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HEALTH PSYCHOLOGY | RESEARCH ARTICLE

High self-efficacy regarding smoking cessation may weaken the intention to quit smoking

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Abstract: Self-efficacy regarding the ability to stop smoking is considered a key factor for successful smoking cessation. However, research has found a weak link between self-efficacy and the intention to stop smoking. The present study aimed to gain a clearer understanding of this weak link, hypothesizing opposing effects of self-efficacy regarding the intention to quit. A representative sample of daily smokers in Switzerland ($N = 362$) completed a questionnaire. As expected, two opposing effects of self-efficacy were found: Self-efficacy was directly associated with the intention to quit, but self-efficacy was negatively linked to risk perception, resulting in a weakened intention to quit. This model explains the overall weak effect of self-efficacy on intention to quit. However, contrary to the hypotheses, dependence was not found to moderate the relationship between self-efficacy and intention to quit. Implications for interventions and future research are discussed.

Subjects: Health Psychology; Applied Social Psychology; Health Communication

Keywords: self-efficacy; risk perception; intention to stop smoking; dependence

Self-efficacy, a person's expectation regarding his or her capability to realize a behavior (Bandura, 1977), is considered a key factor in forming the intention to perform a behavior and in performing the behavior. This is emphasized by many theories and models, including the theory of planned behavior (Ajzen, 1991), the health belief model (Janz & Becker, 1984), and the health action process approach (Schwarzer, 2008). Numerous empirical studies have confirmed that self-efficacy is needed to predict intentions and behavior, such as dietary behavior and eating healthy food (McDermott et al., 2015;



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PUBLIC INTEREST STATEMENT

Smoking is highly addictive, and smokers tend to find reasons not to stop smoking and to justify their smoking behavior. Thus, it is important to identify not only factors that contribute to successful smoking cessation, but also those that counteract the quitting process. In addition to the well-documented desirable effects of self-efficacy, this article reveals that self-efficacy might serve as a justification to continue smoking rather than to stop smoking. The article thus reveals a psychological process that counteracts the intention to quit smoking, a finding that contributes to the understanding of why current smokers often do not want to stop smoking. Based on the results of the study, the article discusses how to prevent negative effects of self-efficacy and thereby increase the probability that smokers will quit smoking.

Povey, Conner, Sparks, James, & Shepherd, 2000). However, contrary to the predictions of these theories and models, a meta-analytic study found surprisingly weak effects of self-efficacy on smoking cessation when self-efficacy was measured *before* individuals quit smoking, whereas self-efficacy was found to predict successful smoking cessation when measured *after* smokers had quit (Gwaltney, Metrik, Kahler, & Shiffman, 2009). Likewise, in panel studies, Hyland et al. (2006) and West, McEwen, Bolling, and Owen (2001) found that self-efficacy had no independent effect on attempts to stop smoking or on smoking cessation before individuals quit smoking. Gwaltney et al. (2009) explained that judgments about self-efficacy made before quitting may be influenced by unrealistic expectations, because people have limited capacities to project how they will feel or act in circumstances different from their current ones.

Moreover, many studies have found no significant relationship between self-efficacy and *intention* to stop smoking (Rahman, Mannan, & Rahman, 2018; Rise, Kovac, Kraft, & Moan, 2008; Van Den Putte, Yzer, & de Bruijn, 2011).

Taken together, these results suggest that self-efficacy does not predict intention to stop smoking or smoking cessation among current smokers. The aim of the present study was thus to take a closer look at the role of self-efficacy expectations regarding the intention to quit smoking.

