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Adolescents' protection motivation and smoking behaviour

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Abstract

The protection motivation theory (PMT) is a well-known theory of behaviour change. This study tested the applicability of the sub-constructs of threat and coping appraisal in predicting adolescents' smoking-related behavioural intentions and smoking behaviour longitudinally. Adolescents ($N = 494$) aged 11–16 years and not currently smoking at baseline participated in the study. Predictive validity of PMT constructs was tested in a path analysis model. Self-efficacy significantly predicted behavioural intention at baseline, which significantly predicted behavioural intention at follow-up, which in turn predicted smoking behaviour at follow-up. The effect of self-efficacy on behavioural intention at follow-up was mediated by behavioural intention at baseline and the effect of self-efficacy on smoking behaviour was mediated by behavioural intention at baseline and follow-up. In conclusion, we found support for one part of the PMT, namely for the predictive validity of the coping appraisal construct self-efficacy in predicting adolescents' smoking-related behavioural intention and smoking behaviour. These results fail to support the appropriateness of the PMT's construct threat appraisal in longitudinally predicting adolescents' smoking as well as the applicability of communicating fear and negative information as preventive interventions for this target group.

Introduction

One prominent theory of behaviour change is the protection motivation theory (PMT) [1, 2]. The PMT has been described as a theory belonging to the 'social cognitions models' which propose that peoples' intentions are best predicted by their cognitions [3]. It has been widely used in programmes evaluating the effect of persuasive communications targeting health-promoting and health-compromising behaviours [4]. Surprisingly, little research has used the PMT to examine youth smoking behaviour. This study examines the applicability of the PMT as a theoretical framework to predict the development of smoking behaviour over the course of 2.5 months in a sample of German adolescents.

According to the PMT, 'threat appraisal' and 'coping appraisal' determine peoples' 'protection motivation' (i.e. intention) to engage in a health-related behaviour [3]. 'Threat appraisal' consists of the 'perceived severity' of the potential health threat and the 'perceived vulnerability' of the individual to be affected by the negative consequences of the threat. A third factor that was subsequently added to the theory [1] and is also assumed to influence threat appraisal is called 'rewards of maladaptive response' and comprises the rewards a person expects to get from the maladaptive behaviour (e.g. weight control or expected social approval by means of cigarette smoking) [4]. Greater motivation to engage in the health-promoting behaviour (e.g.

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non-smoking) is therefore expected if the perceived severity and vulnerability are high and perceived rewards are low. 'Coping appraisal', on the other hand, consists of the coping resources to deal with the perceived threat available to the individual [4]. Coping appraisal consists of perceived 'response-efficacy' and 'response costs', as well as 'self-efficacy'. Response-efficacy describes the individual's perception of how the recommended health-promoting behaviour can effectively reduce the threat and response costs capture perceived costs that are associated with the recommended behaviour (e.g. negative social consequences from the peer group for smoking cessation). 'Self-efficacy' is the individual's belief that he/she can succeed in the recommended behaviour [5] and was also added to the original theory during a revision [1]. 'Response-efficacy' and 'self-efficacy' are expected to promote 'coping appraisal', whereas 'response costs' are expected to reduce it.

Results of research on the PMT have been summarized in two meta-analyses. One meta-analysis, which analysed 27 studies concluded that sub-constructs of both threat and coping appraisal were able to predict health-related intentions and concurrent behaviour, but less useful in predicting future behaviour, with the predictive validity of coping appraisal exceeding the predictive validity of threat appraisal [6]. The results of the other meta-analysis analysing 65 studies [7] suggested that coping appraisal variables and especially self-efficacy are the strongest predictors of protection motivation and behaviour.

In the area of addiction research, the PMT has recently received some attention in a review of theories of behaviour change and their potential value in informing interventions [3]. With regard to smoking behaviour, one of the meta-analyses [7], which included six studies on smoking, concluded that coping appraisal variables showed stronger effects regarding prevention of smoking and smoking cessation than threat appraisal variables. However, only a few studies have examined the applicability of the PMT in explaining adolescent smoking. Greening [8] found that PMT variables significantly predicted current smoking behaviour in a cross-sectional correlational study with 690 high-school students (14–19 years old). Significant predictive effects were reported for severity, vulnerability, rewards of maladaptive response and response-efficacy in a multiple regression model. Maddux and Rogers [9] used written information about the health consequences of smoking and successfully manipulated PMT variables in an experimental design. Their aim was to influence behavioural intentions to quit smoking in a sample of 153 undergraduate students, who were regular smokers (>10 cigarettes per day for the previous year). Self-efficacy and response-efficacy emerged as the only significant factors to predict intentions to quit, with self-efficacy being the strongest. However, they did not examine any effects on smoking behaviour.

