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**The role of time preference in smoking cessation: a longitudinal analysis of data from the Household Income and Labour Dynamics of Australia survey, 2001-08**

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**The role of time preference in smoking cessation: a longitudinal analysis of data from the Household Income and Labour Dynamics of Australia survey, 2001-08**

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**Abstract***Aims*

To establish whether time preference predicts smoking cessation in a longitudinal analysis.

*Design*

Secondary analysis of data from the Household Income and Labour Dynamics of Australia survey.

*Setting*

Australian community.

*Participants*

Members of the Household Income and Labour Dynamics of Australia survey panel, aged 15-64, who responded to at least four waves of data collection between 2001 and 2008, and reported any level of tobacco consumption at any wave.

*Measurements*

Smoking cessation was measured using a self-report question. Time preference was measured using self-reported time period for financial planning. A range of socio-demographic and smoking-related co-variables were controlled for.

*Findings*

A total of 1817 individuals were included in the analysis, representing 7913 separate observations. After control for socio-demographic and smoking-related covariates hazard ratio of quitting in those with longer vs shorter term time preference (95% confidence intervals) = 1.28 (1.02 - 1.59).

*Conclusions*

Adult smokers with a longer term time preference are more likely to quit smoking.

## Introduction

The economic concept 'time preference' describes the trade-offs that individuals make between costs and benefits occurring at different points of time.<sup>1</sup> More future orientated people prefer future over immediate gains and place more value on these as a consequence. Differences in how much value different individuals place on future outcomes are likely to play some role in present day behavioural decisions.

Related psychological concepts that reflect how consideration of future events may affect present day behavioural decisions include time perspective,<sup>2</sup> consideration of future consequences,<sup>3</sup> delay of gratification,<sup>4</sup> and impulsivity.<sup>5</sup>

Time preference, and related concepts, are a key component in Becker & Murphy's "Theory of Rational Addiction".<sup>6</sup> This suggests that individuals will continue to consume addictive substances only if the present day benefits outweigh the future costs. Thus, for example, an individual who values the long term benefits of not smoking (e.g. decreasing the risk of disability and disease), more than the present day benefits of smoking (e.g. increasing relaxation and coping)<sup>7</sup> would be expected not to smoke. Furthermore, a smoker who values the long term benefits of not smoking, more than the present day benefits of smoking would be expected to be more likely to successfully quit smoking.

There is now substantial evidence from cross-sectional studies that smokers tend to have shorter term time preferences and think about and value the future less than non-smokers, with ex-smokers being more similar to never smokers than current smokers.<sup>8-14</sup> However, few studies have explored the longitudinal relationship between time preference and smoking cessation. It, therefore, remains unclear if smokers who become successful quitters represent those smokers who are most future orientated and have the longest time preference; if successful cessation leads to a change to longer term time preference; or a combination of both.

Only a small number of studies have explored the longitudinal relationship between time preference and smoking cessation, and fewer still have focused on general adult populations. Two studies (one in Japanese general adult cohort,<sup>15</sup> and one in a cohort of American pregnant women)<sup>16</sup> explored the relationship between time preference early in a quit attempt and successful long term quitting. As expected, both found that those quitters with the longest time preference early in their quit attempt were more likely to be successful quitters

in the long term.<sup>15, 16</sup> A further study explored the relationship between time preference and quitting amongst a cohort of older individuals who were all smokers at baseline.<sup>17</sup> Again, as expected, those smokers with the longest time preference at baseline were more likely to quit over four years of follow up. In a small group (n=30) of adolescent smokers entering a cessation programme, experimental, but not self-reported, measures of impulsivity were associated with quitting over four weeks.<sup>18</sup> Similarly, in a group of adult smokers who were also heavy drinkers, enrolled in a smoking cessation programme, time perspective was associated with quitting over six months.<sup>19</sup> However, we are not aware of any study, to date, that explored the longitudinal relationship between time preference and smoking cessation in a general adult population of smokers (rather than quitters).

In order to provide further information on the relationship between time preference and smoking cessation in a general adult cohort, we analysed data from a large Australian longitudinal panel study.

## **Method**

### *Data*

The Household Income and Labour Dynamics of Australia (HILDA) survey is a longitudinal, nationally representative household survey which began in 2001 and is administered annually.<sup>20</sup> Similar to other nationally representative household surveys<sup>21, 22</sup> the sampling unit is the household; which can either be single person or multi-person. A multi-person household is defined as a group of people who reside together at least 50% of the time<sup>23</sup>.

Household selection was based on a multi-stage approach. The first stage involved selection of a sample of 488 Census Collection Districts (CD) comprising 200-250 households. Next, within each CD, a sample of approximately 22 to 34 dwellings were selected based upon occupancy and expected response rates of the area. Finally, within each dwelling, approximately three households were chosen for the sample. Members of each household are traced indefinitely. Thus, sample members are followed when the household has moved, split, or a combination of the two. In the first eight waves of HILDA, data was collected by the marketing firm, Nielsen<sup>23</sup>.

The focus of HILDA is on economic and subjective well-being, and labour market and family dynamics. Each year, all members of panel households aged 15 and older are interviewed

either in a face-to-face interview (the majority of interviews) or by telephone, and requested to fill-in a self-completion questionnaire to be returned at a later date<sup>23</sup>.

### *Inclusion criteria*

This analysis used information from HILDA waves 1 to 8 (2001-2008). In order to focus on a general adult population, the sample was restricted to respondents aged between 15 and 65 years old. The longitudinal nature of the data was exploited by restricting the sample to survey participants that responded to at least four waves. As our focus was particularly on smoking cessation, ex-smokers who quit smoking before the first wave of data collection, as well as never smokers, were excluded from the analysis. This was determined from responses to the question included in the self-completion questionnaire at wave 1: “Do you smoke cigarettes or any other tobacco products” with response options of no, I have never smoked; no, I no longer smoke; yes, I smoke daily; yes, I smoke weekly (but not daily); and yes, I smoke less often than weekly. Those who responded either “no, I have never smoked” or “no, I no longer smoke” were excluded from the analyses.

### *Quitting status*

A binary quitting variable was created from answers to the same question in waves 2-8. Those who responded “no, I no longer smoke” were classified as quitters and the remainder as non-quitters.

### *Time preference*

Time preference was measured using the question in the self-completion questionnaire: “In planning your savings and spending, which of the following periods is most important to you?” The response options were: the next week; the next few months; the next year; the next 2-4 years; the next 5-10 years; and more than 10 years ahead. This question has previously been used as a marker for time preference<sup>17, 24-26</sup> and is associated with other economic and psychological measures of time preference and related concepts.<sup>26</sup>

Pairwise comparisons between the different categories of the time preference variable controlling for the non-linearity of the hazard rate of quitting, multiple observations per individual, and individual heterogeneity were estimated. The results indicate that reporting a savings horizon of the next week was significantly different from the other time preference

categories. There were no significant differences between the other time preference categories.