Smoking is highly addictive (WHO, 2016), and addictive behavior is very difficult to change (Sheeran, Milne, Webb, & Gollwitzer, 2005). It is therefore likely that smokers tend to find reasons not to stop smoking. One of these reasons could be underestimating one's personal health risk. Indeed, research shows that smokers tend to underestimate their personal smoking-related risk, compared with the risk they estimate for other smokers and compared with their real risk (Weinstein, Marcus, & Moser, 2005). An underestimation of one's personal risk compared with the risk of others engaging in a similar amount of a risky behavior is termed "unrealistic optimism" (Weinstein, 1987). Unrealistically optimistic smokers underestimate their smoking-related health risks. As risk perception is a very important predictor of smoking cessation (McCaul et al., 2006), unrealistic optimism regarding smoking-related health risks might serve as a strategy to continue, rather than stop, the risky behavior. In other words, the more smokers underestimate their health-related risks of smoking, the less likely they are to stop smoking.

One factor that can bolster smokers' underestimations of their personal risk is controllability, which has been found to support unrealistic optimism (Harris, 1996). Meta-analytic studies have confirmed that the more people felt in control of their risky behavior, the less they felt at risk (Helweg-Larsen & Shepperd, 2001; Klein & Helweg-Larsen, 2002). As self-efficacy and controllability have been shown to be highly positively correlated (Terry & O'Leary, 1995), "and together they comprise the higher-order concept of perceived behavioral control" (Ajzen, 2002, p. 678), it is expected that the negative relationship between controllability and risk perception also holds for self-efficacy and risk perception. It is thus plausible that the more people feel hypothetically capable of stopping smoking, the less they might feel at risk from smoking-related health risks. Thus, self-efficacy could "help" smokers to feel less at risk.

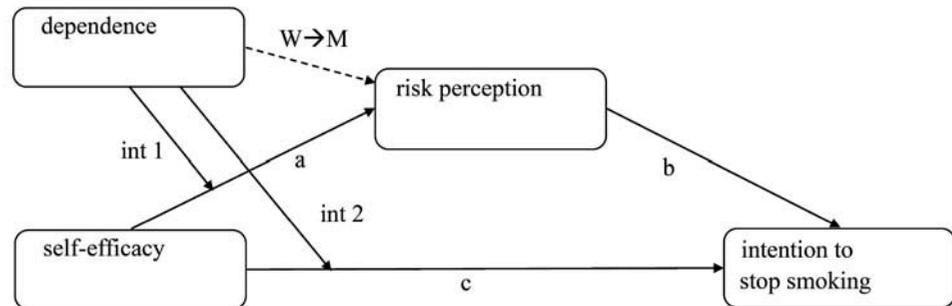
H1: Self-efficacy regarding smoking cessation is negatively related to risk perception regarding smoking-related health risks.

However, as mentioned earlier, high risk perception is an important predictor of intention to stop smoking (Janz & Becker, 1984; McCaul et al., 2006); thus, it can be assumed that risk perception is necessary to form the intention to stop smoking.

H2: Risk perception regarding smoking-related health risks is positively related to intention to stop smoking.

If self-efficacy is associated with lower risk perception and risk perception is needed to form the intention to quit, consequently, reduced risk perception might weaken the intention to stop smoking. However, according to the theory of planned behavior (Ajzen, 1991), self-efficacy is necessary to form

Figure 1. Theoretical assumptions of the relationships in the moderated mediation model



the intention to perform a specific behavior. Thus, without feeling capable of realizing a behavior, people will not form the intention to do it. Self-efficacy therefore seems to be needed to form the intention to quit smoking, but self-efficacy might also weaken the intention to quit via reduced risk perception.

H3: Self-efficacy and intention to stop smoking are linked through a direct positive relationship and through an indirect negative relationship via risk perception toward intention to stop smoking.

It can be assumed that the relationships between self-efficacy and risk perception and between self-efficacy and intention will not be the same for every individual smoker. The key moderating variable influencing the effect of self-efficacy on intention to quit might be the dependence of the smoker: Messer, Trinidad, Al-Delaimy, and Pierce (2008) found that highly dependent smokers had lower intentions to quit than did less dependent smokers. Thus, the higher the dependence of the smokers, the more they might use their self-efficacy as a risk-reducing strategy that could help them to continue smoking rather than to stop smoking. Dependence is therefore hypothesized to moderate the relation between self-efficacy and risk perception and the relation between self-efficacy and intention to stop smoking.

