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Brief Report

Do Early Smoking Experiences Count in Development of Smoking?: Temporal Stability and Predictive Validity of an Early Smoking Experience Questionnaire in Adolescents

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Abstract

Aims: The experience during initial experimentation with smoking might influence later development of smoking behavior; however, measuring early smoking experience (ESE) usually requires self-reports for which stability and predictive validity are relatively understudied. The aims of the study are (a) to examine temporal stability of the ESE questionnaire and (b) to test the hypothesis that early pleasant and unpleasant experience scales predict changes in smoking status among adolescents.

Methods: In two waves of the Budapest Adolescent Smoking study, a school-based longitudinal study, 1,286 ninth-grade students reported their ESE on both occasions (45.9% girls; mean age = 15.3, *SD* = 0.54). Questions related to smoking behavior and ESEs were administered in both waves (average 5 month apart). To examine temporal stability, test–retest correlations and a multiindicator autoregressive model were estimated. To test the predictive validity, 2 structural equation models with binary outcome variables (change in smoking status) were estimated in experimenters (*N* = 798) and nondaily smokers (*N* = 506) separately.

Results: Test–retest correlations of pleasant and unpleasant experiences were .63 and .66, respectively. Pleasant and unpleasant experiences predict the change of smoking status in the group of experimenters (odds ratio [*OR*] = 1.57 [1.00–2.48] and 0.58 [0.42–0.80], respectively), but these coefficients (*OR* = 1.53 [0.79–1.74] and 1.17 [0.82–2.83], respectively) did not reach the level of significance in nondaily smokers.

Conclusions: Self-reports of ESE demonstrate good short-term temporal stability. The early unpleasant smoking experience might have a different role in different stages of smoking acquisition.

Introduction

Early subjective experience with smoking may be a potential predictor of further progression from experimentation to more regular smoking among adolescents (DiFranza et al., 2004; Pomerleau, Collins, Shiffman, & Pomerleau, 1993). The sensitivity model (Pomerleau, 1995) suggests that individuals experiencing more intense positive and probably aversive experiences when they first experiment with smoking are more likely to increase their smoking rate and develop stronger nicotine dependence.

Initial experimentation with smoking can yield both negative experiences, including coughing, dizziness, burning throat, nausea, lightheadedness, and positive experiences, including relaxation, rush, or buzz (Hirschman, Leventhal, & Glynn, 1984; Pomerleau, Pomerleau, & Namenek, 1998). Although both of these effects may be important in determining the likelihood of continued smoking, the positive pleasant effects have stronger association with later smoking behavior (Eissenberg & Balster, 2000). Quantification of initial smoking experience has been difficult, and several different approaches have been used to measure the individual differences in initial smoking experience. While DiFranza et al. (2004) applied descriptions of four experiences, namely irritation, nausea, dizziness, and relaxation, Perkins, Gerlach, Broge, Grobe, and Wilson (2000) used a Visual Analog Scale with items, such as "head rush," "relaxed," "pleasant," and "jittery." Pomerleau et al. (1998) constructed an Early Smoking Experience (ESE) questionnaire with seven items referring to both pleasant and unpleasant experiences. Rodriguez and Audrain-McGovern (2004) applied the modified version of ESE to a sample of adolescents where the two-factorial structure of initial smoking experience was supported. They excluded the dizziness item because it is loaded on both factors in exploratory analyses and added a new item referring to the difficulty of inhaling. They also demonstrated the validity of the

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adolescent version of ESE. The pleasant experience positively correlated with nicotine dependence. Moreover, the pleasant experience also correlated with smoking status, but the unpleasant experience did not correlate with smoking status. Pleasant experience and unpleasant experience concurrently predict smoking status and the degree of nicotine dependence both in adolescents (Urbán, 2010a) and in adults (Ríos-Bedoya, Pomerleau, Neuman, & Pomerleau, 2009).

Because the ESE is a retrospective self-reported measure, there are concerns regarding validity (Perkins, Lerman, Coddington, & Karelitz, 2008). ESE might be prone to memory bias and distortion, given that current smoking status may lead to biased recall or reporting of early smoking experience (ESE). In their research, however, Perkins et al. (2008) performed a validity study with young nonsmoking adults and presented evidence that two items, namely pleasurable buzz and dizziness, correlate with the subjective rating of the effect of experimental nicotine administration.

