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Age and the purchase of prescription drug insurance by older adults

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Abstract

The Medicare Part D Prescription Drug Program places an unprecedented degree of choice in the hands of older adults despite concerns over their ability to make effective decisions and desire to have extensive choice in this context. While previous research has compared older adults to younger adults along these dimensions, our study, in contrast, examines how likelihood to delay decision making and preferences for choice differ by age *among* older age cohorts. Our analysis is based on responses of older adults to a simulation of enrollment in Medicare Part D. We examine how age, numeracy, cognitive reflection, and the interaction between age and performance on these instruments are related to the decision to enroll in a Medicare prescription drug plan and preference for choice in this context. We find that numeracy and cognitive reflection are positively associated with enrollment likelihood and that they are more important determinants of enrollment than age. We also find that greater numeracy is associated with a lower willingness to pay for choice. Hence, our findings raise concern that older adults, and, in particular, those with poorer numerical processing skills, may need extra support in enrolling in the program: they are less likely to enroll than those with stronger numerical processing skills, even though they show greater willingness to pay for choice.

Keywords

Choice; Aging; Numeracy; Cognitive Reflection; Medicare

In 2006, the U.S. government dramatically expanded publicly funded insurance coverage of prescription drugs for older adults. The new benefit, in which coverage is provided exclusively by competing private insurers, places an unprecedented degree of choice among health insurance plans in the hands of Medicare beneficiaries. In order to obtain publicly subsidized coverage, older adults must choose a prescription drug plan from those offered by insurers in the area in which they live.

The role of choice in this program has been controversial. The ability of older adults to make effective choices in this context is one source of concern. Because health insurance is a complex product, choosing among plans is a difficult task, and these types of decisions may

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be particularly challenging for older adults facing age-related cognitive decline. Yet, plan choices may have important health and financial implications for older adults. The extensive number of plans from which beneficiaries choose has compounded these concerns. Over 45 plans are available in all areas of the country (Hargrave, Hoadley, Cubanski, & Neuman, 2009), and recent research has suggested that extensive choice may have detrimental consequences for consumers (Botti & Iyengar, 2006).

In this paper, we examine decision making among older adults in this important context. Our study builds on research indicating that older adults are more likely to delay decision making in response to choice and have weaker preferences for choice than younger adults. Our study, in contrast, examines how these outcomes differ by age cohort *among* older age cohorts. Based on the responses of older adults to a simulation of enrollment in Medicare Part D, we examine the relationship between age and the decision to delay a decision as well as the relationship between age and preference for choice when choosing a Medicare prescription drug plan. Based on empirical evidence documenting 70 years as a pivotal age for cognitive decline, we analyze differences among those 65-69, 70-74, and 75 and older. Because cognitive skills are an important factor in decision making, we also examine how numeracy, cognitive reflection, and the interaction of each of these measures with age affects older adults' decisions to delay decision making and preferences for choice.

Background

Aging and Decision Making

Human competency on many tasks decreases with age. For example, aging is associated with declines in controlled processes - cognitive processes that are activated and controlled by the subject, such as memory or explicit learning (see Peters, Hess, Vastfjall, and Auman, 2007a for a review). The work of Paul and Margret Baltes (P.B. Baltes, 1987; P.B. Baltes & M.M. Baltes, 1990; P.B. Baltes, 1997) provides an interdisciplinary explanation for why life span architecture becomes more incomplete with aging. The application of three principles – the reduction of biological potential with increased age as a result of evolutionary selection, the increased need of culture-based (psychological, social, material, and symbolic) resources, and the reduced efficiency of cultural factors and resources –means that old age is characterized with more losses than gains in functioning.

However, not all processes involved in decision making decline with age. This can be seen through the comparison of performance on tasks related to cognitive mechanics (basic information processing) to those related to cognitive pragmatics (factual and procedural knowledge), where improvements with age based on greater expertise, for example, are possible. Emotion is also a cognitive process that does not necessarily decline with age, and, as people age, they place a greater focus on goals with emotional meaning and their decision making processes become more intuitive and automatic (Carstensen, Isaacowitz, & Charles, 1999). While the use of more intuitive processes may help older adults make better decisions in some situations, it may be problematic (lead to lower long-term utility) in others (Lockenhoff & Carstensen, 2004).

Older adults may also compensate by adapting their decision processes to changes in their cognitive abilities. The Selection, Optimization, and Compensation (SOC) framework focuses on the ability of all organisms to adapt and improve performance by understanding the environment (P.B. Baltes, 1987; P.B. Baltes & M.M. Baltes, 1990; M.M. Baltes & Carstensen, 1996; P.B. Baltes, 1997)). The SOC framework suggests that individual differences in the effect of aging on decision making may be driven by differences among individuals in how they adapt to their changing abilities.

As an example, older adults may be more likely to use simplifying heuristics, which may sometimes, but not always lead to better decisions (Baron, 2008). It has not been found that less deliberation among older adults leads to better decision making (Hess, Queen, & Patterson, In Press). However older adults seem to do better when less deliberation is necessary (Queen & Hess, 2010). Consistent with this finding, older adults generally perform better when policies encourage a focus on emotion, versus a focus on information acquisition (Mikels et al., 2010). Based on a meta-analysis, Mata and Nunes (2009) find that older adults generally engage in less pre-decisional information search than younger adults.

Mata, Schooler, and Rieskamp (2007) contrast two main arguments for why we may find age-related differences in strategy selection. The first is that cognitive decline may restrict the possible strategies available to older adults and/or the amount of effort that older adults can exert to implement them. Constraints in the set of possible strategies, in turn, may lead to poorer decisions. On the other hand, experience may allow older adults to select a better decision making strategy for a given environment. The second argument implies that older adults may make better quality decisions because they are more adaptive decision makers. This idea is supported by recent reviews that suggest that some improvements in decision making with age can be due to age-related increases in experience, despite decreases in fluid cognitive ability over the life-span (Hanoch, Wood, & Rice, 2007; Bruine de Bruin, Parker, & Fischhoff, In press; Peters et al., 2007a; Peters & Bruine de Bruin, In press).