H4a: The relationship between self-efficacy and risk perception is moderated by dependence: The higher people's dependence, the more negative the relationship between self-efficacy and risk perception.

H4b: The relationship between self-efficacy and intention to stop smoking is moderated by dependence: The higher people's dependence, the less positive the relationship between self-efficacy and intention to stop smoking.

The conceptual model of all hypotheses is shown in Figure 1.

1. Methods

1.1. Participants and design

Study participants were recruited via email by Respondi, a German provider of international access panels, in the German-speaking part of Switzerland. After excluding nonsmokers and non-daily smokers, 406 daily smokers remained in the sample. Forty-four daily smokers were excluded because of extremely long or short survey completion times. The final sample comprised 362 daily smokers (41.4% women) with an age range of 18–75 years ($M = 44.38$, $SD = 13.14$). Of the final sample, 5.2% had completed obligatory school as their highest level of education, 57.5% had finished an apprenticeship or earned a college diploma, and 37.3% had completed higher education (university, college of higher education, polytechnic).

The sample was representative of daily smokers in terms of sex, age, and education (Swiss Federal Statistical Office, 2012).

The study used data from an online survey. Self-efficacy served as the independent variable. Risk perception and intention to stop smoking were the dependent variables. Dependence served as the moderating variable for the relationship between self-efficacy and risk perception and for the relationship between self-efficacy and intention to stop smoking.

1.2. Procedure

The online survey consisted of a questionnaire written in German. Participants were told that the goal of the study was to understand the thinking and behavior of smokers. At the beginning of the questionnaire, participants were asked about their smoking habits, such as their daily frequency of smoking. Participants also reported their sex, age, and education. Afterwards, they were asked about their self-efficacy. They were then asked about their intention regarding smoking cessation and their risk perception for smoking-related health risks. At the end of the questionnaire, participants were thanked and given the possibility to provide open comments.

1.3. Measures

All constructs were assessed via self-reports on five-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree) or from 1 (not likely at all) to 5 (very likely). An overall score was computed for each scale by calculating the average of all of the items in the scale.

1.3.1. Self-efficacy

Self-efficacy was measured using a translated version of a validated 10-item self-efficacy/situational temptation scale, constructed by Velicer, DiClemente, Rossi, and Prochaska (1990) and translated by Jäkke, Keller, Baum, and Basler (1999). The scale assesses confidence in not smoking in a variety of situations in which smokers are likely to smoke (e.g., “I’m confident about not smoking when I’m extremely stressed” and “I’m confident about not smoking when I’m with friends at a party”). As the 10-item scale yielded good reliability ($\alpha = .91$), no items were excluded.

1.3.2. Risk perception

Based on Weinstein et al. (2005), four items were constructed to assess risk perception regarding smoking-related health risks. The most damaging and the most frequent health consequences of smoking were combined in one scale. According to the Centers for Disease Control and Prevention (CDC, 2017), lung cancer and respiratory diseases are among the most damaging health risks of smoking. Likewise, skin aging is regarded as a frequent health consequence of smoking (Morita, 2007). In the present study, the participants were thus asked to respond to the following statements: “I am damaging my health if I continue to smoke as usual”, “My smoking behavior increases my risk of getting lung cancer”, “I increase my risk of skin aging if I continue to smoke as usual”, and “Smoking reduces my fitness level.” The reliability of the risk perception scale was good ($\alpha = .83$).

1.3.3. Intention to stop smoking

According to Armitage and Conner (2001), probability measures register intention in more detail than do simple questions such as “Do you intend to quit smoking?” Thus, based on a scale constructed by Pierce, Choi, Gilpin, Farkas, and Merritt (1996), three items were used to measure intention to quit smoking. These items asked respondents to gauge the probability of their being a nonsmoker within the next 12 months, after a year, and after five years (e.g., “Do you think you will be smoking 1 year from now?”). The scale yielded good reliability ($\alpha = .88$).

