



Short Communication

Smoking outcome expectancies: A multiple indicator and multiple cause (MIMIC) model

Róbert Urbán*, Zsolt Demetrovics

Eötvös Loránd University, Department of Personality and Health Psychology Budapest, H-1064, Izabella u. 46, Hungary

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ABSTRACT

The present study was carried out to assess the construct validity of the short form of the Smoking Consequences Questionnaire, a brief measure of smoking outcome expectancies on a large sample of adolescents ($N=953$). The results of this study support a four-factor structure of smoking outcome expectancies, including expectancies of negative consequences, positive reinforcement, negative reinforcement and appetite–weight control, as well as the assertion that gender, smoking status and sensation-seeking have a distinct pattern of associations with the four outcome expectancy factors.

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1. Introduction

Outcome expectancies play a major role in determining legal and illegal drug use including smoking (Donovan, 1988). Although research on the measures of alcohol-related outcome expectancies is burgeoning, smoking-related outcome research has not developed as far as could be expected. The first measure of smoking outcome expectancies is the Smoking Consequences Questionnaire (Brandon & Baker, 1991) which measures four dimensions which are negative consequences, negative reinforcement, positive reinforcement and appetite–weight control. Copeland and colleagues developed an adult version of SCQ (SCQ-A), which consists of eight dimensions reflecting the crystallization process of outcome expectancies after heavy use (Copeland, Brandon & Quinn, 1995). Moreover Rasch and Copeland (2008) have developed the Brief Smoking Consequences Questionnaire for use in clinical research with adult heavy smokers. These studies, however, focused only on college students and adults who were heavy smokers. Myers, McCarthy, MacPherson and Brown (2003) constructed a short form of SCQ (S-SCQ), and applied it to relatively small samples of young adults ($N=107$) and adolescents ($N=125$) with some history of addictive problems. Considering that the confirmatory factor analytical approach would usually require larger sample size (Kline, 2005), until now, however, the S-SCQ has not been validated in a large adolescent sample. Our main goal was to support the construct validity of four smoking outcome expectancies, namely negative consequences, positive reinforcement, negative reinforcement and appetite–weight control measured by short

version of Smoking Consequences Questionnaire for the later use in a large school-based longitudinal study on initiation and maintenance of smoking in adolescents. In the present study we focus on four types of outcome expectancies (Brandon & Baker, 1991; Myers et al., 2003) namely negative consequences, positive reinforcement, negative reinforcement and appetite and weight control expectancies. These expectancies can be regarded as core expectancies which are presented in other scales as well. Negative consequences refer to the expectancies related to long-term negative health consequences of smoking. Positive/sensory reinforcement expectancies refer to the expectancies regarding to individual sensory satisfaction from smoking. Negative reinforcement denotes expectancies regarding to coping and negative emotion regulation through smoking. Finally, appetite and weight control represents the expectancies regarding that smoking helps to manage appetite and weight.

Another goal of the present study was to examine the relationship between smoking behavior and smoking outcome expectancies and between smoking outcome expectancies and gender. Adult women put more emphasis on tension reduction/relaxation, stimulation and social reasons for smoking than do men (Berlin et al., 2003). Among African-American smokers, women scored higher on negative affect reduction compared with men (Pulvers et al., 2004). However, very few studies have examined the gender differences in smoking outcome expectancies among adolescents. Vidrine, Anderson, Pollak and Wetter (2006) used a free-listing measure of outcome expectancies and reported different associations with smoking for boys and girls. Boys' smoking was more related to excitement, pleasure, taste/smell, stimulation, which reflects the construct of positive reinforcement in S-SCQ. In contrast, girls' smoking was more related to weight control, negative aesthetics, addiction and negative mood, which are related to negative consequences, negative reinforcement and appetite and weight control expectancies in S-SCQ. However, these

* Corresponding author. Tel.: +36 30 565 2992.

E-mail addresses: urban.robert@ppk.elte.hu, r.urban.bp@gmail.com (R. Urbán).

results need to be confirmed by using psychometrically validated measures, such as the S-SCQ.

Finally, our third goal was to examine the relationship between sensation-seeking and the components of smoking outcome expectancies. Sensation-seeking is recognized as a risk factor for legal and illegal drug use (Zuckerman, 1994; Roberti, 2004). It is well documented that alcohol-related positive outcome expectancy correlates reliably with sensation-seeking, and partially mediates the association between sensation-seeking and alcohol consumption (e.g. Darkes, Greenbaum & Goldman, 2004; Urbán, Kökönyei & Demetrovics, 2008). Similarly, the general association between sensation-seeking and smoking behavior has also been demonstrated (Zuckerman, 1994). Disinhibition, a component of sensation-seeking, showed a reliable association with current cigarette use and heavy use in a large community adolescent sample (Kopstein, Crum, Celentani & Martin, 2001), and higher sensation-seeking was also associated with higher initial sensitivity to nicotine (Perkins, Gerlach, Broge, Grobe, & Wilson, 2000). The relationship between the components of smoking-related expectancies and sensation-seeking, however, has not yet been analysed in large adolescent samples.