Other recent work also makes the role of the environment focal in explaining individual decision making. The Person-Task Fit Theory put forward by Finucane, Mertz, Slovic, and Schmidt (2005) suggests that older adult's ability to perform on tasks is related to the *fit* between environment and abilities and is consistent with SOC, as is the suggestion by Hanoch et al. (2007) to connect the adaptive tool-box approach (Gigerenzer, Todd, & the ABC Research Group, 1999) to theories of aging. More generally, research in decision making points to the importance of decision-makers' abilities to understand the environment and to adapt to it (Payne, Bettman, & Johnson, 1993; Gigerenzer et al., 1999). An important and implicit policy implication of this research is to look beyond how the individual can change his/her decision process, to consider how the policy maker can change the environment surrounding the decision. Good "choice architecture" can prod individuals into making better decisions (Thaler & Sunstein, 2008).

One relatively robust empirical finding is that older adults are more likely to avoid making decisions, and hence delay decision making more than younger people (Mather, 2006). While a potential explanation for greater decision avoidance among older adults is that people become more risk averse as they age, and thus less likely to make a decision in the face of risk, evidence on risk behavior does not support this explanation. Older adults tend to behave in similar ways when approaching risks as younger adults (reviewed by Mather, 2006). The role of emotional conflict in decision making also provides a potential explanation for the relationship between decision avoidance and age. Decision avoidance is a general response to avoid the conflict created by choice (Tversky & Shafir, 1992). Because making decisions often involves emotional conflict, avoiding decisions is a way to regulate emotional feelings (a strategy that may work at least in the short run). Since older adults place more emphasis on regulating emotion, this may explain why they tend to delay decisions more than their younger counterparts. A second explanation for this effect is that older adults might not trust themselves to make decisions, so they avoid them. The latter explanation is consistent with the existence of declines in cognitive ability with aging. However, decision delay is not necessarily inconsistent with ecologically rational decision making (Gigerenzer et al., 1999). For example, avoiding decisions, at least the first time round, may be a rational strategy if important decisions often 'turn up' a second time.

Empirical research differs as to when cognitive decline begins (see Salthouse, 1991, pgs. 33-34 for an illustration). Many earlier studies identify 60 years as a pivotal age with decline in abilities increasing after age 60 (Schaie, 1990) and changes in brain activity (as measured by Electroencephalography) occurring at that age (Busse, 1985). Other work, in contrast, points to 70 as a critical age. Many mental illnesses, for example Alzheimers disease, appear with higher frequencies at 70 years of age (P.B. Baltes, 1997). Examining wisdom, Paul Baltes (1997) also finds that older adults perform as well as younger adults up to the age of 70. Furthermore, P.B. Baltes and Lindenberger (1997) find that sensory functioning, specifically visual and auditory ability, is very highly correlated with cognitive functioning in older adults. The strong relationship between sensory and cognitive functioning is even stronger in adults 70 years and older, compared to their younger counterparts. Using longitudinal data, Schaie (1989) shows that amongst those that are "intellectually advantaged", rates of cognitive decline before 70 years of age are small in the absence of pathology (although there is the exception of immediate decline following retirement in some individuals).

Decision Making among Older Adults in the Context of Health Insurance

Making good decisions about health insurance requires the comprehension and use of health information (Peters, Hibbard, Slovic, & Dieckmann, 2007b). Studies of decision making in the context of health insurance have raised questions about the effectiveness of the choices made by older adults. Studies have found that Medicare beneficiaries (the majority of whom are 65 or older) are often uninformed about their health plan options (Hibbard, Jewett, Engelmann, & Tusler, 1998; Hibbard, Slovic, Peters, Finucane, & Tusler, 2001) and have difficulty interpreting plan information (Finucayne, Slovic, Hibbard, Peters, Mertz, & Macgregor, 2002.). In a comparison of younger and older adults, Finucane et al. (2002) found that older adults made more errors in comprehension and more often demonstrated inconsistent preferences, even when controlling for other individual characteristics. More recent work examining choice in the context of Medicare Part D prescription drug plans has documented that many beneficiaries appear to make suboptimal choices considering the likely effects of plan characteristics on their out of pocket expenditures (Abaluck & Gruber, In Press). Similarly, Kling, Mullainathan, Shafir, Vermeulen, and Wrobel (2009) find that many beneficiaries do not choose the lowest cost plan given their current drug profile and that providing more accessible information on lower cost options causes many people to switch plans.

Older Adults and Choice Set Size

The extent of choice has been another major concern in the implementation of the Medicare Part D Prescription Drug program. While, Medicare beneficiaries are required to choose from over 45 different plans, recent studies have challenged the notion that people always benefit from having extensive choice (Botti & Iyengar, 2006; Schwartz, 2004). In the context of consumer products, many psychology and marketing experiments have shown that individuals often are either dissatisfied with their choice or forgo a purchase when choosing from a large number of options (Iyengar & Lepper, 2000; Reutskaja & Hogarth, 2009). (However, Scheibehenne, Greifeneder, and Todd (2010) challenge the generalizability of this finding.) In the context of health insurance, Hanoch, Rice, Cummings, and Wood (2009) find that it is more difficult for older than younger adults to identify the lowest cost plan when choice is extensive. In another study, Tanius, Wood, Hanoch, and Rice (2009) did not find that older adults performed worse than younger adults when rating prescription drug plans, despite quicker processing and higher numeracy scores among younger adults. Levy and Weir (2010) find, using data from the Health and Retirement Survey, that older adults with low cognitive ability, as measured by the serial

sevens test (in which respondents count backwards from 100 in multiples of 7) are less likely to be enrolled in a prescription drug plan.

Other research demonstrates that older adults have weaker preferences for choice than younger adults when choosing among health care products (including drug plans) and other consumer products (Reed, Mikels, & Simon, 2008). Similarly, Mikels, Reed, and Simon (2009) show that willingness to pay for choice of drug plans is lower among older adults than for younger adults. Finally, Bundorf and Szrek (2010) find that, among older adults, both the benefits of choice, measured by whether the chosen plan is close to the ideal plan, and the costs, measured by whether the respondent found decision making difficult, increase with choice set size.