In order to test whether ESEs are salient enough to be resilient to memory bias, test–retest analysis could show the stability of the construct through time. Only one study assessed the test–retest reliability of the initial experiences of smoking (Riedel, Blitstein, Robinson, Murray, & Klesges, 2003). The authors applied five dichotomous items measuring the initial smoking experience, namely coughing, feeling dizzy, feeling sick, feeling high, or feeling relaxed. After one-year follow-up, temporal stability of two items (feeling dizzy and coughing) was moderate, all other items reflected poor stability. The authors also reported good concurrent validity with current smoking status but lack of predictive validity with smoking status one-year later.

Predictive validity of ESE is evaluated only in four prospective studies; however, these studies focused mainly on development of nicotine dependence.

In a prospective cohort study of seventh grade students, DiFranza et al. (2004) presented evidence that among the first experiences with smoking, reported dizziness and relaxation predicted the progression to monthly smoking, while experience of irritation prevented from this progression. In a further study, DiFranza et al. (2007) reported among the first four responses to initial inhaling, reports of relaxation and dizziness or light-headedness were associated with the loss of autonomy and development of nicotine dependence. Moreover, if relaxation was reported as the first reaction, a faster loss of autonomy over nicotine and subsequent development of dependence were found.

Audrain-McGovern, Al Koudsi, et al. (2007) demonstrated in a cohort study that initial pleasant experience with smoking is associated with higher level of nicotine dependence at baseline but did not predict the further development of nicotine dependence. In another study, Hu, Muthén, Schaffran, Griesler, and Kandel (2008) examined the developmental trajectories of *DSM-IV* criteria of nicotine dependence in adolescents. Comparing four developmental trajectories, including no *DSM-IV* criteria, early onset/chronic use, early onset/remission, and late *DSM* onset, the pleasant ESE predicts the early onset of nicotine dependence symptoms regardless of later courses of trajectories. Although these studies applied different approaches to measure nicotine addiction, they consistently report that pleasant initial experience is associated with earlier development of nicotine addiction in adolescents.

Our goals here are twofold: The first goal is to examine temporal stability of the ESE questionnaire. The second goal is to test the hypothesis that early pleasant and unpleasant experiences predict the change in smoking status in adolescents.

Methods

Participants

The present analysis involves two waves from a school-based longitudinal study called Budapest Adolescent Smoking Study in which 2,565 and 2,521 adolescents participated, respectively. The two-stage cluster sampling method is described in more details in Urbán (2010b). In the first wave (between October and December 2008), 1,599 adolescents reported any experience of smoking (798 experimenters, 506 nondaily smokers, and 295 daily smokers) and in the second wave (between March and May 2009), 1,691 adolescents (838 experimenters, 513 nondaily smokers, and 340 daily smokers). Two thousand one hundred and sixteen adolescents participated in both waves; 1,286 reported their ESE on both occasions (45.9 % girls; mean age = 15.3, $SD = 0.54$, range between 14.0 and 17.8, median 15.3), and they were included in this analysis.

Measures

Self-Reported Smoking Status

Two questions included (a) have you ever tried a cigarette, even if only a few puffs? and (b) did you smoke at least one cigarette in the past 30 days and if so, how many? Respondents were categorized into four groups: *never tried smoking*, *experimenter* (tried it but did not smoke during the past 30 days), *nondaily smokers* (did not smoke every day during the past 30 days), and *daily smokers* (smoked every day during the past 30 days).

The ESE questionnaire (seven items; Rodriguez & Audrain-McGovern, 2004) was administered in both data collection waves. The items are rated on a 4-point scale, ranging from 1 (*none*) to 4 (*intense*). In an earlier report, we demonstrated the construct validity and concurrent predictive validity of the Hungarian version of ESE Scale (Urbán, 2010a). We also retained the item "dizziness" in the test–retest analysis of the items; however, it was deleted from ESE questionnaire because of its loading on both pleasant and unpleasant factors.

Statistical Analysis

The first step of analysis involved calculating test–retest correlation of items and scales using Pearson's correlation coefficients.