1.3.4. Dependence

Heavy smokers have been shown to be more dependent than light smokers (Killen, Fortmann, Telch, & Newman, 1988). Thus, the number of cigarettes smoked per day was used as a proxy for dependence.

1.4. Data analyses

For testing H1-H3 a mediation analysis was conducted using model 4 of the SPSS PROCESS Macro (version 3.00) (Hayes, 2013). Self-efficacy was the independent variable, risk perception was the mediator, and intention to stop smoking was the dependent variable.

To test H4, a moderated mediation model was calculated using SPSS PROCESS Macro model 8. The number of cigarettes smoked per day was the moderator in the relation between self-efficacy and risk perception and in the relation between self-efficacy and intention to stop smoking.

Unstandardized indirect effects were computed for each of 10,000 bootstrapped samples, and 95% confidence intervals (CIs) were computed by determining the indirect effects at the 2.5th and 97.5th percentiles. All variables were mean centered (Hayes, 2013).

2. Results

2.1. Preliminary analyses

Descriptive statistics revealed that participants had lower self-efficacy ($M = 2.69$, $SD = 0.97$) and intention to quit smoking ($M = 2.62$, $SD = 1.19$) than personal risk perception ($M = 3.63$, $SD = 0.88$). Bivariate correlations were calculated for all variables. Higher self-efficacy was associated with lower risk perception ($r = -.22$, $p < .01$), whereas risk perception was positively associated with intention to stop smoking ($r = .32$, $p < .01$). There was no significant association between self-efficacy and intention to stop smoking ($r = .05$, *ns*).

Smoking behavior was analyzed and bivariate correlations were calculated for the association between cigarettes per day and the variables used in the model. On average, smokers smoked 16.92 cigarettes per day ($SD = 9.24$). The range was 1–70 cigarettes per day. 11.1% of the participants smoked 1–5 cigarettes per day, 19.0% smoked 6–10 cigarettes per day, 50.3% smoked 11–20 cigarettes per day, 19.5% smoked 21–40 cigarettes per day, and 0.1% smoked more than 40 cigarettes per day. The more cigarettes smokers smoked per day, the lower their self-efficacy was for being able to stop smoking ($r = -.27$, $p < .01$). Accordingly, the more smokers smoked, the less they intended to quit ($r = -.12$, $p < .05$). However, the more cigarettes they smoked per day, the higher their personal risk perception ($r = .18$, $p < .01$). Thus, the higher the dependence of the smokers, the more they felt at risk, but at the same time, they experienced lower self-efficacy and intention to quit smoking. The association between the demographic variables and the variables used in the models were tested as well (see Table 1). T-tests for independent samples revealed that men smoked more cigarettes per day than women. However, sex had no significant effect on self-efficacy expectations, risk perception and intention to quit smoking. One-way ANOVAs showed that higher educated individuals (those, who earned a college diploma) smoked less cigarettes per day than those who had finished an apprenticeship and those who had completed obligatory school. However, education had no significant effect on self-efficacy, risk perception and intention to quit smoking. Bivariate correlations revealed that age was positively related to cigarettes per day. Thus, the older the smokers were, the more they smoked per day. However, age was not significantly associated with self-efficacy, risk perception and intention to quit smoking.

To summarize, men, older individuals and lower educated people tended to smoke more, which corresponds to the findings of the Swiss Federal Statistical Office (2012). However, demographic variables had no significant relation with self-efficacy, risk perception and intention to quit smoking.