The aim of this study was to examine the applicability of the PMT in explaining adolescent smoking behaviour longitudinally. First, we wanted to assess how well the different constructs of threat and coping appraisal predict smoking-related behavioural intentions cross-sectionally in a sample of adolescent non-smokers at baseline. Furthermore, we analysed whether these factors predict smoking-related behavioural intentions and smoking behaviour at follow-up, directly or mediated by behavioural intention at baseline. On the basis of previous research, we hypothesize that both coping appraisal and threat appraisal variables will be significant predictors of intention and behaviour.

Methods

Procedure

All study procedures were approved by the ethics commission of the German Psychological Society. Participants completed questionnaires at baseline (T1) and at follow-up (T2) 2.5 months later. Questionnaires at T1 and T2 were connected using a code (first two letters of first name of mother and father) and participants' age and gender, thus guaranteeing anonymity and confidentiality. Parental consent of participation in the study was requested

beforehand by letters sent to the schools and distributed by teachers.

Participants

The analyses are based on 494 students from 18 German secondary schools from the area of Heidelberg and Mannheim in southwest Germany. These schools participated in a cluster-randomized controlled trial that aimed at evaluating the effectiveness of a clinic-based emotionally arousing intervention for tobacco prevention in adolescents. Participants' age range was 11–16 years (mean = 13.15, SD = 0.89) and 50.61% were female. Of 930 eligible students, 673 (72.4%) were included at baseline. Excluded students were either not present in the classroom on the day of the assessment ($n = 154$), were current smokers ($n = 70$), or gave inconsistent self-reports of their current smoking status ($n = 33$). Of this sample, $n = 110$ (16.3%) were lost to follow-up, because they were not present in the classroom at the time of the assessment. To ensure sufficient quality of self-reported data, observations with more than 50% missing values on all variables and more than 66% missing values on items of any scale considered in the analyses were excluded ($n = 61$). Observations with missing values on gender or smoking status at T2 were excluded as well ($n = 8$), resulting in an analytical sample of 494 students (53.1% of eligible students). Those students excluded from the analyses ($n = 179$) did not significantly differ from the analytical sample with regard to age and gender. However, they reported lower perceived severity (excluded: mean = 5.07, SD = 3.24; analysed: mean = 5.93, SD = 2.73; $t(671) = 3.4$, $P < 0.001$), lower self-efficacy (excluded: mean = 3.31, SD = 0.87; analysed: mean = 3.50, SD = 70; $t(632) = 2.7$, $P < 0.01$) and higher response costs (excluded: mean = 2.09, SD = 0.98; analysed: mean = 1.71, SD = 0.88; $t(665) = -4.8$, $P < 0.001$) at T1.

Measures

For an operationalization of the constructs in the areas of threat appraisal, coping appraisal and intentions specified by the PMT, we built on the work of Pechmann *et al.* [10]. Specifically, the scales 'perceived severity', 'vulnerability' and 'self-efficacy', several items of the scales 'rewards of maladaptive response' and 'response costs', and the single item for 'behavioural intention' were adopted from the English version developed by Pechmann *et al.* [10]. These measures have previously shown good psychometric properties (internal consistency of the scales Cronbach's α ranging from 0.7 to 0.8) and have been extensively used in effectiveness studies of anti-smoking advertisements with adolescent samples [10, 11].

Threat appraisal (T1)

'Perceived severity' of smoking was assessed with 10 items concerning the areas of health, physical attractiveness, finances and harm to others. Participants were asked to mark each consequence of smoking they considered very serious on a dichotomous scale (e.g. 'Dying sooner'). Because of the good internal consistency (Cronbach's $\alpha = 0.86$), an average score was created. 'Perceived vulnerability' to consequences of smoking was assessed using the same 10 items as the perceived severity of smoking scale, asking participants how likely each consequence was to occur if they smoked regularly (e.g. 'I would die sooner'). Answers were recorded on a 5-point Likert scale ranging from 1 (very unlikely) to 5 (very likely). Again, an average score was calculated (internal consistency: Cronbach's $\alpha = 0.84$). 'Rewards of maladaptive response' were assessed with eight items concerning benefits of smoking on mood, concentration, social approval and coping with boredom (e.g. 'I would feel less stressed.'). Participants had to indicate each positive consequence they expected if they smoked on a dichotomous scale. A sum score was calculated over all items of the scale. The scale had low internal consistency (Cronbach's $\alpha < 0.5$) and was therefore excluded from further analyses.

