Time preference risk preferences and behavioral response to health services of a park land ecosystem: An experimental economics approach.

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Abstract (289/300 words)

Background: Research suggests that individual time preference may be associated with health-related behaviors, such as using the services of natural ecosystems for physical activity. For example, those who maintain regular physical activity may place a higher value on long-term health benefits, whereas individuals with inactive lifestyles may discount future benefits more heavily. Empirical evidence of this type in physical activity is scant.

Purpose: To investigate the relationship between discount rates and risk preferences and physical activity (measured objectively), and how these preferences can influence participants' response to physical activity benefits, an important ecosystem service of natural parklands..

Methods: Participants (n=176; mean age 42.2 years) were invited to take part in a behavioral economic field experiment. Two economic experiments, using multiple price lists and monetary trade-off tables involving real choices, were conducted face-to-face with participants to measure their risk preferences and discount rates, respectively, and both variables were jointly estimated by maximum likelihood. Secondly, individuals estimated risk preferences and discount rates were related to minutes of objectively-measured physical activity using a physical activity in a natural parkland using a loyalty card scheme while controlling for socio-economic variables (e.g. age, gender).

Results: Those with higher discount rates ($p<0.008$) and more risk averse ($p<0.006$) did significantly less physical activity than those with lower discount rates. In particular, the

negative association was significant for certain sub-groups, such as younger and married adults (i.e. <43 years old), those with lower staff grade, and those who smoke ($p<0.05$). There was also a significant association between discounting rate and trial retention ($p<0.10$).

Conclusions: Results show that individual's financial discounting rates are significantly associated with their physical activity which has implications for the design of future novel public health interventions using natural ecosystem services. Behavioral economic concepts such as time and risk preferences have been largely overlooked and underutilized to date in designing public health interventions and could shed light on important factors contributing to uptake of the public health benefits of ecosystem services such as physical activity in natural parklands.

Keywords: Physical Activity, Ecosystem Services of Natural Parkland. Time Preference, Discounting Rate, Risk Preference, Behavioral Economics

JEL Codes: D03; D91; Q57;II20

Introduction

Due to adverse trends in lifestyles factors, such as obesity and sedentary living, healthcare systems throughout the developed world are facing a budgetary precipice because of an inexorable growth in related conditions such as diabetes.[1] Thus policy makers are calling for a major re-think about how to reverse these trends if we are to have any hope of improving health and sustaining viable healthcare for an aging population.[2] Changing health-related behaviors is not straight forward and there have been a number of high level government reports,[3,4] including from the so-called "Nudge Unit" in the UK Cabinet Office, and influential academic literature that invokes the need to place *individual* behavior in a broader behavioral psychology and socioecological context.[5, 41-43] If an effective recipe for such interventions can be found, the potential dividend is substantial.[6]

However, in practice most of us struggle to lead healthy lives but the question of what role governments should play in cajoling us to do the right thing is contested, and some governments (including the UK, Australia and Norway) have opted for policy "nudges" that change the choice architecture, to make the healthier choices the easier ones.[7] In particular, the UK Government have supported the role of behavioral economics.[7] Such approaches have shown potential in public health;[8,9] This paper looks at how public health can make use of the well-established physical activity services of natural parkland ecosystems.

Of significance in this regard is the current debate on the importance of financial time preferences for the design of public health interventions.[10-13] Elsewhere this time issue is referred to as the self-control problem,[41] the procrastination problem,[42] or the short term-self versus long term-self problem.[43] Research has shown that individuals who were more

concerned with their future or long-term self's preferences were more likely to exhibit behaviors associated with positive health consequences—such as physical activity and seeking preventive healthcare—and less likely to procrastinate in adopting healthy behaviors or exhibit behaviors associated with negative health consequences from lack of self-control—such as smoking and eating unhealthy foods.[14] However, Connel-Price found that more "myopic" individuals (with a bias for the present) exercise more, a finding that is consistent with a view of exercise as providing immediate gratification, in contrast to the view of exercise as a "future-oriented" preventive health behavior, which is standard in the literature.[10] These divergent findings may be partially attributable to how time preferences have been elicited (either through the use of hypothetical financial choices tasks, or in economic experiments using real money) and whether or not risk preferences have been estimated in tandem with the estimation of time preference effects.[15-17]

