Bidirectional relationship between time preference and adolescent smoking and alcohol use: Evidence from longitudinal data

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HIGHLIGHTS

- We examined a relationship between time preference and adolescent health behaviors.
- Higher time discounting increases the risk of starting smoking and drinking.
- Conversely, smoking and drinking leads to a higher discount rate.
- The bidirectional relationship may help explain gateway effects of these behaviors.

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ABSTRACT

Introduction: Scholarly interest in time preference as a potential predictor of risky health behaviors in adolescents has increased in recent years. However, most of the existing literature is limited due to the exclusive reliance on cross-sectional data, precluding the possibility of establishing the direction of causality. Using longitudinal data from the Korea Youth Panel Survey (2003–7), which followed up a nationally representative sample of 3449 adolescents aged 14 years for five years, this study examines a bidirectional relationship between time preference and smoking and drinking behaviors among adolescents.
Methods: We used discrete time hazard models of smoking and drinking initiation as a function of time preference measured at the baseline and fixed-effects ordered logit model of time preference, respectively. Our measure of time preference was derived from the survey question on a hypothetical choice between immediate enjoyment today and likely higher scores on an exam tomorrow.
Results: The overall results provide evidence on the bidirectional relationship; that is, higher time discounting (i.e., greater relative preference for present utility over future utility) results in an increased risk of engaging in smoking and drinking, and conversely, adopting such behaviors leads to a higher discount rate.
Conclusions: The bidirectional relationship may function as a mechanism for adolescents to engage in increased smoking and drinking or additional negative health behaviors via gateway effects, strengthening the case for preventing the initiation of risky health behaviors among adolescents.

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1. Introduction

The development of noncommunicable diseases (NCDs)—in particular cancer, cardiovascular disease, and chronic respiratory illness—is associated with common behavioral risk factors, including smoking and drinking (Engelgau et al., 2011). These behaviors are often established during adolescence and persist into adulthood. Moreover, because the damage caused by smoking and drinking is cumulative, the health consequences of adopting these behaviors are likely to be more severe if started at a young age (Burt, 2002; Engelgau et al., 2011). For instance, most smokers start smoking in their teens (Frieden, 2012), and people who start drinking during adolescence have a higher risk of becoming dependent on alcohol within ten years than those who start at an older age (Hingson, Heeren, & Winter, 2006). Engagement in smoking and drinking also leads to uptake of additional and possibly more risky health behaviors such as illicit drug use ("gateway" effects). Adolescence is therefore recognized as a "foundation for future health" (Sawyer et al., 2012) and the "last best chance" to prevent poor health habits and to build healthy behaviors (Baldwin & Amato, 2012).

Time preference—i.e., the relative preference for present utility over future utility (Frederick, Loewenstein, & O'donoghue, 2002) or marginal rate of substitution between current and future utility (Becker & Mulligan, 1997)—has been studied as a possible predictor of engaging in harmful health behaviors (Cawley & Ruhm, 2012; Chesson et al., 2006; Melanko & Larkin, 2013; Smith, Bogin, & Bishai, 2005; Weller et al., 2008; Yi, Mitchell, & Bickel, 2010). It has been measured in different ways in different fields of research—for instance, an individual's self-report of the degree to which he or she discounts the value of uncertain future goods has been used in economics (Guthrie, Butler, & Ward, 2009), while researchers in biology and psychometrics have adopted measures such as impulsivity, risk-taking propensity, and self-management (Harrison et al., 2005; Lejuez et al., 2004; Maitra, 2010). The initial interest in time preference in relation to health behavior was sparked in attempts to explain consistent and well-established educational inequalities across different measures of health (Fuchs, 1982). Farrell and Fuchs (1982) find that the negative association between schooling and smoking at age 24 (when schooling was completed) is explained by differences in smoking at age 17 already (when all were still in school), rejecting the causal effect of additional years of schooling above 17 on smoking behavior. Time preference makes a plausible candidate for a hidden third variable that drives both schooling and health, and thereby confounds the causal effect of schooling on health, as intertemporal preferences are involved both between future income earning and greater educational investment and between future health and the immediate gratification derived from risky health behaviors.

Studies have subsequently provided evidence on the association of higher time discount rates (i.e., greater relative preference for present utility over future utility) with the likelihood of smoking, alcohol use, substance abuse, or risky sexual behaviors (Keough, Zimbardo, & Boyd, 1999; Petry, Bickel, & Arnett, 1998; Rothspan & Read, 1996), mostly based on samples of adults. Of the few studies specifically focusing on adolescent populations, Lejuez et al. (2007) demonstrated that risk-seeking adolescents are more likely to engage in a series of risk behaviors, using the youth-friendly version of the Balloon Analogue Risk Task (BART-Y), where adolescents were asked to accrue points exchangeable for prizes by inflating computer-simulated balloons that were to explode at some point (monetary rewards provided in the adult version of the BART); McDade et al. (2011) relied on adolescents' self-rating of their chances to live up to middle age and to attend college to measure "expectations for the future" and showed that adolescents with more positive perspectives on the future are more likely to exercise frequently and less likely to smoke.