2. Method

2.1. Participants and procedure

Thirty general high schools were invited to participate in the study, of which two refused to participate. One or two classes were randomly selected from each school. Subjects were asked to complete the questionnaire in their classrooms within one class session, so the sample characteristics reflect the composition of the participating classes. Subjects were informed both orally and in writing that participation in the study was voluntary and anonymous. Of a total of 986 students who participated in the study, the data of 34 subjects were dropped due to the high number of missing values.

The final sample is composed of 953 high-school students (mean age = 16.6 years, SD = 1.44 years, age range 14–20; 362 boys and 591 girls). The higher proportion of girls in this sample is in accordance with gender distribution in general high schools in Hungary (Hungarian Ministry of Education and Culture, 2006).

2.2. Measures

2.2.1. Smoking behavior

Smoking behavior was assessed by questions on the lifetime and the frequency of smoking in the past month. Two groups were created: *non-smokers*, who reported no smoking during the last 30 days, and *smokers*, who reported smoking at least one cigarette in the last 30 days.

2.2.2. Smoking outcome expectancies

The 21-item, short form of the Smoking Consequences Questionnaire (Myers et al., 2003) was used to measure smoking outcome expectancies. The items of the original version of the Smoking Consequences Questionnaire was published by Myers et al. (2003), the Hungarian version of the Smoking Consequences Questionnaire is available from the authors of the present report. The questionnaire was translated as well as back-translated, and inconsistencies were resolved. We included only the likelihood rating form, as suggested by Myers et al. (2003), since the likelihood scores discriminate best between different levels of smoking.

2.2.3. Sensation-seeking

The Sensation-seeking Scale form V (SSS-V, Zuckerman, 1994) was used to measure sensation-seeking ($\alpha = 0.76$). The items referring explicitly to any drug use were not calculated.

2.2.4. Peer smoking

Peer smoking was assessed by a single question asking “How many of your close friends smoke cigarettes weekly or more regularly?” A 10-point scale was used in which 0 referred to “none of my friends”, while 9 referred to “10 or more close friends”.

2.2.5. Presence of a smoking parent

Parental smoking was assessed by two questions inquiring about the smoking status of the father and mother. The answers were combined into one dichotomous variable in which 0 represents that none of the parents smoke and 1 represents that at least one parent smokes.

3. Results

3.1. Statistical analysis

We applied a multiple indicators multiple causes (MIMIC) confirmatory factor analysis to validate the structure of the S-SCQ and test the association between the expectancy scales and gender, sensation-seeking and smoking status. The MIMIC technique, a specification of structural equation modeling, was chosen for the present study, because MIMIC models can estimate the effect of grouping variables or other continuous variables on the latent variables are also included. Maximum likelihood estimation was used in AMOS 16.0. Satisfactory degree of fit requires the comparative fit index (CFI) to be larger than 0.95, non-normed fit index (NNFI or TLI) to be larger than 0.95, and the third fit index applied in this study is root mean square error approximation (RMSEA). RMSEA below 0.05 indicates excellent fit, the value around 0.08 indicates adequate fit, and value above 0.10 specifies poor fit.

Fig. 1 represents a four-factor MIMIC model constructed for the present study. The left side of the model displays the relationship between latent variables, namely smoking outcome expectancies, and individual items that are “indicators” of latent variables. This outlines the measurement part of this model which is equivalent to a confirmatory factor analysis. On the right side, the model is complemented with the structural part by including a set of exogenous variables, such as age, gender, smoking status, peer smoking, sensation-seeking, presence of a smoking parent to

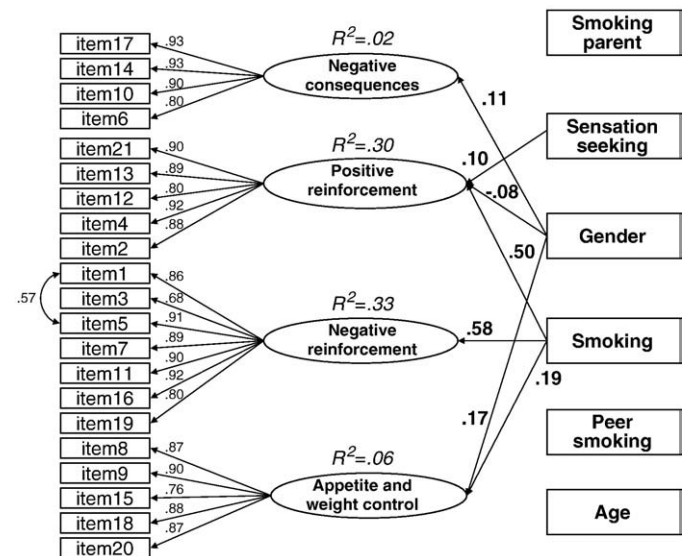


Fig. 1. The final trimmed MIMIC model (the non-significant paths are fixed to zero). The covariances among latent variables and covariances among ‘causal’ variables are not shown for the sake of clarity.

investigate effect of these variables (“causes”) on the latent constructs.