The second step was testing the temporal stability with a multiindicator autoregressive model estimated with Mplus 5.2. We used maximum likelihood parameter estimates with *SE*s and chi-square test statistics that are robust to nonnormality and nonindependence of observation owed to clustering (Muthén & Muthén, 1998–2007, p. 484). Satisfactory degree of fit requires the comparative fit index (CFI) to be larger than 0.95 (Brown, 2006); the second fit index applied in these models was root mean square error approximation (RMSEA). RMSEA below 0.05 indicates excellent fit, a value around 0.08 indicates

adequate fit, and a value above 0.10 signifies poor fit (Brown, 2006). The third fit index was the standardized root mean square residual (SRMR); value below 0.08 is considered a good fit (Brown, 2006). The autoregressive model has several advantages (Brown, 2006; Khoo, West, Wu, & Kwok, 2006): (a) Stability coefficients are not attenuated by measurement error and (b) the residual variance may not be due to a systematic feature of the items that is not shared with the latent constructs. Correlating uniqueness over each pair of time periods removes any influence of the stability of these systematic components of the residual.

The third step is to test the predictive validity of the scales using structural equation modeling. Two separate models were estimated with Mplus 5.2 for experimenters and nondaily smokers at Time 1. The estimation method used binary logistic regression analysis to determine regression coefficients and used maximum likelihood estimation with robust *SE*s. The outcome variable was the change of smoking status, which was conceptualized as moving at least one step toward the higher intensity of smoking. Experimenters could move toward nondaily and/or daily smoking, and nondaily smokers could move forward to daily smoking. The dichotomous change score reflects no change (coded 0) and moving toward the higher intensity of smoking (coded 1).

Results

Sample Statistics and Test–Retest Correlations

The basic statistics of items in the two waves, statistical analysis of change, and test–retest correlations are presented in Table 1.

If we consider the average five-month follow-up, the test–retest correlations of items ranged between .41 and .58. Taking into consideration the length of the time between the two measurements, we evaluate the temporal stability as good or moderate. We also calculated the scale level test–retest correlations of pleasant and unpleasant experiences, which are $r = .63$ and $r = .66$, respectively. The scale level test–retest correlates are also acceptable.

Despite the relatively good temporal stability of the items, we identified significant increases in the items pleasant feeling, unpleasant feeling, relaxation, and rush or buzz. However, the effect size measures of these increases indicate that the differences were practically not important according to the interpretation proposed by Wolf (1986).

An Autoregressive Model

In the second step, we estimated an autoregressive model on the total sample. The degree of model fit was adequate (χ^2 (64) = 296.5, CFI = .963, TLI = .948, RMSEA = .048 [.042–.053], SRMR = .043), and in this model, the test–retest correlations between latent variables are .34 (unpleasant experience) and .36 (pleasant experience). The correlations between the uniqueness of items ranged between $r = .05$ and $r = .32$.

Predictive Validity

We also estimated the predictive validity of both pleasant and unpleasant experiences as latent variables with structural regression model with a binary outcome. The outcome variable was the change of smoking status, which was coded 0 if the respondents' smoking status was the same at Time 1 and Time 2 and coded 1 if the smoking status has developed further. About 19.7% of experimenters moved further to nondaily or daily smoking, and 16.0% of nondaily smokers moved further to daily smoking. The results of the logistic regression model including odds ratios (*OR*s) and *CI*s are presented in Table 2. In the case of pleasant experience, the *OR*s are practically similar in both groups, and their *CI*s are overlapping in large degree. The fact that the *OR* of pleasant experience is not significant in nondaily smokers can be attributed to the lower power of the present study to detect the effect. However, in the case of unpleasant experience, the picture is different. In the group of experimenter smokers, the unpleasant experience predicts lower likelihood of becoming nondaily or daily smokers. In nondaily smokers, the unpleasant experience is not associated with the outcome variable, though the *CI* is quite wide. Nevertheless, the *CI*s of *OR*s do not overlap in the two groups; therefore, the different pattern cannot be attributed to the lack of power to detect the effect.