In this paper, we examine the effects of age on decision making in the context of Medicare Part D prescription drug plans. Our analysis is based on the results of an Internet-based experiment in which people 65 and older make hypothetical choices among prescription drug plans. We examine two types of decision outcomes. First, we examine decision avoidance based on whether older adults state they are likely to enroll in a prescription drug plan. We hypothesize that decision avoidance will increase with age. We also examine preferences for choice. A key feature of the program is that beneficiaries must choose a plan in order to enroll in publicly subsidized coverage. Thus, preferences for choice may be an important indicator of beneficiary well-being in this context. While research has documented differences between older and younger adults for both of these outcomes, very few studies have examined whether differences exist among older age groups. We hypothesize that preference for choice will decline with age.

We also assess the roles of numeracy and cognitive reflection, two components of the multi-faceted construct of cognitive ability, in the decision making of older adults in this context. Numeracy has been recognized as an important skill for understanding health care decisions, such as choices amongst health plans (Peters et al., 2007b; Reyna, Nelson, Han, & Dieckmann, 2009). Cognitive reflection, in contrast, measures a different component of cognitive ability related to numeracy. In particular, cognitive reflection is the ability to reject an intuitive but wrong answer in favor of a reflective and correct answer. Because the contribution of cognitive ability to decision making is well documented, we expect that both measures will be correlated with the outcomes we examine. We hypothesize that older adults with greater numeracy and greater cognitive reflection will be less likely to avoid a decision and show stronger preferences for choice.

Based on theory suggesting that people adopt different types of decision strategies as they age, understanding differences among older adults in their preferences for choice and decision making capabilities is increasingly important to develop suitable policies in the face of increased life expectancy. Empirical research suggests that there is much heterogeneity in aging, which can be explained by genetic factors, environmental conditions, individual lifestyle, and patterns of pathology (P. Baltes & M. Baltes, 1990). While much research has been focused on the differences between young adults and older adults, the Committee on Aging Frontiers in Social Psychology, Personality, and Adult Developmental Psychology has specifically recommended more research that helps to understand the very diverse outcomes amongst older adults (Carstensen & Hartel, 2006). This paper represents a step towards understanding differences among older adults in how they are likely to fare under choice-based policies such as the recently enacted Medicare Prescription Drug Benefit. Understanding differences among those eligible for the program can help inform the development of policies that ensure that publicly subsidized benefits are meeting the diverse needs of beneficiaries.

Methods

Participants

We fielded the experiment during December 2007 on a sample of individuals 65 years and older drawn from an Internet-enabled panel developed and maintained by Knowledge Networks (www.knowledgenetworks.com). Our study sample includes 281 respondents who were recruited by an online survey company to participate in a survey about health. The study population is younger, disproportionately male, more highly educated, and more likely to be married than a nationally representative population (Bundorf & Szrek, 2010). Table 1 presents the characteristics of the study sample.

Procedure

The online survey company sent an email to participants with a link to our website. 1 Upon entering our site, respondents were asked to provide informed consent for participating. They were asked to assume that they were not able to obtain prescription drug coverage from any other source and were told to answer carefully, as if they were making real decisions. Participants were then given information about Medicare Drug Plans, which they could keep open for the duration of the experiment.

Respondents were randomized to one of two experimental conditions, based on the extent of differentiation in the characteristics of the plans in their choice set.2 Within each condition, respondents were then randomized to a set of either 2, 5, 10, or 16 drug plans and asked to choose a plan from the set. After choosing, respondents were asked questions about their chosen plan and the set of plans from which they chose. After answering these questions, respondents were again randomized to a set of drug plans (without replacement) with either 2, 5, 10, or 16 plans within the same experimental condition. Respondents chose a drug plan and then responded to the same post-choice questions.

Respondents then participated in a second experiment measuring their willingness to pay for plan choice. In this experiment, respondents were asked how much they would be willing to pay to choose from a set of plans rather than being offered only a single plan. Respondents participated in this exercise twice, with the features of the pre-chosen plan changing between the choices. Respondents were then shown a final screen on which they were asked a set of questions about their personal characteristics including their current enrollment in prescription drug plans and about their drug utilization.

Materials

The descriptions of the plan attributes were compiled from materials from the Medicare web site. The plan characteristics were chosen to resemble those available in the market based on data on plan offerings publicly available from the Centers for Medicaid and Medicare Services (CMS). In addition, the premium was chosen to reflect the plan characteristics based on a model of the relationship between observed premiums and plan characteristics (Simon & Lucarelli, 2006). Using this information, we then created pre-selected sets of 16 different drug plans, and randomly assigned participants to different sets as well as different numbers of plans from each set.

[1]Our experiment can be viewed at: http://www.stanford.edu/group/health_surveys/cgibin/ex/mkb1.htm.
[2]Our experiment involved a study arm in which the plans were highly differentiated and one in which the level of differentiation was low. In this paper we control for study arm, but we do not directly analyze this feature of the experiment.

Measures

Decision Avoidance—Our measure of decision avoidance is the response to the following question: "If presented with the choice of the above plans [plans from the previous choice set were listed], how likely would you be to enroll in ANY plan (where the alternative is going without a plan)?" Responses ranged from (1) certain not to enroll to (7) certain to enroll. Respondents answered this question twice, once after each choice. In this study, we analyze only the first response to avoid confounding due to repeated choice. In particular, this was a concern because the degree to which decisions become easier with experience could confound with age.

Willingness to pay (WTP)—We use measures of willingness to pay from two separate questions. In the first question, respondents saw the features of a pre-chosen plan which was a "standard plan" with the average plan characteristics among those available in the market at the time. Respondents were asked, "Suppose that there is one plan available. The plan has the following characteristics:" (and they were shown the standard plan), "How much would you be willing to pay to **instead** have a choice among the following plans? Assume this would be a one-time fee at the time you enroll. (This is the set of plans from which you most recently chose [shown set of plans from the second choice].)" Thus, in this question, respondents were asked their willingness to pay for the opportunity to choose from a set of plans rather than the opportunity to enroll in a single plan representing the average plan.

The second willingness to pay question was the same as the first, with the exception that the single plan was the plan the respondent had chosen in the first experiment rather than the plan with the average characteristics. More specifically, respondents were told, "Again suppose there is one plan available. This time this is the plan you most recently chose:". They were then shown the plan they had chosen from the choice set. They were then asked, "how much would you be willing to pay to INSTEAD have a choice among the following plans. Assume this would be a one-time fee at the time you enroll. (This is the set of plans from which you most recently chose.)" and were shown the same set of plans.