While most of the empirical studies so far have focused on the direction of causality from time preference to health behavior, causality can also run in the opposite direction. Becker and Mulligan (Becker & Mulligan, 1997) argue that time preference is influenced by individual health through a process of endogenous determination: better health status increases subjective survival probability and makes future utility more likely and higher, which subsequently increases investment in patience in the current period. Bishai (2004) uses data from the 1979–1994 National Longitudinal Survey of Youth to obtain compensating differentials as a proxy for time preference among labor force participants in each survey wave and finds that older age and more schooling lead to greater patience, consistent with the theory of endogenous time preference (Becker & Mulligan, 1997).

The theory of endogenous time preference, in combination with the observed associations of time preference with health behaviors, has significant potential implications for research as well as for public health practice and policy. First, the observed cross-sectional associations between time preference and risky health behaviors (or poorer health) may not necessarily support the causal effect of time preference on individual choices of health behaviors. Second, if both directions of causality are at work (e.g., a higher time discount rate causes a greater likelihood of engaging in smoking, and smokers then have a higher time discount rate), the relationship between time preference and poorer health

behaviors (as well as other behaviors involving intertemporal investment) may form a vicious cycle—the effect of time preference on risky health behavior would be amplified through a positive feedback, offering another explanation for the "gateway" effects (Hale & Viner, 2012). However, cross-sectional, nonexperimental data typically do not allow for examining separately one direction of causality from the other nor for controlling for unobserved heterogeneity between individuals with poor health behaviors and those without, that may also influence time preference. To overcome the limitations of cross-sectional data and examine causation running from time preference to smoking, Brown and Adams (Brown & Adams, 2013) conducted a longitudinal analysis with a sample of Australian adults, and showed that current smokers at baseline who consider the future periods more in their financial planning are more likely to quit smoking. Fernie et al. (2013) explicitly took into account the potential bidirectional relationship in their cross-lagged analyses using data collected five times over two years, and argued that behavioral impulsivity leads to a higher likelihood of alcohol use in adolescents while the converse is not true. The interval of a few months between each wave, however, may not allow sufficient time for adolescents' health behaviors to alter their time preference through the endogenous pathway.

This study uses longitudinal data (2003–7) from a nationally representative sample of South Korean adolescents to test for the following two hypotheses: first, adolescents with a higher time discount rate have an increased risk of initiating smoking and drinking; second, engaging in smoking and drinking increases time discount rates.

2. Material and methods

2.1. Data

The Korea Youth Panel Survey (KYPS) was conducted by the National Youth Policy Institute (NYPI) of South Korea to explore tendencies of adolescents in developing deviant behaviors and to examine underlying socio-cultural influences. Using a stratified, multi-stage cluster sampling method, the KYPS randomly selected 104 middle schools (for students aged 13–15) from 12 provinces, and surveyed one class for students aged 14 years (in 8th grade) from each chosen school in 2003. A total of 3449 adolescents were surveyed in the initial wave and followed up annually through 2007, when most in-school students were 18 years (in 12th grade). In 2004, 3188 underwent a follow-up survey (92.4% retention rate), followed by 3125 in 2005 (90.6%), 3121 in 2006 (90.5%), and 2967 in 2007 (86.0%). The causes of attrition that the NYPI provided include refusal, death, inability to respond, contact failure due to studying abroad, running away from home, being detained at the youth detention center and being hospitalized or employed. The sample adolescents were interviewed face-to-face by well-trained interviewers, except for the section on deviant behaviors completed by the paper-and-pencil method. A supplemental telephone survey was administered to parents or guardians to provide additional information on demographic and socio-economic characteristics of the adolescents' families (e.g., household income and parent or guardian education), and all surveys were conducted in Korean. Excluding observations with missing values for the study variables and the relatively small portion of non-student observations (1195 and 139, each accounting for 7.5% and 0.9% of the original sample of 15,850 person-year observations), 14,516 complete cases from 3446 respondents were included for this study. This study was reviewed by the Seoul National University Institutional Review Board (SNU IRB), and was considered exempt from full IRB review.

2.2. Measures

2.2.1. Time preference

Our time preference measure was derived from the survey question on the self-report scale of impulsivity, developed originally by Grasmick