2.2. Relation between self-efficacy and intention to stop smoking, mediated by risk perception

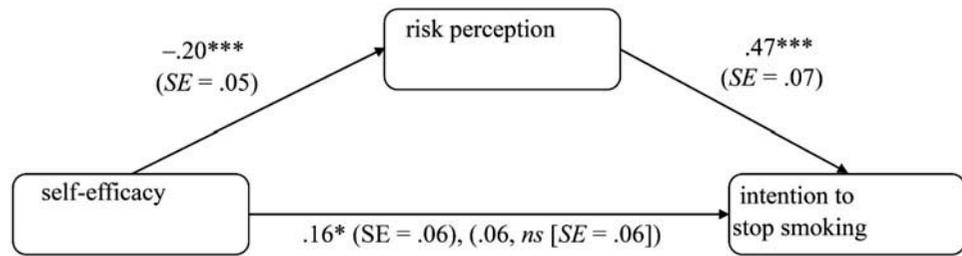
The results of the mediation analysis showed that self-efficacy was significantly negatively related to risk perception ($b = -.20$, $SE = .05$, $t = 4.31$, $p < .001$). Thus, Hypothesis 1 was supported. Risk perception had a significant positive relation to intention to stop smoking ($b = .47$, $SE = .07$, $t = 6.79$, $p < .001$), Hypothesis 2 was supported too. The direct effect was significant ($b = .16$, $SE = .06$, $p < .05$), as was the indirect effect ($b = -.09$; $SE = .03$; 95% CI: $-.17$ to $-.04$). The total effect was not significant ($b = .06$, $SE = .06$, $t = 0.95$, *ns*). These results indicate that the influence of self-efficacy on intention to stop smoking was mediated through risk perception. As assumed, the results suggest a negative indirect effect and a direct positive effect of self-efficacy on intention to stop smoking. Thus, H3 was confirmed (see Figure 2 and Table 2).

Table 1. T-Tests, one-way ANOVA and bivariate correlations for testing the effects of sex, education and age on cigarettes per day, self-efficacy, risk perception and intention to quit smoking

	Sex		t	Education			F	Age
	m (n = 212)	w (n = 150)		low (n = 19)	medium (n = 208)	high (n = 135)		
	M (SD)	M (SD)		M (SD)	M (SD)	M (SD)	r	
Cigarettes per day	17.80 (9.42)	15.68 (8.87)	2.12*	19.84 (10.05)	18.08 (8.82)	14.73 (9.38)	6.59**	.16**
Self-efficacy	2.76 (0.93)	2.58 (0.99)	-1.89, ns	2.64 (1.23)	2.65 (0.96)	2.74 (0.93)	0.40, ns	-.06, ns
Risk perception	3.58 (0.83)	3.70 (0.95)	-1.27, ns	3.85 (0.84)	3.64 (0.91)	3.58 (0.84)	0.83, ns	-.08, ns
Intention to quit	2.56 (1.14)	2.71 (1.25)	-1.19, ns	2.93 (1.09)	2.59 (1.17)	2.63 (1.23)	0.72, ns	-.09, ns

Note: N = 362; *p < .05; **p < .01; ns = not significant

Figure 2. Mediation model for testing Hypotheses 1–3. Coefficients are unstandardized; the total effect is in parentheses. (N = 362; *p < .05; *p < .001; ns = not significant)**

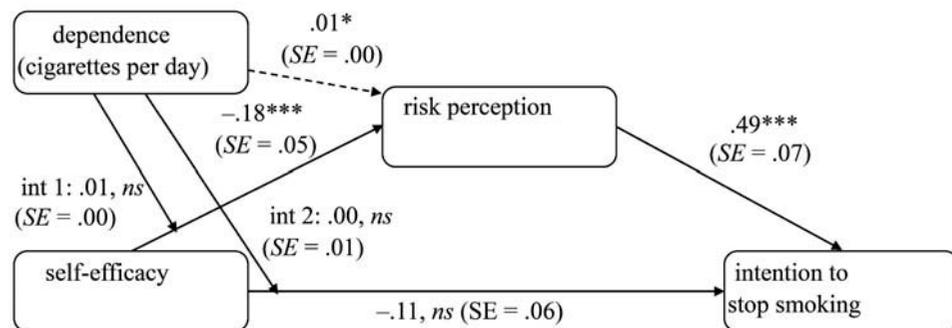


The mediation analysis was controlled for demographic variables. Sex, education and age were included as covariates in the model. Neither controlling for them separately, nor combined, changed significance levels of the associations in the model. Moreover, none of these demographic variables were significantly related to the mediator or the dependent variable.