For both willingness to pay questions, respondents were asked to choose a dollar value from a predefined range to represent their willingness to pay for choice ($0, $1-10, $11-20, $21-40, $41-60, $61-80, $81-100, $101-125, $126-150, $151-175, 176-200, more than $200).

Numeracy—Measures of financial numeracy were modeled after Lipkus, Samsa, and Rimer's (2001) general numeracy questions and Schwartz, Woloshin, Black, & Welch's (1997) original 3-item instrument. Our questions were identical to Lipkus et al.'s (2001) three general numeracy questions, the first of which was modified from the earlier version of the instrument (a coin toss was changed to a roll of a die). The instrument has three general numeracy questions that were developed to test how well respondents performed simple mathematical operations using percentages or proportions and how well they converted between percentages, proportions, and probabilities.

Cognitive reflection—Three separate cognitive reflection questions were adapted from Frederick (2005), who has shown that correct answers on these questions are correlated with performance on the Wonderlic Personnel Test (WPT), the Need for Cognition scale (NFC), self-reported SAT/ACT scores, and patience as measured using a time-preference instrument. The questions have an intuitive but wrong answer, and hence they require the respondent both to be good at math to determine the correct answer and to be patient enough to think twice before replying. For example, the first question in the instrument is "A bat and a ball cost $1.10 in total. The bat cost $1.00 more than the ball. How much does the ball

cost?" The incorrect focal answer here is 10 cents. Arriving at this answer, instead of the correct one (5 cents), is probably a function not just of cognition but of questioning one's answer as the name of the instrument implies.

Appendix 1 contains the numeracy and cognitive reflection questions. We adapted these questions to our survey by making them multiple choice rather than open-ended. We expect that this could change the probability that a respondent obtained the correct answer or perhaps even the decision process they used. Thus, rates of correct responses from our respondents are not directly comparable to those from other settings. To the extent that guessing can lead to errors that make it harder to distinguish between high and low numeracy or cognitive reflection, this makes it less likely for us to find statistically significant effects.

Personal Characteristics—The survey company provided information on respondent characteristics including age, education level, race, household income, employment status, marital status, and household size. Information on actual enrollment in a prescription drug plan and the number of drugs taken regularly was collected during the experiment.

Data and Analysis

For the analysis, older adults were divided into three cohorts by age (65-69, 70-74, 75 and older). Categorical indicators, rather than a continuous variable, allow for non-linearities in the effect of age. The youngest cohort includes the youngest older adults who are age-eligible for Medicare. Based on research reviewed earlier indicating that a pivotal point for the emergence of cognitive decline is age 70, we chose this age as a cut-off point between age groups. Our final age group (75 and older) includes the oldest age group, for which we may expect a higher likelihood of cognitive decline. See Table 1 for the characteristics of respondents by age cohort. Based on chi-squared tests, the proportion of respondents that take at least 6 drugs regularly and the proportion of white respondents vary across age groups.

Respondents were also divided into high and low numeracy groups as well as into high and low cognitive reflection groups based on their responses to each of these instruments. Since approximately half of the respondents had two or more correct answers for the numeracy task and approximately half had one or more correct answers for the cognitive reflection question, we defined high numeracy as two or more correct answers and high cognitive reflection as one or more correct answers. The percent of each subsample with a low numeracy score is similar across the age groups, but there are fewer respondents with a low cognitive reflection score in the oldest group of respondents. The difference in the proportion of respondents with low cognitive reflection scores is significantly different across the groups.

The three dependent variables were coded as follows. The first, decision avoidance, was condensed from a 7-point Likert Scale to a 3-category scale of 1 to 3. The new scale differentiates between a neutral response (4 on the original scale), unlikely to enroll (less than 4) and likely to enroll (greater than 4). The 3-point scale has a more natural interpretation.

Both willingness to pay variables were recoded as categorical variables to distinguish between positive and zero willingness to pay for choice. We collapsed the responses into two categories because our interest was not in obtaining a precise estimate of willingness to pay, but rather to contrast willingness to pay for choice under the two scenarios. In particular, the difference between the two scenarios is driven by the product differentiation value of choice. We expected to have many respondents express positive willingness to pay

to the first question where choice would potentially allow them to enroll in a preferred plan. In the second WTP question, in contrast, we expected more respondents to indicate a zero willingness to pay since they were stating their willingness to pay for choice relative to their preferred plan from the choice set. Here there is no product differentiation value of choice. Thus, the important distinction between the two categories is between a positive and zero willingness to pay.

In the results that follow, we present the distribution of each dependent variable by age, both overall and by numeracy and by cognitive reflection. We then estimate multivariate models of each dependent variable as a function of age, numeracy, cognitive reflection, and the interaction of age with numeracy and cognitive reflection, controlling for individual characteristics. We estimate three models for each dependent variable, with the models differing based on whether and how we include the controls for numeracy and cognitive reflection. In the first model, we do not include these variables. In the second, we include them and in the third, we include their interactions with age group. While the correlation between these measures is not particularly high (0.32), we have also estimated models in which we analyze each measure separately and the results are substantively the same, although there are small changes in the estimates of the coefficients and standard errors.

In all models, the control variables include education, race, gender, family income, household size, employment status, marital status, number of drugs taken regularly by the respondent, number of plans in the choice set to which the respondent was randomized as well as an indicator of the study arm. These last two variables (number of plans, study arm) were included to control for experimental manipulations that were randomized across respondents and which could affect enrollment (Bundorf & Szrek, 2010). The other control variables are standard variables used in the health economics literature to control for demand for insurance in general (Bundorf, 2002; Cooper & Schone, 1997; Scanlon, Chernew, & Lave, 1997) and demand for Medicare Prescription Drug Plans in particular (Levy & Weir, 2010).

Results

Decision Avoidance

In Table 2, we show the relationship between age and decision avoidance (measured by the likelihood that an individual would enroll, which is the opposite of avoiding a decision). We also present the relationship by numeracy and cognitive reflection within age groups. In these analyses, age does not have a consistent relationship with decision avoidance and differences by age group are not statistically significant. Within age groups, in contrast, both numeracy and cognitive reflection are generally positively associated with likelihood of enrollment and hence negatively associated with decision avoidance. In the case of numeracy, more highly numerate older adults age 65-69 and 70-74 are significantly more likely to enroll in a prescription drug plan (and less likely to avoid a decision) than their less numerate counterparts. For the oldest group (75+), the effect seems to be reversed, although the effect is not statistically significant. For cognitive reflection, those with greater cognitive reflection have higher mean enrollment likelihood (and lower decision avoidance), but the difference is significant only for the middle age cohort (age 70-74).