Coping appraisal (T1)

'Response-efficacy' was assessed with eight items concerning the benefits from not smoking or quitting

smoking in the areas health, independence, social approval and money (e.g. 'I would stay healthier.'). 'Response costs' were assessed with three items concerning the areas of social disapproval and loss of fun (e.g. 'I would be made fun of'). Participants were asked how likely each benefit or cost was if they continued not to smoke or would stop smoking on a 5-point Likert scale ranging from 1 (very unlikely) to 5 (very likely). Average scores were calculated for both scales. The response-efficacy scale had high internal consistency (Cronbach's $\alpha = 0.92$) and the response costs scale had adequate internal consistency (Cronbach's $\alpha = 0.77$). 'Self-efficacy' at refusing a cigarette offer was assessed with three items (e.g. 'If a friend offers me a cigarette, I can say no'). Participants were asked to answer on a 4-point Likert scale ranging from 1 (very unlikely) to 4 (very likely). An average score was calculated over the items of the scale. The scale had good internal consistency (Cronbach's $\alpha = 0.85$).

Behavioural intention (T1 and T2)

'Behavioural intention' was assessed with the item: 'If someone offers me a cigarette in the near future, I will decline.' Participants were asked to answer on a 4-point Likert scale ranging from 1 (very unlikely) to 4 (very likely).

Current smoking status and smoking behaviour (T2)

Self-reported smoking behaviour was assessed with the one question 'On how many days have you smoked a cigarette in the last 30 days?' To approximate a normal distribution and reduce the impact of outliers, a log-transformed variable was used in the analyses [12]. Current smokers were determined based on this question to reflect past 30-day smoking status (dichotomized to yes–no). Biochemical verification of self-reports was conducted for a random subsample of two schools at both baseline ($n = 74$ students) and follow-up ($n = 72$ students) using carbon-monoxide breath analysers (BMC 2000 CO Monitor, Senko Co., Ltd, Korea). When utilizing a cut-off score of 9 ppm CO, self-reported smoking within the last 7 days (assessed with the question: 'When was the last time you smoked a cigarette?') matched breath analyser results in 94.6% of students at baseline [70 correct negatives and 4 false positives (self-report: yes; biochemical verification: no)] and 88.9% at follow-up [64 correct negatives, 6 false positives (self-report: yes; biochemical verification: no), and 2 false negatives (self-report: no; biochemical verification: yes)].

Analysis plan

Remaining missing values on the items protection motivation ($n = 14$) and intention ($n = 13$) were imputed by means of multiple imputation by chained equations [13, 14] utilizing the ICE procedure for Stata 10.1 [15]. ICE assumes that missing values are missing at random and imputes these values by using the maximum available information for an individual from other items in the imputation model. A manifest path analysis model was estimated using Mplus 5 [16]. A just identified model with zero degrees of freedom was calculated, in order to assess how well the variables at T1 predicted behavioural intention at T1 and T2, and smoking behaviour at T2 and to test indirect effects and mediation. The model tested can be seen in Fig. 1.

The small number of schools prevented the use of sandwich estimators, which are usually applied to adjust standard errors in cluster sampling designs. As suggested in the literature [17], the usual 5% α-error threshold was elevated to 1% in order to counteract reporting significant effects that might result from artificially enhanced test power due to underestimated standard errors.

Since data for this study were obtained from an intervention study with an intervention-control group design we first conducted a multiple-group path analysis. As no significant between-group differences emerged from this analysis, we pooled groups and report only the one group model in this article. Results from the multiple-group path analysis model are available from the corresponding author upon request.