2.3. Dependence as a moderator in the relation between self-efficacy and risk perception and in the relation between self-efficacy and intention to stop smoking

There was no significant interaction effect of self-efficacy and the number of cigarettes smoked per day on risk perception ($b = .01$; $SE = .00$, $t = 1.82$, *ns*) or on intention to stop smoking ($b = .00$; $SE = .01$, $t = .22$, *ns*). No significant index was found for moderated mediation ($b = .00$, $SE = .00$; $CI = -.00$ to $.01$). Thus, H4a and H4b were not confirmed (see Figure 3 and Table 2). However, the number of cigarettes smoked per day had a significant effect on risk perception ($b = .01$; $SE = .01$, $t = 2.43$, $p < .05$): The more cigarettes people smoked per day, the more they felt at risk (see Figure 3).

Figure 3. Moderated mediation model for testing Hypotheses 4a and 4b. Coefficients are unstandardized. (N = 362; *p < .05; *p < .001, ns = not significant)**



The moderated mediation analysis was controlled for demographic variables. Sex, education and age were included as covariates in the model. Neither controlling for them separately, nor combined, changed significance levels of the associations and the interaction terms in the model. Moreover, none of these demographic variables were significantly related to the mediator or the dependent variable. However, including sex, education and age as covariates led to an increased level of significance of the positive relation between cigarettes per day and risk perception.¹

In summary, the results indicate that self-efficacy is negatively related to risk perception, weakening the intention to quit, and is positively related to the intention to stop smoking, resulting in a non-significant total effect. According to Hayes (2013), a non-significant total effect, resulting from a positive direct effect and a negative indirect effect, is theoretically possible. Moreover, as there was no moderating effect of dependence, the results suggest that the above-described processes may be true independently of smokers' dependence; i.e., the number of cigarettes they smoked per day.

Table 2. Path coefficients from models estimated using SPSS

	H3 mediation model		H4 moderated mediation model		
	b (SE)	CI 95%	b (SE)	CI 95%	
a	self-efficacy → risk perception	-.2016*** (.0468)	[-.2936; -.1096]	-.1769*** (.0483)	[-.2936; -.1096]
b	risk perception → intention	.4673*** (.0688)	[.3320; .6026]	.4927*** (.0689)	[.3572; .6281]
c	self-efficacy → intention (total effect)	.0613, ns (.0648)	[-.0662; .1887]	.1051, ns (.0641)	[-.0208; .2331]
c'	self-efficacy → intention (direct effect)	.1554* (.0626)	[.0323; .2786]		
int 1	self-efficacy x cigarettes per day → risk perception			.0085, ns (.0046)	[-.0007; .0176]
int 2	self-efficacy x cigarettes per day → intention			.0014, ns (.0061)	[-.0106; .0133]
W→M	cigarettes per day → risk perception			.0122* (.0050)	[.0023; .0221]

Note: N = 362; *p < .05; **p < .01; ***p < .001; ns = not significant

3. Discussion

The aim of the present study was to uncover the mechanism behind the surprisingly weak relation between self-efficacy and intention to stop smoking reported in previous studies. Self-efficacy expectations about being able not to smoke did not relate to intentions to quit smoking. Thus, the present study confirmed previous research that found no relation between self-efficacy and intention to stop smoking (Rahman et al., 2018; Rise et al., 2008; Van Den Putte et al., 2011). In the present study, an underlying psychological mechanism for this lacking relationship was uncovered. It was found that the higher smokers' self-efficacy regarding not smoking in difficult situations, the less they felt at risk from the health-related risks of smoking, resulting in reduced intention to quit. Although causal relationships cannot be assumed (see the discussion of study limitations in Section 3.2.), based on the findings of previous research (e.g., Ajzen, 1991; Helweg-Larsen & Shepperd, 2001), the present results might be interpreted as follows: When smokers have high self-efficacy regarding quitting, they might think that they are able to stop smoking when they want. Thus, the higher their self-efficacy, the less vulnerable smokers might feel to the health-related risks of smoking. Because they feel less at risk, they do not feel pressure to stop smoking. Consequently, smokers feeling less at risk intend to stop smoking less than do smokers who feel at risk. Confirming these assumptions, previous research found that overestimating one's own capability may counteract the motivation to perform a behavior (Stone, 1994; Vancouver & Kendall, 2006; Vancouver, Thompson, Tischner, & Putka, 2002).