In Table 3, we show the coefficients, confidence intervals, and standard errors from ordered probit regressions of enrollment likelihood. Our table shows three different models, one in which we control just for age cohort, one in which we add controls for numeracy and cognitive reflection, and one model that includes the interaction of age with both numeracy and cognitive ability. In our simplest model (Model 1), we find that age has a negative effect on enrollment likelihood but the effect is not statistically significant. In Model 2, we find

that both numeracy and cognitive reflection have a positive effect on the likelihood of enrollment, although only the effect of numeracy is significant at conventional levels. After including the controls for numeracy and cognitive reflection, the negative effect of age that we observed in Model 1 is slightly larger but remains statistically insignificant.

The positive effect of numeracy on enrollment likelihood, however, is concentrated among those in the 65-69 and the 70-74 age groups (Model 3). Although numeracy has a negative effect on enrollment likelihood for those 75 and over, the effect is not significant at the 5% level. The positive effect of cognitive reflection on enrollment likelihood, in contrast, is concentrated among the oldest age group (75 and over) (Model 3).

The coefficients on the control variables, presented in appendix 2 (Model 1), show some important effects. First, respondents who take one or more drugs regularly are more likely to enroll than those who do not. Second, we find that individuals with household income between $25,000 and $74,999 or greater than $75,000 are more likely to enroll than those in the lower income category (less than $25,000). Individuals who are employed, in contrast, are less likely to enroll, possibly because they have other coverage available. Finally, enrollment is more likely for people who chose from five or ten plans than for those who chose from two drug plans. This result contrasts with results from a previous paper in which we find that choice set size was not associated with enrollment probability (Bundorf & Szrek, 2010). Here we find that when we control for numeracy and cognitive reflection (as in Appendix 2 – Model 1), enrollment probability does change when respondents are randomized to a different number of options. We analyze the effect of cognition measures on the effect of choice set size in another paper (Szrek & Bundorf, 2011).

Willingness to pay for choice

We show the relationship between age and willingness to pay for choice in Table 4. For each willingness to pay measure, we test whether the proportion of respondents with a positive willingness to pay varies by age group. Then within each age group, we test whether the proportion with a positive willingness to pay varies by numeracy and by cognitive reflection. For both questions, willingness to pay for choice is lowest for the oldest age group, although the differences by age are not statistically significant for either question. In the case of willingness to pay for choice compared to the standard plan, differences within age groups by numeracy and by cognitive reflection are not statistically significant. On the other hand, willingness to pay for choice relative to the chosen plan is significantly lower in both younger cohorts (age 65-69 and 70-74) for those with high numeracy and high cognitive reflections scores than for those with low scores. Although the direction of the effects of numeracy and cognitive reflection are the same for the oldest group, the differences are not statistically significant at a 5% level.

Overall, we find large differences between responses to the two willingness to pay questions. 81% of respondents have a positive willingness to pay for choice relative to the standard plan. In contrast, 66% have a positive willingness to pay for choice relative to the chosen plan (results not shown in tables). The higher willingness to pay for choice relative to the standard plan is consistent across age groups.

In Table 5, we show the coefficients of our logistic regressions for the main variables of interest when we control for other factors. Our table shows three models for each dependent variable, with the same structure as in Table 3, where the first model includes control variables plus age, whereas the following models control for numeracy and cognitive reflection as well. The table includes results from six models because we have measures of willingness to pay for choice under two conditions: relative to the standard plan and relative to the chosen plan.

When including the control variables, we find a negative effect of age on willingness to pay for both questions (Models 1 and 4), with respondents in the oldest cohort showing significantly lower willingness to pay than the youngest cohort. The negative effect of age on willingness to pay for adults in the oldest cohort is similar in magnitude but becomes less precise when controlling for numeracy and cognitive reflection and is no longer significant at conventional levels (Models 2 and 5). Numeracy has a strong, negative effect on willingness to pay for both measures, as evidenced by the highly significant coefficients for numeracy in Models 2 and 5. Cognitive reflection, in contrast, does not have a statistically significant effect in either model.

In Models 3 and 6, we test the effect of numeracy and cognitive reflection by age group. Here, the results diverge between the two willingness to pay settings. In the case of willingness to pay for choice relative to a standard plan, we do not find an effect of numeracy on willingness to pay (Model 3). In the model of willingness to pay relative to the chosen plan (Model 6), in contrast, numeracy has a negative effect in the younger two cohorts. The results also indicate that cognitive reflection has a positive effect on willingness to pay for choice relative to a standard plan among the oldest age group. While greater drug utilization among the oldest group could be an explanation for this type of effect, the regression controls for drug utilization, suggesting this type of an effect is not driving the result.

In general, the control variables (shown in appendix 2) were not significant in these regressions with a couple important exceptions. First, respondents who use 6 or more drugs regularly showed statistically higher willingness to pay for choice in all models and taking 3 or more drugs regularly affected the second willingness to pay measure in all models. Second, when the number of plans in the choice set was 10, this significantly increased willingness to pay for choice relative to the standard plan.

Discussion

Our findings indicate that, among older adults, decision avoidance is more strongly associated with numeracy and cognitive reflection than with age. While the literature provides evidence that older adults are more likely to avoid decisions than younger adults, we did not find a parallel result among adults over 65. However, we did find that, among older adults, possessing high numeracy skills was strongly associated with less decision avoidance as measured by a question on enrollment likelihood. Our findings suggest that numeracy is indeed an important attribute and perhaps more important than age in understanding decision making in response to choice among older adults. This finding supports the increased emphasis on cognition in studies on aging (Peters et al., 2007a) as well as the recognition of cognition as an important individual difference in understanding decision making across individuals (Peters et al., 2006), particularly in the domain of health (Finucane et al., 2002; Peters et al., 2007b).

While our results are consistent with those of Mikels et al. (2009) who find that older adults are not willing to pay as much for choice of drug plans as younger adults, they indicate that numeracy is also an important determinant of willingness to pay. Interestingly, we find that greater cognitive reflection amongst the oldest cohort of adults is associated with a greater willingness to pay for choice relative to a standard plan. It is possible that, while adults in the oldest cohort are more skeptical than their younger peers about the benefits of choice relative to a standard plan, the more thoughtful older adults are more willing to pay for choice when the benefits are in the form of access to a preferred product.

Our framework allows us to consider if older adults value choice when choice may be instrumental to their well-being as well as if they value choice when choice has a more limited value (an intrinsic value in and of itself). We find that numeracy is important in both cases, but especially important in the latter: many older adults with low numeracy may falsely believe that choice is instrumental to their well-being when it is not. We note that other studies also find that individuals value choice in and of itself (Bown, Read & Summers, 2003; Szrek & Baron, 2007). Yet, our results raise concern that the people willing to pay for choice in and of itself are those with lower cognitive ability. On the other hand, our results also point out that people, particularly the oldest age group, with higher cognitive reflection, do not want choice for its own sake, but value choice when it provides benefits in the form of access to their most preferred plan. (We note also that cognitive reflection and numeracy have a very low correlation in the oldest age group, 0.09, so high correlation among the measures does not explain this finding as one might expect.) It may be that in the second willingness to pay question, respondents also saw the benefit to choice as the benefit of being able to revisit their original decision. With this interpretation, those with higher numeracy showed lower willingness to pay to revisit their decisions, especially for adults in the younger two age groups.

One curious issue is why we find slightly different relationships between numeracy, cognitive reflection, and our main outcomes amongst older adults. While both numeracy and cognitive reflection are shown to be important, their effects are independent. This is particularly evident in the oldest cohort, where the correlation of high numeracy and high cognitive reflection is lowest (0.09 vs. 0.36 and 0.39 in the youngest and middle cohorts, respectively). In our sample, the effects of numeracy were most pronounced among the younger cohorts (ages 65-69 and 70-74) and the effects of cognitive reflection were most pronounced among the oldest cohort (age 75 and older). It may be that numeracy tests for general math understanding and hence is a good indicator of whether the respondent understands plan attributes, decision situations, etc., but that cognitive reflection encompasses a different aspect of cognitive ability that requires questioning one's priors. This would help explain why older adults with high cognitive reflection scores were more likely to be willing to pay for choice than their low cognitive reflection counterparts when the alternative was the standard plan; perhaps they had some understanding that choice as compared to a standard plan may have benefits, despite the extra cost. A variation of this argument is that high cognitive reflection is a signal of how much an individual wants to search (Cokely & Kelley, 2009) and that more search leads to higher enrollment likelihood among the oldest cohort of adults, even when high numeracy does not improve enrollment likelihood. This is an interesting interpretation, because if true, this would imply that, with more motivation, older adults may be able to make better decisions despite cognitive decline. An alternative view is that cognitive reflection is not as good a measure as numeracy perhaps because the questions are too difficult, and hence, that some of our high cognitive reflection respondents are simply individuals that guessed a correct answer. We prefer the view that these are different measures, which are correlated, but which naturally pick up slightly different aspects of cognitive ability.

Finally, we draw a few cautions about our results. First, our results are drawn from a small sample of respondents. Correspondingly, our results are somewhat sensitive in models in which we interact age cohort with numeracy and cognitive reflection, although they are robust to the exclusion of outliers. When we estimate models with different specifications of the dependent variables (7 categories in the case of enrollment likelihood and 12 categories in the case of willingness to pay), the magnitude and statistical significance of some of the point estimates changes somewhat. Second, we ran additional models of enrollment likelihood that controlled for whether or not the respondent was actually enrolled in Medicare Part D and/or whether they had other drug coverage and found that other coverage

had a significant and negative coefficient, however this only slightly changed the magnitude of the other coefficients. Third, we note that we did not survey respondents over time, and hence we cannot measure changes in numeracy and cognitive reflection over time. Instead we are identifying the effect of age based on cross sectional differences in age. Tracking respondents over time to see how their numeracy, cognitive reflection ability, and preferences for choice change would be an interesting avenue for future research. Fourth, another limitation of our study is that our menu of plans only went up to 16 and not up to 45 plans which is the amount available in most states. Our results are consistent with Levy and Weir (2010) that consider enrollment in Medicare Part D in a non-randomized setting, which attenuates concerns about this affecting our results. Fifth, our experimental procedures had older adults making decisions on their own. However, in most cases adults will make decisions in consultation with others. A literature on collaborative cognition (Dixon, 1992; Strough & Margrett, 2002) conceptualizes cognition as a social process and addresses how adults can use their social context to make better decisions. Finally, we recommend that further work include process tracing to better understand the role of numeracy and cognitive reflection on the decision processes that are used to make decisions.

These results extend our knowledge about the decision making of older adults in the face of choice in the context of Medicare Part D drug plans. The comparison of different cohorts of older adults is useful to both understand how decision making varies across older age groups and to inform Medicare Part D policy. As more adults are living longer, understanding differences among older age groups in decision making, particularly in the context of social programs, will become increasingly important. Our results shed caution on evaluating decision making of older adults based on age alone. We found that, within older age groups, the valuation of choice and decision making ability of older adults varied significantly depending on numeracy skills and cognitive reflection.

Our findings also have implications for policy. First, those with low numeracy need to be given more assistance in choosing, especially because it may be the case (as we found in our experiment) that some of these individuals desire choice but avoid decisions more. Second, differences between plans should be highlighted to help people make the right decisions, but also so that the benefits of choosing are clear to beneficiaries. We found that willingness to pay among respondents was higher for choice relative to the standard plan as compared to choice in and of itself, suggesting that beneficiaries value actual differences between options so that choice can be instrumental to their well-being. Finally, we point to two groups of Medicare beneficiaries who may struggle in the current program – older beneficiaries who have weaker preferences for choice but are nonetheless required to choose among plans to obtain drug coverage and beneficiaries with lower cognitive skills who may like choice more but may be making less effective decisions.

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Appendix 1

Numeracy and Cognitive Reflection Questions

A. Numeracy questions (adapted from Schwartz et al., 1997 and Lipkus et al., 2001)	**B. Cognitive reflection questions (adapted from Frederick, 2005)**
1. Imagine that we rolled a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even (2, 4, or 6)? a.166 b.333 c.400 (d.500) e.600	1. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? a. 3 cents (b.5 cents) c.10 cents d.15 cents e.20 cents
2. In the BIG BUCKS LOTTERY, the chances of winning a $10.00 prize is 1%. What is your best guess about how many people would win a $10.00 prize if 1,000 people each buy a single ticket to BIG BUCKS? a.1 (b.10) c.20 d.100 e.200	2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? (a.5min) b.20min c.50min d.100min e.200min
3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets to ACME PUBLISHING SWEEPSTAKES win a car? a. 0.01% (b.0.1%) c.1% d.1.1% e.10%	3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? a.18 days b.24 days c.30 days d.40 days (e.47 days)

Note: Possible responses are listed after each question. Correct answers are enclosed in parentheses.

Appendix 2

Full Regression Models

	Decision Avoidance [1]	**Willingness to pay for choice Standard Plan [2]**	**Willingness to pay for choice Chosen Plan [3]**
Age (70-74)	−0.345 [0.303]	−0.39 [0.709]	−0.051 [0.783]
Age (75+)	−0.109 [0.410]	−1.575 [0.840]	−1.102 [0.859]
Age (< 70) & High numeracy	0.833 [0.283]**	−0.127 [0.563]	−1.94 [0.559]**
Age (70-74) & High numeracy	0.961 [0.335]**	−1.138 [0.721]	−1.907 [0.682]**
Age (75+) & High numeracy	−0.705 [0.392]	−1.348 [0.813]	−1.194 [0.696]
Age (< 70) & High cognitive reflection	−0.021 [0.279]	−0.779 [0.564]	−0.3 [0.501]
Age (70-74) & High cognitive reflection	0.279 [0.332]	0.907 [0.692]	−0.492 [0.597]
Age (75+) & High cognitive reflection	0.861 [0.397]*	1.779 [0.775]*	−0.331 [0.725]
Number of plans in the choice set (omitted category is 2)			
is 5	0.603 [0.261]*	0.069 [0.494]	−0.046 [0.476]
is 10	0.52 [0.243]*	1.019 [0.502]*	0.696 [0.442]
is 16	0.395 [0.253]	1.042 [0.546]	0.902 [0.497]

	Decision Avoidance [1]	Willingness to pay for choice Standard Plan [2]	Willingness to pay for choice Chosen Plan [3]
Experimental condition is high	−0.304 [0.174]	−0.171 [0.353]	0.158 [0.321]
Drugs take regularly (relative to omitted category of 0)			
is 1-2	0.812 [0.276]**	0.795 [0.556]	0.754 [0.526]
is 3-5	0.784 [0.255]**	0.239 [0.497]	1.362 [0.506]**
is 6+	1.043 [0.289]**	1.225 [0.606]*	1.615 [0.578]**
Education (omitted category is less than high school)			
is high school	0.469 [0.303]	−1.079 [0.691]	−0.668 [0.699]
is Bachelors degree or higher	0.135 [0.303]	−0.015 [0.697]	−0.1 [0.693]
Race is white	0.465 [0.240]	−0.018 [0.521]	0 [0.466]
Female	0.264 [0.180]	0.299 [0.375]	0.169 [0.339]
Family income (omitted category is less than $24,999)			
$25,000 to 74,999	0.638 [0.235]**	0.649 [0.504]	−0.074 [0.494]
$75,000+	0.755 [0.299]*	0.287 [0.592]	−0.778 [0.589]
Household size=1 household member	−0.211 [0.298]	0.111 [0.584]	0.908 [0.573]
Employed	−0.584 [0.214]**	−0.305 [0.434]	−0.62 [0.396]
Married	0.282 [0.293]	0.085 [0.602]	−0.76 [0.602]
Constant		0.861 [1.069]	1.078 [1.065]
Observations	261	256	256

Note: Cells show the coefficients [standard errors] after ordered probit (Model 1) and logistic regression (Models 2 and 3). These are the full models for Table 3 Model 3, Table 5 Model 3, and Table 5 Model 8. Significance levels shown are

* significant at 5%;

** significant at 1%

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Table 1

Sample Characteristics by Age Group

	(Age 65-69) n=132	(Age 70-74) n=92	(Age 75+) n=57
Age (mean)	66.85	71.60	78.52 **
Number of plans in choice set (mean)	8.28	8.40	9.16
Amount of plan differentiation is high (not low)	0.56	0.51	0.49
Number of drugs take regularly (0)	0.17	0.10	0.11
Drugs take regularly (1-2)	0.26	0.26	0.18
Drugs take regularly (3-5)	0.40	0.35	0.40
Drugs take regularly (6 or more)	0.17	0.29	0.32 **
Education (less than high-school)	0.05	0.13	0.14
Education (high-school)	0.32	0.35	0.30
Education (Bachelor's degree or higher)	0.63	0.52	0.56
Race (% white)	0.86	0.78	0.93 **
Gender (% female)	0.44	0.51	0.54
Income (Less than $25,000)	0.15	0.25	0.21
Income ($25,000 to 74,999)	0.61	0.55	0.65
Income (More than $75,000)	0.24	0.20	0.14
Employed	0.28	0.16	0.09
Married	0.77	0.71	0.67
Household size (% 1 HH member)	0.24	0.25	0.28
Numeracy score (%low numeracy)	0.47	0.45	0.48
Cognitive reflection score (%low reflection)	0.48	0.52	0.35 *
Enrollment likelihood (%Likely to enroll)	0.67	0.62	0.63
Willing to pay (>0) for a			
Choice set instead of a standard plan	0.82	0.82	0.72
Choice set with preferred plan instead of preferred plan	0.66	0.68	0.62

Note: n reflects the highest number of respondents in each group. Respondents were not required to answer each question, so actual number of responses varied per question. Responses were complete for most variables and the maximum number of missing values within an age group was 4. Statistical significance is calculated based on a chi-squared test of the difference in the distribution of characteristics across groups:

* significant at 5%;

** significant at 1%.

Table 2

Relationship between Age and Enrollment, Overall and by Numeracy and Cognitive Reflection

	Percent Likely to Enroll		
	(Age 65-69)	(Age 70-74)	(Age 75+)
All	66.92	61.96	62.50
Low Numeracy	52.54*	45.00**	73.08
High Numeracy	80.60*	80.85**	53.85
Low Cognitive Reflection	63.93	48.94*	50.00
High Cognitive Reflection	70.77	76.19*	68.57

Note: Cells show percent likely to enroll from each category. Significant differences in enrollment by numeracy and cognitive reflection, within each age group, are marked (tested using chi-square tests for differences within groups):

* significant at 5%;

** significant at 1%.

Table 3

Relationship between Enrollment Likelihood, Age, Numeracy and Cognitive Reflection

	Model 1: Age only	Model 2: Age, Numeracy, and Cognitive Reflection	Model 3: Age and Age-Numeracy and Age-Cognitive Reflection Interactions
Age (70-74)	−0.096 [−0.457 - 0.265] [0.184]	−0.12 [−0.507 - 0.266] [0.197]	−0.345 [−0.939 - 0.250] [0.303]
Age (75 and older)	−0.289 [−0.712 - 0.134] [0.216]	−0.392 [−0.846 - 0.063] [0.232]	−0.109 [−0.912 - 0.695] [0.410]
High numeracy		0.479 [0.107 - 0.850] [0.190]*	
High cognitive reflection		0.33 [−0.034 - 0.693] [0.185]	
Age(< 70) & High numeracy			0.833 [0.279 - 1.387] [0.283]**
Age (70-74) & High numeracy			0.961 [0.304 - 1.617] [0.335]**
Age (75+) & High numeracy			−0.705 [−1.474 - 0.063] [0.392]
Age(< 70) & High cognitive reflection			−0.021 [−0.567 - 0.526] [0.279]
Age (70-74) & High cognitive reflection			0.279 [−0.371 - 0.929] [0.332]
Age (75+) & High cognitive reflection			0.861 [0.082 - 1.639] [0.397]*
Observations	277	261	261

Note: The cells in the table display coefficients, [confidence intervals], and [standard errors] from ordered probit models of enrollment likelihood. Models include controls for education, race, gender, household income, household size, employment status, marital status, number of drugs taken regularly, number of plans in the choice set, and an indicator of the study arm. Significance levels are as follows:

* significant at 5%;

** significant at 1%.

Table 4

Relationship between Willingness to Pay for Choice of Drug Plans, Age Cohort, Numeracy, and Cognitive Reflection

	% Positive Willingness to Pay for Choice		
	(Age 65-69)	(Age 70-74)	(Age 75+)
Willingness to pay for choice compared to standard plan			
All	82.03	82.22	72.73
Low Numeracy	83.33	87.18	84.00
High Numeracy	79.69	76.09	65.38
Low Cognitive Reflection	87.10	80.00	61.11
High Cognitive Reflection	75.81	83.33	82.35
Willingness to pay for choice compared to chosen plan	**Willingness to pay for choice compared to chosen plan**		
All	66.14	67.78	61.82
Low Numeracy	84.21**	89.74**	76.00
High Numeracy	48.48**	46.81**	50.00
Low Cognitive Reflection	77.05**	80.00**	73.68
High Cognitive Reflection	54.84**	54.67**	57.58

Note: Cells show percentage of respondents with a positive willingness to pay. Significant differences in willingness to pay by numeracy and cognitive reflection, within each age group, are marked (tested using chi-square tests for differences within groups):

** significant at 1%.

Table 5

Willingness to Pay for Choice

	Willingness to Pay for Choice instead of Standard Plan as Dependent Variable			Willingness to Pay for Choice Compared to the Chosen Plan as Dependent Variable		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
VARIABLES						
Age (70-74)	−0.086 [−0.846 - 0.675] [0.388]	−0.085 [−0.862 - 0.691] [0.396]	−0.39 [−1.779 - 0.999] [0.709]	−0.278 [−0.923 - 0.366] [0.329]	−0.147 [−0.862 - 0.568] [0.365]	−0.051 [−1.585 - 1.483] [0.783]
Age (75 and older)	−0.85 [−1.678 - −0.022] [0.422]*	−0.766 [−1.653 - 0.121] [0.452]	−1.575 [−3.221 - 0.070] [0.840]	−0.768 [−1.525 - −0.011] [0.386]*	−0.637 [−1.472 - 0.198] [0.426]	−1.102 [−2.785 - 0.581] [0.859]
High numeracy		−0.78 [−1.550 - −0.011] [0.392]*			−1.729 [−2.467 - −0.992] [0.376]**	
High cognitive reflection		0.339 [−0.390 - 1.068] [0.372]			−0.401 [−1.067 - 0.265] [0.340]	
Age (< 70) & High numeracy			−0.127 [−1.231 - 0.976] [0.563]			−1.94 [−3.036 - −0.845] [0.559]**
Age (70-74) & High numeracy			−1.138 [−2.551 - 0.276] [0.721]			−1.907 [−3.244 - −0.571] [0.682]**
Age (75+) & High numeracy			−1.348 [−2.942 - 0.246] [0.813]			−1.194 [−2.559 - 0.171] [0.696]
Age (< 70) & High cognitive reflection			−0.779 [−1.885 - 0.327] [0.564]			−0.3 [−1.283 - 0.682] [0.501]
Age (70-74) & High cognitive reflection			0.907 [−0.450 - 2.263] [0.692]			−0.492 [−1.662 - 0.679] [0.597]
Age (75+) & High cognitive reflection			1.779 [0.259 - 3.299] [0.775]*			−0.331 [−1.751 - 1.089] [0.725]

	Willingness to Pay for Choice instead of Standard Plan as Dependent Variable			Willingness to Pay for Choice Compared to the Chosen Plan as Dependent Variable		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Constant	0.85 [−1.072 - 2.772] [0.981]	0.655 [−1.350 - 2.660] [1.023]	0.861 [−1.235 - 2.957] [1.069]	0.475 [−1.244 - 2.194] [0.877]	1.052 [−0.974 - 3.077] [1.033]	1.078 [−1.009 - 3.165] [1.065]
Observations	272	256	256	271	256	256

Note: Cells show the coefficients, [confidence intervals], and [standard errors] after logistic regression. Models include controls for education, race, gender, household income, household size, employment status, marital status, number of drugs taken regularly, number of plans in the choice set as well as an indicator of the study arm. Significance levels shown are

* significant at 5%;

** significant at 1%.