Furthermore, different time discount functions (exponential or hyperbolic) may be more or less aligned to different types of preventive health-related behaviors among different types of people, and so in the context of a financial incentive intervention, different incentive structures may be required either to initiate behavior change in the short term or to maintain it in the longer term.[17] For example, physical activity participation may have short term wellbeing gains and longer term health benefits whereas smoking cessation has short term wellbeing losses coupled with longer term health gains and one can imagine that the same discount function might not align equally well with participants making decisions over these two behaviors.

In the context of a quasi-experimental trial of a workplace financial incentive scheme to promote physical activity,[18] behavioral economic experiments were conducted to investigate

the relationship between financial time and risk preferences and participation and physical activity. We hypothesize that those who maintain regular physical activity in the intervention are more concerned with long-term health and financial benefits, whereas inactive individuals tend to discount both future benefits more. Further, we surmised that a more financially risk-averse individual was more likely to have healthy habits than his/her less risk-averse counterparts.

Methods

Context

The Physical Activity Loyalty (PAL) card scheme (12-week intervention) was a quasi-experimental study where 406 office-based employees from a workplace setting were each given a loyalty card to monitor their physical activity levels, by swiping their card at sensors placed along designated walking routes, within the grounds of their workplace (office buildings based in a natural parkland ecosystem). Participants were randomly allocated to either an Incentive or No Incentive group. For the Incentive Group, minutes of physical activity were converted into points and these points could be redeemed for rewards (retail vouchers) sponsored by local businesses. The study collected data on socio-demographic characteristics, objectively measured physical activity (throughout the 12-week intervention), self-report physical activity (Global Physical Activity Questionnaire (GPAQ)), quality of life (EuroQol 5D) and time discounting behavior at baseline, at the end of the intervention and after 6-months. In summary, the study found a trend for 'modest' short term increases in physical activity levels and quality of life among those receiving financial incentives.[18]

Behavioral Economic Field Experiment

A random sub-sample of participants from the Incentive and No Incentive Group were invited via email (representative sample regarding age, gender and staff grade) to participate in the behavioral economic field experiments following the 6-month data collection period. A further random sample of participants (in the same workplace) that did not take part in the intervention was invited to participate (Control Group). No further eligibility criteria were applied. Those expressing an interest in participating were invited to one of the lunchtime sessions. These sessions were facilitated by trained members of the research team DH, GH, SC), involved 8-16 participants on each occasion and took on average 45 minutes. Prior to taking part, participants confirmed that they had read and understood the Participant Information Sheet and provided written informed consent.

Participants were asked to complete a short questionnaire regarding socio-demographic characteristics and financial information, including details regarding current and savings accounts. The financial data was necessary in order to correctly estimate the discount rates of individuals from the discounting task as their choices were censored by the borrowing and saving rates they had access to outside of the discounting task. Ethical approval was obtained from the Queen's University Belfast School of Medicine, Dentistry and Biomedical Sciences Ethics Committee (ref: 12/04).

Elicitation of Time and Risk Preference

To elicit their financial discount rates participants were presented with multiple price lists which offered a choice between two monetary amounts (Option A and Option B).[19,20] Option A paid a smaller amount (subject to 1-month front end delay) whilst Option B offered a larger amount after a longer delay. Each multiple price list consisted of 10 choices between A and B; the sooner amount (Option A) and the delay to receiving Option B remained constant,

however progressing down each choice task the interest rate, or reward, for delay increased. According to their time preferences some participants will accept a smaller reward for a given delay more than others. Six choice tasks corresponding to six different time delays (1 month, 2 months, 3 months, 4 months, 5 months and 6 months) were used. Each participant was presented with three choice tasks randomly chosen from the six to control for order effects. The one-month front-end delay treatment was used for both Options to avoid the potential problem of extra transaction cost with Option B (which. includes, credibility of the future money actually being paid etc.). The starting principle for each choice task was £250 (approximately $375) which is comparable to previous studies on financial discounting conducted in developed societies, for instance Andersen et al (2014). Further details and an example of the discount task are included in Appendix A.