Conversely, the more smokers think that they would be unable to abstain from smoking even if they wanted to do so, the more they might be anxious about their risk, because they cannot control what happens to them, this influences positively their intention to quit smoking. However, in line with the theory of planned behavior (Ajzen, 1991), the findings also indicated a positive direct association between self-efficacy and intention to quit. This means that feeling able to abstain from smoking in difficult situations is a key factor for forming the intention to quit. Moreover, older individuals, men and lower educated people smoked more cigarettes per day; however, demographic variables did not change the associations between the variables in the model.

This is the first study to reveal the psychological processes behind the weak relation between self-efficacy and the intention to quit smoking, finding two contradicting self-efficacy effects: Self-efficacy is needed to form the intention to quit, but self-efficacy might also bolster people's underestimation of their own health-related risk, thus weakening the intention to quit. This second effect of self-efficacy is a new insight, because it reveals why previous research (e.g., Rise et al., 2008) did not find self-efficacy to predict intention to quit among current smokers. This second effect of self-efficacy might be a justification that smokers use to continue rather than to stop smoking.

This study, focusing on smoking cessation, is also the first to reveal a negative relation between two factors (i.e., self-efficacy and risk perception) that have previously been conceptualized to influence the intention to perform a specific behavior independently (e.g., the health belief model; Janz & Becker, 1984; the theory of planned behavior; Ajzen, 1991). Finally, this is the first study to find risk perception to be a mediator between self-efficacy and the intention to quit smoking.

3.1. Dependence as a possible moderator

The strength of the relations between self-efficacy and risk perception and between self-efficacy and intention was expected to vary with the amount of dependence, measured by the number of cigarettes smoked per day. However, there was no moderation effect of the number of cigarettes smoked per day on risk perception, or intention to stop smoking. These findings suggest that, independently of the level of dependence of smokers, the effects of self-efficacy might be contradictory for every individual smoker. However, the findings also showed that the more cigarettes smokers smoked per day, the more they felt at risk. This finding is in line with previous research results showing that, compared with light smokers, heavy smokers know that they are more at risk but underestimate the extent of their higher risk (Hahn & Renner, 1998). Thus, even though

smokers that are more dependent had higher risk perception, lower self-efficacy and lower quit intentions than less dependent smokers (see preliminary analyses), dependence did not change the associations between these variables in the model.

3.2. Strengths and limitations

Many previous studies have been conducted with people who already wanted to change their smoking behavior, investigating factors that contribute to successful smoking cessation (e.g., Boardman, Catley, Mayo, & Ahluwalia, 2005; Borrelli, Hayes, Dunsiger, & Fava, 2009; Hughes & Naud, 2016). A key strength of the present study was thus the representative sample of daily smokers, which allowed to consider not only the factors that contribute to successful quitting, but also the factors that might counteract successfully quitting addictive behaviors.

The present study had several limitations. Self-efficacy was considered an independent variable. Considering the findings of previous research (e.g., Ajzen, 1991; Klein & Helweg-Larsen, 2002; McCaul et al., 2006) and the results of the present study, it is likely that self-efficacy has an influence on risk perception and that risk perception, in turn, has an influence on the intention to stop smoking. However, because the study data came from a cross-sectional survey, causal relations cannot be inferred. Because of the correlational nature of the analysis, a reverse or mutual influence of the constructs cannot be excluded: One might argue that people who want to quit need to mobilize high self-efficacy to form the intention to stop smoking and to actually stop smoking. Previous studies have confirmed that self-efficacy regarding stopping smoking had positive effects on smoking cessation when people wanted to quit (e.g., Hukkelberg, