donoghue, 2002; Rachlin & Green, 1972; Rachlin, Raineri, & Cross, 1991; Raineri & Rachlin, 1993). Prior research has demonstrated that smokers and other people with substance use disorders show steeper delay discounting than those who do not abuse substances (e.g., Baker, Johnson, & Bickel, 2003; Bickel, Odum, & Madden, 1999; Coffey, Gudleski, Saladin, & Brady, 2003; Heil, Johnson, Higgins, & Bickel, 2006; Kirby, Petry, & Bickel, 1999; Madden, Bickel, & Jacobs, 1999; Richards, Zhang, Mitchell, & De Wit, 1999). In smokers, delay discounting may account for some of the variance in the association of educational attainment with smoking status such that lower

levels of educational attainment are associated with greater discounting (e.g., Jaroni, Wright, Lerman, & Epstein, 2004; Wilson et al., 2015).

To my knowledge, few other biases in decision-making have been examined among smokers or other groups with health-related behavior problems. Identifying novel measures of biases in decision-making that are related to use of cigarettes and other tobacco and nicotine delivery products and/or to educational attainment may help to elucidate complex associations between risk factors and smoking initiation, dependence, and difficulty quitting cigarette smoking and other types of tobacco and nicotine use. They may also be factors to consider in assessing the potential impact of new tobacco products and tobacco marketing practices on vulnerable populations. I have selected for inclusion in this study three biases in decision-making that have emerged from behavioral-economics research: delay discounting, which has been examined relatively extensively in smokers but not in users of other tobacco or nicotine delivery products, and opportunity cost neglect and status quo bias, which to my knowledge, have not been previously studied in smokers, users of other tobacco or nicotine delivery products, or other populations with health-related behavior problems. Below I provide more information on each of these decision-making biases of interest.

Bias for the present. As mentioned above, delay (or temporal) discounting refers to the decrease in the present value of a monetary gain or other reward as a function of the delay to receiving that reward. When presented with a choice between a small, immediate reward and a larger, delayed reward, some people choose the smaller, immediate option even when delays to the larger alternative are relatively short (e.g., Bickel & Marsch, 2001; Frederick et al., 2002). Such individuals are referred to as

"steeper discounters," and steeper discounting rates have been reliably found in smokers and those with substance use disorders (for reviews, see Bickel, Jarmolowicz, Mueller, Koffarnus, & Gatchalian, 2012; Bickel & Marsch, 2001; Reynolds, 2006). Steeper discounting has also been observed in people with lower educational attainment in the general population (e.g., Bauer & Chytilová, 2009; de Wit, Flory, Acheson, McCloskey, & Manuck, 2007; Jarmolowicz, Bickel, Carter, Franck, & Mueller, 2012; Reimers, Maylor, Stewart, & Chater, 2009), and among smokers more specifically (Jaroni et al., 2004; Wilson et al., 2015). For example, Jaroni and colleagues (2004) reported that smokers with no college had significantly steeper discounting compared to smokers with some college and to smokers with college degrees. Steeper delay discounting is related to a host of smoking characteristics, including earlier initiation of smoking (Audrain-McGovern et al., 2009), smoking more cigarettes per day (Heyman & Gibb, 2006; Ohmura, Takahashi, & Kitamura, 2005; although see Johnson, Bickel, & Baker, 2007), higher levels of nicotine dependence (Sweitzer, Donny, Dierker, Flory, & Manuck, 2008), and lower likelihood of quitting smoking (Krishnan-Sarin et al., 2007).

In at least one study conducted by our research team, steeper discounting was associated with relapse back to smoking postpartum among disadvantaged women who quit during pregnancy (Yoon et al., 2007), although there is still much to learn about the role delay discounting may be playing in relation to smoking in women of reproductive age. For example, in a more recent study by our group further examining whether delay discounting predicted spontaneous quitting among pregnant women, it did so at lower (<10 cigs/day) but not higher pre-pregnancy smoking rates, while educational attainment was an independent predictor at lower and higher smoking rates (White, Redner, Skelly,

& Higgins, 2014). In another study, delay-discounting did not predict during-treatment or post-treatment cessation rates among pregnant and newly postpartum smokers (Lopez, 2014). This research suggests that delay discounting has at least a modest association with smoking and difficulties quitting among pregnant women, but clearly other important factors are involved as well, including educational attainment.

The present study used the Monetary Choice Questionnaire (MCQ; Kirby et al., 1999) which is a standard measure of delay discounting that has been used effectively in a slightly modified version in at least one prior online study examining associations between delay and probability discounting (Jarmolowicz et al., 2012). These investigators reported reliable unadjusted associations between discounting rates and both smoking status and education level in a general population sample, and discounting results were reported to be comparable to those assessed under controlled laboratory conditions. Including the MCQ in the present study allows us to extend prior discounting research to examining discounting rates specifically in women of reproductive age and their independent relation to educational attainment and smoking status, and to determine whether measures of other biases might operate similarly to delay discounting in their relationship to educational attainment and smoking status.

Although delay discounting is generally thought of as a trait-like construct that is relatively stable over time, there is some evidence that discount rates can be modified through interventions or environmental changes (for a review, see Koffarnus, Jarmolowicz, Mueller, & Bickel, 2013), so understanding discounting rates and ways to modify them in populations such as those with lower educational attainment may be important in considering what preventative measures and interventions might be effective

in populations where smoking is especially recalcitrant. An emerging but reliable finding is that delay discounting can be reduced in the laboratory by reframing the question to make the zero option explicit (Koffarnus & Bickel, 2014; Magen, Dweck, & Gross, 2008; Radu, Yi, Bickel, Gross, & McClure, 2011). For example, a conventional delay-discounting question asks people to choose between $84 today or $100 in one week. The explicit-zero versions asks people to choose between $84 today and $0 in one week or $0 today and $100 on one week. This modified explicit-zero version, which makes it *explicit* that people have a choice between something now but nothing later or nothing now but something larger at a later time has reduced discounting rates in three different measures of delay discounting in the general population (Koffarnus & Bickel, 2014; Magen et al., 2008; Radu et al., 2011). Whether exposure to this kind of framing permanently shifts a person's underlying tendency to discount the future across all situations or whether this shift is specific to the choice situation in which the framing is employed remains an empirical question. However, even in the situation-specific case, the fact that framing choices to make zero options more explicit shifts people's choices away from the more immediate outcomes toward the more beneficial, later outcomes in that specific situation has important treatment implications because it suggests that people may be helped to make better decisions simply by changing the way in which choices are presented. However, to my knowledge, delay discounting with explicit-zero framing has not been examined in smokers or in relation to any other health-related behavior problem, nor has it been examined in relation to educational attainment or with the MCQ format specifically. Including an explicit-zero version of the MCQ along with the usual delay-discounting task in the present study permits systematic replication of prior research

using a conventional delay discounting task specifically in women of reproductive age, extends research on the explicit-zero procedure to a new population, and permits an examination of whether the reduction in discounting resulting from the explicit-zero framing manipulation differs by smoking status, educational level, or their interaction. As is discussed more below, the explicit-zero procedure may actually be a framing manipulation that functions by increasing consideration of opportunity costs, one of the other three biases of interest in this study.

Because delay discounting is often considered a measure of impulsivity, the Barratt Impulsiveness Scale-11 (BIS-11) was included to determine whether the relationship of smoking status and education with discounting mirrored the relationship with impulsivity or if they differed. (BIS-11) is a widely used measure of trait-level impulsiveness (BIS-11; Patton, Stanford, & Barratt, 1995) that has been reported to be related to education level (de Wit et al., 2007), smoking status (Mitchell, 1999), and delay discounting in some studies (de Wit et al., 2007, A. Lopez, personal communication, October 21, 2013; although see Mitchell, 1999).

Opportunity cost neglect. Decisions often involve selecting one option from two or more available options. The lost opportunity to obtain one of these other options as a function of choosing one option is called opportunity cost. Some decisions have many explicit alternatives where it is more apparent that choosing one option forfeits the others, whereas other situations seem to be solitary decisions in which only one option is presented and the decision required is whether to accept or reject the sole option. Even in these solitary decisions, however, choosing to accept the option at hand often means forfeiting other options even if the alternatives are not made explicit. For example, if

your neighbor asks you to buy a $4 box of fundraising cookies, the choice appears to be between buying the cookies or not buying the cookies. But in reality, this $4 can be used for only one expenditure so if it is used to buy the cookies, it cannot be used to purchase new socks, go to a movie, or to save toward the purchase of a home. The next best use (according to that person's individual preferences) of this $4 is the opportunity cost of spending the $4 on the cookies.

In general people are not very good at spontaneously considering opportunity costs when making a decision, especially when these opportunity costs are not made explicit (Frederick, Novemsky, Wang, Dhar, & Nowlis, 2009; Spiller, 2011). To my knowledge, opportunity cost neglect has only been studied using decision-making scenarios related to business or finance in general population samples (e.g., Becker, Ronen, & Sorter, 1974; Northcraft & Neale, 1986) or to relatively arbitrary scenarios presented to participants from the general population (Frederick et al., 2009; Spiller, 2011). For example, in one study participants were asked whether they would hypothetically purchase a DVD on sale for $14.99; their answer options for not buying it were worded as either "not buy" or as "keep the $14.99 for other purchases" (Frederick et al., 2009). While 75% of participants chose to purchase the DVD when the alternative was worded as "not buy," only 55% of participants chose to buy the DVD when the alternative was worded as "keep the $14.99 for other purchases" suggesting that simply reminding people of other uses for their money, thereby making opportunity costs more salient, changes behavior. Failing to consider opportunity costs is especially likely when not all options are immediately available, when the options are ill-defined in number, or the consequences of the choices are delayed in time or probabilistic in likelihood of

occurrence (Frederick et al., 2009), all of which are hallmarks of many of the alternatives to engaging in unhealthy behaviors such as smoking.

To my knowledge, opportunity cost neglect/consideration has not yet been studied in smokers specifically or any other population with health-related behavior problems, or in relation to educational attainment. To the extent that decisions about smoking and smoking cessation may be influenced by considering different ways to spend the money normally spent on cigarettes, it could be important to understand whether smokers might differ from non-smokers in sensitivity to explicit opportunity costs, ability to spontaneously consider non-explicit opportunity costs, and whether such differences may be exacerbated among those with lower educational attainment.

Two measures were employed in the present study to investigate the extent to which people incorporate opportunity costs into their decision-making. One measure was the Opportunity Cost Consideration Scale (OCCS), a three-item self-report scale in which participants rate the extent to which they consider alternatives when making decisions (Spiller, 2011). The other measure was the Breakfast Purchase Task (BPT), a hypothetical decision-making task that asks people to choose various items from a breakfast menu, asks them to describe how they make their decision, and then asks them to explicitly generate other items that they could have purchased instead of the breakfast items they chose. Participants' responses are coded, and those who report considering non-breakfast items in their description of how they chose are considered to display opportunity cost consideration while participants who do not mention any alternatives to breakfast are not considered to display opportunity cost consideration (Spiller, 2011). For example, people who reply they picked a bagel because they like bagels, or a

breakfast sandwich because it has the most protein, or a muffin because it had a low price would not be coded as considering opportunity costs, whereas those who report that they wanted to save money for lunch, or might need to purchase gas later, or wanted to save money for emergencies that might come up would be coded as considering opportunity costs. Both the OCCS and the BPT have been used in only a few studies, but they have shown individual differences related to people's propensity to plan for their money expenditures (see below regarding propensity to plan) and are sensitive to manipulations of budget constraint in studies using samples from the general population (Spiller, 2011).

While not originally conceptualized as such, I propose that the wording of the questions in the explicit-zero version of the delay discounting measure (Explicit-Zero MCQ) discussed above is an opportunity cost manipulation. Rather than presenting the choices as one amount available now or another larger amount later, the explicit-zero wording reframes the choices as "something now but nothing later'' versus ''nothing now but more later,'' drawing attention to the $0 outcomes in both of the options and making the opportunity costs of both choices over both time points more salient. Much like reminding people that not spending $14.99 on a DVD now means they will have this money for other purchases shifts some people toward refraining from purchasing the DVD, making it more obvious that a choice for the immediately available $84 means $0 in 1 week instead of the $100 in 1 week available in the other option shifts some people toward selecting the larger, later option. The current study examined whether there are individual differences in the reduction in discounting rates as a result of making the zero-option explicit that relate to smoking rates, educational attainment, or their interaction.

Propensity to plan is a trait-like construct that reflects both generating and considering plans which has been reported to be related to both opportunity cost consideration and to educational attainment in study participants from the general population (Lynch, Netemeyer, Spiller, & Zammit, 2010; Spiller, 2011). People who have a higher propensity to plan seem to consider alternatives and to spontaneously consult those alternatives when making a decision. They are more likely to spontaneously consider opportunity costs, whereas people with a lower propensity to plan fail to consider opportunity costs unless their budget is constrained (Spiller, 2011). Propensity to plan also tends to increase with increasing educational attainment (Lynch et al., 2010). This suggests a possible pathway through which greater educational attainment may enhance people's ability to consider other alternatives via an increased propensity to plan. Two propensity to plan scales were included in the present study: propensity to plan for the short-term use of money (PPMS) and propensity to plan for the long-term use of money (PPML). To my knowledge, propensity to plan has not been assessed in relation to smoking status.

Status quo bias. Status quo bias refers to the tendency to disproportionately choose an option that is already in place or that one has previously chosen. This is referred to as status quo bias, which is typically measured by presenting participants with a series of hypothetical scenarios each having a number of alternatives to choose from, and asking which alternative they would choose (e.g., Baron & Ritov, 1994; Chernev, 2004; Samuelson & Zeckhauser, 1988; Schweitzer, 1994). In the neutral versions of the task, the choices are presented without indicating any status quo position. In the status quo versions, one of the choices is designated as the current state (that is, the status quo),

and participants are asked whether they would retain the current option or choose one of the other alternatives. For example, in one scenario from the seminal study, the hypothetical scenario was based on imagining the participant has inherited a large sum of money and is asked which of several detailed portfolios to invest in (Samuelson & Zeckhauser, 1988). In the neutral version, participants were asked to consider the four portfolios and asked which they would choose (e.g. invest in Company A, invest in Company B, invest in treasury bills, invest in municipal bonds). In the status quo version, they were told the funds were currently invested in one of the portfolios, and were asked to consider the four portfolios and indicate which they would choose (e.g. retain investment in Company A, invest in Company B, invest in treasury bills, invest in municipal bonds). In this study across several different types of decision scenarios (allocating a budget toward different priorities, and deciding what color car to purchase) including the investment portfolio example above, participants were more likely to choose an option when it was in the status quo position as compared to when it was in a neutral position, suggesting a generalized bias for the status quo (Samuelson & Zeckhauser, 1988).

Following this seminal study, the status quo bias has been demonstrated across many different types of decisions, including in laboratory experiments examining topics such as stock trading (Brown & Kagel, 2009), escalation of commitment to failing projects (Fox, Bizman, & Huberman, 2009) and decisions regarding electricity providers (Hartman, 1991). In addition to hypothetical situations in lab based studies, researchers have noted evidence of the status quo bias in field data from the US mutual fund equity market (Kempf & Ruenzi, 2006), and in employees' selection of health insurance plans

and allocations to retirement funds (Agnew, Balduzzi, & Sunden, 2003; Samuelson & Zeckhauser, 1988).

While status quo bias has been studied in many different contexts, very few existing measures lend themselves to research designs that might permit an examination of individual differences in this bias. Two measures were identified for inclusion in the current study. The first (SQB-Scenarios) asks participants to choose between two options in three scenarios from different categories: health club, apartment, and hotel (Yen & Chuang, 2008). In each category, two options are briefly described, and participants are asked which they would choose. The descriptions have been selected so that the two options are about equal in desirability (that is, neither dominates the other). One of the options is designated as the current (e.g., status quo), option and the other is designated as the new (e.g. alternative) option, counterbalanced across participants. For example, in the apartment scenario, participants are asked: "Imagine that you have been renting a one-bedroom apartment (Current Apartment). Your current lease is up and you have the chance to stay in your current apartment or move to a different apartment (New Apartment). What will you do?" Below the question, one apartment is described as being in a new apartment building, having a color TV and cable, and new wall-to-wall carpeting, and the other apartment is described as having a dishwasher and refrigerator, the cost of heating included in the rent, and nice new furniture. Participants are asked which option they would choose. The second measure included in the current study (SQB-Investments) presents choices between two future investments at different rates, one which is the status quo option and one which is the alternate option (Chernev, 2004). In both measures, participants who are more prone to choose the current (status quo)

option rather than to switch to the new option when both options are equally desirable or when the new option is better than the status quo option are considered to exhibit the status quo bias.

To my knowledge, status quo bias has not yet been studied in smokers specifically or any other population with health-related behavior problems, although status quo bias very well could be relevant when examining inability or unwillingness to discontinue an established behavior pattern despite knowing that it may be harmful.