To ensure that decisions were fully incentivized, each participant had a 10% chance of receiving real monetary payments based on their decisions in the discounting task. Each participant rolled a 10-sided die and received actual payment if they rolled a 1. A 6-sided die was then rolled to determine which multiple price list was selected to be paid out, followed by a 10-sided die to determine which decision within the list was paid (maximum payment approximately $487). The participant then received the payment that corresponded to their decision in this task. Payments were paid via a direct bank transfer to the participants account at the appropriate time delay.

To elicit risk preferences, participants were presented with a single multiple price list that consisted of 10 decisions between two lotteries (Option A or Option B) (31, 32). Each lottery offered a chance to receive a larger or smaller amount of money (See Appendix A). In the first example, Option A was a lottery consisting of a 10% chance of receiving £140 (~$210)

and a 90% chance of receiving £80 (~$120). The difference between Option A and B is that Option B was more risky and had a higher large amount ($300) and a lower small amount ($30). As the participant moved down the 10 decisions in the list the chance of receiving the larger amount in both lotteries increased. For example, a risk neutral participant would prefer Option A because of its higher expected payoff up to choice 5 where they would be an equal expected payoff for A and B and from Option 6 onward they would prefer Option B. Furthermore, so-called "risk loving" participants, may choose Option B in choices before choice 5 because of the larger high payment and risk averse participants may still choose Option A in choices after choice 5 because of the larger low payment.

In the risk preference task a 10-sided die was rolled to determine if each participant received payment, with participants receiving payment if a 1 was rolled. A second 10-sided die was rolled to determine the pay-out choice and payment was determined by a third throw for the chosen lottery (maximum payment $300). Payments were made via a cheque at the end of the field experiment session.

Statistical analyses

The analyses followed a three-step procedure. Firstly, discount rates and risk preferences were jointly estimated by maximum likelihood following Andersen et al 2014 (See Appendix B for a detailed description of the ML procedure). Data used for the ML estimation included responses on three discount rate tasks and one risk preference task for each participant (total n=176; n=95 were involved from the PAL scheme and n=81 from the Control Group). Since each task involved a series of 10 binary choices, this resulted in 7040 observations. Secondly, an ordinal variable (4 categories) was constructed to investigate the association between time preferences, risk preferences and trial retention (see Table 4). Next, the predicted risk

preferences and discounting rates were regressed on levels of physical activity of participants from the PAL scheme, while controlling for their socio-economic characteristics. The 17 participants that had zero minutes of physical activity were excluded to avoid a skewed dependent variable, resulting in a sample of n=78 for the second-stage analysis. Heckman's procedure was used to test the existence of sample selection bias.[20-24] Finally, this model was used to test if the associations of physical activity with risk preferences and discounting rates were different across sub-groups including age, gender, staff-grade and other household characteristics. Elasticities rather than coefficients were reported for discounting rates and risk preferences whose means are smaller than 1 and have small variances The former is more informative and reflects the proportional change in physical activity for a proportional change in discounting rates and risk preferences. All data were analyzed using Stata version 13.

Results

Socio-demographic Characteristics of Sample (n=176)

Briefly, 58.5% (n=103) of the sample were female, mean age 42.2 years (95% CI 40.7, 43.7), 77% (n=135) were single, 67% (n=118) had no children and 47.2% (n=83) were smokers (see Appendix C).

Discounting Behavior

The estimated discounting function assuming risk aversion is presented in Appendix D1. Appendix D2 presents the summary statistics for the estimated discounting rates spread over time horizons assuming risk aversion and risk neutrality, respectively. Hyperbolic discount functions are observed for both cases, where discounting rates decrease with length of time horizons (delays). More specifically, under risk aversion the discounting rate is 63.91% for Horizon30, followed by a sharp fall to 31.39% for Horizon60, finally to 15.83% for

Horizon180.. The same conclusion holds also for the sub-group estimations (Appendix D3). Further, after controlling for risk preference, hyperbolic discounting rate decreased. Therefore, a hyperbolic discount function, controlled for risk preference, was used in subsequent analyses.

Table 1 highlights the unadjusted differences in discounting rates across various subgroups. Results demonstrate significantly higher discount rates among younger versus older adults (i.e. <43 years old; discount rate for Horizon180= 16.2% versus 14.8%; p=0.012), those with a lower staff grade versus higher staff grade show (discount rate for Horizon180= 13.9% versus 17.8%; p<0.000), those who are single versus married (discount rate for Horizon180=17.8% versus 14.8%; p<0.00) and having no children versus with children (discount rate for Horizon180= 16.3% versus 13.4% p<0.00). These identified sub-groups may be more likely to discount longer term benefits in favor of shorter term gains than their comparators.

Unadjusted Association between Discounting Behavior and Physical Activity

Table 2 shows the association between minutes of objectively measured physical activity in PAL and discounting rates for various sub-groups. Results for discounts rates and risk preference are presented as elasticities and demonstrate that participants who have higher discount rates [p=0.008] and are more risk averse [p=0.006] did significantly less physical activity within the trial and suggests that a 1% increase in an individual's hyperbolic discounting rate assuming risk aversion leads to a 3.0057% and 3.4362% decrease in physical activity within the trial, respectively. Furthermore, those with a higher staff grade [p=0.047] had lower discounting rates and did more physical activity within the trial. The negative marginal effect of staff grade however indicates that physical activity within the trial decrease

by 109.76 minutes for a movement of staff grade from one grade to a higher one. Moreover, non-smokers tended to have 186.28 higher minutes of physical activity within the trial than smokers or ex-smokers (p=0.034).

Sub-Groups Association between Discounting Behavior and Physical Activity

Adjusted analyses showing the association between discounting rates and minutes of physical activity for various sub-groups are presented in Table 3. Results show that young adults [-p<0.05], those with a lower staff grade [p<0.05] who smoke [p<0.01] and are married[p<0.01] had a significant negative association between individual's discount rates and physical activity. For example, this suggests that a 1% increase in a young (aged <43) adult's hyperbolic discounting rate leads to a 5.3402 % decrease in physical activity within the trial.

Association between Discounting Behavior, Risk Preference and Trial Retention

Table 4 presents the results of the analyses investigating the influence of discount rates and risk preference on individual's retention throughout the 12 weeks of the trial. Results demonstrate that those with higher individual discount rates tended to drop out of the study earlier [-34.21 (20.44); p=0.094]. Furthermore, males [0.698 (0.291); p=0.016], those who worked part time [-1.798 (0.803); p=0.025], are single [1.162 (0.661); p=0.079] and have no children [-0.653 (0.390); p=0.094] were more likely to remain throughout the period of the trial. Results also showed no significant relationship between risk preference and retention in the trial [-3.580 (5.242); p=0.495].

Discussion

Key Findings

The aim of the study was to investigate the relationship between individuals financial discount rates, risk preference and physical activity to increase our understanding of

individuals' time and risk preferences in relation to this specific and important health behavior. Results use best practice objective measures of time and risk preference and demonstrated a significant relationship between discount rates and physical activity within our trial, i.e. those with higher individual financial discount rates and those who are more financially risk averse did significantly less physical activity than those with lower discount rates ($p<0.05$). In particular higher discount rates are found among, younger adults (i.e. <43 years old), those who smoke and those who are married. These sub-groups did significantly less physical activity within the trial ($p<0.05$). There was also a significant association between discounting rates and trial retention ($p<0.10$).

Time Preferences and Behavior Change

These findings are similar to previous research which has shown that those with lower discount rates (so-called future-oriented individuals) were more likely to demonstrate healthy behaviors, such as being physically active.[14] This is consistent with the view that physical activity is a future-oriented health prevention behavior with long term benefits. However, other research has shown contrasting findings suggesting that individuals with higher discount rates did more physical activity,[10] proposing that physical activity provides immediate benefits such as improved mood and wellbeing. Indeed, physical activity behavior has proven short and long term benefits. However, it is important to note that these contrasting findings may be due to methodological differences in how time and risk preferences were elicited. Results suggest that time preferences have implications for physical activity behavior change and could (and should) be utilized and "exploited" in public health interventions. Time preferences could be used to help target interventions more effectively. For example, socio-economic hardships may shorten peoples time horizons and it has been suggested that low socio-economic position (SEP) might also relate to present time orientation and impulsivity.[25]

Our results also suggest that for certain sub-groups such as younger adults, those with children and smokers higher discount rates significantly decrease physical activity, and therefore could be the target of interventions aimed at changing temporal perspectives, an emerging topic in intervention research.

Further, time preference rates are increasingly being used in designing interventions and have been used to set realistic weight-loss goals in overweight and obese populations[26], with implications for tailored communication for promoting healthy eating.[27] Furthermore, public health campaigns might successfully employ "framing" manipulations to heighten a focus on the delayed financial and other consequences associated with purchasing cigarettes. Also, the effectiveness of financial incentive interventions to change behavior may be particularly influenced by individual time preferences and may help those with high discount rates to initiate healthy behaviors with long-term benefits.[28]

Changing Time Preferences

Changing or reducing discounting rates (that are related to unhealthy behaviors), has important implications for public health.[29] Although individual differences in discounting rates have been commonly regarded as stable,[30] recent studies suggest that discounting rates can be changed or modulated by therapeutic cognitive, behavioral, or structural environmental manipulation.[31]

Shifting preferences to favor long-term outcomes requires either suppressing or ignoring participant's desire for the immediate reward or down-regulating its value (i.e. shifting attentional resources from "now" to later). In particular, training cognitive skills such as attention, working memory, and executive functioning is believed to be effective in changing time preference biases.[29] Through the simple reframing of a message of a classical

discounting choice as "something now but nothing later" versus "nothing now but more later" has been shown to decrease discount rates.[29] The Temporal Self-regulation Theory proposed by Hall and Fong (2007)[32] is a useful model to underpin such interventions.

Further, contingency management interventions[33] provide incremental reinforcement (in the form of vouchers or other tangible rewards) that is contingent upon repetition of the desired behavior. It forces participants to make a choice between "using now" and "earning no reward later". For example a contingency management intervention was shown to increase preference for delayed hypothetical money over smaller values of immediately available cigarettes.[34]

Implications for Public Health

Our findings, and those of others, suggest that time preferences have significant implications for improving public health. Three promising implications include 1) utilizing individuals' time preferences to better target behavior change interventions, for example, by targeting interventions at those sub-groups with high discount rates; 2) taking account of time preferences in the design of the intervention, for example, in goal setting and framing of messages; 3) interventions to change time preferences. Such interventions could help bridge the gap between previous interventions which tended to put too much weight on costs and benefits that are immediate and too little on those that are delayed (known as present bias).[8] Interventions of this kind could potentially improve multiple health outcomes as time preferences are also predictive of health-related behaviors other than physical activity, such as eating habits and smoking.[25]

However, whilst research (such as the current study) has shed light on the association between objectively measured time preferences and physical activity behavior, we know little about the potential for interventions to "exploit" time preferences (i.e. interventions that

400 purposefully utilize time preferences to influence behavior change). Given the purported
401 influence of time preferences on a number of health behaviors, including physical activity,
402 more research is warranted.
403
404 *Implications for Future Research*
405 Despite a growing number of trials investigating the association between time preferences for
406 physical activity behavior change and an emerging literature on time preference
407 interventions,[29,31] few studies have, by design, harnessed the power of time preferences within
408 bespoke public health interventions. Theory[32] and a small number of simulated
409 "experiments"[35-37] suggest that time preference parameters can mediate the transmission or
410 adoption of health behaviors. Whether such parameters could be harnessed to support a
411 successful public health intervention would depend on a range of practical and theoretical
412 issues that have yet to be studied. For example, what types of intervention would be favored?
413 What psycho-social theories might more plausibly underpin the design of a time preference
414 intervention? However, such interventions present various theoretical, methodological and
415 implementation challenges, for example, how to choose an appropriate control/comparator
416 group, how to measure intervention exposure. There are also a range of unanswered
417 questions. For example, previous research has demonstrated that the social environment, such
418 as social networks, can influence time preferences;[35-37] however, we do not know at present
419 how best to incorporate social dynamics into time preference interventions.
420
421 *Strengths and Limitations*
422 To our knowledge this is one of few studies to investigate the influence of objectively
423 measured individual financial discount rates and risk preference on physical activity which
424 has important implications for designing public health interventions. Key strengths include

the use of an objective measure of physical activity and economic experiments with real payments which have more predictive power than hypothetical methods[20] and self-reported measures.[38-40] Therefore, both physical activity and discounting rates were measured using revealed preference methods which avoid the biases and inaccuracies of stated preference methods. Further, discount rates were controlled for risk preferences by joint estimations to eliminate bias caused by separate estimations of the variables.[21] Andersen et al[20] have demonstrated that when discount rates and risk preferences are elicited together, discount rates can be significantly reduced. Substantial incentives present in these elicitation processes ensured that participants responded carefully and truthfully by comparison with hypothetical elicitations where the considerable effort required in the process is not earnings related. However, results from the sub-group analyses should be interpreted with caution due to the smaller sample size.

Conclusion

The decision to maintain a healthy habit, such as using the services of parkland ecosystems for physical activity, involves a trade-off between a short-term cost, such as time and effort, which are commonly identified as barriers to physical activity, and a long-term health benefit. Understanding individuals' time and risk preference can therefore inform appropriate interventions to address health behaviors using the services of natural ecosystems. Results demonstrated that time preferences have a significant impact on physical activity levels in general and the impact is more significant for specific sub-groups, for example, younger adults and smokers in our study. Our research suggests that future public health interventions should be cognizant of individuals' time preferences and incorporate them into intervention design, such as goal setting and messaging. Further, recent research has demonstrated that interventions can change time preferences. We argue that behavioral economic concepts such

as time and risk preferences have been largely overlooked and underutilized to date in designing public health interventions and could shed light on important factors contributing to uptake and maintenance of healthy behaviors which make use of natural ecosystems for physical activity .

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Table 1: Differences in discounting rates across sub-groups

Table 2: Marginal effects on physical activity (mins/week) of explanatory variables

Table 3: The association of hyper-discounting and physical activity (mins/week) across sub-groups

Table 4: Association between discounting rate and risk preference and trial retention

Appendices

Appendix A: Examples of discounting rates and risk preference tasks

Appendix B: Econometric modelling

Appendix C: Socio-demographic characteristics of sample

Appendix D1: Estimation of discounting function assuming risk aversion

Appendix D2: Summary statistics of estimated discounting rates from different scenarios

Appendix D3: Estimation of discounting function using sub-groups

Table 1: Differences in discounting rates across sub-groups

Characteristics	Grouping criteria	Number of observations	Horizon180[1]	p-value
Age	Age<43	45	16.2%	0.012
	Age>43	50	14.8%	
Gender	Male	30	14.9%	0.092
	Female	48	15.8%	
Staff grade	If staff grade =G5+,G6,G7,DP,SO (higher staff grade)	57	13.9%	0.000
	If staff grade =EOI,EOII,AO,AA	38	17.8%	
Smoker	Current/former smoker	42	15.8%	0.145
	Non-smoker	53	15.2%	
Marital Status	Single	22	17.8%	0.000
	Couple	73	14.8%	
Number of children	Has child/children	28	13.4%	0.000
	No child/children	67	16.3%	

Note: [1]Only the differences of Horizon180 among the sub-groups are compared, since comparison of the other horizons leads to similar results. A p-value less than 0.05 indicates the discounting rate of one sub-group is significantly higher or lower than that of its counterpart sub-group.

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647 Table 2: Marginal effects on physical activity (mins/week) of explanatory variables using the
648 hyperbolic discount function

Dependent variable: PAL minutes	Coefficients	T-value	P-value
-discounting rate [a]	-3.0057*** (1.1048)	-2.72	0.008
-risk preference[a]	-3.4362*** (1.2047)	-2.85	0.006
Age	0.8974 (0.5765)	1.56	0.124
Male	99.53 (97.42)	1.02	0.310
Staff grade	-109.76** (54.24)	-2.02	0.047
Non-smoker	186.28** (86.14)	2.16	0.034
Household size	-91.84 (55.31)	-1.66	0.101
Constant	3840.19*** (1312.00)	2.93	0.005
R^2	0.175		
Observations	78		

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650 Note: [a] Elasticity with respect to PAL minutes; *Age* is measured by number of years; *Male*
651 takes the value of 1 if the participant is male, 0 otherwise; *Staff grade* is measured on a 9-
652 point scale with the lowest grade (AA) being 0 and the highest grade (G5+) 8; *Non-smoker* is
653 measured as 1 if the participant is a non-smoker; otherwise 0; *Household size* is defined as the
654 number of person in the household. ** indicates 5%.

Table 3: The association of hyperbolic -discounting and physical activity (mins/week) across sub-groups

Characteristics	Grouping criteria	Number of observations	Association of *discounting* with PAL minutes	R^2
Age	Age<43	36	-5.3402(2.1674)**	0.302
	Age>43	42	No association	----
Gender	Male	30	No association	----
	Female	48	No association	----
Staff grade	Higher staff grade	48	No association	----
	Lower staff grade	30	-2.7085(1.2187)**	0.514
Smoker	Current/former smoker	33	-4.1961(1.3019)***	0.313
	Non-smoker	45	No association	----
Marital status	Single	20	No association	----
	Couple	58	-3.8222(1.3181)***	0.189
Number of children	Has child/children	20	No association	----
	No child/children	58	No association	----

Note: ** indicates 5%; the coefficients of control variables, e.g. age, staff grade, smoker, income, single and child are not reported to reduce table size; the number of samples with PAL minutes larger than 0 is 78.

Table 4: Association between discounting rate risk preference and trial retention

Dependant variable: *Loyalty*	Coefficients	T-value	P-value
Hyperbolic discounting rate	-34.21(20.44)*	-1.67	0.094
Hyperbolic risk preference	-3.5798(5.24)	-0.68	0.495
Male	0.6982(0.2908)**	2.40	0.016
Full-time	-1.7980(0.8032)**	-2.24	0.025
Single	1.1623(0.6612)*	1.76	0.079
Has children	-0.6529(0.3902)*	-1.67	0.094
Household size	-0.2259(0.2240)	-1.01	0.313
Own house	0.8673(0.5177)*	1.68	0.094
Household income	0.3452(0.3137)	1.10	0.271
log likelihood	-105.04		
Observations	95		

Note: an ordinal variable was constructed to explain why some participants dropped out of the PAL scheme while others continued. The four categories included: 0 = if a participant never participated in the PAL scheme (0 mins/week throughout the 12-week intervention); 1 = if a participant did some physical activity (> 0 mins/week) during the first 4 weeks of the intervention but has 0 minutes for the rest of the intervention; 2 = if a participant did some physical activity in both week 1-4 and week 5-8 of the intervention but 0 minutes for the rest of the intervention; 3= if participants did some physical activity throughout the intervention (week 1-4, week 5-8, week 9-12).

Number of participants for each category: Category 0=17; Category =15; Category 2=11; Category=49.