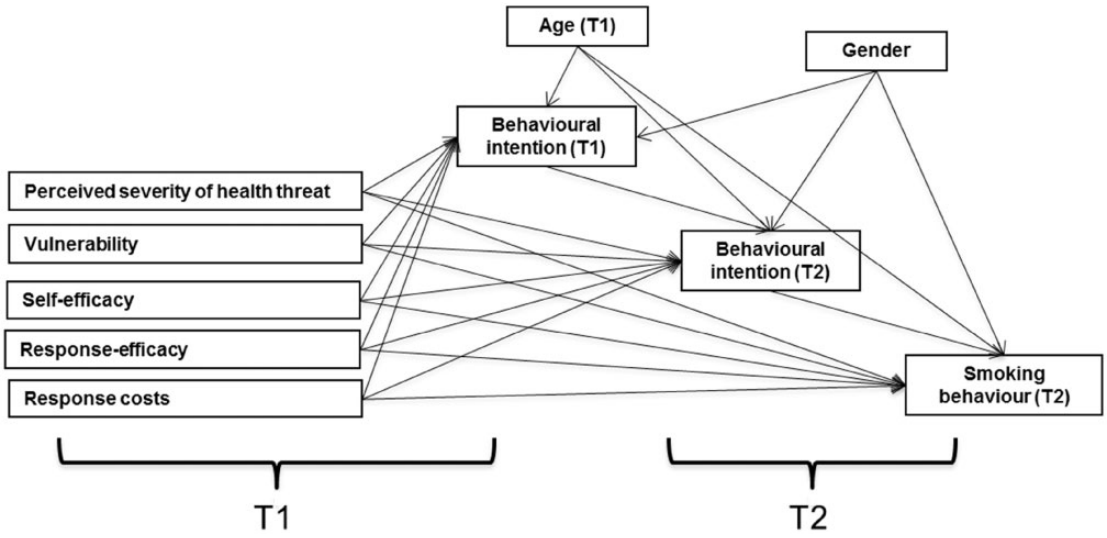

Fig. 1. Graphical representation of the estimated path analysis model. *Notes*: T1, assessed at baseline; T2, assessed at follow-up.

Table I. *Descriptive statistics* (n = *494*)

Variables	Mean (SD)/*n* (%)	Range
Age (T1)	13.15 (0.89)	11–16
Gender (female)	250 (50.6%)	—
Severity (T1)	5.93 (2.73)	0–10
Vulnerability (T1)	3.93 (0.66)	1–5
Self-efficacy (T1)	3.50 (0.70)	1–4
Response-efficacy (T1)	4.14 (1.03)	1–5
Response costs (T1)	1.71 (0.88)	1–5
Behavioural intention (T1)	3.71 (0.71)	1–4
Behavioural intention (T2)	3.74 (0.70)	1–4
Current smokers (T2)	22 (4.5%)	—
Smoking frequency (T2)	0.25 (1.97)	0–30

Notes: T1, assessed at baseline; T2, assessed at follow-up.

Results

Descriptive statistics and correlations

Table I contains the sample characteristics. All students reported to be non-smokers at T1. Students reported rather high values of severity, vulnerability, self-efficacy and response-efficacy at T1 and high values of behavioural intention at T1 and T2. A total of 22 students (4.5%) were classified as current smokers at T2. The bivariate correlations between all study variables included in the path analysis model are displayed in Table II. There were weak to moderate correlations between behavioural intention (T1) and severity, vulnerability, response-efficacy and response costs, and a strong correlation between behavioural intention (T1) and self-efficacy. Behavioural intention at T2 was weakly to moderately correlated with self-efficacy and weakly negatively with response costs. Behavioural intention at T1 and T2 moderately correlated with each other. The correlation between smoking behaviour and behavioural intention at T2 was moderate and negative.

Path analysis model

Results of the path analysis model can be found in Table III. Self-efficacy significantly predicted behavioural intention at T1. Furthermore, behavioural intention at T1 significantly predicted behavioural intention at T2, which in turn significantly predicted smoking behaviour. All other predictors at T1 did not reach significance. No significant effects of age and gender on any of the outcomes were observed (Table III).

Table II. *Correlations among variables* (n = *494)*

Variables	1	2	3	4	5	6	7	8	9
1. Age (T1)									
2. Gender	−0.13**								
3. Severity (T1)	−0.00	0.05							
4. Vulnerability (T1)	0.02	−0.01	0.26***						
5. Self-efficacy (T1)	−0.06	−0.03	0.09*	0.20***					
6. Response-efficacy (T1)	0.11*	0.10*	0.11*	0.15**	0.23***				
7. Response costs (T1)	0.02	−0.09	−0.08	−0.03	−0.06	−0.10*			
8. Behavioural intention (T1)	−0.02	−0.03	0.13**	0.23***	0.65***	0.23***	−0.11*		
9. Behavioural intention (T2)	−0.05	−0.05	0.08	0.04	0.18***	−0.03	−0.12*	0.26***	
10. Smoking frequency (T2)	−0.02	0.07	−0.01	−0.01	0.00	−0.05	−0.03	−0.01	−0.24***

Notes: T1, assessed at baseline; T2, assessed at follow-up; gender is coded 1 = male, 2 = female. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Self-efficacy had a significant indirect association with behavioural intention at T2 via behavioural intention at T1 (Beta = 0.14, $t = 4.1$, $P < 0.001$) and a significant indirect association with smoking behaviour, via behavioural intention at T1 and T2 (Beta = −0.07, $t = -3.7$, $P < 0.001$). This suggests that the effects of self-efficacy on behavioural intention at T2 and smoking behaviour are fully mediated by behavioural intention at T1. No other indirect association with behavioural intention at T2 or smoking behaviour reached significance.

The explained variance of the three dependent variables in the path model was 43.8% for behavioural intention at T1, 9.3% for behavioural intention at T2 and 14.4% for smoking behaviour (Table III).

Discussion

The aim of this study was to analyse, how well the constructs of threat and coping appraisal, as defined by the PMT, predict smoking-related concurrent as well as future behavioural intentions and future smoking behaviour in adolescents. The results of this study provide only partial support for the PMT in the context of adolescent smoking. Contrary to our hypotheses, the threat appraisal constructs perceived severity of the health threat and perceived vulnerability were not able to significantly predict concurrent or future behavioural intention and future smoking behaviour. On the other hand and consistent with our hypotheses, the coping appraisal construct self-efficacy exhibited some predictive value, suggesting that self-efficacy may be the strongest predictor of concurrent smoking-related behavioural intention. Furthermore, self-efficacy was the only construct that significantly predicted subsequent behavioural intention mediated by baseline behavioural intention and smoking behaviour mediated by behavioural intention at baseline and follow-up. The mediating role of behavioural intention between self-efficacy and smoking behaviour is consistent with the PMT. This suggests that a high confidence of adolescents in their ability to resist cigarette offers is associated with a high intention to decline these offers, which was in turn, related to behaviour. Furthermore, the results suggest that intentions are somewhat stable over time.

These findings are consistent with the results reported by Maddux and Rogers [9] in a study on smoking undergraduate students with respect to the role of self-efficacy. However, our findings also extend these results. First, we found a predictive effect of self-efficacy on smoking-related concurrent and future behavioural intention in a sample of adolescents who were non-smokers at baseline. Second, we showed that this predictive value of self-efficacy extends to actual smoking behaviour. In contrast to the findings of Greening [8], we examined future instead of current smoking behaviour

Table III. *Predictors and dependent variables in the path analysis model (standardized regression coefficients,* t *ratios in brackets and explained variance,* n = *494)*

Predictors	DV: behavioural intention (T1)	DV: behavioural intention (T2)	DV: smoking frequency (T2)
Severity (T1)	0.04 (1.2)	0.06 (1.3)	−0.01 (−0.2)
Vulnerability (T1)	0.09 (2.4)	−0.02 (−0.4)	0.00 (0.2)
Self-efficacy (T1)	0.60 (20.6)***	0.04 (0.8)	0.05 (1.0)
Response-efficacy (T1)	0.07 (1.9)	−0.11 (−2.3)	−0.09 (−2.1)
Response costs (T1)	−0.06 (−1.7)	−0.11 (−2.4)	−0.06 (−1.4)
Behavioural intention (T1)	—	0.24 (4.2)***	—
Behavioural intention (T2)	—	—	−0.38 (−9.3)***
Age (T1)	0.00 (0.1)	−0.04 (−0.8)	0.00 (0.1)
Gender	−0.03 (−0.8)	−0.05 (−1.1)	0.06 (1.5)
Explained variance (R^2)	43.8%	9.3%	14.4%

Notes: T1, assessed at baseline; T2, assessed at follow-up; DV, dependent variable. Gender is coded 1 = male, 2 = female. $^{**}P < 0.01$; $^{***}P < 0.001$.

and did not find significant effects of any of the threat appraisal variables.

Furthermore, our results are in line with previous research suggesting that coping appraisal, and of this construct especially self-efficacy, is the better predictor of health behaviour than threat appraisal; therefore, threat communication may be less important in influencing this behaviour [18, 19]. Our results are also consistent with studies that highlight the importance of self-efficacy in adolescent smoking, e.g. in protecting against a relapse [20].

Relatively high values in severity and vulnerability were reported by our participants. These findings are consistent with previous research. Reyna and Farley [21] have argued that adolescents already feel vulnerable, and vulnerability may decrease as they get older. Yet, in our sample, these factors were not associated with behavioural intention and smoking behaviour. These results potentially suggest that within the examined age group, the perception of threat from smoking may not be the leading determinant of smoking behaviour and other factors may be more important.

Regarding practical implications, this study points at the importance of enhancing adolescents' perceived self-efficacy in refusing and abstaining from cigarettes, even though the relationship of self-efficacy with smoking behaviour may be indirect and mediated by behavioural intention. Some possibilities to improve self-efficacy, such as mastery experiences and vicarious experiences have been noted by Webb *et al.* [3]. Teenagers can for example be taught to refuse cigarette offers in a role-play-type intervention. Interventions based on a social resistance skills and life-skills interventions both incorporate, among others, aspects that are meant to improve adolescents' self-efficacy in resisting pro-smoking peer group influence. There are results supporting the efficacy of these types of interventions [22].

Limitations and strengths

Several limitations of this study have to be noted. First of all, the small number of schools in the sample precluded accounting for the clustered structure of the data in our path analysis model. In order to counteract this, we adopted a more conservative level of significance (1%).

Another limitation of this study is that the path analysis model was tested with manifest variables. Testing with latent variables would have been advantageous in order to assess the constructs free of measurement error; however, due to the small sample size and the high number of constructs included, latent testing was not feasible in this study. Furthermore, the follow-up interval of 2.5 months used in this study was short. As adolescent smoking develops over longer periods of time,

future studies should increase the length of this interval.

Concerning the sample of this study, it should be noted that only students from certain types of schools (no upper track schools were included) and from a certain area in Germany participated. Therefore, our sample cannot be considered representative for adolescents in Germany and results should therefore be treated with caution. The generalizability of our findings may be further limited, since students excluded from our analyses reported lower perceived severity, lower self-efficacy and higher response costs than the analysed sample at baseline and these variables may be associated with subsequent smoking behaviour.

There was low agreement between self-reports of smoking and breath analyser results in our study with regard to identifying current smokers (low sensitivity). Although we are not able to control for this mismatch, as only a subsample of students was tested for breath CO, we overall do not expect our self-reports to be more unreliable than other smoking studies with adolescents, since we took the usual precautions against false self-reports (e.g. anonymity and confidentiality was ensured to participants, questionnaires were anonymously coded, data were collected by project staff and not by teachers or school employees).

Lastly, only 14.4% of the variance of smoking behaviour at follow-up was accounted for by our model, suggesting that other influence factors not incorporated by the PMT have a large effect on smoking. In this study, we examined the ability of cognitive, intentional factors within the individual to predict behaviour. This approach excludes influences of habit, stereotypes and reactive action control, which have all been found to be better predictors of adolescents' smoking behaviour than intentions [23]. Additionally, social factors such as peer-context and peer-influence are assumed to have a large impact on adolescent substance use behaviour [24]. Future research should aim at testing the influences of these factors on adolescent smoking simultaneously.

A major strength of this study concerns the use of longitudinal data, which enabled us to test the predictive value of the different components of the PMT prospectively—a need that has been expressed by Norman *et al.* [4].

Conclusions

The results of our study highlight the importance of smoking-related self-efficacy in adolescent smoking, which is in line with the assumptions of the social cognitive theory [25], stressing the fundamental role of self-efficacy for human agency. The lack of predictive validity of threat appraisal variables such as perceived severity of the health threat and perceived vulnerability in predicting concurrent and subsequent smoking-related behavioural intention and subsequent smoking behaviour provides further indication that communicating fear and negative information to adolescents as means of smoking prevention may not be the most effective strategy. Instead, it may be more fruitful to enhance adolescents' self-efficacy to resist cigarettes by strengthening their refusal skills utilizing interactive intervention methods.

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Conflict of interest statement

None declared.

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