Use of Other Tobacco and Nicotine Delivery Products

The use of non-cigarette tobacco and nicotine delivery products (including e-cigarettes) is on the rise, and use of one of these alternative tobacco or nicotine products is more prevalent than use of cigarettes alone (e.g., Lee, Hebert, Nonnemaker, & Kim, 2014). However, knowledge of the characteristics of users of these products that might inform regulatory science and public health initiatives has not kept pace with the explosion of their use (Benowitz, 2014; Prignot, Sasco, Poulet, Gupta, & Aditama, 2008). Recent reports suggest that users of emerging tobacco and nicotine products tend to be cigarette smokers, White, of younger age, and of higher educational attainment (e.g., King, Patel, Nguyen, & Dube, 2015; McMillen, Maduka, & Winickoff, 2012; Richardson, Williams, Rath, Villanti, & Vallone, 2014), but to my knowledge use of other tobacco and nicotine delivery products has not been examined specifically in women of reproductive age. The current study assessed use of other tobacco and nicotine delivery products across all participants to understand the use of these products among this vulnerable population of women of reproductive age which is an important first step in determining whether users of these products are at risk for additional harms to

themselves and their children and to begin considering whether and how best to regulate use of these emerging products.

Online Research Platforms

Online data collection was employed in the current study to facilitate obtaining a relatively large sample (N = 800) of current smokers and never smokers from across the entire geographic region of the United States. This study was administered using two internet-based tools, Amazon Mechanical Turk (AMT; https://www.mturk.com) and Limesurvey (http://www.limesurvey.org).

AMT is an online crowdsourcing marketplace that brings together individuals offering small jobs for pay with individuals willing to complete web-based tasks for payment. People (e.g. researchers) who have work to offer (called "requestors") post work opportunities called "Human Intelligence Tasks" (HITs). Users on AMT called "workers" can browse available HITs and decide which, if any, they would like to complete. Requestors may specify various criteria for workers that are visible to workers, and only eligible workers are permitted to accept those HITs. Requestors set the pay rate for their task, review the quality of the work, and can either reject payment for unsuitable work or process payment to the worker using Amazon's payment system. The requestor has access only to the worker's Worker ID number – no other identifying information is shared with the requestor. While the tasks offered in HITs take many formats such as transcribing, data entry, or searching the web for specific information, AMT is being used with increasing frequency and positive results for psychological research (e.g., Buhrmester, Kwang, & Gosling, 2011; Crump, McDonnell, & Gureckis, 2013; Mason & Suri, 2012; Paolacci & Chandler, 2014; Rand, 2012; Shapiro, Chandler,

& Mueller, 2013). As briefly mentioned above, one recent study specifically sought to examine the suitability of conducting valid delay discounting research on AMT and found comparable discounting rates for AMT participants compared to rates from previous studies as well as significant associations between discounting and other factors that replicate findings from previous laboratory-based studies (Jarmolowicz et al., 2012). AMT was used both to recruit participants as well as to process payment for the current study.

LimeSurvey is open-source software for collecting survey data that can be configured to automate all processes of data collection including screening participants, determining eligibility based on quotas, and presenting branching questions based on previous answers. Data can be collected anonymously via Limesurvey by configuring it to remove personal identifiers (including IP addresses) from the data, and refraining from asking participants to self-report personal identifiers. The current study used Limesurvey configured for anonymous data collection and hosted on a server at the University of Vermont to collect all the survey data.

Study Aims

The overarching aim of this study was to examine associations between cigarette smoking status and use of other tobacco and nicotine delivery products, educational attainment, and three biases in decision-making (delay discounting, opportunity cost neglect, status quo bias) in women of reproductive age. I hypothesized stronger biases among (a) current cigarette smokers compared to never smokers and (b) women with lower educational attainment compared to women with higher educational attainment. In addition, I aimed to examine whether smoking status and educational attainment interact

in their influence on decision-making biases. Lastly, I included a secondary aim to examine the association of decision-making biases with use of e-cigarettes in this population of women of reproductive age as prevalence of use of this product is growing rapidly in the U.S and abroad and yet relatively little is known about individual differences in who uses. I know of no prior studies examining associations between e-cigarette use and biases in decision-making.

Method

Participants

The target population for the present study was women residing in the United States aged 24-44 years. Reproductive age is typically defined as women aged 15-44 years, but because this study examines educational attainment and higher education typically continues through one's early 20s, women under the age of 24 were excluded to maximize the likelihood that they have reached their terminal education level. The study was approved by the Committee on Human Research in the Behavioral and Social Sciences at University of Vermont.

Participants (N = 800) were recruited via the Amazon Mechanical Turk platform and eligibility screening was conducted by asking participants to answer three brief screening questions asking about gender, age, and current smoking status (see smoker characteristics section below for wording of smoking status question). Women aged 24-44 years were invited to participate in the study if they responded that they were either a current daily cigarette smoker or a never smoker and the quota representing their smoking status had not yet been reached (2 groups, n = 400 per group). Exclusion criteria were < 24 or > 44 years of age, male, a former smoker, or a current but not a daily smoker. Educational attainment was not used to determine study eligibility. To obtain 800 unique participants, the software Turkgate (Goldin & Darlow, 2013) was used, which allows each AMT Worker ID (only one AMT Worker ID is permitted per person) to complete the survey only once across all days of data collection.

Procedure

Data collection occurred in two waves: a two-week period in August 2014 (n = 250) and a two-week period in December 2014 (n = 550). HITs were made available for viewing to potential workers on AMT in batches of 100 or smaller on different days of the week (excluding weekends) and at different times of day to decrease the likelihood of collecting data from an idiosyncratic sample as a result of the timing of data collection. Participants accessed and completed the study via computer at their own location. Criteria were set in AMT so that only people residing in the United States and who had at least 95% of the HITs they completed previously approved by other requestors were able to accept the HIT. Prior to accepting the HIT, potential participants could see the study listing, which included a title ("20-40 Minute Research Study about Everyday Decisions"), a brief description of the HIT ("A research survey about everyday decisions conducted by the University of Vermont"), and the payment available ("Reward per assignment: $2.00"). When participants clicked on the HIT, a slightly longer study description appeared informing them not to complete the study more than once, and noting that there would be three brief screening questions to determine study eligibility. The study description is shown in Appendix A; a slightly shorter version was used with the initial 150 participants. After accepting the HIT and accessing the screener, eligible participants saw the IRB-approved information sheet that included informed consent information. Participants clicked "next" to continue on to the survey, implying consent to participate, or rejected participation by closing the browser window or clicking a button to discard all data and exit.

Participants completed the remainder of the survey at their own pace. Survey questions addressed sociodemographics, drug use histories, and several measures of impulsivity and decision-making bias. The first half of the survey on sociodemographics and drug use histories was presented in a static order for all participants. In the second half of the survey, the order of items assessing decision-making bias, impulsivity, and propensity to plan was randomized for each participant. The exception was the investment status quo measure (SQB-Investments), which was the last decision-making measure presented for the initial 250 participants and randomized as described above for the final 550 participants. Survey length varied depending on a participant's overall pace and answers to branching questions on cigarette, alcohol, and drug use. Participants were allowed up to 3 hours to complete the survey in case of distractions or needs for breaks, with a median completion time of 23 min and a range of 9-163 min.

Upon completing the survey and clicking the submit button, the participant received a unique completion code and instructions to return to the AMT screen to enter the code for payment. Research staff had up to 48 hours to review and accept the submissions, and upon acceptance, participants were credited $2.00 to their Amazon payment account (for additional information about behavioral research and payment rates on AMT, see Buhrmester et al., 2011; Crump et al., 2013; Horton, Rand, & Zeckhauser, 2011; Mason & Suri, 2012).

Measures

Sociodemographic questions. Sociodemographic questions assessed education level, age, marital status, and race. Education level options were: 1) 8th grade or less, 2) some high school 3) GED, 4) high school graduate, 5) some college, 6) Associate's

degree/2-year degree 7) Bachelor's degree/ 4-year degree, and 8) graduate or professional degree, although they were collapsed into three categories for data analysis, roughly equivalent to the categories used by Jaroni and colleagues (2004): 1) High school graduate or less; 2) Some college/Associate's Degree (AA); and 3) Bachelor's degree (BA) or higher.

Smoker characteristics. To assess smoking status, all participants answered the following question during the screener: "Pick the statement that best describes you: 1) I have NEVER smoked, or I have smoked LESS THAN 100 cigarettes ever; 2) I USED to smoke but I have quit smoking (no cigarettes in at least the last six months); 3) I USED to smoke but am in the process of quitting (stopped smoking within the last six months); 4) I am a CURRENT smoker, I smoke daily or nearly every day; 5) I am a CURRENT smoker, but I do not smoke daily or nearly every day." In the survey, smokers answered questions assessing number of cigarettes per day, how long they had been smoking this number of cigarettes per day, and age of first cigarette. They were also queried about any plans to quit smoking in the next 30 days, current use of nicotine replacement therapies, and completed the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström 1991) to determine the degree of nicotine dependence.

Use of other tobacco and nicotine delivery products. All participants reported on their use of tobacco and nicotine delivery products using a question modeled after the 2012 National Adult Tobacco Survey (see Lee et al., 2014). Participants reported how often over the past 30 days and how often over the 12 months (every day, some days, or not at all) they used each product (cigars, hookah, bidis/cloves, smokeless tobacco, snus, e-cigarettes, other tobacco products).

Alcohol and drug use history. Alcohol and other drug use questions were adapted from the drug and alcohol use section of the Addiction Severity Index (McLellan et al., 1992) and asked about alcohol use including number of drinks per week, use of illegal substances or misuse of prescription drugs and whether the participant had ever been treated for alcohol or substance abuse.

Bias for the present. As mentioned above, two measures of delay discounting were included along with a measure of impulsivity:

1. To assess delay discounting, Kirby Monetary Choice Questionnaire (MCQ), a 27-item measure that is administered in questionnaire format (Kirby et al., 1999). Each MCQ question asks participants to make a hypothetical choice between two amounts of money: a smaller amount available now and a larger amount available at some delay. For example, a participant would be asked "Would you prefer $54 today or $55 in 117 days?" Delays range from 7 to 186 days. Nine items are included for each of three different magnitudes of delayed rewards: small (ranging from $25-35), medium (ranging from $50-60) and large (ranging from $75-85), and the 27 items together can be used to calculate a total score. Presentation of the items followed a fixed order established by Kirby and colleagues (1999).

The relationship between temporal delay and reward value is best represented by a hyperbolic function that can be characterized by the following equation, $V = A/(1+kD)$, where V is the present value of the delayed reward, A is the undiscounted value of the delayed reward, and D is the delay to receipt of the delayed reward. The parameter k is a free parameter that represents the discount rate (Mazur, 1987; Rachlin et al., 1991). Larger k values indicate greater discounting of future rewards and can be used to quantify

individual differences in discounting. I calculated an overall *k* for all 27 items using the estimation procedure described by Kirby and colleagues (1999) for the MCQ using a script running in Matlab R2014a. No *k* value was calculated if participants had missing data for more than 3 items on the MCQ.

2. To assess delay discounting with explicit-zero framing, a modified version of the MCQ in which explicit zero options were included for each question (Explicit-Zero MCQ). All items, instructions, and presentation order were identical to the MCQ as described above, except that the wording of each item was altered to provide the $0 outcome for each option. For example, a participant was asked "Would you prefer $54 today and $0 in 117 days, or $55 in 117 days and $0 today?" An overall *k* was calculated for all 27 items from the Explicit-Zero MCQ in the same manner as described for the MCQ above.

3. To assess impulsivity, Barratt Impulsiveness Scale-11 (BIS-11) which consists of 30 statements describing common impulsive and non-impulsive behaviors and characteristics (e.g., "I have racing thoughts," "I do things without thinking, ""I plan tasks carefully") and has demonstrated reliability and validity (Patton et al., 1995). Participants were instructed not to spend too long on any statement and to answer quickly and honestly, and to rate the frequency of each item on a 4-point scale: 1 = *Rarely/Never*, 2 = *Occasionally*, 3 = *Often*, & 4 = *Almost Always/Always*.

BIS-11 yields both a total score and three subscores. The total score (BIS-Total) is the sum of the 30 individual items, with the non-impulsive behaviors and characteristics reverse-scored. The maximum total score is 120, with higher scores indicating more impulsiveness (Patton et al., 1995). The attentional impulsiveness

subscale (BIS-Attentional) consists of 8 items with a maximum possible score of 32, and assesses intrusive and racing thoughts as well as ability to focus on tasks (e.g. “I am restless at the theater or lectures”). The motor impulsiveness subscale (BIS-Motor) consists of 11 items with a maximum possible score of 44, and assesses acting on the spur of the moment as well as maintaining a consistent lifestyle (e.g. “I change jobs”). The nonplanning impulsiveness subscale (BIS-Nonplanning) consists of 11 items with a maximum possible score of 44, and assesses the desire to plan and think through things as well as enjoyment of complex tasks (e.g. “I like to think about complex problems”).

Opportunity cost neglect. As mentioned above, two measures of opportunity cost neglect were included, which could be administered to all participants (i.e., did not require a between-subjects manipulation) along with two measures of propensity to plan:

1. Breakfast Purchase Task (BPT), originally developed in testing with undergraduate students in North Carolina (Spiller, 2011). The text was modified slightly from the original to be more generic with regard to geography and age (modified from Spiller, 2011; see Appendix B for full text). In this hypothetical choice task, participants were asked to imagine they are spending all day in a city to complete several job interviews and have not yet had breakfast, and they go to a local restaurant to purchase breakfast and discover they have no debit cards, credit cards, or checks with them and have only a small amount of cash (e.g. $10). They were shown a breakfast menu with prices listed for 12 items (e.g. Coffee $1.25, Donut $1.00) and were asked to indicate which items on the menu they would choose, and could choose as many as they wish or choose a “buy nothing” option. Next, participants were asked to describe how they made their decisions; these responses were coded independently by two coders blind to

conditions and study hypotheses, to determine if participants spontaneously considered alternatives other than breakfast following the coding scheme used by Spiller (2011), who reported 94% coder agreement. Coders in the present study achieved 95.6% agreement; disagreements between raters were settled using the coding scheme by the experimenter, who was blind to conditions for participants while coding. This dichotomous measure of consideration (yes vs. no) was the primary measure of spontaneous consideration of opportunity costs.

2. Opportunity Cost Consideration Scale (OCCS), a three-question scale assessing self-report of opportunity cost consideration (Spiller, 2011). The three items are: "I often think about the fact that spending money on one purchase now means not spending money on some other purchase later"; "When I'm faced with an opportunity to make a purchase, I try to imagine things in other categories I might spend that money on"; and "I often consider other specific items that I would not be able to buy if I made a particular purchase." Participants rated the degree to which they agree or disagree with each of the three statements on a scale from 1 (*Strongly Disagree*) to 6 (*Strongly Agree*). The mean response on these three items is taken as the measure of opportunity cost consideration, with higher scores indicating increased consideration of opportunity costs (across the three items in a prior report, α =.85; Spiller, 2011). The OCCS is reported to correlate with the propensity to plan for the long-term use of money scale (PPML, described more below, r = .20), but displayed discriminant validity from this scale in a previous study in which the nine items from the two scales loaded onto two factors representing the original scales, with all loadings on original scales greater than .80 and all cross-scale loadings less than .20 (Spiller, 2011).

3. Propensity to plan for the use of money, involving both the short-term (e.g. "I decide beforehand how my money will be used in the next few days", PPMS) and the long-term (e.g. "I set financial goals for the next 1-2 months for what I want to achieve with my money", PPML) use of money (see Appendix B for full text). Each scale consisted of 6 items rated from 1 (*Strongly Disagree*) to 6 (*Strongly Agree*) (Lynch et al., 2010). Each subscale's score is the mean of the 6 items, and both scales have demonstrated internal consistency (alphas range from .88 to .92) and test-retest reliability (PPMS, r = .77; PPML, r = .69) in a prior report (Lynch et al., 2010).

Status quo bias. As mentioned above, two measures of status quo bias were examined:

1. SQB-Scenarios, representing everyday decisions from three categories: apartments, health clubs, or hotels for a vacation (Yen & Chuang, 2008). For each category, participants read a short description of two options, one of which was labeled the current option (e.g. the status quo) and one of which was labeled the new option (e.g. the alternative), and were asked to choose between them (see Appendix C for full text). Which of the two options was designated as the current option was counterbalanced across participants. The attributes of each option were selected by the original authors so that they are roughly equal in desirability (that is, neither option dominated the other), and prior reports on these scenarios have not noted differences in preferences for these scenarios (Nowlis, Kahn, & Dhar, 2002; Yen & Chuang, 2008). For each of the three categories, the dependent variable was whether the choice the participant made was for the status quo (current) option or for the alternative (new) option.

2. The second measure of status quo bias was a set of hypothetical scenarios relating to financial investments (SQB-Investments). Participants read four versions of the same scenario in which they were given information about the actual percentage rate of return of a fund they currently invest in and about future performance forecasts for their current fund and an alternate fund (see Appendix C). For example, one version of the scenario reads (Chernev, 2004):

> The fund you are currently invested in now earns 7.1% interest. For next year, you have to choose whether to stay with the same fund or to switch to a new fund by checking a box on a form. The only information you have about the two funds is the expected rate of interest for the next year. These expected rates of return are only predictions; the actual rates could be higher or lower than predicted. Your options are:
>
> A. Stay with the same fund, expected to earn 8.15%
>
> B. Switch to a new fund, expected to earn 8.65%

Participants rated two versions of a loss scenario in which both future rates of return (8.15% and 8.65%) were predicted to be lower than the current rate (9.1%) and two versions of a gain scenario in which both future rates of return (8.15% and 8.65%) were predicted to be higher than the current rate (7.1%). For each pair of scenarios, each future interest rate occupied the status quo position in one version of a given scenario and the alternative position in one version of that same scenario. For each scenario, participants were asked whether they would stay with the current fund or change to the

alternate fund. Because rational decision-making would suggest choosing whatever fund has the better rate of return regardless of which fund is the current fund, participants were expected to choose the status quo option when it was projected to have a better rate of return (that is, when it is the dominant option) but not when the status quo option was projected to have a worse rate of return (that is, when it is the nondominant option) as compared to the alternative fund. Participants who selected the status quo option on questions when it was the nondominant option were considered to demonstrate a status quo bias.

Attention-check questions. Six attention-check questions were included in the study battery to assess the degree to which people were reading questions carefully (e.g., a question that at quick glance looks like it is asking what their favorite color is, but has instructions to select both "blue" and "red"; a delay discounting item that asks people whether they would choose $35 today or $85 today, which people just choosing the "today" option without reading will fail the check by choosing the $35 today option) (e.g., Oppenheimer, Meyvis, & Davidenko, 2009; Paolacci & Chandler, 2014). In the present study, 85.3% of participants passed all 6 attention checks, and 100% passed 3 or more checks; therefore all participants were retained for data analysis.

Statistical Methods

Decision-making. Statistical analyses for the decision-making measures were completed in four steps.

First, frequencies and descriptive statistics of participants' smoking status, education level, age, race, marital status, drug use, and smoker characteristics were examined (Table 1). Tests of differences between current smokers and never smokers

were conducted on the above items using Fisher's Exact Test for categorical variables and Wilcoxon Rank Sum Test for continuous variables (Table 1). Because Pearson correlations between participant characteristics revealed significant correlations between illegal drug use and both number of drinks per week ($r = .23$, $p < .001$) and ever having been treated for drug or alcohol abuse ($r = .21$, $p < .001$), only illegal drug use was retained for additional analyses.

Second, using univariate ANOVA for continuous measures (Table 2) and logistic regression for dichotomous measures (Table 3), any participant characteristic that had a univariate relationship with a particular decision-making measure at $p < .10$ was retained as a covariate for that measure for use in step four.

Third, two-way ANOVAs with smoking status (i.e., current smoker vs. never smoker) and educational attainment (i.e. high school or less vs. some college/AA vs. BA or higher) as factors were used for analyses of delay discounting, impulsivity, opportunity cost neglect measure OCCS, and propensity to plan, testing for main effects of smoking status and education and their interaction.

Fourth, for models in which smoking status, education, or their interaction had significant effects in step three, an ANCOVA was conducted including the particular covariates for each measure from step 2. This step controlled for the influence of potential confounders of associations between smoking status and education with the impulsivity and decision-making outcomes of interest. An additional ANCOVA examining both MCQ measures with instruction type as a within-subject factor was conducted to examine discounting with versus without explicit-zero framing instructions. Post-hoc tests were conducted using the Tukey-Kramer procedure.

Regarding the dichotomous measures of decision-making, logistic regression was used to perform multivariable analysis of BPT and logistic regression with repeated measures modeled using Generalized Estimating Equations (GEE; Liang & Zeger, 1986) was used to perform multivariable analyses for SQB-Scenarios and SQB-Investments following the same general sequence as outlined above in steps three and four.

Use of other tobacco and nicotine delivery products. Frequencies of participants' use of other tobacco and nicotine delivery products were examined and tested for differences between current smokers and never smokers were conducted using Fisher's Exact Test.

To better understand differences between e-cigarette users and non-users in the sample, the following analyses were conducted separately for current smokers and never smokers:

Frequencies and descriptive statistics of participants' education level, age, race, marital status, drug use, smoker characteristics, impulsivity, propensity to plan, delay discounting, opportunity cost neglect, status quo bias, and use of other tobacco and nicotine delivery products were examined and tests of differences between e-cigarette users and non-users were conducted using Fisher's Exact Test for categorical variables and Wilcoxon Rank Sum Test for continuous variables.

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC). Across all tests, statistical significance was defined as $p < .05$ (2-tailed) unless otherwise stated.

Results

Participant Characteristics

Table 1 summarizes baseline participant characteristics for the overall sample as well as for current smokers and never smokers. Overall, the majority of participants was relatively young ($\leq$ 32 years), White, completed at least some college, and was unmarried. As expected, smokers generally showed less social stability than never smokers, being less educated, less likely to be married, and more likely to use other substances than never smokers. The average smoking characteristics of the sample of current smokers are representative of regular, moderately dependent smokers.

Decision-Making Measures

Bias for the present.

Delay discounting. As shown in Figure 1, current smokers exhibited steeper discounting than never smokers on the MCQ task without and with the explicit-zero included, and women with lower educational attainment discounted more steeply than women with higher educational attainment. As seen in Table 4, those effects were significant before and after including covariates in the models and with and without the explicit-zero instructions. There was no significant interaction of smoking status and education in either model. Race was also associated with discounting rates (Table 4).

Figure 2 displays adjusted discounting rates when instruction type was included as a third, within-subjects factor in the model and race was retained as a covariate. As seen in Figure 2, making the zero options explicit on the MCQ task decreased discounting rates across the board, $F(1,793) = 23.84$, $p < .0001$, such that discounting was less steep when participants received the explicit-zero instructions compared to when

they received the typical instructions regardless of their smoking status or educational attainment. None of the two-way interactions were significant and were removed from the final model. Smoking status, education, and race all displayed significant main effects regardless of the type of MCQ instructions, $F(1, 789) = 21.28$, $p < .0001$; $F(2, 789) = 8.06$, $p = .003$; $F(2, 789) = 9.01$, $p = .0001$, respectively.

Barratt impulsiveness scale. As shown in Table 4, current smokers were more impulsive than never smokers on BIS-Total, -Nonplanning, and -Motor scales. However, when covariates were added to the model, this relationship remained significant only for the BIS-Motor scale (Table 4) (BIS-Motor: current smokers' adjusted $M = 21.65$, $SE = 0.31$ vs. never smokers' adjusted $M = 20.60$, $SE = 0.35$; BIS-Total: current smokers' adjusted $M = 60.51$, $SE = 0.83$; never smokers' adjusted $M = 58.61$, $SE = 0.95$; BIS-Nonplanning: current smokers' adjusted $M = 23.65$, $SE = 0.39$; never smokers' adjusted $M = 23.03$, $SE = 0.45$). Covariates including illegal drug use were significantly associated with these scales (Table 4).

Educational attainment was significantly associated with BIS-Nonplanning before and after including covariates in the model (Table 4). Women with a BA or higher were less impulsive (adjusted $M = 22.47$, $SE = 0.38$) compared to women with some college/AA (adjusted $M = 23.45$, $SE = 0.36$, $p = .045$) and to women with a high school diploma or less (adjusted $M = 24.10$, $SE = 0.64$, $p = .037$). BIS-Total and BIS-Motor were not significantly related to education (BIS-Total: high school or less adjusted $M = 59.80$, $SE = 1.37$; some college/AA adjusted $M = 60.13$, $SE = 0.78$; BA or greater adjusted $M = 58.74$, $SE = 0.80$; BIS-Motor: high school or less adjusted $M = 20.84$, $SE = 0.52$; some college/AA adjusted $M = 21.27$, $SE = 0.28$; BA or greater adjusted $M =$

21.28, *SE* = 0.29). The interaction of smoking status and educational attainment was not significant for any of the BIS subscales. The overall model for BIS-Attentional scale was not significant (current smokers' adjusted *M* = 15.63, *SE* = 0.24; never smokers' adjusted *M* = 14.76, *SE* = 0.31; high school or less adjusted *M* = 14.90, *SE* = 0.49; some college/AA adjusted *M* =15.54, *SE* = 0.23; BA or greater adjusted *M* = 15.15, *SE* = 0.24.)

Opportunity cost neglect.

Breakfast purchase task. Figure 3 displays the percentages of participants who considered opportunity costs on the BPT in each subgroup. Current smokers appeared to exhibit less opportunity cost consideration than never smokers and lower educational attainment appeared to be related to reduced consideration of opportunity cost. When tested using logistic regression (Table 5), the effect of educational attainment was significant but smoking status was not before or after including covariates. For education overall, the odds of considering opportunity costs for women with a Bachelor's degree were 93% higher than for women with some college/Associate's degree. There was a significant interaction of smoking status and education. As can be seen in Figure 3, women with high school or less or BA or higher show the predicted relationship of smokers considering opportunity costs less than non-smokers whereas women with some college/AA do not show this pattern. Examination of these relationships using logistic regression revealed two significant comparisons: (a) the odds of considering opportunity costs for current smokers was 41% lower than for never smokers among participants with a BA or higher; (b) the odds of considering opportunity costs among never smokers were 93% higher for women with a BA or higher compared to women with some college/AA. No other comparisons were significant.

Opportunity cost consideration scale. The overall model for OCCS was not significant and is not discussed further (Table 5) (current smokers' adjusted *M* = 4.25, *SE* = 0.07; never smokers' adjusted *M* = 4.32, *SE* = 0.09; high school or less adjusted *M* = 4.30, *SE* = 0.14; some college/AA adjusted *M* = 4.44, *SE* = 0.07; BA or greater adjusted *M* = 4.13, *SE* = 0.07).

Propensity to plan scales. The overall model for PPMS was not significant (Table 5) (current smokers' adjusted *M* = 4.38, *SE* = 0.07; never smokers' adjusted *M* = 4.37, *SE* = 0.09; high school or less adjusted *M* = 4.30, *SE* = 0.14; some college/AA adjusted *M* = 4.52, *SE* = 0.07; BA or greater adjusted *M* = 4.30, *SE* = 0.07).

For PPML, current smokers had a lower propensity to plan for the long-term use of money compared to never smokers in the model without covariates (Table 5). However, when covariates were added to the model, smoking status was no longer significant and marital status and illegal drug use were significant (current smokers' adjusted *M* = 3.82, *SE* = 0.08; never smokers' adjusted *M* = 3.96, *SE* = 0.11; high school or less adjusted *M* = 3.76, *SE* = 0.16; some college/AA adjusted *M* = 3.90, *SE* = 0.08; BA or greater adjusted *M* = 4.02, *SE* = 0.08). No other effects were significant.

Status quo bias.

SQB scenarios task. No significant effects of smoking status, educational attainment or the interaction of smoking status and educational attainment were noted on the SQB-Scenarios measure (Table 6). Choices for the current option for the Apartment, Club and Hotel options respectively were 59.3%, 58.5% and 64.8% for current smokers; 63.3%, 59.0% and 60.0% for never smokers; 64.0%, 59.6% and 65.2% for high school or

less; 58.0%, 56.3% and 64.4% for some college/AA; and 64.0%, 60.9% and 59.8% for BA or higher.

SQB investments task. No significant effects of smoking status, educational attainment or the interaction of smoking status and educational attainment were noted on the SQB-Investments measure (Table 6). Choices for the status quo option when it was in the nondominant position in the gain and loss conditions respectively were 40.3% and 42.8% for current smokers; 46.8% and 42.0% for never smokers; 53.9% and 50.6% for high school or less; 38.4% and 38.9% for some college/AA; and 46.2% and 43.9% for BA or higher.

Use of Other Tobacco and Nicotine Delivery Products

Current smokers vs. never smokers. As expected, current smokers reported significantly greater use of other tobacco and nicotine delivery products compared to never smokers over both the past 30 days and the past year across all products except for the use of snus over the past 30 days (Table 7). Looking at use on some days or more, e-cigarettes, cigars and hookah were the top three most used products over the past 30 days and past year.

E-cigarette users vs. non-users among current smokers. Among smokers, e-cigarette users and non-users differed on only one sociodemographic characteristic and two tobacco/nicotine use characteristics (Table 8). Regarding sociodemographics, e-cigarette users were slightly more educated. Regarding tobacco/nicotine use, e-cigarette users were more likely to report plans to quit smoking in the next 30 days and greater use of nicotine replacement therapies (Table 8).

E-cigarette users did not differ significantly from non-users on any of the decision-making measures except one of the individual items on SQB-Scenarios where fewer e-cigarette users chose the status quo option (Table 9).

E-cigarette users did not differ significantly from non-users on past 30 day use of any of the other tobacco and nicotine delivery products assessed although they reported significantly more past-year use of hookah, bidis/cloves, and smokeless tobacco compared to non-users (Table 10).

E-cigarette users vs. non-users among never smokers. Among never smokers, e-cigarette users and non-users differed on number of drinks per week, and ever having used illegal drugs, with e-cigarette users reporting significantly more alcohol and drug use (Table 11).

Regarding decision-making measures, e-cigarette users displayed significantly greater impulsivity on BIS-Total, BIS-Attentional and BIS-Motor and less propensity to plan on PPML compared to non-users (Table 12).

E-cigarette users also reported significantly more use of all other tobacco and nicotine delivery products compared to non-users for past-month use and of cigars, hookah, and bidis/cloves for past year use (Table 13).

Discussion

The primary hypotheses that there would be stronger decision-making biases among current cigarette smokers compared to never smokers and women with lower educational attainment compared to women with higher educational attainment were supported in the delay discounting tasks, partially supported in one of the opportunity cost tasks, and not supported in the status quo bias tasks.

In agreement with results from previous studies, delay discounting was steeper among current smokers compared to never smokers (e.g., Baker et al., 2003; Bickel et al., 1999; Johnson et al., 2007; Mitchell, 1999) and for women with high school diplomas or less compared to women with some college or higher (Jaroni et al., 2004; Wilson et al., 2015) on both versions of the MCQ. No interactions between smoking status and educational attainment were observed in the delay discounting tasks, suggesting independent associations with discounting. Race was also associated with steeper discounting, consistent with three prior reports noting steeper discounting among Blacks compared to Whites (Andrade & Petry, 2014; de Wit et al., 2007; Dennhardt & Murphy, 2011). To the extent that delay discounting reflects people's devaluation of delayed rewards, these findings suggest that the efficacy of interventions targeting behavior change among smokers, less educated, and perhaps Black women of reproductive age may be enhanced by the inclusion of material incentives or other strategies that help to bridge the temporal gap between initiating change and reaping naturalistic benefits of doing so.

The positive impact of reducing discounting by framing questions to include an explicit zero observed in the present study replicates results from previous studies on this

topic and to my knowledge provides the first demonstration that the effect extends to smokers (Koffarnus & Bickel, 2014; Magen et al., 2008; Radu et al., 2011). Another strength of the explicit-zero manipulation in the current study is that it was conducted within-subjects, providing a compelling demonstration that reframing choices to make opportunity costs more explicit reduces impulsive behavior among individuals who otherwise will make suboptimal choices. This adds further support to the idea that discounting rates are malleable (Koffarnus et al., 2013). This finding also suggests that in addition to offering incentives when targeting behavior change among women at risk for discounting future rewards, framing interventions to underscore the opportunity costs associated with unhealthy choices may be helpful as well. In the current study, the interaction between instruction type and educational attainment was not significant (p = .068), but trended toward explicit-zero instructions being more impactful among those with a BA or higher compared to those with lower levels of education, suggesting that further study may be needed to enhance the effect of explicit-zero framing at lower levels of educational attainment.

Regarding opportunity cost neglect/consideration, the explicit-zero manipulation in the present study provides the first evidence that making opportunity costs explicit may improve choices made by current smokers and never smokers in a similar fashion, and future research should examine the practical implications of this finding by examining whether framing choices to highlight opportunity costs of poor health decisions in real world contexts shifts people toward more optimal choices which could have practical implications in preventative care and treatment settings. Results obtained from the other opportunity cost tasks examining the extent to which people consider

opportunity costs that are not presented explicitly were mixed. Results from the BPT suggest that considering opportunity costs when they are not explicitly stated may be related to higher educational attainment, with significantly more consideration of opportunity cost association with having a BA or higher, and especially being a nonsmoker with a BA or higher. The effects of smoking and education on OCCS were not significant. To my knowledge, this is the first study to examine opportunity cost neglect bias in relation to smoking status or education, and the results while mixed suggest it is worthy of additional study for understanding how decision-making biases among women with lower educational attainment may increase the likelihood of unhealthy choices. Further investigation would benefit from the development of better behavioral measures of opportunity cost neglect given the lack of concurrence between the explicit-zero task, OCCS self-report of opportunity cost consideration, and actual consideration of opportunity costs on the BPT.

No evidence was found for stronger status quo bias by smoking status or educational attainment in the current study. SQB-Scenarios items were uncorrelated or weakly correlated but not in the same direction across items (Apartment & Club: r = -.18, p < .001; Apartment & Hotel: r = .15, p < .001; Club & Hotel: r = .03, p > .05), suggesting problems with the internal consistency of this measure at least in this sample. For SQB-Investments, the strong correlation (r =.56, p < .001) between choices for the status quo option when in the nondominant position for the loss and gain scenarios suggest that this measure is more likely to be tapping into a tendency to choose the status quo bias, at least for this kind of financial decision-making scenario. It is not clear if status quo bias does not differ in relation to smoking status or educational attainment or if

the measures used in this study were unsuccessful at tapping into the form of status quo bias that might be associated with risk for smoking. It may be that status quo bias is not related to likelihood to initiate smoking but rather to difficulty discontinuing behaviors like smoking that have long occupied a status quo position, so understanding whether status quo bias is related to successful cessation or quit attempts in future studies is warranted.

Consistent with previous research, educational attainment was related to BIS-Nonplanning (Mitchell, 1999) and smoking status was related to BIS-Total, BIS-Motor and BIS-Nonplanning subscales (de Wit et al., 2007) and to PPML in initial models, but remained significant only for the Motor subscale after adjusting for baseline differences in participant characteristics. Illegal drug use was significantly associated with these scales when included in the model as a covariate, suggesting that the relationship between smoking status and both impulsivity and long term propensity to plan is confounded with increased prevalence of illegal drug use among current smokers. Initiation of cigarette smoking often predates use of illicit drugs developmentally, which might argue for not including illicit drug use as a covariate in the present study (e.g., Duncan, Duncan, & Hops, 1998; Merrill, Kleber, Shwartz, Liu, & Lewis, 1999). Instead of that strategy, I opted for reporting the models with and without the covariates included which allows future investigators to make informed choices about how to deal with this question.

A large number of participants in the current study reported use of non-cigarette tobacco and nicotine delivery products in the current study, which is not surprising given recent findings that more people currently use a non-cigarette tobacco or nicotine product

than use cigarettes exclusively (Lee et al., 2014). Of particular interest are e-cigarettes, the prevalence and use of which is growing rapidly in the U.S and abroad and yet relatively little is known about individual differences in who uses them (e.g., Pepper & Eissenberg, 2014; Walton et al., 2015; Wills, Knight, Williams, Pagano, & Sargent, 2015). The large number of e-cigarette users present in my sample permitted what I believe to be the first examination of associations between e-cigarette use and biases in decision-making. Preliminary comparisons of e-cigarette users to non-users among current smokers suggest that using e-cigarettes was largely related to quitting smoking, consistent with previous results from dual cigarette/e-cigarette users whose most frequent self-reported reason for using e-cigarettes is to cut back on or quit smoking (e.g., Etter, 2010; Goniewicz, Lingas, & Hajek, 2013; Kralikova, Novak, West, Kmetova, & Hajek, 2013; Pulvers et al., 2014; Rutten et al., 2015). Importantly, among the current smokers e-cigarette users did not differ from non-users on any of the decision-making measures, including the measures of impulsivity. Conversely, within the never smokers, e-cigarette users demonstrated a pattern of riskier decision-making compared to non-users, with higher prevalence of alcohol, drug, and other tobacco and nicotine delivery product use, poorer propensity to plan for long term uses of money, and more impulsivity on the BIS. These finding suggest that for women of reproductive age above age 24 years, e-cigarette use among current smokers may reflect attempts to quit or cut back on smoking and may not be a cause for additional concern beyond that associated with smoking, whereas e-cigarette use among non-smokers may be a marker of a more impulsive, riskier repertoire. Additional study of this question is needed to see if the observed pattern of results is maintained when e-cigarette users and non-users are specifically recruited with

a larger number of e-cigarette users among never smokers, which will permit the use of multivariable analyses to better categorize the importance of risk factors for e-cigarette use. For regulatory purposes, the current findings suggest an important next step would be to determine the efficacy of e-cigarettes for quitting smoking. If e-cigarettes prove efficacious in reducing or quitting smoking, their widespread acceptance suggests promoting access to these products and regulating them as a cessation aid at least among adults could provide substantial benefits in helping women of reproductive age avoid the harms associated with cigarettes. If e-cigarettes do not prove efficacious in aiding cessation or if they are in fact more harmful than is currently believed, it would suggest the need for clear information on the risks and harms be made available to women of reproductive age and would argue for sharply curbing their access to these products.

This is the second study I am aware of that has successfully replicated previously observed relationships between delay discounting and smoking status and educational attainment using the AMT platform, suggesting that AMT is a viable source of participants for examining the relationships between health behaviors and decision-making measures such as delay discounting (Jarmolowicz et al., 2012). AMT facilitated the collection of a relatively large sample (N = 800) with a broad range of demographic characteristics over a relatively short duration of time, which may be especially important in trying to understand emerging relationships in the ever-changing landscape of using e-cigarettes and other novel tobacco and nicotine delivery products. While women with high school diplomas or less are present on AMT and were included in the sample, they are underrepresented compared to the general population, and targeted recruitment and

screening should be considered in future AMT studies related to smoking status to recruit a larger number of women with lower educational attainment.

At least four limitations of the current study merit mention. First, while reproductive age in women is considered to be between 15 and 44 years of age, only women 24 years of age or older were eligible to participate in the current study in order to increase the likelihood they had obtained their terminal level of educational attainment. While this facilitated the examination of educational attainment, it limits the ability to generalize the results to younger age women. Given that many women have their first child at age 24 or younger (age of first birth at 24 years or younger: 79% of women with HS diploma, 68% of women with some college, 24% of women with BA or higher; Martinez, Daniels, & Chandra, 2012), getting a more complete picture of how smoking status may relate to these decision-making biases in women at younger ages seems warranted. Second, relying exclusively on self-reported smoking status is a potential limitation as smoking is becoming increasingly stigmatized which can be expected to promote underreporting. Third, the extent to which the associations of decision-making biases with educational attainment might be due to differences in income was not examined in the current report, although there is good reason to believe that increased educational attainment relates to improved health over and above the effects of income (for a review, see Cutler & Lleras-Muney, 2010). Finally, causality or directionality between the associations of smoking status, educational attainment, and decision-making cannot be inferred from this observational study, although causal inferences can be made regarding the influence of task manipulations such as the presence or absence of an explicit zero.

The above limitations notwithstanding, the current study confirms that delay discounting and education are important to understanding the use of tobacco and nicotine products in women of reproductive age, and suggests that they are independent risk factors. Second, the observed explicit-zero framing effect suggests that making alternatives more explicit when presenting choices may help reduce discounting and should be examined further as a possible element of treatment for improving the likelihood of healthier decisions around smoking and other health-related lifestyle choices. Third this study shows for the first time that consideration of opportunity costs may be related to educational attainment and is worthy of additional study to determine if it is a factor involved in the link between low educational attainment and smoking status. Finally, preliminary results suggest that among women 24-44 years of age, e-cigarette use among current smokers may reflect attempts to quit or cut back on cigarette smoking whereas e-cigarette use among non-smokers may be a marker of a more impulsive, riskier repertoire.

Table 1. *Participant Characteristics by Smoking Status*

Variable	All (*N* = 800)	Never smokers (*n* = 400)	Current smokers (*n* = 400)	*p*
Sociodemographics				
Age				
24-26	157 (19.6%)	90 (22.5%)	67 (16.8%)	.296
27-29	155 (19.4%)	80 (20.0%)	75 (18.8%)	
30-32	156 (19.5%)	68 (17.0%)	88 (22.0%)	
33-35	146 (18.3%)	69 (17.3%)	77 (19.3%)	
36-38	84 (10.5%)	44 (11.0%)	40 (10.0%)	
39-41	47 (5.9%)	21 (5.3%)	26 (6.5%)	
42-44	55 (6.9%)	28 (7.0%)	27 (6.8%)	
Race				
White	614 (76.8%)	285 (71.3%)	329 (82.3%)	**.001**
Black/African-American	81 (10.1%)	52 (13.0%)	29 (7.3%)	
Other	101 (12.6%)	60 (15.0%)	41 (10.3%)	
Education				
High school or less	89 (11.1%)	28 (7.0%)	61 (15.3%)	**<.001**
Some college or AA	357 (44.6%)	138 (34.5%)	219 (54.8%)	
BA or higher	353 (44.1%)	233 (58.3%)	120 (30.0%)	
Marital status				
Married or remarried	384 (48.0%)	211 (52.8%)	173 (43.3%)	**.009**
Never married, separated, divorced, widowed	416 (52.0%)	189 (47.3%)	227 (56.8%)	
Alcohol and Drug Use				
No. alcoholic drinks /week (*M* ± *SD*)	2.6 ± 4.7	1.8 ± 2.8	3.4 ± 5.9	**.001**
Ever used illegal drugs	299 (37.4%)	87 (21.8%)	212 (53.0%)	**<.001**
Treated for drug or alcohol abuse	36 (4.5%)	3 (0.8%)	33 (8.3%)	**<.001**
Smoking Characteristics				
No. cigarettes smoked/day (*M* ± *SD*) [95% CI]	—	—	13.2 ± 7.5 [12.4, 13.9]	
No. yrs smoking this no. cigarettes (*M* ± *SD*) [95% CI]	—	—	10.6 ± 6.8 [10.0, 11.3]	
Age (yrs) at first cigarette (*M* ± *SD*) [95% CI]	—	—	16.3 ± 3.9 [15.9, 16.7]	
Trying to quit in next 30 days	—	—	171 (42.8%)	
Using nicotine replacement	—	—	32 (8.0%)	
FTND-Total (*M* ± *SD*) [95% CI]	—	—	4.1 ± 2.4 [3.8, 4.3]	

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test. Proportions were tested using Fisher's Exact Test. Yrs = years.
Bold indicates $p < .05$.

Table 2. *Univariate Tests of Predictors of Continuous Decision-Making Measures*

Measure	Smoking status	Education	Age	Race	Marital status	Illegal drug use
MCQ						
Model *df*	1	2	6	2	1	1
Error *df*	797	795	792	792	797	796
F	25.67	8.40	1.14	5.72	2.97	0.96
p	**<.001**	**<.001**	.337	**.003**	**.085**	.327
Explicit-Zero MCQ						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	18.25	12.97	1.34	6.02	2.40	0.12
p	**<.001**	**<.001**	.237	**.003**	.122	.729
BIS-Total						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	19.07	3.61	1.80	5.82	10.83	65.03
p	**<.001**	**.028**	**.097**	**.003**	**.001**	**<.001**
BIS-Attentional						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	4.01	1.24	2.12	7.06	6.11	44.80
p	**.046**	.290	**.049**	**.001**	**.014**	**<.001**
BIS-Motor						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	26.80	0.86	0.69	3.33	14.65	40.75
p	**<.001**	.425	.661	**.036**	**<.001**	**<.001**
BIS-Nonplanning						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	13.26	8.24	1.82	2.83	4.15	45.13
p	**<.001**	**<.001**	**.092**	**.060**	**.042**	**<.001**
OCCS						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	0.37	3.71	0.39	0.14	1.86	0.16
p	.544	**.025**	.887	.868	.173	.692

PPMS						
Model *df*	1	2	6	2	1	1
Error *df*	798	796	793	793	798	797
F	0.14	2.65	0.58	0.90	6.48	10.66
p	.707	.071	.749	.408	**.011**	**.001**
PPML						
Model *df*	1	2	6	2	1	1
Error *df*	797	795	792	792	797	796
F	8.28	3.47	0.70	0.01	8.21	27.71
p	**.004**	**.032**	.648	.991	**.004**	**<.001**

Note. $N = 800$. *df* = Degrees of freedom.
Bold indicates $p < .10$.

Table 3. *Univariate Tests of Predictors of Dichotomous Decision-Making Measures*

Variable	BPT				SQB-Scenarios				SQB-Investments			
		95% CI				95% CI				95% CI		
	OR	LL	UL	*p*	OR	LL	UL	*p*	OR	LL	UL	*p*
Smoking status												
Yes vs. No	0.715	0.536	0.954	**.022**	1.012	0.861	1.189	.884	0.891	0.695	1.141	.360
Education												
BA or higher vs. High school or less	1.771	1.069	2.932	**.026**	0.939	0.713	1.236	.654	0.755	0.486	1.173	.211
Some college or AA vs. High school or less	1.275	0.768	2.118	.348	0.861	0.650	1.142	.300	0.587	0.378	0.910	**.017**
BA or higher vs. Some college or AA	1.389	1.024	1.882	**.035**	1.090	0.920	1.292	.319	1.287	0.992	1.670	**.058**
Age												
27-29 vs. 24-26	0.852	0.534	1.359	.501	1.064	0.837	1.354	.612	0.763	0.515	1.129	.176
30-32 vs. 24-26	1.308	0.830	2.060	.248	1.181	0.919	1.518	.194	1.197	0.814	1.761	.361
33-35 vs. 24-26	1.368	0.860	2.175	.186	1.236	0.956	1.598	.106	0.801	0.537	1.195	.278
36-38 vs. 24-26	0.916	0.526	1.596	.756	1.152	0.862	1.539	.338	0.914	0.567	1.472	.711
39-41 vs. 24-26	0.613	0.294	1.278	.192	1.430	0.959	2.131	**.079**	1.460	0.792	2.689	.225
42-44 vs. 24-26	1.105	0.585	2.089	.758	1.362	0.979	1.894	**.067**	1.332	0.769	2.308	.306
Race												
Black/African American vs. White	0.854	0.522	1.395	.528	1.163	0.866	1.560	.315	0.902	0.595	1.368	.628
Other vs. White	1.293	0.845	1.981	.237	0.962	0.754	1.227	.755	0.856	0.596	1.230	.401
Marital status												
Never married, separated, divorced, or widowed vs. Married or remarried	0.736	0.552	0.981	**.037**	0.899	0.765	1.057	.197	0.852	0.665	1.092	.206

Illegal drug use												
Yes vs. No	0.969	0.720	1.304	.837	0.890	0.755	1.050	.168	0.830	0.642	1.073	.154

Note. N = 800. OR = Odds ratio. CI = Confidence interval. LL = Lower limit. UL = Upper limit.
Logistic regression of SQB outcomes was modified using Generalized Estimating Equations (GEE) to account for repeated measures.
Bold indicates $p < .10$.

Table 4. *Analysis of Variance for Bias for the Present Measures*

	Without covariates					With covariates				
Measure/variable	*df*	SS	MS	*F*	*p*	*df*	SS	MS	*F*	*p*
MCQ										
Model	5	93.04	18.61	7.53	**<.001**	8	137.88	17.23	7.13	**<.001**
Error	792	1956.61	2.47			785	1897.52	2.42		
Smoking status	1	35.18	35.18	14.24	**<.001**	1	43.35	43.35	17.93	**<.001**
Education	2	17.78	8.89	3.60	**.028**	2	18.73	9.37	3.87	**.021**
Smoking status x Education	2	5.26	2.63	1.06	.346	2	4.62	2.31	0.96	.385
Race						2	38.82	19.41	8.03	**<.001**
Marital Status						1	2.09	2.09	0.87	.352
Explicit-Zero MCQ										
Model	5	106.26	21.25	7.80	**<.001**	7	152.57	21.80	8.19	**<.001**
Error	793	2160.64	2.72			787	2094.83	2.66		
Smoking status	1	29.18	29.18	10.71	**.001**	1	38.92	38.92	14.62	**<.001**
Education	2	37.80	18.90	6.94	**.001**	2	36.97	18.48	6.94	**.001**
Smoking status x Education	2	4.52	2.26	0.83	.436	2	5.11	2.55	0.96	.384
Race						2	43.52	21.76	8.18	**<.001**
BIS-Total										
Model	5	2990.50	598.10	4.55	**<.001**	15	11922.98	794.87	6.52	**<.001**
Error	793	104315.37	131.55			778	94795.60	121.85		
Smoking status	1	1747.29	1747.29	13.28	**<.001**	1	386.38	386.38	3.17	.075
Education	2	279.67	139.83	1.06	.346	2	313.79	156.89	1.29	.277
Smoking status x Education	2	224.12	112.06	0.85	.427	2	232.79	116.39	0.96	.385
Age						6	1253.28	208.88	1.71	.115
Race						2	924.53	462.27	3.79	**.023**

Marital Status						1	747.42	747.42	6.13	**.014**
Illegal drug use						1	4845.96	4845.96	39.77	**<.001**
BIS-Attentional										
Model	5	134.06	26.81	1.48	.193					
Error	793	14352.98	18.10							
Smoking status	1	88.35	88.35	4.88	.027					
Education	2	40.12	20.06	1.11	.331					
Smoking status x Education	2	39.22	19.61	1.08	.339					
BIS-Motor										
Model	5	505.11	101.02	5.47	**<.001**	9	1208.36	134.26	7.57	**<.001**
Error	793	14656.14	18.48			784	13904.93	17.74		
Smoking status	1	319.43	319.43	17.28	**<.001**	1	119.50	119.50	6.74	**.010**
Education	2	14.39	7.20	0.39	.678	2	12.74	6.37	0.36	.698
Smoking status x Education	2	3.73	1.86	0.10	.904	2	2.18	1.09	0.06	.941
Race						2	83.92	41.96	2.37	.095
Marital Status						1	182.37	182.37	10.28	**.001**
Illegal drug use						1	370.64	370.64	20.90	**<.001**
BIS-Nonplanning										
Model	5	719.13	143.83	5.14	**<.001**	15	2078.67	138.58	5.20	**<.001**
Error	793	22192.09	27.98			778	20723.65	26.64		
Smoking status	1	211.08	211.08	7.54	**.006**	1	41.61	41.61	1.56	.212
Education	2	228.00	114.00	4.07	**.017**	2	238.30	119.15	4.47	**.012**
Smoking status x Education	2	65.08	32.54	1.16	.313	2	77.58	38.79	1.46	.234
Age						6	333.22	55.54	2.08	.053
Race						2	66.27	33.13	1.24	.289
Marital Status						1	52.96	52.96	1.99	.159
Illegal drug use						1	765.29	765.29	28.73	**<.001**

Note. N = 800. *df* = Degrees of freedom. SS = Sum of squares. MS = Mean square. **Bold** indicates $p < .05$.

Table 5. *Logistic Regression and Analysis of Variance for Opportunity Cost Neglect Measures*

Measure/variable	Without covariates				With covariates			
		95% CI				95% CI		
	OR	LL	UL	*p*	OR	LL	UL	*p*
Breakfast Purchase Task								
Smoking status								
Yes vs. No	0.406	0.156	1.058	.065	0.406	0.155	1.060	.066
Education								
BA or higher vs. High school or less	1.192	0.540	2.631	.663	1.169	0.529	2.584	.700
Some college or AA vs. High school or less	0.616	0.269	1.416	.254	0.607	0.264	1.396	.240
BA or higher vs. Some college or AA	1.934	1.241	3.014	**.004**	1.926	1.234	3.004	**.004**
Interactions of smoking and education								
Smoking x Education 1	1.395	0.482	4.037	.539	1.448	0.499	4.202	.496
Smoking x Education 2	3.112	1.078	8.988	**.036**	3.164	1.093	9.160	**.034**
Yes with BA or higher vs. No with BA or higher	**0.566**	**0.358**	**0.896**		**0.588**	**0.370**	**0.932**	
Yes with Some college or AA vs. No with Some college or AA	1.263	0.802	1.990		1.284	0.814	2.027	
Yes with High school or less vs. No with High school or less	0.406	0.156	1.058		0.406	0.155	1.060	
No with BA or higher vs. No with High school or less	1.192	0.540	2.631		1.169	0.529	2.584	
No with BA or higher vs. No with Some college or AA	**1.934**	**1.241**	**3.014**		**1.926**	**1.235**	**3.004**	
No with Some college or AA vs. No with High school or less	0.616	0.269	1.415		0.607	0.264	1.396	
Yes with BA or higher vs. Yes with High school or less	1.664	0.819	3.380		1.692	0.832	3.443	
Yes with BA or higher vs. Yes with Some college or AA	0.867	0.542	1.387		0.881	0.550	1.411	
Yes with Some college or AA vs. Yes with High school or less	1.919	0.993	3.708		1.920	0.993	3.715	
Marital status					0.762	0.569	1.021	.069

Measure/variable	Without covariates					With covariates				
	df	SS	MS	*F*	*p*	*df*	SS	MS	*F*	*p*
OCCS										
Model	5	16.89	3.38	2.14	.059					
Error	793	1254.57	1.58							
Smoking status	1	0.54	0.54	0.34	.559					
Education	2	15.12	7.56	4.78	.009					
Smoking status x Education	2	2.12	1.06	0.67	.513					
PPMS										
Model	5	8.57	1.71	1.09	.364					
Error	793	1246.36	1.57							
Smoking status	1	0.03	0.03	0.02	.897					
Education	2	8.34	4.17	2.65	.071					
Smoking status x Education	2	0.24	0.12	0.08	.927					
PPML										
Model	5	28.57	5.71	2.74	**.018**	7	81.55	11.65	5.75	**<.001**
Error	792	1651.42	2.09			789	1598.42	2.03		
Smoking status	1	10.97	10.97	5.26	**.022**	1	2.08	2.08	1.03	.311
Education	2	5.58	2.79	1.34	.263	2	5.28	2.64	1.30	.272
Smoking status x Education	2	3.52	1.76	0.84	.431	2	3.67	1.83	0.91	.405
Marital Status						1	10.38	10.38	5.12	**.024**
Illegal drug use						1	39.14	39.14	19.32	**<.001**

Note. *N* = 800. OR = Odds ratio. CI = Confidence interval. LL = Lower limit. UL = Upper limit. *df* = Degrees of freedom. SS = Sum of squares. MS = Mean square.

For smoking status x education comparisons on BPT, significance based on 95% confidence interval of the odds ratios.

Bold indicates p < .05.

Table 6. *Logistic Regression for Status Quo Bias Measures*

Measure/variable	OR	95% CI LL	95% CI UL	*p*
SQB-Scenarios				
Smoking status				
Yes vs. No	1.165	0.702	1.933	.555
Education				
BA or higher vs. High school or less	1.041	0.688	1.573	.850
Some college or AA vs. High school or less	0.947	0.605	1.483	.814
BA or higher vs. Some college or AA	1.098	0.853	1.414	.467
Interactions of smoking and education				
Smoking x Education 1	0.861	0.490	1.514	.604
Smoking x Education 2	0.871	0.491	1.544	.636
SQB-Investments				
Smoking status				
Yes vs. No	0.674	0.285	1.594	.369
Education				
BA or higher vs. High school or less	0.569	0.270	1.199	.138
Some college or AA vs. High school or less	0.497	0.232	1.062	.071
BA or higher vs. Some college or AA	1.145	0.802	1.633	.456
Interactions of smoking and education				
Smoking x Education 1	1.538	0.598	3.957	.372
Smoking x Education 2	1.249	0.491	3.178	.642

Note. N = 800. OR = Odds ratio. CI = Confidence interval. LL = Lower limit. UL = Upper limit. Logistic regression was modified using Generalized Estimating Equations (GEE) to account for repeated measures.

Table 7. *Use of Other Tobacco and Nicotine Delivery Products by Smoking Status*

Product	All (n = 800)	Never Smokers (n = 400)	Current Smokers (n = 400)	p
Cigars over past month				
Every day	42 (5.3%)	0 (0%)	42 (10.5%)	**<.001**
Some days	62 (7.8%)	13 (3.3%)	49 (12.3%)	
Not at all	693 (86.6%)	386 (96.5%)	307 (76.8%)	
Cigars over past year				
Every day	37 (4.6%)	0 (0%)	37 (9.3%)	**<.001**
Some days	97 (12.1%)	19 (4.8%)	78 (19.5%)	
Not at all	655 (81.9%)	375 (93.8%)	280 (70.0%)	
Hookah over past month				
Every day	5 (0.6%)	1 (0.3%)	4 (1.0%)	**.001**
Some days	41 (5.1%)	10 (2.5%)	31 (7.8%)	
Not at all	751 (93.9%)	388 (97.0%)	363 (90.8%)	
Hookah over past year				
Every day	2 (0.3%)	1 (0.3%)	1 (0.3%)	**<.001**
Some days	72 (9.0%)	16 (4.0%)	56 (14.0%)	
Not at all	713 (89.1%)	377 (94.3%)	336 (84.0%)	
Bidis/cloves over past month				
Every day	2 (0.3%)	1 (0.3%)	1 (0.3%)	**<.001**
Some days	16 (2.0%)	1 (0.3%)	15 (3.8%)	
Not at all	780 (97.5%)	398 (99.5%)	382 (95.5%)	
Bidis/cloves over past year				
Every day	2 (0.3%)	1 (0.3%)	1 (0.3%)	**<.001**
Some days	23 (2.9%)	2 (0.5%)	21 (5.3%)	
Not at all	763 (95.4%)	391 (97.8%)	372 (93.0%)	
E-cigarettes over past month				
Every day	17 (2.1%)	1 (0.3%)	16 (4.0%)	**<.001**
Some days	140 (17.5%)	6 (1.5%)	134 (33.5%)	
Not at all	638 (79.8%)	392 (98.0%)	246 (61.5%)	
E-cigarettes over past year				
Every day	14 (1.8%)	0 (0%)	14 (3.5%)	**<.001**
Some days	241 (30.1%)	22 (5.5%)	219 (54.8%)	
Not at all	531 (66.4%)	371 (92.8%)	160 (40.0%)	

Smokeless tobacco over past month				
Every day	4 (0.5%)	0 (0%)	4 (1.0%)	**.003**
Some days	16 (2.0%)	3 (0.8%)	13 (3.3%)	
Not at all	778 (97.3%)	397 (99.3%)	381 (95.3%)	
Smokeless tobacco over past year				
Every day	3 (0.4%)	1 (0.3%)	2 (0.5%)	**<.001**
Some days	17 (2.1%)	0 (0%)	17 (4.3%)	
Not at all	767 (95.9%)	393 (98.3%)	374 (93.5%)	
Snus over past month				
Every day	1 (0.1%)	1 (0.3%)	0 (0%)	.217
Some days	6 (0.8%)	1 (0.3%)	5 (1.3%)	
Not at all	788 (98.5%)	395 (98.8%)	393 (98.3%)	
Snus over past year				
Every day	1 (0.1%)	1 (0.3%)	0 (0%)	**<.001**
Some days	12 (1.5%)	0 (0%)	12 (3.0%)	
Not at all	769 (96.1%)	389 (97.3%)	380 (95.0%)	
Other tobacco over past month				
Every day	25 (3.1%)	1 (0.3%)	24 (6.0%)	**<.001**
Some days	10 (1.3%)	4 (1.0%)	6 (1.5%)	
Not at all	745 (93.1%)	391 (97.8%)	354 (88.5%)	
Other tobacco over past year				
Every day	26 (3.3%)	1 (0.3%)	25 (6.3%)	**<.001**
Some days	14 (1.8%)	4 (1.0%)	10 (2.5%)	
Not at all	737 (92.1%)	385 (96.3%)	352 (88.0%)	

Note. Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

Table 8. *Participant Characteristics for E-Cigarette Users vs. Non-Users among Current Smokers*

Variable	E-Cigarette users (*n* = 233)	Non-users (*n* = 167)	*p*
Sociodemographics			
Age			
24-26	46 (19.7%)	21 (12.6%)	.405
27-29	41 (17.6%)	34 (20.4%)	
30-32	53 (22.8%)	35 (21.0%)	
33-35	39 (16.7%)	38 (22.8%)	
36-38	22 (9.4%)	18 (10.8%)	
39-41	17 (7.3%)	9 (5.4%)	
42-44	15 (6.4%)	12 (7.2%)	
Race			
White	194 (83.3%)	135 (80.8%)	.549
Black/African-American	14 (6.0%)	15 (9.0%)	
Other	24 (10.3%)	17 (10.2%)	
Education			
High school or less	28 (12.0%)	33 (19.8%)	**.023**
Some college or AA	140 (60.1%)	79 (47.3%)	
BA degree or higher	65 (27.9%)	55 (32.9%)	
Marital status			
Married or remarried	89 (38.2%)	73 (43.7%)	.302
Never married, separated, divorced, widowed	144 (61.8%)	94 (56.3%)	
Alcohol and Drug Use			
No. alcoholic drinks/week (*M* ± *SD*)	3.6 ± 5.6	3.1 ± 6.4	.053
Ever used illegal drugs	131 (56.2%)	81 (48.5%)	.128
Treated for drug or alcohol abuse	23 (9.9%)	10 (6.0%)	.198
Smoking Characteristics			
No. cigarettes smoked/day (*M* ± *SD*) [95% CI]	13.6 ± 7.3 [12.7, 14.6]	12.5 ± 7.7 [11.3, 13.7]	.086
No. yrs smoking this no. cigarettes (*M* ± *SD*) [95% CI]	10.8 ± 6.9 [9.9, 11.7]	10.4 ± 6.5 [9.4, 11.4]	.609
Age (yrs) at first cigarette (*M* ± *SD*) [95% CI]	16.1 ± 3.9 [15.6, 16.6]	16.5 ± 4.1 [15.9, 17.1]	.287
Trying to quit in next 30 days	115 (49.4%)	56 (33.5%)	**.002**
Using nicotine replacement	28 (12.0%)	4 (2.4%)	**<.001**
FTND-Total (*M* ± *SD*) [95% CI]	4.3 ± 2.4 [4.0, 4.6]	3.8 ± 2.4 [3.4, 4.2]	.069

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test. Proportions were tested using Fisher's Exact Test. yrs = years.
Bold indicates p < .05.

Table 9. *Unadjusted Comparisons of Decision-Making of E-Cigarette Users vs. Non-Users among Current Smokers*

Measure	E-Cigarette users (n = 233)	Non-users (n = 167)	*P*
Delay Discounting			
MCQ ($M \pm SD$)	-4.2 ± 1.5	-4.1 ± 1.6	.194
Explicit-Zero MCQ ($M \pm SD$)	-4.5 ± 1.6	-4.2 ± 1.7	.065
Impulsivity			
BIS-Total ($M \pm SD$)	61.6 ± 12.3	60.5 ± 12.4	.451
BIS Attentional ($M \pm SD$)	15.9 ± 4.3	15.3 ± 4.6	.122
BIS Motor ($M \pm SD$)	22.3 ± 4.4	21.6 ± 4.6	.062
BIS Nonplanning ($M \pm SD$)	23.4 ± 5.6	23.7 ± 5.8	.428
Opportunity Cost Neglect			
BPT: % considered opportunity costs	85 (36.5%)	49 (29.3%)	.162
OCCS ($M \pm SD$)	4.3 ± 1.3	4.2 ± 1.3	.447
Propensity to Plan			
PPMS ($M \pm SD$)	4.5 ± 1.2	4.4 ± 1.3	.585
PPML ($M \pm SD$)	3.9 ± 1.5	3.8 ± 1.4	.593
SQB-Scenarios			
% choosing current apartment	139 (59.7%)	98 (58.7%)	.918
% choosing current club	126 (54.1%)	108 (64.7%)	**.040**
% choosing current hotel	142 (60.9%)	117 (70.1%)	.089
SQB-Investments			
% choosing status quo when dominant; gain	217 (93.1%)	164 (98.2%)	.070
% choosing status quo when nondominant; gain	91 (39.1%)	70 (41.9%)	.679
% choosing status quo when dominant; loss	225 (96.6%)	161 (96.4%)	1.000
% choosing status quo when nondominant; loss	99 (42.5%)	72 (43.1%)	.919

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test. Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

Table 10. *Use of Other Tobacco and Nicotine Delivery Products of E-Cigarette Users vs. Non-Users among Current Smokers*

Product	E-Cigarette users (*n* = 233)	Non-users (*n* = 167)	*p*
Cigars over past month			
Every day	21 (9.0%)	21 (12.6%)	.436
Some days	27 (11.6%)	22 (13.2%)	
Not at all	183 (78.5%)	124 (74.3%)	
Cigars over past year			
Every day	20 (8.6%)	17 (10.2%)	.179
Some days	53 (22.8%)	25 (15.0%)	
Not at all	160 (68.7%)	120 (71.9%)	
Hookah over past month			
Every day	3 (1.3%)	1 (0.6%)	.797
Some days	19 (8.2%)	12 (7.2%)	
Not at all	210 (90.1%)	153 (91.6%)	
Hookah over past year			
Every day	1 (0.4%)	0 (0%)	**.023**
Some days	41 (17.6%)	15 (9.0%)	
Not at all	190 (81.6%)	146 (87.4%)	
Bidis/cloves over past month			
Every day	0 (0%)	1 (0.6%)	.229
Some days	11 (4.7%)	4 (2.4%)	
Not at all	221 (94.9%)	161 (96.4%)	
Bidis/cloves over past year			
Every day	0 (0%)	1 (0.6%)	**.029**
Some days	17 (7.3%)	4 (2.4%)	
Not at all	216 (92.7%)	156 (93.4%)	
Smokeless tobacco over past month			
Every day	1 (0.4%)	3 (1.8%)	.351
Some days	9 (3.9%)	4 (2.4%)	
Not at all	222 (95.3%)	159 (95.2%)	
Smokeless tobacco over past year			
Every day	0 (0%)	2 (1.2%)	**.029**
Some days	14 (6.0%)	3 (1.8%)	
Not at all	218 (93.6%)	156 (93.4%)	

Snus over past month			
Every day	0 (0%)	0 (0%)	.406
Some days	4 (1.7%)	1 (0.6%)	
Not at all	228 (97.9%)	165 (98.8%)	
Snus over past year			
Every day	0 (0%)	0 (0%)	.133
Some days	10 (4.3%)	2 (1.2%)	
Not at all	221 (94.9%)	159 (95.2%)	
Other tobacco over past month			
Every day	15 (6.4%)	9 (5.4%)	.900
Some days	4 (1.7%)	2 (1.2%)	
Not at all	205 (88.0%)	149 (89.2%)	
Other tobacco over past year			
Every day	15 (6.4%)	10 (6.0%)	.881
Some days	5 (2.2%)	5 (3.0%)	
Not at all	208 (89.3%)	144 (86.2%)	

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test.
Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

Table 11. *Participant Characteristics for E-Cigarette Users vs. Non-Users among Never Smokers*

Variable	E-Cigarette users (*n* = 22)	Non-users (*n* = 378)	*p*
Sociodemographics			
Age			
24-26	7 (31.8%)	83 (22.0%)	.069
27-29	6 (27.3%)	74 (19.6%)	
30-32	1 (4.6%)	67 (17.7%)	
33-35	1 (4.6%)	68 (18.0%)	
36-38	3 (13.6%)	41 (10.9%)	
39-41	0 (0%)	21 (5.6%)	
42-44	4 (18.2%)	24 (6.4%)	
Race			
White	16 (72.7%)	269 (71.2%)	.054
Black/African-American	0 (0%)	52 (13.8%)	
Other	6 (27.3%)	54 (14.3%)	
Education			
High school or less	2 (9.1%)	26 (6.9%)	.159
Some college/AA	11 (50.0%)	127 (33.6%)	
BA or higher	9 (40.9%)	224 (59.3%)	
Marital status			
Married or remarried	7 (31.8%)	200 (52.9%)	.077
Never married, separated, divorced, widowed	15 (68.2%)	178 (47.1%)	
Alcohol and Drug Use			
No. alcoholic drinks/ week (*M* ± *SD*)	3.4 ± 3.3	1.7 ± 2.7	**.001**
Ever used illegal drugs	12 (54.6%)	75 (19.8%)	**<.001**
Treated for drug or alcohol abuse	1 (4.6%)	2 (0.5%)	.151

Note. The continuous variable was tested using the Wilcoxon Rank Sum Test. Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

Table 12. *Unadjusted Comparisons of Decision-Making of E-Cigarette Users vs. Non-Users among Never Smokers*

Measure	E-Cigarette users (*n* = 22)	Non-users (*n* = 378)	*P*
Delay Discounting			
MCQ (*M* ± *SD*)	-4.6 ± 1.3	-4.7 ± 1.6	.788
Explicit-Zero MCQ (*M* ± *SD*)	-4.3 ± 1.3	-4.9 ± 1.7	.130
Impulsivity			
BIS-Total (*M* ± *SD*)	64.7 ± 13.2	57.2 ± 10.2	**.009**
BIS Attentional (*M* ± *SD*)	17.0 ± 4.9	14.9 ± 4.0	**.042**
BIS Motor (*M* ± *SD*)	23.5 ± 4.3	20.3 ± 4.0	**.001**
BIS Nonplanning (*M* ± *SD*)	24.3 ± 5.5	22.1 ± 4.9	.091
Opportunity Cost Neglect			
BPT: % considered opportunity costs	6 (27.3%)	160 (42.3%)	.186
OCCS (*M* ± *SD*)	4.3 ± 1.1	4.3 ± 1.2	.692
Propensity to Plan			
PPMS (*M* ± *SD*)	4.0 ± 1.3	4.4 ± 1.3	.136
PPML (*M* ± *SD*)	3.4 ± 1.4	4.2 ± 1.4	**.008**
SQB-Scenarios			
% choosing current apartment	15 (68.2%)	238 (63.0%)	.821
% choosing current club	11 (50.0%)	225 (59.5%)	.383
% choosing current hotel	13 (59.1%)	227 (60.1%)	1.000
SQB-Investment			
% choosing status quo when dominant; gain	21 (95.5%)	365 (96.6%)	.500
% choosing status quo when nondominant; gain	7 (31.8%)	180 (47.6%)	.261
% choosing status quo when dominant; loss	22 (100.0%)	369 (97.6%)	1.000
% choosing status quo when nondominant; loss	7 (31.8%)	161 (42.6%)	.379

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test.
Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

Table 13. *Use of Other Tobacco and Nicotine Delivery Products of E-Cigarette Users vs. Non-Users among Never Smokers*

Product	E-Cigarette users (*n* = 22)	Non-users (*n* = 378)	*p*
Cigars over past month			
Every day	0 (0%)	0 (0 %)	**<.001**
Some days	5 (22.7%)	8 (2.1%)	
Not at all	17 (77.3%)	369 (97.6%)	
Cigars over past year			
Every day	0 (0%)	0 (0%)	**<.001**
Some days	7 (31.8%)	12 (3.2%)	
Not at all	15 (68.2%)	360 (95.2%)	
Hookah over past month			
Every day	1 (4.6%)	0 (0%)	**.006**
Some days	2 (9.1%)	8 (2.1%)	
Not at all	19 (86.4%)	369 (97.6%)	
Hookah over past year			
Every day	1 (4.6%)	0 (0%)	**<.001**
Some days	6 (27.3%)	10 (2.7%)	
Not at all	15 (68.2%)	362 (95.8%)	
Bidis/cloves over past month			
Every day	1 (4.6%)	0 (0%)	**.003**
Some days	1 (4.6%)	0 (0%)	
Not at all	20 (90.9%)	378 (100.0%)	
Bidis/cloves over past year			
Every day	1 (4.6%)	0 (0%)	**<.001**
Some days	2 (9.1%)	0 (0%)	
Not at all	19 (86.4%)	372 (98.4%)	
Smokeless tobacco over past month			
Every day	0 (0%)	0 (0%)	**.008**
Some days	2 (9.1%)	1 (0.3%)	
Not at all	20 (90.9%)	377 (99.7%)	
Smokeless tobacco over past year			
Every day	1 (4.6%)	0 (0%)	.056
Some days	0 (0%)	0 (0%)	
Not at all	21 (95.5%)	372 (98.4%)	

Snus over past month			
Every day	1 (4.6%)	0 (0%)	**.003**
Some days	1 (4.6%)	0 (0%)	
Not at all	20 (90.9%)	375 (99.2%)	
Snus over past year			
Every day	1 (4.6%)	0 (0%)	.056
Some days	0 (0%)	0 (0%)	
Not at all	21 (95.5%)	368 (97.4%)	
Other tobacco over past month			
Every day	1 (4.6%)	0 (0%)	**.012**
Some days	1 (4.6%)	3 (0.8%)	
Not at all	20 (90.9%)	371 (98.2%)	
Other tobacco over past year			
Every day	1 (4.6%)	0 (0%)	.073
Some days	0 (0%)	4 (1.1%)	
Not at all	21 (95.5%)	364 (96.3%)	

Note. Continuous variables were tested using the Wilcoxon Rank Sum Test.
Proportions were tested using Fisher's Exact Test.
Bold indicates $p < .05$.

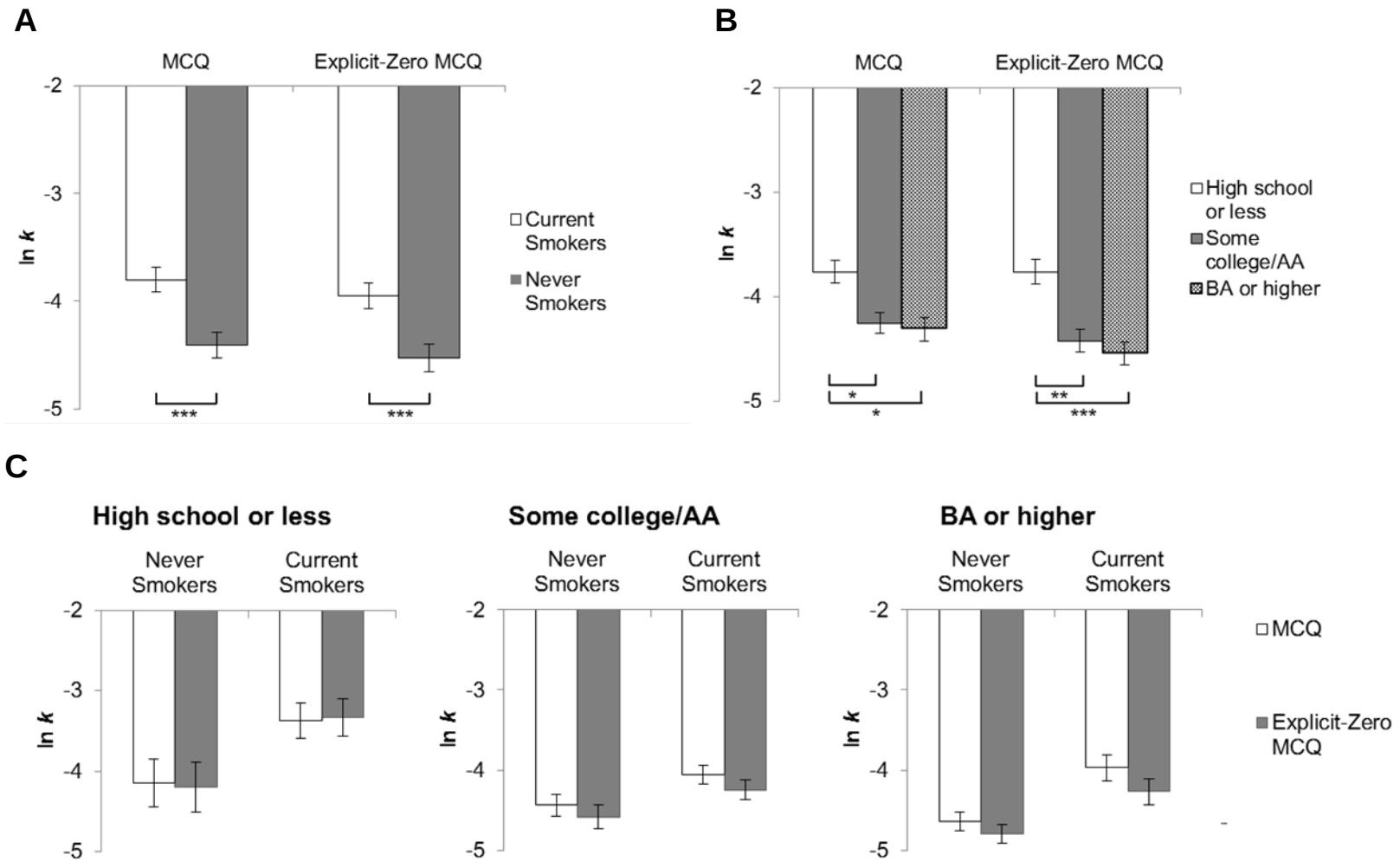

Figure 1. Adjusted mean discounting rates (ln *k*) from Monetary Choice Questionnaire (MCQ) for standard and explicit-zero instruction formats separately by (A) smoking status, (B) educational attainment, and (C) both smoking status and educational attainment. Error bars represent standard error of the mean. Significant group differences are indicated by *p < .05; **p < .01; ***p < .001.

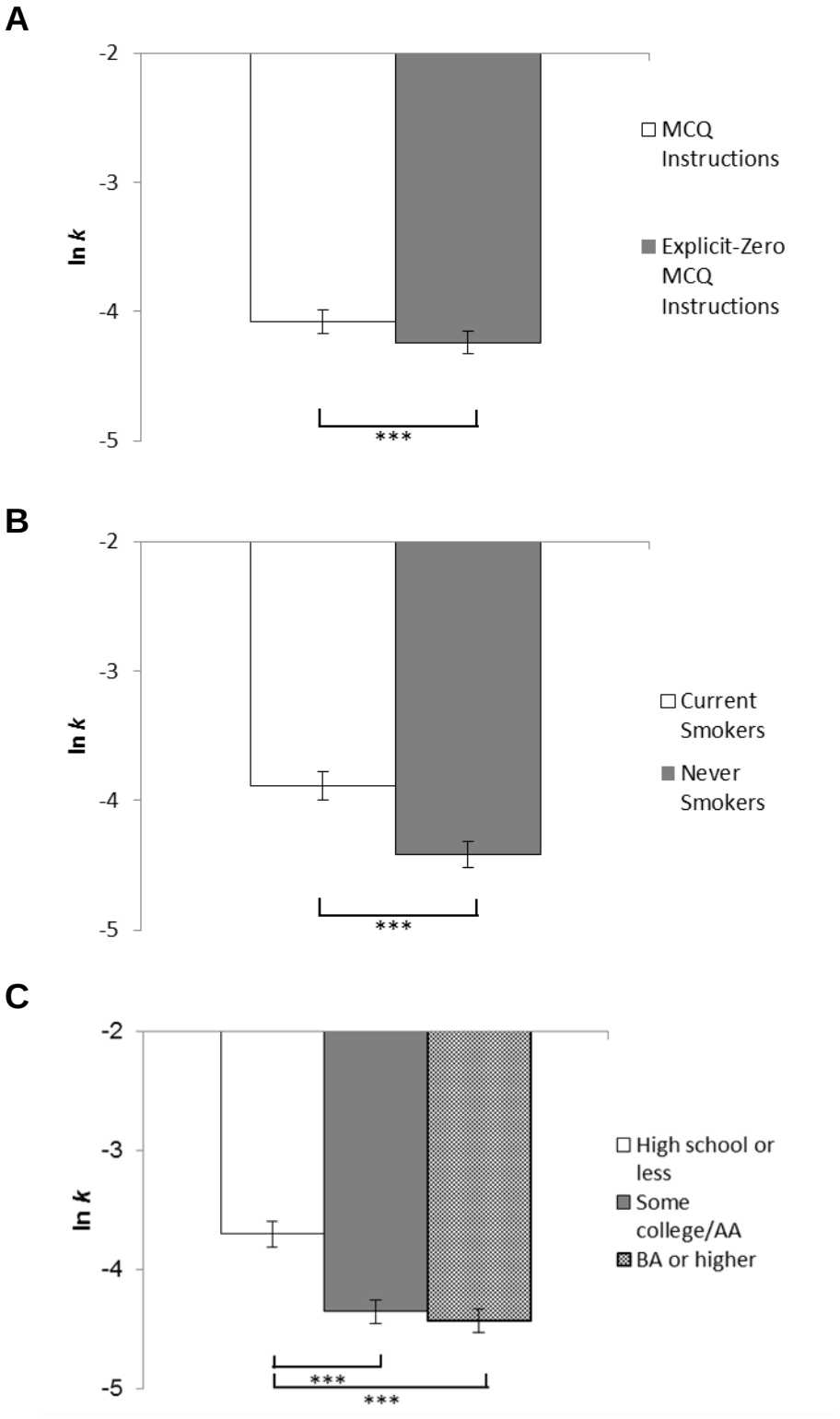

Figure 2. Adjusted mean discounting rates (ln *k*) from Monetary Choice Questionnaire (MCQ) when instruction type was included as a within-subjects factor by (A) type of instruction, (B) smoking status, and (C) educational attainment. Error bars represent standard error of the mean. Significant group differences are indicated by ***p < .001.

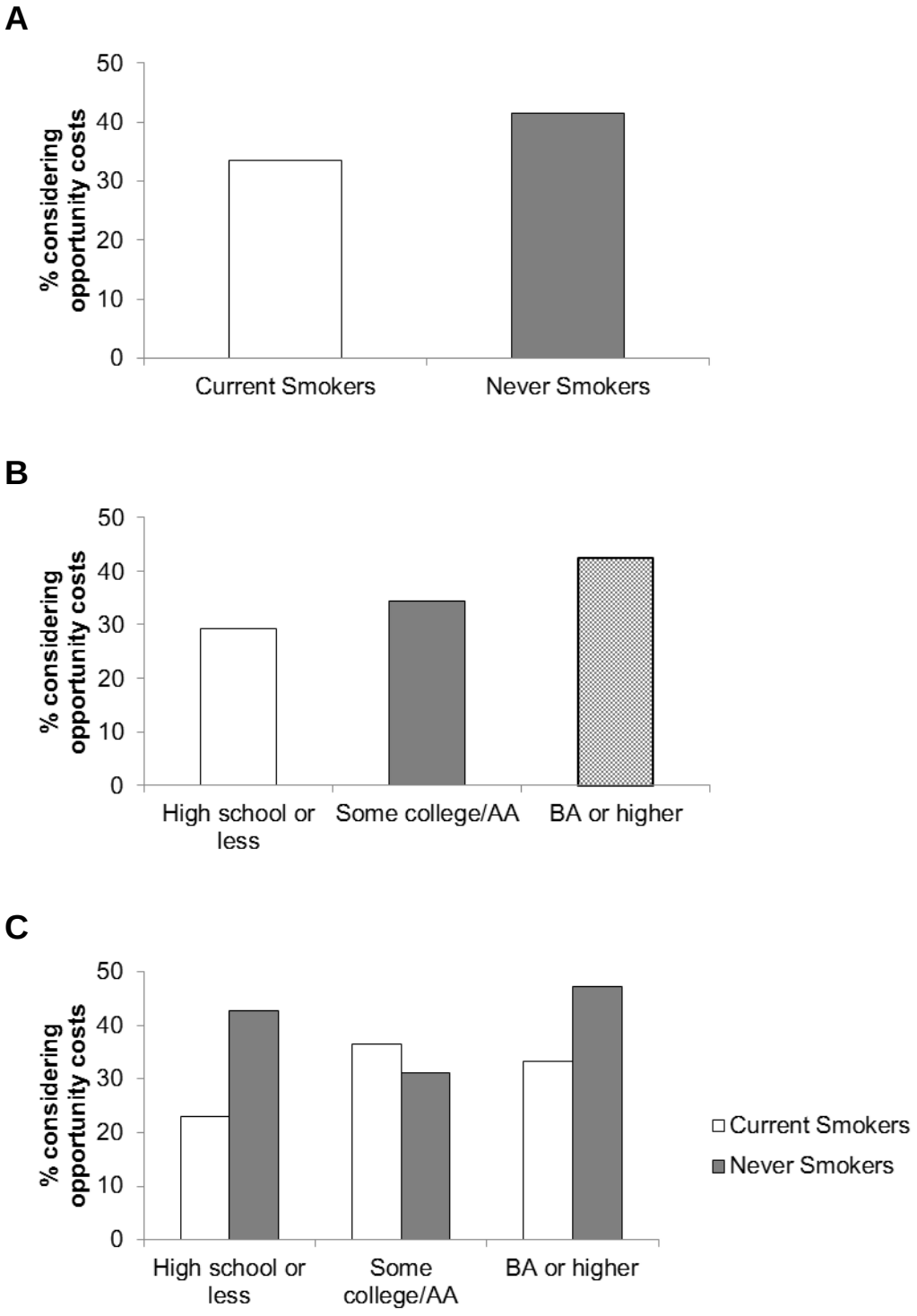

Figure 3. Percentage of participants considering opportunity costs on Breakfast Purchase Task by (A) smoking status, (B) educational attainment, and (C) both smoking status and educational attainment.

References

Agnew, J., Balduzzi, P., & Sunden, A. (2003). Portfolio choice and trading in a large 401(k) plan. *The American Economic Review, 93*(1), 193-215. doi: 10.1257/000282803321455223

Andrade, L. F., & Petry, N. M. (2014). White problem gamblers discount delayed rewards less steeply than their African American and Hispanic counterparts. *Psychology of Addictive Behaviors, 28*(2), 599-606. doi: 10.1037/a0036153

Audrain-McGovern, J., Rodriguez, D., Epstein, L. H., Cuevas, J., Rodgers, K., & Wileyto, E. P. (2009). Does delay discounting play an etiological role in smoking or is it a consequence of smoking? *Drug and Alcohol Dependence, 103*(3), 99-106. doi: 10.1016/j.drugalcdep.2008.12.019

Baker, F., Johnson, M. W., & Bickel, W. K. (2003). Delay discounting in current and never-before cigarette smokers: Similarities and differences across commodity, sign, and magnitude. *Journal of Abnormal Psychology, 112*(3), 382-392. doi: 10.1037/0021-843X.112.3.382

Baron, J., & Ritov, I. (1994). Reference points and omission bias. *Organizational Behavior and Human Decision Processes, 59*(3), 475-498. doi: 10.1006/obhd.1994.1070

Bauer, M., & Chytilová, J. (2009). *The impact of education on the subjective discount rate in Ugandan villages*. Paper presented at the Social Science Research Network, IZA Discussion Paper No. 4057. Available at SSRN: http://ssrn.com/abstract=1369803.

Becker, S. W., Ronen, J., & Sorter, G. H. (1974). Opportunity costs--An experimental approach. *Journal of Accounting Research, 12*(2), 317-329. doi: http://www.jstor.org/stable/2490379

Benowitz, N. L. (2014). Emerging nicotine delivery products. Implications for public health. *Annals of the American Thoracic Society, 11*(2), 231-235. doi: 10.1513/AnnalsATS.201312-433PS

Bickel, W. K., Jarmolowicz, D. P., Mueller, E. T., Koffarnus, M. N., & Gatchalian, K. M. (2012). Excessive discounting of delayed reinforcers as a trans-disease process contributing to addiction and other disease-related vulnerabilities: Emerging

evidence. *Pharmacology & Therapeutics, 134*(3), 287-297. doi: http://dx.doi.org/10.1016/j.pharmthera.2012.02.004

Bickel, W. K., & Marsch, L. A. (2001). Toward a behavioral economic understanding of drug dependence: Delay discounting processes. *Addiction, 96*(1), 73-86. doi: 10.1046/j.1360-0443.2001.961736.x

Bickel, W. K., Odum, A. L., & Madden, G. J. (1999). Impulsivity and cigarette smoking: delay discounting in current, never, and ex-smokers. *Psychopharmacology, 146*(4), 447-454. doi: 10.1007/PL00005490

Bonnie, R., Stratton, K., & Wallace, R. (2007). Ending the tobacco problem: A blueprint for the nation: Washington, DC: The National Academies Press.

Brown, A. L., & Kagel, J. H. (2009). Behavior in a simplified stock market: The status quo bias, the disposition effect and the ostrich effect. *Annals of Finance, 5*(1), 1-14. doi: 10.1007/s10436-007-0092-0

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6*(1), 3-5. doi: 10.1177/1745691610393980

Chernev, A. (2004). Goal orientation and consumer preference for the status quo. *Journal of Consumer Research, 31*(3), 557-565. doi: 10.1086/425090

Chilcoat, H. D. (2009). An overview of the emergence of disparities in smoking prevalence, cessation, and adverse consequences among women. *Drug and Alcohol Dependence, 104, Supplement 1*(0), S17-S23. doi: 10.1016/j.drugalcdep.2009.06.002

Cnattingius, S. (2004). The epidemiology of smoking during pregnancy: Smoking prevalence, maternal characteristics, and pregnancy outcomes. *Nicotine & Tobacco Research, 6*(Suppl 2), S125-S140. doi: 10.1080/14622200410001669187

Coffey, S. F., Gudleski, G. D., Saladin, M. E., & Brady, K. T. (2003). Impulsivity and rapid discounting of delayed hypothetical rewards in cocaine-dependent individuals. *Experimental and Clinical Psychopharmacology, 11*(1), 18-25. doi: 10.1037/1064-1297.11.1.18

Crump, M. J., McDonnell, J. V., & Gureckis, T. M. (2013). Evaluating Amazon's Mechanical Turk as a tool for experimental behavioral research. *PloS one, 8*(3), e57410.

Cutler, D. M., & Lleras-Muney, A. (2010). Understanding differences in health behaviors by education. *Journal of Health Economics, 29*(1), 1-28. doi: http://dx.doi.org/10.1016/j.jhealeco.2009.10.003

de Wit, H., Flory, J. D., Acheson, A., McCloskey, M., & Manuck, S. B. (2007). IQ and nonplanning impulsivity are independently associated with delay discounting in middle-aged adults. *Personality and Individual Differences, 42*(1), 111-121. doi: 10.1016/j.paid.2006.06.026

Dennhardt, A. A., & Murphy, J. G. (2011). Associations between depression, distress tolerance, delay discounting, and alcohol-related problems in European American and African American college students. *Psychology of Addictive Behaviors, 25*(4), 595-604. doi: 10.1037/a0025807

Duncan, S. C., Duncan, T. E., & Hops, H. (1998). Progressions of alcohol, cigarette, and marijuana use in adolescence. *Journal of Behavioral Medicine, 21*(4), 375-388. doi: 10.1023/A:1018730814379

Ershoff, D. H., Ashford, T. H., & Goldenberg, R. L. (2004). Helping pregnant women quit smoking: An overview. *Nicotine & Tobacco Research*. doi: 10.1080/14622200410001669204

Etter, J.-F. (2010). Electronic cigarettes: A survey of users. *BMC Public Health, 10*(1), 231.

Fox, S., Bizman, A., & Huberman, O. (2009). Escalation of commitment: The effect of number and attractiveness of available investment alternatives. *Journal of Business and Psychology, 24*(4), 431-439. doi: 10.1007/s10869-009-9124-2

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature, 40*(2), 351-401. doi: 10.1257/002205102320161311

Frederick, S., Novemsky, N., Wang, J., Dhar, R., & Nowlis, S. (2009). Opportunity cost neglect. *Journal of Consumer Research, 36*(4), 553-561. doi: 10.1086/599764

Galobardes, B., Shaw, M., Lawlor, D. A., Lynch, J. W., & Davey Smith, G. (2006). Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health, 60*(1), 7-12. doi: 10.1136/jech.2004.023531

Goldin, G., & Darlow, A. (2013). TurkGate (Version 0.4.0) [Software]. Available from http://gideongoldin.github.com/TurkGate/.

Goniewicz, M. L., Lingas, E. O., & Hajek, P. (2013). Patterns of electronic cigarette use and user beliefs about their safety and benefits: An Internet survey. *Drug and Alcohol Review, 32*(2), 133-140. doi: 10.1111/j.1465-3362.2012.00512.x

Graham, H., Inskip, H. M., Francis, B., & Harman, J. (2006). Pathways of disadvantage and smoking careers: Evidence and policy implications. *Journal of Epidemiology and Community Health, 60*(suppl 2), ii7-ii12. doi: 10.1136/jech.2005.045583

Hartman, R. S. (1991). Consumer rationality and the status quo. *The Quarterly Journal of Economics, 106*(1), 141-162. doi: 10.2307/2937910

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström , K.-O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction, 86*(9), 1119-1127. doi: 10.1111/j.1360-0443.1991.tb01879.x

Heil, S. H., Johnson, M. W., Higgins, S. T., & Bickel, W. K. (2006). Delay discounting in currently using and currently abstinent cocaine-dependent outpatients and non-drug-using matched controls. *Addictive Behaviors, 31*(7), 1290-1294. doi: 10.1016/j.addbeh.2005.09.005

Heyman, G. M., & Gibb, S. P. (2006). Delay discounting in college cigarette chippers. *Behavioural Pharmacology, 17*(8), 669-679. doi: 10.1097/FBP.0b013e3280116cfe

Higgins, S. T., & Chilcoat, H. D. (2009). Women and smoking: An interdisciplinary examination of socioeconomic influences. *Drug and Alcohol Dependence, 104, Supplement 1*(0), S1-S5. doi: 10.1016/j.drugalcdep.2009.06.006

Higgins, S. T., Heil, S. H., Badger, G. J., Skelly, J. M., Solomon, L. J., & Bernstein, I. M. (2009). Educational disadvantage and cigarette smoking during pregnancy. *Drug and Alcohol Dependence, 104, Supplement 1*(0), S100-S105. doi: 10.1016/j.drugalcdep.2009.03.013

Horton, J. J., Rand, D. G., & Zeckhauser, R. (2011). The online laboratory: Conducting experiments in a real labor market. *Experimental Economics, 14*(3), 399-425. doi: 10.1007/s10683-011-9273-9

Jarmolowicz, D. P., Bickel, W. K., Carter, A. E., Franck, C. T., & Mueller, E. T. (2012). Using crowdsourcing to examine relations between delay and probability discounting. *Behavioural Processes, 91*(3), 308-312. doi: http://dx.doi.org/10.1016/j.beproc.2012.09.001

Jaroni, J. L., Wright, S. M., Lerman, C., & Epstein, L. H. (2004). Relationship between education and delay discounting in smokers. *Addictive Behaviors, 29*(6), 1171-1175. doi: 10.1016/j.addbeh.2004.03.014

Johnson, M. W., Bickel, W. K., & Baker, F. (2007). Moderate drug use and delay discounting: A comparison of heavy, light, and never smokers. *Experimental and Clinical Psychopharmacology, 15*(2), 187-194. doi: 10.1037/1064-1297.15.2.187

Kandel, D. B., Griesler, P. C., & Schaffran, C. (2009). Educational attainment and smoking among women: Risk factors and consequences for offspring. *Drug and Alcohol Dependence, 104, Supplement 1*(0), S24-S33. doi: 10.1016/j.drugalcdep.2008.12.005

Kempf, A., & Ruenzi, S. (2006). Status quo bias and the number of alternatives: An empirical illustration from the mutual fund industry. *Journal of Behavioral Finance, 7*(4), 204-213. doi: 10.1207/s15427579jpfm0704_3

King, B. A., Patel, R., Nguyen, K. H., & Dube, S. R. (2015). Trends in awareness and use of electronic cigarettes among US adults, 2010–2013. *Nicotine & Tobacco Research, 17*(2), 219-227. doi: 10.1093/ntr/ntu191

Kirby, K. N., Petry, N. M., & Bickel, W. K. (1999). Heroin addicts have higher discount rates for delayed rewards than non-drug-using controls. *Journal of Experimental Psychology: General, 128*(1), 78-87. doi: 10.1037/0096-3445.128.1.78

Koffarnus, M. N., & Bickel, W. K. (2014). A 5-trial adjusting delay discounting task: Accurate discount rates in less than one minute. *Experimental and Clinical Psychopharmacology, 22*(3), 222-228. doi: 10.1037/a0035973

Koffarnus, M. N., Jarmolowicz, D. P., Mueller, E. T., & Bickel, W. K. (2013). Changing delay discounting in the light of the competing neurobehavioral decision systems

theory: A review. *Journal of the Experimental Analysis of Behavior, 99*(1), 32-57. doi: 10.1002/jeab.2

Kralikova, E., Novak, J., West, O., Kmetova, A., & Hajek, P. (2013). Do e-cigarettes have the potential to compete with conventional cigarettes?: A survey of conventional cigarette smokers' experiences with e-cigarettes. *Chest, 144*(5), 1609-1614. doi: 10.1378/chest.12-2842

Krishnan-Sarin, S., Reynolds, B., Duhig, A. M., Smith, A., Liss, T., McFetridge, A., . . . Potenza, M. N. (2007). Behavioral impulsivity predicts treatment outcome in a smoking cessation program for adolescent smokers. *Drug and Alcohol Dependence, 88*(1), 79-82. doi: 10.1016/j.drugalcdep.2006.09.006

Lee, Y. O., Hebert, C. J., Nonnemaker, J. M., & Kim, A. E. (2014). Multiple tobacco product use among adults in the United States: Cigarettes, cigars, electronic cigarettes, hookah, smokeless tobacco, and snus. *Preventive Medicine, 62*(0), 14-19. doi: http://dx.doi.org/10.1016/j.ypmed.2014.01.014

Liang, K.-Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika, 73*(1), 13-22.

Link, B. G., & Phelan, J. (2009). The social shaping of health and smoking. *Drug and Alcohol Dependence, 104, Supplement 1*(0), S6-S10. doi: 10.1016/j.drugalcdep.2009.03.002

Lopez, A. A. (2014). *Examining delay discounting and response to incentive-based smoking-cessation treatment among pregnant women* (Doctoral dissertation). from http://scholarworks.uvm.edu/graddis/272

Lumley, J., Chamberlain, C., Dowswell, T., Oliver, S., Oakley, L., & Watson, L. (2009). Interventions for promoting smoking cessation during pregnancy. *Cochrane Database of Systematic Reviews, 3*(3). doi: 10.1002/14651858.CD001055.pub3

Lynch, John G., Jr, Netemeyer, Richard G., Spiller, Stephen A., & Zammit, A. (2010). A generalizable scale of propensity to plan: The long and the short of planning for time and for money. *Journal of Consumer Research, 37*(1), 108-128. doi: 10.1086/649907

Madden, G. J., Bickel, W. K., & Jacobs, E. A. (1999). Discounting of delayed rewards in opioid-dependent outpatients: Exponential or hyperbolic discounting functions?

Experimental and Clinical Psychopharmacology, 7(3), 284-293. doi: 10.1037/1064-1297.7.3.284

Magen, E., Dweck, C. S., & Gross, J. J. (2008). The hidden-zero effect: Representing a single choice as an extended sequence reduces impulsive choice. *Psychological Science, 19*(7), 648-649. doi: 10.1111/j.1467-9280.2008.02137.x

Martinez, G., Daniels, K., & Chandra, A. (2012). Fertility of men and women aged 15-44 years in the United States: National Survey of Family Growth, 2006-2010. *National Health Statistics Reports*, (51), 1-28.

Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods, 44*(1), 1-23. doi: 10.3758/s13428-011-0124-6

Mazur, J. E. (1987). An adjustment procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevins & H. Rachlin (Eds.), *Quantitative analysis of behaviour: The effect of delay and intervening events on reinforcement value* (pp. 55-73). Hillsdale, NJ: Erlbaum.

McLellan, A. T., Kushner, H., Metzger, D., Peters, R., Smith, I., Grissom, G., . . . Argeriou, M. (1992). The fifth edition of the addiction severity index. *Journal of Substance Abuse Treatment, 9*(3), 199-213. doi: http://dx.doi.org/10.1016/0740-5472(92)90062-S

McMillen, R., Maduka, J., & Winickoff, J. (2012). Use of emerging tobacco products in the United States. *Journal of Environmental and Public Health, 2012,* Article ID 989474, http://dx.doi.org/10.1155/2012/989474.

Merrill, J. C., Kleber, H. D., Shwartz, M., Liu, H., & Lewis, S. R. (1999). Cigarettes, alcohol, marijuana, other risk behaviors, and American youth. *Drug and Alcohol Dependence, 56*(3), 205-212. doi: http://dx.doi.org/10.1016/S0376-8716(99)00034-4

Mitchell, S. H. (1999). Measures of impulsivity in cigarette smokers and non-smokers. *Psychopharmacology, 146*(4), 455-464. doi: 10.1007/PL00005491

Northcraft, G. B., & Neale, M. A. (1986). Opportunity costs and the framing of resource allocation decisions. *Organizational Behavior and Human Decision Processes, 37*(3), 348-356. doi: 10.1016/0749-5978(86)90034-8

Nowlis, S. M., Kahn, B. E., & Dhar, R. (2002). Coping with ambivalence: The effect of removing a neutral option on consumer attitude and preference judgments. *Journal of Consumer Research, 29*(3), 319-334. doi: 10.1086/344431

O'Donoghue, T., & Rabin, M. (1999). Doing it now or later. *American Economic Review, 89*(1), 103-124.

Ohmura, Y., Takahashi, T., & Kitamura, N. (2005). Discounting delayed and probabilistic monetary gains and losses by smokers of cigarettes. *Psychopharmacology, 182*(4), 508-515. doi: 10.1007/s00213-005-0110-8

Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology, 45*(4), 867-872. doi: http://dx.doi.org/10.1016/j.jesp.2009.03.009

Paolacci, G., & Chandler, J. (2014). Inside the Turk: Understanding Mechanical Turk as a participant pool. *Current Directions in Psychological Science, 23*(3), 184-188. doi: 10.1177/0963721414531598

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology, 51*(6), 768-774. doi: 10.1002/1097-4679(199511)51:6<768::AID-JCLP2270510607>3.0.CO;2-1

Pauly, J. R., & Slotkin, T. A. (2008). Maternal tobacco smoking, nicotine replacement and neurobehavioural development. *Acta Paediatrica, 97*(10), 1331-1337. doi: 10.1111/j.1651-2227.2008.00852.x

Pepper, J. K., & Eissenberg, T. (2014). Waterpipes and electronic cigarettes: Increasing prevalence and expanding science. *Chemical Research in Toxicology, 27*(8), 1336-1343. doi: 10.1021/tx500200j

Prignot, J. J., Sasco, A. J., Poulet, E., Gupta, P. C., & Aditama, T. Y. (2008). Alternative forms of tobacco use. *The International Journal of Tuberculosis and Lung Disease, 12*(7), 718-727.

Pulvers, K., Hayes, R. B., Scheuermann, T. S., Romero, D. R., Emami, A. S., Resnicow, K., . . . Ahluwalia, J. S. (2014). Tobacco use, quitting behavior, and health characteristics among current electronic cigarette users in a national tri-ethnic

adult stable smoker sample. *Nicotine & Tobacco Research*. doi: 10.1093/ntr/ntu241

Rachlin, H., & Green, L. (1972). Commitment, choice and self-control. *Journal of the Experimental Analysis of Behavior, 17*(1), 15.

Rachlin, H., Raineri, A., & Cross, D. (1991). Subjective probability and delay. *Journal of the Experimental Analysis of Behavior, 55*(2), 233.

Radu, P. T., Yi, R., Bickel, W. K., Gross, J. J., & McClure, S. M. (2011). A mechanism for reducing delay discounting by altering temporal attention. *Journal of the Experimental Analysis of Behavior, 96*(3), 363-385. doi: 10.1901/jeab.2011.96-363

Raineri, A., & Rachlin, H. (1993). The effect of temporal constraints on the value of money and other commodities. *Journal of Behavioral Decision Making, 6*(2), 77-94.

Rand, D. G. (2012). The promise of Mechanical Turk: How online labor markets can help theorists run behavioral experiments. *Journal of Theoretical Biology, 299*(0), 172-179. doi: http://dx.doi.org/10.1016/j.jtbi.2011.03.004

Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences, 47*(8), 973-978. doi: http://dx.doi.org/10.1016/j.paid.2009.07.026

Reynolds, B. (2006). A review of delay-discounting research with humans: Relations to drug use and gambling. *Behavioural Pharmacology, 17*(8), 651-667. doi: 10.1097/FBP.0b013e3280115f99

Richards, J. B., Zhang, L., Mitchell, S. H., & De Wit, H. (1999). Delay or probability discounting in a model of impulsive behavior: Effect of alcohol. *Journal of the Experimental Analysis of Behavior, 71*(2), 121-143. doi: 10.1901/jeab.1999.71-121

Richardson, A., Williams, V., Rath, J., Villanti, A. C., & Vallone, D. (2014). The next generation of users: Prevalence and longitudinal patterns of tobacco use among US young adults. *American Journal of Public Health, 104*(8), 1429-1436. doi: 10.2105/AJPH.2013.301802

Rutten, L. J. F., Blake, K. D., Agunwamba, A. A., Grana, R. A., Wilson, P. M., Ebbert, J. O., . . . Leischow, S. J. (2015). Use of e-cigarettes among current smokers: Associations among reasons for use, quit intentions, and current tobacco use. *Nicotine & Tobacco Research*. doi: 10.1093/ntr/ntv003

Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty, 1*(1), 7-59. doi: 10.1007/BF00055564

Schweitzer, M. (1994). Disentangling status quo and omission effects: An experimental analysis. *Organizational Behavior and Human Decision Processes, 58*(3), 457-476. doi: 10.1006/obhd.1994.1046

Shapiro, D. N., Chandler, J., & Mueller, P. A. (2013). Using Mechanical Turk to study clinical populations. *Clinical Psychological Science, 1*(2), 213-220. doi: 10.1177/2167702612469015

Spiller, S. A. (2011). Opportunity cost consideration. *Journal of Consumer Research, 38*(4), 595-610. doi: 10.1086/660045

Sweitzer, M. M., Donny, E. C., Dierker, L. C., Flory, J. D., & Manuck, S. B. (2008). Delay discounting and smoking: Association with the Fagerström Test for Nicotine Dependence but not cigarettes smoked per day. *Nicotine & Tobacco Research, 10*(10), 1571-1575. doi: 10.1080/14622200802323274

Walton, K. M., Abrams, D. B., Bailey, W. C., Clark, D., Connolly, G. N., Djordjevic, M. V., . . . Hatsukami, D. K. (2015). NIH electronic cigarette workshop: Developing a research agenda. *Nicotine & Tobacco Research, 17*(2), 259-269. doi: 10.1093/ntr/ntu214

White, T. J., Redner, R., Skelly, J. M., & Higgins, S. T. (2014). Examining educational attainment, prepregnancy smoking rate, and delay discounting as predictors of spontaneous quitting among pregnant smokers. *Experimental and Clinical Psychopharmacology, 22*(5), 384-391. doi: 10.1037/a0037492

Wills, T. A., Knight, R., Williams, R. J., Pagano, I., & Sargent, J. D. (2015). Risk factors for exclusive e-cigarette use and dual e-cigarette use and tobacco use in adolescents. *Pediatrics, 135*(1), e43-e51. doi: 10.1542/peds.2014-0760

Wilson, A. G., Franck, C. T., Mueller, E. T., Landes, R. D., Kowal, B. P., Yi, R., & Bickel, W. K. (2015). Predictors of delay discounting among smokers: Education

level and a utility measure of cigarette reinforcement efficacy are better predictors than demographics, smoking characteristics, executive functioning, impulsivity, or time perception. *Addictive Behaviors, 45*(0), 124-133. doi: http://dx.doi.org/10.1016/j.addbeh.2015.01.027

Yen, H. R., & Chuang, S.-C. (2008). The effect of incidental affect on preference for the status quo. *Journal of the Academy of Marketing Science, 36*(4), 522-537. doi: 10.1007/s11747-008-0084-2

Yoon, J. H., Higgins, S. T., Heil, S. H., Sugarbaker, R. J., Thomas, C. S., & Badger, G. J. (2007). Delay discounting predicts postpartum relapse to cigarette smoking among pregnant women. *Experimental and Clinical Psychopharmacology, 15*(2), 176-186. doi: 10.1037/1064-1297.15.2.186

Appendix A: Description of HIT in AMT

Study description workers saw in AMT before they accepted the HIT:

The University of Vermont is conducting a research survey about decision-making. This survey should take about 20-40 minutes to complete.

Please be aware this study is part of a group of studies called [redacted] and if you have accepted any of the studies in this group, you will not be able to access this survey or complete this HIT. In this case, please don't accept the HIT, because you'll have to return it. You can check to see if you have already completed one of the studies in this group at the link below:
Check Past Participation

If you have not participated in one of these studies in the past and begin the survey, you will be asked to answer *three brief questions* to determine if you are eligible for the study, and *not everyone will be eligible to participate*. If you accept this HIT and then are not eligible for the study after answering the eligibility questions, you will need to return the HIT. Please do not accept this HIT if you do not want to have to return a HIT if you are not eligible. Only eligible participants who complete the longer survey will receive a code for payment.

For technical reasons, you cannot preview the study and can only access it once you have accepted the HIT. Once you accept the HIT, you will receive a link to the survey and can open it in a new window and complete the eligibility questions.

If you are eligible for the study and complete the longer survey, you will receive a confirmation code at the end of the survey. **Copy the entire code and return to this page to paste the confirmation code** in the text entry box below in order to receive credit for this HIT and earn your payment.

Thank you for helping us with our study.

Enter the completion code here:

We appreciate any comments and feedback. Please enter comments below or email us directly at [redacted].

You must ACCEPT the HIT before you can submit the results.

Study description workers saw in AMT after they accepted the HIT:

The University of Vermont is conducting a research survey about decision-making. This survey should take about 20-40 minutes to complete.

Please be aware this study is part of a group of studies called [redacted] and if you have accepted any of the studies in this group, you will not be able to access this survey or complete this HIT.

If you have not participated in one of these studies in the past and begin the survey, you will be asked to answer *three brief questions* to determine if you are eligible for the study, and *not everyone will be eligible to participate*. If you accept this HIT and then are not eligible for the study after answering the eligibility questions, you will need to return the HIT. Please do not accept this HIT if you do not want to have to return a HIT if you are not eligible. Only eligible participants who complete the longer survey will receive a code for payment.

Click here to open the survey.

If you are eligible for the study and complete the longer survey, you will receive a confirmation code at the end of the survey. **Copy the entire code and return to this page to paste the confirmation code** in the text entry box below in order to receive credit for this HIT and earn your payment.

Thank you for helping us with our study.

Enter the completion code here:

We appreciate any comments and feedback. Please enter comments below or email us directly at [redacted].

Submit

Appendix B: Opportunity Cost Neglect Measures

Breakfast Purchase Task

Spiller, S. A. (2011). Opportunity cost consideration. *Journal of Consumer Research, 38*(4), 595-610. doi: 10.1086/660045

Question 1.
Imagine that you are spending all day in a city interviewing for jobs. One interview session is scheduled from 9:00 AM until 11:00 AM, and a second session is scheduled from 2:30 PM until 4:30 PM. You arrive in the city at 8:20 AM without having had breakfast, and you plan to stick around until at least 7:30PM to avoid having to deal with rush hour traffic as you drive back home. As you run in to a local breakfast restaurant to get something to eat before your interview, you realize that you must have left your credit and debit cards at home, and you never carry a checkbook with you. All you have with you are the two $5 bills you have in your wallet.

Below is the On The Move breakfast menu offered at the diner for patrons in a hurry. What would you buy? Choose as many or as few items as you would like.

Please choose all that apply:
__Donut: $1.00
__Everything Bagel: $1.25
__Kashi Cereal Crunch Bar: $1.50
__Bacon, Egg, and Cheese Biscuit: $2.00
__Banana: $0.75
__Yogurt: $1.25
__Bran Muffin: $1.50
__Fruit Salad: $1.75
__Coffee: $1.25
__Milk: $1.50
__Small Orange Juice: $1.50
__Large Orange Juice: $2.50
__Nothing (skip breakfast): $0.00

Question 2.
Please use the space below to describe to us how you decided what to order.
What went through your mind as you chose? There are no right or wrong answers; we're simply interested in how you decided. Try to make a list of everything that came to mind, but only include items that came to mind while you were deciding what to order.
Please write your answer here:

Question 3.
You had two $5 that you could have used to buy breakfast. Instead of breakfast, for what else could you have used that money?
Enter as many things as come to mind, one per line.

Question 4.
All else equal, would you be better off using that money for breakfast or (Alternative from Question 3)?
Please choose the appropriate response for each item:

1	2	3	4	5	6	7
(Breakfast)			**(About equal)**			**(Alternative from Q.3)**

Question 4 is repeated for each item listed in Question 3 in the (Alternative from Q.3) until all alternatives have been queried.

Opportunity Cost Consideration Scale

Spiller, S. A. (2011). Opportunity cost consideration. *Journal of Consumer Research, 38*(4), 595-610. doi: 10.1086/660045

Please rate the degree to which you disagree/agree with each of the following statements.

Please choose the appropriate response for each item:

	1 (Strongly Disagree)	**2**	**3**	**4**	**5**	**6 (Strongly Agree)**
I often think about the fact that spending money on one purchase now means not spending money on some other purchase later.	○	○	○	○	○	○
When I'm faced with an opportunity to make a purchase, I try to imagine things in other categories I might spend that money on.	○	○	○	○	○	○
I often consider other specific items that I would not be able to buy if I made a particular purchase.	○	○	○	○	○	○

Propensity to Plan Scales

Adapted and reprinted with kind permission of Chicago University Press from:
Lynch, John G., Jr, Netemeyer, Richard G., Spiller, Stephen A., & Zammit, A. (2010). A generalizable scale of propensity to plan: The long and the short of planning for time and for money. *Journal of Consumer Research, 37*(1), 108-128. doi: 10.1086/649907

PPMS

Please rate the degree to which you disagree/agree with each of the following statements. Please choose the appropriate response for each item:

	1 (Strongly Disagree)	**2**	**3**	**4**	**5**	**6 (Strongly Agree)**
I set financial goals for the next few days for what I want to achieve with my money.	○	○	○	○	○	○
I decide beforehand how my money will be used in the next few days.	○	○	○	○	○	○
I actively consider the steps I need to take to stick to my budget in the next few days.	○	○	○	○	○	○
I consult my budget to see how much money I have left for the next few days.	○	○	○	○	○	○
I like to look to my budget for the next few days in order to get a better view of my spending in the future.	○	○	○	○	○	○

It makes me feel better to have my finances planned out in the next few days.	○	○	○	○	○	○

PPML

Please rate the degree to which you disagree/agree with each of the following statements. Please choose the appropriate response for each item:

	1 (Strongly Disagree)	**2**	**3**	**4**	**5**	**6 (Strongly Agree)**
I set financial goals for the next 1–2 months for what I want to achieve with my money.	○	○	○	○	○	○
I decide beforehand how my money will be used in the next 1–2 months.	○	○	○	○	○	○
I actively consider the steps I need to take to stick to my budget in the next 1–2 months.	○	○	○	○	○	○
I consult my budget to see how much money I have left for the next 1–2 months.	○	○	○	○	○	○
I like to look to my budget for the next 1–2 months in order to get a better view of my spending in the future.	○	○	○	○	○	○
It makes me feel better to have my finances planned out in the next 1–2 months.	○	○	○	○	○	○

Appendix C: Status Quo Bias Measures

SQB-Scenarios

Adapted and reprinted with kind permission of Springer Science+Business Media from:
Yen, H. R., & Shih-Chieh, C. (2008). The effect of incidental affect on preference for the status quo. *Journal of the Academy of Marketing Science, 36*(4), 522-537. doi: 10.1007/s11747-008-0084-2

Imagine that you have been renting a one-bedroom apartment (Current Apartment). Your current lease is up and you have the chance to stay in your current apartment or move to a different apartment (New Apartment). Information about some of the included features of each apartment is below.

New Apartment	Current Apartment
New apartment building	Dishwasher and refrigerator
Color TV and cable included in rent	Cost of heat included in rent
New wall-to-wall carpeting	Nice new furniture

Which apartment would you choose?

Only answer this question if the following conditions are met:
((RandomSQ1 == 2))

Please choose **only one** of the following:

- ○ New Apartment
- ○ Current Apartment

Imagine that you have been attending a health club (Current Club). Your membership will expire in one week and you have the chance to stay at your current club or go to a different club (New Club). Information about some of the features of each club is below.

Current Club	New Club
Great variety of exercise machines	Professional coach
Shorter driving time to health club	Big space
High-quality service	Spa and sauna

Which health club would you choose?

Only answer this question if the following conditions are met:
((RandomSQ1 == 1))

Please choose **only one** of the following:

- ○ Current Club
- ○ New Club

Imagine you are planning a weekend break in the country with some old friends. You have spent many happy, relaxing weekends in a favorite hotel, the Manor, which has always provided you with excellent hospitality and the personal touch. You hear of another hotel in the same area (the Grange) which appears to offer a slightly higher standard of accommodation. You wonder which hotel you should book.

The Manor (Current Hotel)	The Grange (New Hotel)
High standard of service	Nice meals
Excellent hospitality	Nice view
Convenience	Good decoration
Big space	Internet provided

Which hotel would you choose?

Only answer this question if the following conditions are met:
((RandomSQ1 == 1))

Please choose **only one** of the following:

- ○ The Manor (Current Hotel)
- ○ The Grange (New Hotel)

SQB-Investments

Adapted and reprinted with kind permission of Chicago University Press from:
Chernev, A. (2004). Goal orientation and consumer preference for the status quo. *Journal of Consumer Research, 31*(3), 557-565. doi: 10.1086/425090

Status Quo Option Dominant, Gain:

The fund you are currently invested in now earns 7.1% interest. For next year, you have to choose whether to stay with the same fund or to switch to a new fund by checking a box on a form. The only information you have about the two funds is the expected rate of interest for the next year. These expected rates of return are only predictions; the actual rates could be higher or lower than predicted.

Your options are:

Please choose **only one** of the following:

- ○ Stay with the same fund, expected to earn 8.65%.
- ○ Switch to a new fund, expected to earn 8.15%.

Status Quo Option Nondominant, Gain:

The fund you are currently invested in now earns 7.1% interest. For next year, you have to choose whether to stay with the same fund or to switch to a new fund by checking a box on a form. The only information you have about the two funds is the expected rate of interest for the next year. These expected rates of return are only predictions; the actual rates could be higher or lower than predicted.

Your options are:

Please choose **only one** of the following:

- ○ Stay with the same fund, expected to earn 8.15%.
- ○ Switch to a new fund, expected to earn 8.65%.

Status Quo Option Dominant, Loss:

The fund you are currently invested in now earns 9.1% interest. For next year, you have to choose whether to stay with the same fund or to switch to a new fund by checking a box on a form. The only information you have about the two funds is the expected rate of interest for the next year. These expected rates of return are only predictions; the actual rates could be higher or lower than predicted.

Your options are:

Please choose **only one** of the following:

- ○ Stay with the same fund, expected to earn 8.65%.
- ○ Switch to a new fund, expected to earn 8.15%.

Status Quo Option Nondominant, Loss:

The fund you are currently invested in now earns 9.1% interest. For next year, you have to choose whether to stay with the same fund or to switch to a new fund by checking a box on a form. The only information you have about the two funds is the expected rate of interest for the next year. These expected rates of return are only predictions; the actual rates could be higher or lower than predicted.

Your options are:

Please choose **only one** of the following:

- ○ Stay with the same fund, expected to earn 8.15%.
- ○ Switch to a new fund, expected to earn 8.65%.