Table 1. The Basic Statistics of Items in the Two Waves, Statistical Analysis of Change, and Test–Retest Correlations

Item	Wave 1 *M* (*SD*)	Wave 2 *M* (*SD*)	*t* (*df*)	*p* value	Effect size for change and 95% *CI*[a]	Test–retest correlation[b]
Pleasant feeling	1.83 (0.93)	2.05 (1.00)	7.97 (1,031)	<.0001	0.34 (0.28–0.40)	.56
Unpleasant feeling	2.34 (1.08)	2.43 (1.05)	2.4 (1,009)	<.006	0.12 (0.05–0.18)	.48
Nausea	1.41 (0.81)	1.42 (0.81)	0.04 (1,125)	n.s.		.51
Relaxation	1.83 (0.99)	1.94 (1.04)	3.89 (1,089)	<.0001	0.11 (0.09–0.22)	.52
Dizziness	1.93 (1.05)	1.98 (1.07)	1.79 (1,125)	n.s.		.56
Rush or buzz	1.54 (0.86)	1.65 (0.91)	3.90 (1,060)	<.0001	0.16 (0.11–0.22)	.41
Coughing	2.06 (1.02)	2.05 (1.03)	0.41 (1,127)	n.s.		.58
Difficulty inhaling	2.04 (1.00)	2.04 (1.00)	0.07 (964)	n.s.		.51

Note. n.s. = non significant.

[a]Refers to Cohen *d* for repeated measures (Cohen, 1977). According to Wolf (1986) interpretation, the effect size as large as 0.20, there is no practical difference, and effect size about 0.50 are important.

[b]Pearson's correlation, $N = 965–1,128$.

Table 2. Predictors of Change in Smoking Status

Scale	*OR* (95% *CI*)	*p* value
Experimenter smokers at Time 1 ($N = 798$)		
Pleasant experience	1.57 (1.00–2.48)	.046
Unpleasant experience	0.58 (0.42–0.80)	.001
Nondaily smokers at Time 1 ($N = 506$)		
Pleasant experience	1.53 (0.79–1.74)	.169
Unpleasant experience	1.17 (0.82–2.83)	.417

Note. Gender and age are controlled in both models. *OR* = odds ratio.

Discussion

Both short temporal stability and predictive validity of ESE questionnaire are supported. The temporal stability of the ESE questionnaire is satisfactory, and this study demonstrated stronger reliability of the report of ESEs than it was previously described (Riedel et al., 2003). Our study differs from the previous one in the response form since we applied a 4-point scale response format, while the previous study (Riedel et al., 2003) applied a dichotomous (yes/no) format. The present study has a shorter length of the follow-up, which might influence the stability coefficients. We also identified some changes in the report of ESE items between two measurement occasions; however, the size of these changes was practically not significant.

Although the sensitivity model (Pomerleau, 1995) emphasizes the importance of ESEs in the development of nicotine dependence, the role of ESE in later development of smoking is rarely examined in a longitudinal analysis. Our study highlights that the ESEs have an important role during the earlier stages of smoking. On the one hand, the predictive validity of the ESE questionnaire is supported; therefore, more intense positive experience increased the chances of becoming nondaily or daily smokers. Our finding that pleasant early experience predicts the development of smoking behavior is consistent with previous prospective studies (Audrain-McGovern et al., 2007; DiFranza et al., 2007; Hu et al., 2008). DiFranza et al. (2004) reported that relaxation predicted the progression to monthly smoking. Other prospective studies (Audrain-McGovern et al., 2007; DiFranza et al., 2007; Hu et al., 2008) focused on development of nicotine dependence and not the stage of smoking measured by frequency of cigarette use.

Only one previous prospective study demonstrated the impact of unpleasant early experience. DiFranza et al. (2004) also presented that experience of irritation prevented from this progression. DiFranza et al. (2007) and Audrain-McGovern et al. (2007) reported that unpleasant early experience did not predict the loss of autonomy and nicotine dependence. Our result demonstrated that unpleasant early experience can prevent later progression in smoking at least in the stage of experimentation. Clarification of the role of unpleasant early experience in further experimentation with smoking require additional cohort studies with young population since later experience with smoking might overwrite the early experiences and distort the retrospective account.

Our study supports that ESEs have important roles in determining the progression toward more established smoking.

There are at least two major limitations of the present study. First, we cannot completely exclude the memory bias that the ESE scale was a self-report measure. For example, for experimenters who are not daily smokers, the early experiences are likely fresher in their memory. Nondaily smokers have likely adapted to the negative effects of nicotine or developed tolerance to it and may be presenting a memory bias that causes them to underreport the initial negative experiences. Second, smoking is measured by self-report; however, some studies demonstrated that self-report alone can accurately measure smoking status (Dolcini, Adler, Lee, & Bauman, 2003).

Understanding the role of the ESE can help to form prevention program, which can avert adolescents from further experimentation with cigarette.

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Declaration of Interests

None declared.

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