Respondents were, therefore, dichotomised into those reporting a savings and spending horizon of the next few months or more (longer time horizon) or the next week (shorter time horizon).

The stability of time preference was explored by calculating transition probabilities of the mean change in time preference over the sample period controlling for multiple observations per individual in the sample. There was a high degree of persistence in time preference with 88% of respondents who reported a longer time horizon in period  $t-1$  reporting a longer time horizon in period  $t$ .

#### *Additional covariates*

Age, number of children, household income, educational attainment, employment status, daily number of cigarettes smoked, all measured in the previous data collection wave ( $t-1$ ); as well as whether or not any previous unsuccessful quit attempts had ever been made, and total number of years smoked, were included as potential confounders in any relationship between time preference and smoking cessation. All of these variables have previously been found to be associated with successful cessation.<sup>27-32</sup>

Total household income, equivalised for household composition,<sup>33</sup> was logged for analyses. Marital status was categorised as married or cohabiting, divorced or separated, or single. Educational attainment was categorised as no formal education, high school, post high school education, and university level education. Employment status was categorised as employed, unemployed, or not active in the labour market. Daily number of cigarettes was calculated using information collected from smokers on weekly cigarette consumption; which was then divided by seven to give an approximate daily consumption. This variable was logged in the analysis.

Categorical variables with more than two levels (i.e. marital status, employment status, educational attainment,) were converted into a series of binary variables for inclusion in multivariable analyses. Relevant reference categories were single, not active in the labour market, and no formal education

To account for time dependence, a continuous variable controlling for number of years smoked measured in period  $t-1$  was included in the analysis. Respondents who indicated that they had been regular smokers at some point during their life were asked by the interviewer in wave 7 at what age they started smoking regularly. This information was subtracted from their current age to construct a variable controlling for number of years smoked and extrapolated to the other years of data.

### *Statistical analysis*

To assess the fully adjusted relationship between time preference and the probability of quitting, a discrete time transition duration model was estimated, controlling for all covariates. The model controls for time dependence biasing the results by explicitly modelling spell length by including previous quit attempts and years smoked as covariates in the model. This permits unbiased estimation by the standard maximum likelihood function used by the logistic command in most statistical software packages. By controlling for spell length, the maximum likelihood function permits multiple observations per individual as each individual in the sample may contribute as many observations to the data as they have years of being at “risk” for quitting smoking<sup>34</sup>. If an individual is observed as being quit during two or more consecutive data collection waves, they are removed from the sample to avoid double or triple counting of single quit attempts. If an individual begins to smoke again they are once again at “risk” for quitting and added back into the sample. Additionally, individual level random effects are introduced to the model permitting the integration of time constant individual heterogeneity from the likelihood function<sup>35</sup>. Robust standard errors were clustered by individual to control for multiple observations over the sample period.

All covariates in the model were measured in data collection wave ( $t-1$ ), to control for past behaviour and decisions impacting quitting in data collection wave  $t$ . The key statistic estimated in these models is the hazard ratio (with 95% confidence intervals). Here a hazard ratio above one indicates factors that increase the likelihood of quitting and a hazard ratio below one indicates factors that decrease the likelihood of quitting.

A Wald test was used to determine if the hazard ratio for the time preference variable is significantly different between men and women. Multiple observations per individual were controlled for. The hazard ratio is not significantly different between men and women (Chi(2)=0.63, p=0.4278). The analysis presented is thus pooled by gender.

All analyses were conducted in STATA v.12 and a p-value of  $<0.05$  was considered to indicate statistical significance. An individual user licence was obtained from the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs which permitted analysis of the data for this project. We did not require ethical permission to conduct this secondary analysis of anonymised data

## Results

A total of 1817 unique individuals, who represented 7913 unique observations over the study period, met the inclusion criteria and were included in the analyses.

Appendix 1 summarises the characteristics of smokers in the study who did and did not quit. 76% of quitters reported a longer planning horizon and 66% of continuing smokers reported a longer planning horizon.

Appendix 2 presents the results from the discrete time transition model. After full adjustment, having a longer term time preference was associated with a greater chance of quitting (hazard ratio 1.28, 95% confidence intervals 1.02 - 1.59).

## Discussion

### *Summary of results*

In this analysis of data from a large, longitudinal general adult population sample from Australia, we found that those smokers who quit smoking have a longer and more future focused time preference than those who do not. This is the first longitudinal analysis of the relationship between time preference and smoking cessation in a general population sample of adult smokers (rather than quitters), and extends existing cross-sectional work by confirming that time preference temporally predicts successful smoking cessation.

### *Strengths and weaknesses*

Much previous work on time preference and smoking status has been cross sectional.<sup>8-14</sup> In contrast, our longitudinal analysis is able to shed light on the temporal relationship between these two variables. Furthermore, this data also represents a significant improvement on previous longitudinal work in this area which has focused on specific, rather than general adult populations, including pregnant women,<sup>16</sup> older adults,<sup>17</sup> adolescents,<sup>18</sup> smokers who were also heavy drinkers,<sup>19</sup> and only those smokers who had already initiated smoking

cessation.<sup>15, 16</sup> In addition, by using data from a multi-purpose study we had access to a wide variety of variables and were able to control for a wide range of potential confounders. The large sample size included means that our results are unlikely to be underpowered.

However, this work also suffers from a number of limitations. A number of markers of time preference exist<sup>2, 3, 26</sup> and there is no consensus on which of these is most appropriate or should be considered the 'gold standard'.<sup>36</sup> Although we used a measure of time preference that has been used previously<sup>17, 24-26</sup> and appears to be associated with a variety of other markers of time preference,<sup>26</sup> it remains unclear what the ideal operationalization of time preference is.<sup>36</sup> It has previously been suggested that measures of time perspective that focus on money and finances are likely to be confounded by socio-economic position.<sup>36</sup> By controlling for a variety of socio-economic factors, we are likely to have reduced such a possibility. But it remains the case that time perspective may be domain-specific and that time perspective for money may not be the most important domain in terms of health behaviours.

In addition, we only had access to a relatively simple, annual assessment of smoking status. We were, therefore, unable to determine how established any particular quit episode was. The group of 'quitters' in our sample could include individuals who quit between 12 months and one week before data collection and may not necessarily only represent those who are 'established' quitters.

If an individual is observed quitting for more than one period in the data they are removed from the sample to avoid double or triple counting quitting. If they begin smoking again they are brought back into the sample as they are once again at "risk" for quitting. Therefore, in the analysis we can control for previous quit attempts but cannot control for people who exit the sample because they have quit for the remainder of the sample. The nature of the smoking variable would make the definition of a permanent smoker difficult as we would have individuals who have quit for up to one year and up to two years but would not be able to define the exact length of the quit period.