3.1.1. Descriptive statistics of smoking behavior

The sample consisted of 69% non-smokers, while 31% had smoked at least one cigarette during the past 30 days. In the non-smoker group, 43% of participants ($N = 284$) have not ever tried the cigarette, while 57% of non-smokers have already experimented with smoking, but did not smoke during the past 30 days. In the smoker group, the rate of everyday smoking was 40% ($N = 117$).

3.1.2. Structural equation modeling: Confirmatory factor analysis

In the first step, we estimated a confirmatory factor model to test the global fit of the factor structure of smoking outcome expectancies to empirical data. We based our analysis on the factor structure suggested in Myers et al. (2003). The general fit was adequate. Although $\chi^2 = 898$ ($df = 182$, $p < .0001$) is significant, the other fit indices showed adequate fit (CFI = .96, TLI = .96, RMSEA = .064 [.060–.068]). The range of size of factor loadings is between .76 and .93. The weak or moderate correlations between factors support the discriminant validity of the four expectancy scales. We also performed a multigroup CFA in order to test the fit of the model in both smokers and non-smokers. The fit indices show adequate fit ($\chi^2 = 1110$; $df = 364$; $p < .0001$; CFI = .96; TLI = .95; RMSEA = .046 [.043–.050]).

3.1.3. Multiple indicator multiple cause model (MIMIC)

In the second step, we added the structural part of the model to the measurement model and estimated the MIMIC model. Before the estimation of the model fit, the binary correlations of study variables including latent variables and predictor variables were estimated and presented in Table 1. Negative consequences and appetite and weight control expectancies correlated with gender only. Positive reinforcement expectancies correlated with gender, smoking status, sensation-seeking and peer smoking. Negative reinforcement expectancies correlated with age, smoking status, peer smoking, and presence of a smoking parent.

In the first step of structural equation model testing, the fully saturated structural model was estimated. This model showed adequate degree of fit to the data ($\chi^2 = 1091$; $df = 284$; $p < .0001$; CFI = .96; TLI = .95; RMSEA = .054 [.051–.058]). In the third step, the model was trimmed by constraining the non-significant paths to zero. The trimmed MIMIC model presented in Fig. 1, also showed adequate fit ($\chi^2 = 1107$; $df = 297$; $p < .0001$; CFI = .96; TLI = .95; RMSEA = .054 [.050–.057]).

The influence of age, gender, presence of a smoking parent, smoking status, sensation-seeking and peer smoking on four different smoking outcome expectancies was estimated simultaneously via standardized partial regression coefficients. Overall, girls were more likely to endorse appetite and weight control expectancies ($\beta = .17$; $z = 5.10$; $p < .0001$) and negative consequences ($\beta = .11$; $z = 3.28$,

$p < .001$). Boys are more likely to endorse positive reinforcement expectancies ($\beta = -.11$; $z = 2.87$; $p < .001$) than girls. No other significant paths were identified from gender. Smokers were more likely to report higher positive reinforcement expectancies ($\beta = .50$; $z = 16.69$; $p < .0001$), higher negative reinforcement expectancies ($\beta = .58$; $z = 18.25$; $p < .0001$), and also higher appetite and weight control expectancies ($\beta = .19$; $z = 5.80$; $p < .0001$). Path from smoking to negative consequences was not significant. Sensation-seeking had a significant path coefficient only to positive reinforcement expectancies ($\beta = .10$, $z = 3.20$; $p < .0001$). However, sensation-seeking had significant covariance with many causes included in this model, therefore indirect effects could be also estimated from sensation-seeking to other expectancy factors. No other paths from ‘causal’ variables to expectancies were found significant; therefore neither age nor the presence of a smoker parent or peer smoking predicted directly the four expectancies latent variables.

4. Discussion

Our results support the construct validity of the short form of the Smoking Consequences Questionnaire (S-SCQ). The four-factor structure of smoking outcome expectancies was confirmed in a relatively large adolescent sample. The pattern of associations with sensation-seeking, gender and smoking status was tested simultaneously, and the final model also bolsters the construct validity. Three of the four outcome expectancy scales are associated with smoking—status, gender and sensation-seeking—but the negative consequences scale is associated only with gender in our model.

Sensation-seeking predicts only positive reinforcement expectancies. The nature of causality is not clear here, however, owing to the cross-sectional data. Correlation between sensation-seeking and positive expectancies related to drug use is well established in the case of alcohol (e.g. Urbán et al., 2008), but with regard to smoking it has so far held little interest for researchers. In our model, sensation-seeking also had significant covariance with all other causes, giving rise to the possibility of indirect effects of sensation-seeking on other expectancy factors. The role of these associations, however, deserves further attention in understanding the pathway between sensation-seeking and smoking experimentation and regular use. In another ongoing research study, we test this relationship in a prospective design with another independent sample.

Although an earlier study (Lewis-Esquerre, Rodrigue, & Kahler, 2005) has reported no associations between gender and expectancies, another study (Vidrine, et al., 2006) presented significant correlations between gender and expectancies similarly what we have found in the present study, namely gender had different causal association with positive reinforcement, appetite and weight control and negative consequences. Boys are more inclined to report higher positive reinforcement expectancies of smoking, and this finding also deserves further investigation. One possible explanation is that nicotine has a longer-lasting effect on the adolescent male brain (Slotkin, 2002), but it is also known that smoking is associated more frequently with positive peer interactions (Eissenberg & Balster, 2000), which enhances the positive expectancies in boys more than girls. The girls reported higher endorsement with appetite and weight control. This result is in accordance with other studies investigating the role of smoking as a weight control strategy among girls and young women (Saarni, Silventoinen, Rissanen, Sarlio-Lahteenkorva, & Kaprio, 2004). It is important to understand in later research the role of gender differences in smoking-related outcome expectancies in both smoking initiation and cessation in boys and girls.

Smoking status showed a strong association with positive and negative reinforcement and had a somehow weaker relationship with appetite and weight control expectancy. Since we cannot infer causality here due to the cross-sectional nature of the present study, two possible causal explanations can account equally for these

Table 1
Estimated correlations between latent variables and predictor variables.

Study variables	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Gender	–								
2. Age	.00	–							
3. Smoking	–.01	.20*	–						
4. Sensation-seeking	–.03	.01	.12*	–					
5. Peer smoking	.06	.16*	.27*	.06	–				
6. Smoking parent	.04	.11*	.20*	.04	.18*	–			
7. Negative consequences	.11*	.00	.06	.06	–.02	.02	–		
8. Positive reinforcement	–.11*	.08	.52*	.10*	.18*	.07	.06	–	
9. Negative reinforcement	.04	.10*	.55*	.08	.22*	.14*	.19*	.62*	–
10. Appetite and weight control	.16*	.01	.16*	.04	.08	.07	.23*	.29*	.47*

Note: $N = 953$; * $p < .01$. Smoking is coded 0 for non-smokers and 1 for smokers. Gender is coded 1 for boys and 2 for girls. Smoking parent was coded 0 for the cases when both parents are non-smokers, 1 for at least one parent is a smoker.

associations. On the one hand, higher positive and negative reinforcement expectancies drive the experimentation and regular use of cigarettes. On the other hand, positive and negative reinforcement expectancies develop through the experimentation and more regular use of tobacco. It is somewhat surprising that smoking status was not associated with negative consequences expectancies. Emphasizing negative long-term consequences of smoking might be not a sufficient prevention strategy since both smokers and non-smokers are equally aware of the possible negative health impact of smoking. However further research should test the awareness and impact of short-term negative consequences upon smoking behaviors of adolescents.

Parental smoking might have an important role in learning process related to smoking behavior. Prior research has yielded inconsistent results regarding the link between parental smoking and smoking-related expectancies. One research shows that parental smoking is associated with expectancies of negative physical feelings from smoking and negative affect reduction (Lewis-Esquerre et al., 2005). Two other studies have reported the lack of association between parental smoking and expectancies (Hine, McKenzie-Richer, Lewko, Tilleczek, & Perreault, 2002; Hine, Honan, Marks, & Brettschneider, 2007). In the present study, parental smoking was associated with negative reinforcement expectancies, however in the MIMIC analysis, this association has ceased to be significant. Further research should clarify the impact of parental smoking on smoking-related expectancies and its role in the development of smoking behaviors of adolescents.

New studies with larger representative samples and longitudinal design are needed to assess more directly the currency of our findings. However, we can conclude that the short form of the Smoking Consequences Questionnaire provides researchers and practitioners with an economical method for assessing the development and effect of smoking outcome expectancies. It could also be used to identify those factors that might bolster and maintain the outcome expectancies and the methods to change it in prevention work.

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Contributors

Nothing declared.

Conflict of Interest

Nothing declared.

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