Our findings suggest that time perspective is longitudinally associated with quitting smoking. However, we cannot rule out the possibility that quitting smoking is also associated with a change in time perspective. This is because, in each year only a small percentage of smokers quit. Any cross-sectional analyses of the impact of quitting on time perspective would, therefore, have limited power to identify an association. It remains possible that successful

smoking cessation leads to development of longer term time perspective, reinforcing the relationship between non-smoking and longer term time perspective.

#### *Interpretation of findings*

Consistent with much of the existing literature on the factors influencing smoking, e.g. <sup>30</sup> we found that higher socioeconomic status measured by equivalised household income and educational attainment, were consistent predictors of smoking cessation. Greater social support and financial resources may explain the greater likelihood of quitting associated with these socio-economic factors, as well as with marriage.<sup>37, 38</sup> Previous quit attempts were positively associated with cessation and daily number of cigarettes was negatively associated with smoking, which is similar to results found in the literature<sup>39</sup>.

#### *Implications of findings for policy, practice and research*

Cross-sectional findings that non- and ex-smokers tend to have a longer term time preference than current smokers<sup>8-14</sup> are unable to distinguish between the possibilities that those smokers with the longest time preference find it easier to quit and that quitting leads to development of a longer term time preference. Our findings suggest that long term time preference is associated with quitting – although we cannot rule out the possibility that quitting also has an impact on time preference.

Similar results have been found in relation to some other health behaviour changes with more future orientated newly diagnosed diabetic people being more likely to make healthy changes to their diet and physical activity behaviours;<sup>40</sup> and cocaine users who discount the future more achieving less abstinence in a contingency management programme.<sup>41</sup>

These results suggest that interventions to develop long term time preferences may be successful in helping smokers to successfully quit and a variety of other individuals to develop a range of healthier behavioural patterns.<sup>42</sup> One example of such an intervention from the physical activity field asked individuals to identify all the short and long term costs and benefits of engaging in regular physical activity.<sup>43</sup> The intervention had a significant impact on physical activity participation and long term thinking about physical activity over 10 weeks in a small group of university students. The impact, if any, on time perspective itself was not measured.

Our research is not able to establish why time preference is associated with successful smoking cessation. Further research is required to determine where in the quit attempt time preference plays its role and, therefore, when a time preference intervention might be most effective. For instance, increasing longer term time preference may help in any or all of: establishing the initial motivation to engage in a quit attempt, initiating a quit attempt, and long term maintenance of smoking cessation. Previous research suggests that motivational factors are consistently associated with initiation of quit attempts, but not quit success.<sup>39</sup> It is, therefore, most likely that time perspective exerts its influence through these routes. This should be confirmed empirically.

### *Conclusions*

Smokers with a longer term time preference are more likely to quit smoking.

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For Review Only

**Appendix 1:** *Characteristics of smokers who did and did not quit, Household Income and Labour Dynamics of Australia survey, 2002-07*

Variable	Level (for categorical variables)	Quitters (n=1804 observations)	Non-quitters (n=6109 observations)
Longer term time preference, proportion (SD)		0.76 (0.43)	0.66 (0.47)
Any previous quit attempt, proportion (SD)		0.07 (0.26)	0.04 (0.19)
Total years smoked (SD)		21.75 (11.30)	21.83 (11.46)
Age in years (SD)		39.53 (11.37)	39.42 (11.97)
Number of children (SD)		0.92 (1.12)	0.86 (1.14)
Daily number of cigarettes smoked (SD)		8.72 (11.11)	12.98 (10.42)
Marital status, proportion (SD)	Married/cohabiting	0.68 (0.47)	0.59 (0.49)
	Divorced/separated	0.13 (0.34)	0.16 (0.37)
	Single	0.19 (0.39)	0.25 (0.43)
Employment status, proportion (SD)	Employed	0.76 (0.42)	0.72 (0.45)
	Unemployed	0.03 (0.16)	0.05 (0.25)
	Not in labour force	0.21 (0.41)	0.23 (0.42)
Equivalised household income in AUS\$ (SD)		30044.80 (22998.85)	26235.56 (23913.79)
Educational attainment, proportion (SD)	No qualification	0.30 (0.46)	0.39 (0.49)
	High school	0.16 (0.37)	0.15 (0.35)
	Post high school	0.34 (0.47)	0.33 (0.47)
	University	0.20 (0.40)	0.13 (0.34)

Notes: All variables are measured in period t-1. Means across the years 2002-2007 are shown

## Time preference &amp; smoking cessation

**Appendix 2:** Discrete duration model of quitting according to time preference and other covariates, Household Income and Labour Dynamics of Australia survey, 2001-08, (n=4939)

Variable (and reference category where appropriate)	$\beta$ coefficient	Robust SE	Hazard ratio	95% CI	p-value
Longer vs shorter term time preference	0.24	(0.11)	1.28	1.02 - 1.59	0.031
Previous vs no previous quit attempt	1.23	(0.15)	3.43	2.55 - 4.60	<0.001
Log total years smoked	0.17	(0.13)	1.18	0.91 - 1.53	0.221
Log daily cigarette consumption	-0.34	(0.04)	0.71	0.66 - 0.76	<0.001
Age in years	0.00	(0.01)	1.00	0.98 - 1.01	0.662
Number of children	-0.14	(0.05)	0.87	0.78 - 0.96	0.006
Married/cohabiting vs single	0.25	(0.13)	1.28	1.00 - 1.65	0.054
Divorced/separated vs single	-0.04	(0.18)	0.96	0.68 - 1.37	0.839
Employed vs not active in labour market	-0.12	(0.13)	0.89	0.68 - 1.15	0.362
Unemployed vs not active in labour market	-0.07	(0.25)	0.93	0.57 - 1.51	0.767
Log equivalised household income in AUS\$	0.10	(0.08)	1.10	0.93 - 1.30	0.255
High School vs no formal qualifications	0.30	(0.15)	1.35	1.00 - 1.82	0.052
Post high school vs no formal qualifications	0.06	(0.12)	1.06	0.84 - 1.35	0.623
University vs no formal qualifications	0.46	(0.15)	1.58	1.18 - 2.12	0.002
Constant	-3.06	(0.83)	0.05	0.01 - 0.24	<0.001

*Note.* All variables are measured in period  $t-1$ ; log likelihood = -1620

Time preference & smoking cessation

**The role of time preference in smoking cessation: a longitudinal analysis of data from the Household Income and Labour Dynamics of Australia survey, 2001-08**

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Time preference & smoking cessation

## Abstract

### *Aims*

To establish whether time preference predicts smoking cessation in a longitudinal analysis.

### *Design*

Secondary analysis of data from the Household Income and Labour Dynamics of Australia survey.

### *Setting*

Australian community.

### *Participants*

Members of the Household Income and Labour Dynamics of Australia survey panel, aged 15-64, who responded to at least four waves of data collection between 2001 and 2008, and reported any level of tobacco consumption at any wave.

### *Measurements*

Smoking cessation was measured using a self-report question. Time preference was measured using self-reported time period for financial planning. A range of socio-demographic and smoking-related co-variables were controlled for.

### *Findings*

A total of 1817 individuals were included in the analysis, representing 7913 separate observations. ~~In univariable analyses, both men and women who reported quitting were more likely to have a longer term time preference in the data collection period immediately prior to quitting than those who did not quit (men:  $t(4126)=4.59$ ,  $p<0.001$ ; women:  $t(3783)=7.18$ ,  $p<0.001$ ). These relationships persisted after~~ After control for socio-demographic and smoking-related covariates (hazard ratio of quitting in those with longer vs shorter term time preference (95% confidence intervals) = ~~1.27-28 (1.03-02 - 1.5759), in men; 1.31 (1.05-1.63) in women).~~

### *Conclusions*

Adult smokers with a longer term time preference are more likely to quit smoking.

## Introduction

The economic concept 'time preference' describes the trade-offs that individuals make between costs and benefits occurring at different points of time.<sup>1</sup> [Present-More future](#) orientated people prefer [immediate-future](#) over [future-immediate](#) gains and place more value on these as a consequence. Differences in how much value different individuals place on future outcomes are likely to play some role in present day behavioural decisions.

Related psychological concepts that reflect how consideration of future events may affect present day behavioural decisions include time perspective,<sup>2</sup> consideration of future consequences,<sup>3</sup> delay of gratification,<sup>4</sup> and impulsivity.<sup>5</sup>

Time preference, and related concepts, are a key component in [the-Becker & Murphy's "Theory of Rational Addiction"](#).<sup>6</sup> This suggests that individuals will continue to consume addictive substances only if the present day benefits outweigh the future costs. Thus, for example, an individual who values the long term benefits of not smoking (e.g. [avoidance decreasing the risk](#) of disability and disease), more than the present day benefits of smoking (e.g. [increasing relaxation and coping-mechanism](#))<sup>7</sup> would be expected not to smoke. Furthermore, a smoker who values the long term benefits of not smoking, more than the present day benefits of smoking would be expected to be more likely to successfully quit smoking.

There is now substantial evidence from cross-sectional studies that smokers tend to have shorter term time preferences and think about and value the future less than non-smokers, with ex-smokers being more similar to never smokers than current smokers.<sup>8-14</sup> However, few studies have explored the longitudinal relationship between time preference and smoking cessation. It, therefore, remains unclear if smokers who become successful quitters represent those smokers who are most future orientated and have the longest time preference; if successful cessation leads to a change to longer term time preference; or a combination of both.

Only a small number of studies have explored the longitudinal relationship between time preference and smoking cessation, and fewer still have focused on general adult populations. Two studies (one in Japanese general adult cohort,<sup>15</sup> and one in a cohort of American pregnant women)<sup>16</sup> explored the relationship between time preference early in a quit attempt and successful long term quitting. As expected, both found that those quitters with the

## Time preference &amp; smoking cessation

longest time preference early in their quit attempt were more likely to be successful quitters in the long term.<sup>15, 16</sup> A further study explored the relationship between time preference and quitting amongst a cohort of older individuals who were all smokers at baseline.<sup>17</sup> Again, as expected, those smokers with the longest time preference at baseline were more likely to quit over four years of follow up. In a small group (n=30) of adolescent smokers entering a cessation programme, experimental, but not self-reported, measures of impulsivity were associated with quitting over four weeks.<sup>18</sup> Similarly, in a group of adult smokers who were also heavy drinkers, enrolled in a smoking cessation programme, time perspective was associated with quitting over six months.<sup>19</sup> However, we are not aware of any study, to date, that explored the longitudinal relationship between time preference and smoking cessation in a general adult population of smokers (rather than quitters).

In order to provide further information on the relationship between time preference and smoking cessation in a general adult cohort, we analysed data from a large Australian longitudinal panel study.

## Method

### Data

The Household Income and Labour Dynamics of Australia (HILDA) survey is a longitudinal, nationally representative household survey which began in 2001 and ~~which~~ is administered annually.<sup>20</sup> Similar to other nationally representative household surveys such as the British Household Panel Survey (BHPS)<sup>21</sup> and the German Socio-Economic Panel Survey (GSOEP)<sup>22</sup> the sampling unit is the household; which can either be single person or multi-person. A multi-person household is defined as a group of people who reside together at least 50% of the time<sup>23</sup>.

Household selection was based on a multi-stage approach. The first stage involved selection of a sample of 488 Census Collection Districts (CD) comprising between 200 to 250 households. Next, within each CD, a sample of approximately 22 to 34 dwellings were selected based upon occupancy and expected response rates of the area. Finally, within each dwelling, approximately 3-3 households were chosen for the sample. Members of each household will be are traced over an indefinite life indefinitely. Thus, sample members are followed when the household has moved, split, or a combination of the two. In the first eight waves of the survey HILDA, the data was collected by the marketing firm, Nielsen<sup>23</sup>.

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The focus of ~~the survey HILDA~~ is on economic and subjective well-being, and labour market and family dynamics. ~~Each year, all members of panel households aged 15 and older are interviewed either in a face-to-face interview setting (the majority of all interviews) or by telephone, and requested to fill-in a self-completion questionnaire to be returned at a later date<sup>23</sup>. Each year, all members of panel households aged 15 and older are interviewed and requested asked to complete a self complete questionnaire. The survey was designed to be consistent with the British Household Panel Survey (BHPS)<sup>21</sup> and the German Socio-Economic Panel Survey (GSOEP).<sup>22</sup>~~

*Inclusion criteria*

~~The This~~ analysis used information from HILDA waves 1 to 8 (2001-2008). In order to focus on a general adult population, the sample was restricted to respondents aged between 15 and 65 years old. The longitudinal nature of the data was exploited by restricting the sample to survey participants that responded to at least four waves. As our focus was particularly on smoking cessation, ex-smokers who quit smoking before the first wave of ~~observations data collection~~, as well as never smokers, were excluded from the analysis. ~~This was determined from responses to the question included in the self-completion questionnaire at wave 1: “Do you smoke cigarettes or any other tobacco products” with response options of no, I have never smoked; no, I no longer smoke; yes, I smoke daily; yes, I smoke weekly (but not daily); and yes, I smoke less often than weekly. Those who responded either “no, I have never smoked” or “no, I no longer smoke” were excluded from the analyses.~~

*Smoking-Quitting status*

~~A binary quitting variable was created from answers to a the same question in the self-completion questionnaire in waves 2-8: “Do you smoke cigarettes or any other tobacco products” with response options of no, I have never smoked; no, I no longer smoke; yes, I smoke daily; yes, I smoke weekly (but not daily); and yes, I smoke less often than weekly. As our focus was particularly on smoking cessation, ex-smokers who quit smoking before the first wave of data collection, as well as never smokers, were excluded from the analysis. Those who responded “no, I no longer smoke” were classified as quitters and the remainder as non-quitters.~~

~~A binary smoking quitting variable was created from answers to a the same question on current smoking status in waves 2-8, in the self-completion questionnaire in all years except~~

## Time preference &amp; smoking cessation

2001: “Do you smoke cigarettes or any other tobacco products” with response options of no, I have never smoked; no, I no longer smoke; yes, I smoke daily; yes, I smoke weekly (but not daily); and yes, I smoke less often than weekly. Respondents that reported any level of tobacco consumption in the current period ( $t=1$ ) were included in the analysis. Those Respondents who responded “no, I no longer smoke” in the current period at the current data collection wave ( $t=1$ ) but reported smoking in the previous period wave ( $t-1$ ) were classified as quitters. All other respondents were classified and the remainder as non-quitters.

*Time preference*

Time preference was measured using the question in the self-completion questionnaire: “In planning your savings and spending, which of the following periods is most important to you?” The response options were: the next week; the next few months; the next year; the next 2-4 years; the next 5-10 years; and more than 10 years ahead. This question has previously been used as a marker for time preference<sup>17, 24-26</sup> and is associated with other economic and psychological measures of time preference and related concepts.<sup>26</sup>

Pairwise comparisons between the different categories of the time preference variable controlling for the non-linearity of the hazard rate of quitting, multiple observations per individual, and individual heterogeneity were estimated. The results indicate that reporting a savings horizon of the next week was significantly different from the other time preference categories. There were no significant differences between the other time preference categories.

Respondents were, therefore, dichotomised into those reporting a savings and spending horizon of the next few months or more (longer time horizon) or the next few weeks (shorter time horizon). dichotomised into those who reported a saving and spending horizon of a year or more (longer term time preference) and those who reported a saving and spending horizon of less than a year (shorter term time preference).

The stability of time preference was explored by calculating transition probabilities of the mean change in time preference over the sample period controlling for multiple observations per individual in the sample. There was a high degree of persistence in time preference with 88% of respondents that who reported a longer time horizon in period  $t-1$  reporting a longer time horizon in period  $t$ .

## Time preference &amp; smoking cessation

*Additional covariates*

Age, number of children, household income, educational attainment, employment status, ~~daily number of cigarettes smoked, and area level disadvantage~~ all measured in ~~period the previous data collection wave ( $t-1$ )~~; as well as whether or not any previous unsuccessful quit attempts had ever been made, and total number of years smoked, were included as potential confounders in any relationship between time preference and smoking cessation. All of these variables have previously been found to be associated with successful cessation.<sup>27-32</sup>

Total household income, equivalised for household composition,<sup>33</sup> was logged for analyses. Marital status was categorised as married or cohabiting, divorced or separated, or single. Educational attainment was categorised as no formal education, high school, post high school education, and university level education. Employment status was categorised as employed, unemployed, or not active in the labour market. ~~Daily number of cigarettes was calculated using information collected from smokers on weekly cigarette consumption; which was then divided by seven to give an approximate daily consumption. This variable was~~ logged in the analysis. ~~Area level disadvantage was calculated from the Socio-Economic Index of Advantage/Disadvantage using information from the 2001 Census and categorised into deciles which were then grouped into three categories for analyses—deciles 1-3 (the most disadvantaged), deciles 4-6, and deciles 7-10 (the most advantaged).~~<sup>34</sup>

Categorical variables with more than two levels (i.e. marital status, employment status, educational attainment, ~~and area level disadvantage~~) were converted into a series of binary variables for inclusion in multivariable analyses. Relevant reference categories were single, not active in the labour market, ~~and~~ no formal education, ~~and the most disadvantage deciles (1-3).~~

To account for time dependence, a continuous variable controlling for number of years smoked measured in period  $t-1$  ~~was~~ included in the ~~first stage of the~~ analysis. Respondents ~~that who~~ indicated that they had been regular smokers at some point during their life were asked by the interviewer in wave 7 at what age they started smoking regularly. This information was subtracted from their current age to construct a variable controlling for number of years smoked and extrapolated to the other years of data.

*Statistical analysis*

## Time preference &amp; smoking cessation

~~Univariable analyses comparing those smokers who did and did not quit on all variables of interest was performed using t tests. Pairwise comparisons between the different categories of the time preference variable controlling for the non-linearity of the hazard rate of quitting, multiple observations per individual, and individual heterogeneity were estimated. The results indicate that reporting a savings horizon of the next week was significantly different from the other time preference categories. There were no significant differences between the other time preference categories. This informed the classification of the time preference variable into a dichotomous variable of shorter time horizon and longer time horizon.~~

~~The stability of time preference was explored by calculating transition probabilities of the mean change in time preference over the sample period controlling for multiple observations per individual in the sample. There is a high degree of persistence in time preference with 88% of respondents that report a longer time horizon in period  $t+1$  reporting a longer time horizon in period  $t$ .~~

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~~To~~ To assess the fully adjusted relationship between time preference and the probability of ~~quitting smoking cessation~~, a discrete time transition duration models was estimated separately for men and women, controlling for all covariates. ~~The model controls for time dependence biasing the results by explicitly modelling spell length for the sample of smokers by including previous quit attempts and years smoked as covariates in the model. Controlling for spell length. This permits unbiased estimation by the standard maximum likelihood function used by the logistic command in most statistical software packages. By controlling for spell length, the maximum likelihood function permits multiple observations per individual as each individual in the sample may contribute as many observations to the data as they have years of being at "risk" for quitting smoking<sup>34</sup>. If an individual is observed as quitting for being quit more than one during two or more consecutive data collection waves, year~~ they are removed from the sample to avoid double or triple counting of single quit attempts. If an individual begins to smoke again they are once again at "risk" for quitting and added back into the sample. Additionally, individual level random effects are introduced to the model permitting the integration of time constant individual heterogeneity from the likelihood function<sup>35</sup>. Robust standard errors were clustered by individual to control for multiple observations over the sample period. ~~If the~~

## Time preference &amp; smoking cessation

All covariates in the model were all-measured in period-data collection wave ( $t-1$ ), to control for past behaviour and decisions impacting quitting in period-data collection wave  $t$ .  
~~then the discrete-time duration model can be consistently estimated using the standard logistic command found in most statistical software packages.<sup>35</sup> Robust standard errors were clustered on individual personal identification number to control for multiple individual observations over the sample period.~~ The key statistic estimated in these models is the hazard ratio (with 95% confidence intervals). Here a hazard ratio above one indicates factors that increase the likelihood of quitting and a hazard ratio below one indicates factors that decrease the likelihood of quitting.

A Wald test was used to determine if the hazard ratio for the time preference variable is significantly different between men and women. Multiple observations per individual were controlled for. The hazard ratio is not significantly different between men and women (Chi(2)=0.63, p=0.4278). The analysis presented is thus pooled by gender.

All analyses were conducted in STATA v.12 and a p-value of <0.05 was considered to indicate statistical significance. An individual user licence was obtained from the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs which permitted analysis of the data for this project. We did not require ethical permission to conduct this secondary analysis of anonymised data

## Results

A total of 1817 unique individuals, who represented 7913 unique observations over the study period, met the inclusion criteria and were included in the analyses.

Table 1 Appendix 1 summarises the characteristics of smokers in the study who did and did not quit. ~~Amongst both men and women, quitters were significantly more likely to have longer term time preference ( $p < 0.001$ ) than non-quitters. 76% of quitters reported a longer planning horizon and 66% of continuing smokers reported a longer planning horizon.~~

~~Amongst both men and women, quitters were more likely to have attempted to quit before, were more likely to be married, had higher household incomes, were less likely to live in the most disadvantaged areas and more likely to live in the most advantaged areas, and were less~~

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## Time preference &amp; smoking cessation

likely to have no formal academic qualification and more likely to have a university education than non-quitters ( $p < 0.001$  in all cases).

In addition amongst men, quitters had more dependent children ( $p < 0.001$ ), were less likely to be divorced/separated ( $p < 0.001$ ) or single ( $p < 0.001$ ), were more likely to be employed ( $p < 0.001$ ) and less likely to be unemployed ( $p = 0.005$ ) or not active in the labour force ( $p = 0.0116$ ) than non-quitters.

Amongst women, quitters were additionally less likely to be divorced/separated ( $p = 0.032$ ) or single ( $p = 0.002$ ), and were more likely to be employed ( $p = 0.036$ ) and less likely to be unemployed ( $p = 0.008$ ).

Tables 2 and 3 Appendix 2 presents the results from the discrete time transition models for men and women respectively. After full adjustment, among men, having adjustment, having a longer term time preference was associated with a greater chance of quitting (hazard ratio 1.2728, 95% confidence intervals 1.0302 - 1.5759), having more dependent children in the household (1.17 (1.02 - 1.34)), being married (1.66 (1.15 - 2.40)), having a higher household income (1.27 (1.01 - 1.59)), and living in the most advantaged area (1.92, (1.39 - 2.66)) were all associated with a greater chance of quitting.

Amongst women, after control for all covariates, having a longer term time preference (1.31 (1.05 - 1.63)), being married (1.59 (1.13 - 2.24)), having a higher household income (1.24 (1.00 - 1.52)), and living in the most advantaged area (1.92 (1.24 - 2.31)), and having a university education (1.96 (1.32 - 2.90)) were associated with greater change of quitting. Being employed (0.69 (0.52 - 0.93)) was associated with lower chances of quitting.

## Discussion

### Summary of results

In this analysis of data from a large, longitudinal general adult population sample from Australia, we found that those smokers who on go to successfully quit smoking have a longer and more future focused time preference than those who do not. This is the first longitudinal analysis of the relationship between time preference and smoking cessation in a general population sample of adult smokers (rather than quitters), and extends existing cross-sectional work by confirming that time preference temporally predicts successful smoking cessation.

### Strengths and weaknesses

## Time preference &amp; smoking cessation

Much previous work on time preference and smoking status has been cross sectional.<sup>8-14</sup> In contrast, our longitudinal analysis is able to shed light on the temporal relationship between these two variables. Furthermore, this data also represents a significant improvement on previous longitudinal work in this area which has focused on specific, rather than general adult populations, including pregnant women,<sup>16</sup> older adults,<sup>17</sup> [adolescents](#),<sup>18</sup> [smokers who were also heavy drinkers](#),<sup>19</sup> and only those smokers who had already initiated smoking cessation.<sup>15, 16</sup> In addition, by using data from a multi-purpose study we had access to a wide variety of variables and were able to control for a wide range of potential confounders. The large sample size included means that our results are unlikely to be underpowered.

However, this work also suffers from a number of limitations. A number of markers of time preference exist<sup>2, 3, 26</sup> and there is no consensus on which of these is most appropriate or should be considered the 'gold standard'.<sup>36</sup> Although we used a measure of time preference that has been used previously<sup>17, 24-26</sup> and appears to be associated with a variety of other markers of time preference,<sup>26</sup> it remains unclear what the ideal operationalization of time preference is.<sup>36</sup> [It has previously been suggested that measures of time perspective that focus on money and finances are likely to be confounded by socio-economic position.](#)<sup>36</sup> [By controlling for a variety of socio-economic factors, we are likely to have reduced such a possibility. But it remains the case that time perspective may be domain-specific and that time perspective for money may not be the most important domain in terms of health behaviours.](#)

In addition, we only had access to a relatively simple, annual assessment of smoking status. We were, therefore, unable to determine how established any particular quit episode was. The group of '-quitters' in our sample could include individuals who quit between 12 months and one [day-week ago before data collection](#) and may not necessarily only represent those who are 'established' quitters.

[If an individual is observed quitting for more than one period in the data they are removed from the sample to avoid double or triple counting quitting. If they begin smoking again they are brought back into the sample as they are once again at "risk" for quitting. Therefore, in the analysis we can control for previous quit attempts but cannot control for people who exit the sample because they have quit for the remainder of the sample. The nature of the smoking variable would make the definition of a permanent smoker difficult as we would](#)

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~~have individuals who have quit for up to one year and up to two years but would not be able to define the exact length of the quit period.~~ <sup>36</sup>

~~Our findings suggest that time perspective is longitudinally associated with quitting smoking. However, we ~~can not~~cannot rule out the possibility that quitting smoking is also associated with a change in time perspective. This is because, ~~in~~ in each year only a small percentage of smokers ~~are observed quitting~~quit. Any cross-sectional analyses of the impact of quitting on time perspective would, therefore, have limited power to identify an association, ~~because of the small sample size, we would get inconsistent results by evaluating at the cross-sectional level if there was a change in time preference for quitters compared to individuals that continued to smoke.~~ It remains possible that successful smoking cessation leads to development of longer term time perspective, reinforcing the relationship between non-smoking and longer term time perspective.~~

*Interpretation of findings*

Consistent with much of the existing literature on the factors influencing smoking, e.g. <sup>30</sup> we found that higher socioeconomic status measured by ~~area level disadvantage~~, equivalised household income, and educational attainment, were consistent predictors of smoking cessation. Greater social support and financial resources may explain the greater likelihood of quitting associated with these socio-economic factors, as well as with marriage.<sup>37, 38</sup>

~~Previous quit attempts were positively associated with cessation and daily number of cigarettes was negatively associated with smoking, which is similar to results found in the literature<sup>39</sup>. Interestingly, the only relationship found between employment status and successful quitting was that women who were employed were less likely to quit than those outside of the labour market. This may reflect peer group effects of the work environment.~~

*Implications of findings for policy, practice and research*

Cross-sectional findings that non- and ex-smokers tend to have a longer term time preference than current smokers<sup>8-14</sup> are unable to distinguish between the possibilities that those smokers with the longest time preference find it easier to quit and ~~the that~~ quitting leads to development of a longer term time preference. Our findings suggest that long term time preference is associated with quitting – although we cannot rule out the possibility that quitting also has an impact on time preference.

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Similar results have been found in relation to some other health behaviour changes with more future orientated newly diagnosed diabetic people being more likely to make healthy changes to their diet and physical activity behaviours;<sup>40</sup> and cocaine users who discount the future more achieving less abstinence in a contingency management programme.<sup>41</sup>

These results suggest that interventions to develop long term time preferences may be successful in helping smokers to successfully quit and a variety of other individuals to develop a range of healthier behavioural patterns.<sup>42</sup> One example of such an intervention from the physical activity field asked individuals to identify all the short and long term costs and benefits of engaging in regular physical activity.<sup>43</sup> The intervention had a significant impact on physical activity participation and long term thinking about physical activity over 10 weeks in a small group of university students. The impact, if any, on time perspective itself was not measured.

Our research is not able to establish why time preference is associated with successful smoking cessation. Further research is required to determine where in the quit attempt time preference plays its role and, therefore, when a time preference intervention might be most effective. For instance, increasing longer term time preference may help in any or all of: establishing the initial motivation to engage in a quit attempt, initiating a quit attempt, and long term maintenance of smoking cessation. Previous research suggests that motivational factors are consistently associated with initiation of quit attempts, but not quit success.<sup>39</sup> It is, therefore, most likely that time perspective exerts its influence through these routes. This should be confirmed empirically.

*Conclusions*

Smokers with a longer term time preference are more likely to quit smoking.

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## Time preference &amp; smoking cessation

Level (for categorical variables)	Men			Women		
	Quitters (n=887 observations)	Non-quitters (n=3241 observations)	T-test of quitters vs non-quitters	Quitters (n=917 observations)	Non-quitters (n=2868 observations)	T-test of quitters vs non-quitters
Preference, proportion (SD)	0.48 (0.50)	0.39 (0.49)	t(4126)=4.59 (p<0.001)	0.50 (0.50)	0.37 (0.48)	t(3783)=7.18 (p<0.001)
Attempt, proportion (SD)	0.09 (0.28)	0.03 (0.18)	t(4126)=6.98 (p<0.001)	0.05 (0.22)	0.04 (0.20)	t(3783)=8.06 (p<0.001)
Age (SD)	23.68 (11.62)	22.91 (11.74)	t(3692)=1.60 (p=0.111)	21.52 (10.80)	21.40 (11.10)	t(3403)=0.29 (p=0.770)
Marital status, proportion (SD)	40.84 (11.21)	41.00 (12.06)	t(4126)=0.35 (p=0.728)	40.32 (11.58)	39.78 (11.90)	t(3783)=1.21 (p=0.227)
Marital status, proportion (SD)	0.94 (1.14)	0.73 (1.09)	t(4126)=5.06 (p<0.001)	0.94 (1.09)	1.01 (1.20)	t(3783)=1.45 (p=0.147)
Married/cohabiting	0.72 (0.45)	0.62 (0.49)	t(4126)=6.16 (p<0.001)	0.66 (0.48)	0.57 (0.50)	t(3783)=4.28 (p<0.001)
Divorced/separated	0.09 (0.28)	0.14 (0.34)	t(4126)=3.82 (p<0.001)	0.17 (0.38)	0.20 (0.40)	t(3783)=2.15 (p=0.032)
Single	0.19 (0.38)	0.24 (0.43)	t(4126)=4.12 (p<0.001)	0.17 (0.37)	0.23 (0.41)	t(3783)=3.13 (p=0.002)
Employment, proportion (SD)	0.84 (0.37)	0.78 (0.41)	t(4126)=3.70 (p<0.001)	0.69 (0.46)	0.65 (0.48)	t(3783)=2.10 (p=0.036)
Employed	0.02 (0.15)	0.04 (0.21)	t(4126)=2.83 (p=0.005)	0.03 (0.17)	0.05 (0.22)	t(3783)=2.64 (p=0.008)
Unemployed	0.14 (0.35)	0.18 (0.38)	t(4126)=2.53 (p=0.0116)	0.28 (0.45)	0.30 (0.46)	t(3783)=0.99 (p=0.321)
Not in labour force	10.17 (0.71)	10.03 (0.71)	t(4104)=4.89 (p<0.001)	10.10 (0.72)	9.90 (0.72)	t(3761)=7.13 (p<0.001)
Household income in AU\$ (SD)	0.29 (0.45)	0.37 (0.48)	t(4126)=4.56 (p<0.001)	0.28 (0.45)	0.38 (0.49)	t(3783)=5.73 (p<0.001)
1-3 (most disadvantaged)	0.28 (0.45)	0.31 (0.46)	t(4126)=1.69 (p=0.091)	0.30 (0.46)	0.32 (0.47)	t(3783)=0.90 (p=0.366)
4-6	0.43 (0.50)	0.32 (0.47)	t(4126)=6.25 (p<0.001)	0.42 (0.49)	0.30 (0.46)	t(3783)=6.75 (p<0.001)
7-10 (most advantaged)	0.27 (0.45)	0.34 (0.47)	t(4121)=3.60 (p<0.001)	0.30 (0.46)	0.41 (0.49)	t(3743)=5.99 (p<0.001)
No qualification	0.15 (0.35)	0.13 (0.34)	t(4121)=0.75 (p=0.453)	0.17 (0.37)	0.16 (0.37)	t(3743)=0.43 (p=0.673)
High school	0.40 (0.49)	0.40 (0.49)	t(4121)=0.24 (p=0.812)	0.29 (0.45)	0.28 (0.45)	t(3743)=0.68 (p=0.495)
Post high school	0.18 (0.39)	0.13 (0.33)	t(4121)=4.48 (p<0.001)	0.24 (0.43)	0.15 (0.36)	t(3743)=6.49 (p<0.001)
University						

**Table 1:** Characteristics of smokers who did and did not quit, Household Income and Labour Dynamics of Australia survey, 2001-08  
 Note. Figures shown are means averaged across the whole sample period (2001-2008); **Appendix 1:** Characteristics of smokers who did and did not quit, Household Income and Labour Dynamics of Australia survey, 2002-07

## Time preference &amp; smoking cessation

Variable	Level (for categorical variables)	Quitters (n=1804 observations)	Non-quitters (n=6109 observations)
Longer term time preference, proportion (SD)		0.76 (0.43)	0.66 (0.47)
Any previous quit attempt, proportion (SD)		0.07 (0.26)	0.04 (0.19)
Total years smoked (SD)		21.75 (11.30)	21.83 (11.46)
Age in years (SD)		39.53 (11.37)	39.42 (11.97)
Number of children (SD)		0.92 (1.12)	0.86 (1.14)
Daily number of cigarettes smoked (SD)		8.72 (11.11)	12.98 (10.42)
Marital status, proportion (SD)	Married/cohabiting	0.68 (0.47)	0.59 (0.49)
	Divorced/separated	0.13 (0.34)	0.16 (0.37)
	Single	0.19 (0.39)	0.25 (0.43)
Employment status, proportion (SD)	Employed	0.76 (0.42)	0.72 (0.45)
	Unemployed	0.03 (0.16)	0.05 (0.25)
	Not in labour force	0.21 (0.41)	0.23 (0.42)
Equivalised household income in AU\$ (SD)		30044.80 (22998.85)	26235.56 (23913.79)
Educational attainment, proportion (SD)	No qualification	0.30 (0.46)	0.39 (0.49)
	High school	0.16 (0.37)	0.15 (0.35)
	Post high school	0.34 (0.47)	0.33 (0.47)
	University	0.20 (0.40)	0.13 (0.34)

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Notes: All variables are measured in period t-1. Means across the years 2002-2007 are shown

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Time preference & smoking cessation

**Table Appendix 2:** Discrete duration model of quitting according to time preference and other covariates, Household Income and Labour Dynamics of Australia survey, 2001-08, men (n=31944939)

Variable (and reference category where appropriate)	$\beta$ coefficient	Robust SE	Hazard ratio	95% CI	p-value
Longer vs shorter term time preference	0.240.21	(0.11)0.11	1.281.27	1.02 - 1.591.03-1.57	0.029031
Previous vs no previous quit attempt	1.230.40	(0.15)0.21	3.431.49	2.55 - 4.600.99-2.24	<0.0010.055
<u>Log (Total years smoked)</u>	0.170.01	(0.13)0.02	1.181.01	0.91 - 1.530.98-1.04	0.552221
<u>Log daily cigarette consumption</u>	-0.34	(0.04)	0.71	0.66 - 0.76	<0.001
Age in years	0.00-0.01	(0.01)0.02	1.000.99	0.98 - 1.010.96-1.03	0.6620.652
Number of children	-0.140.16	(0.05)0.07	0.871.17	0.78 - 0.961.02-1.34	0.022006
Married/cohabiting vs single	0.250.51	(0.13)0.19	1.281.66	1.00 - 1.651.15-2.40	0.007054
Divorced/separated vs single	-0.04-0.15	(0.18)0.29	0.960.86	0.68 - 1.370.49-1.51	0.598839
Employed vs not active in labour market	-0.12-0.11	(0.13)0.20	0.890.90	0.68 - 1.150.61-1.32	0.578362
Unemployed vs not active in labour market	-0.07-0.36	(0.25)0.28	0.930.70	0.57 - 1.510.40-1.21	0.205767
Log equivalised household income in AU\$\$	0.100.24	(0.08)0.12	1.101.27	0.93 - 1.301.01-1.59	0.041255
<u>Disadvantage deciles 4-6 vs 1-3 (most disadvantaged)</u>	0.19	0.17	1.21	0.87 - 1.67	0.265

## Time preference &amp; smoking cessation

<del>Disadvantage deciles 7-10 (most advantaged) vs 1-3 (most disadvantaged)</del>	<del>0.65</del>	<del>0.17</del>	<del>1.92</del>	<del>1.39 - 2.66</del>	<del>&lt;0.001</del>
High School vs no formal qualifications	<u>0.30</u>	<u>0.26</u>	<u>(0.15)</u>	<u>0.22</u>	<u>1.35</u>
Post high school vs no formal qualifications	<u>0.06</u>	<u>0.07</u>	<u>(0.12)</u>	<u>0.17</u>	<u>1.06</u>
University vs no formal qualifications	<u>0.46</u>	<u>0.33</u>	<u>(0.15)</u>	<u>0.22</u>	<u>1.58</u>
Constant	<u>-3.06</u>	<u>-4.37</u>	<u>(0.83)</u>	<u>1.19</u>	<u>0.05</u>
				<u>0.01</u>	<u>-0.24</u>
				<u>0.001</u>	<u>&lt;0.001</u>
				<u>-0.13</u>	

Note. All variables are measured in period  $t-1$ ; log likelihood = ~~-1660~~1620

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## Time preference &amp; smoking cessation

**Table 3:** Discrete duration model of quitting according to time preference and other covariates, Household Income and Labour Dynamics of Australia survey, 2001–08, women (n=2937)

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Variable (and reference category where appropriate)	$\beta$ coefficient	Robust SE	Hazard ratio	95% CI	p-value
Longer vs shorter term time preference	0.27	0.11	1.31	1.05–1.63	0.017
Previous vs no previous quit attempt	0.27	0.20	1.31	0.89–1.92	0.167
Total years smoked	-0.02	0.01	0.98	0.96–1.01	0.171
Age in years	0.02	0.01	1.02	0.99–1.05	0.119
Number of children	-0.06	0.06	0.94	0.84–1.06	0.332
Married/cohabiting vs single	0.46	0.17	1.59	1.13–2.24	0.008
Divorced/separated vs single	0.18	0.23	1.19	0.76–1.86	0.442
Employed vs not active in labour market	-0.37	0.15	0.69	0.52–0.93	0.014
Unemployed vs not active in labour market	-0.47	0.25	0.63	0.38–1.03	0.065
Log equivalised household income in AU\$	0.21	0.11	1.24	1.00–1.52	0.048
Disadvantage deciles 4–6 vs 1–3 (most disadvantaged)	0.19	0.17	1.21	0.98–1.77	0.069
Disadvantage deciles 7–10 (most advantaged) vs 1–3 (most disadvantaged)	0.65	0.17	1.92	1.24–2.31	0.001
High School vs no formal qualifications	0.32	0.20	1.38	0.93–2.06	0.109
Post high school vs no formal qualifications	0.23	0.17	1.26	0.91–1.76	0.165
University vs no formal qualifications	0.67	0.20	1.96	1.32–2.90	0.001
Constant	-4.16	1.03	0.02	0.02–0.12	<0.001

Note. All variables are measured in period  $t-1$ ; log likelihood = -1651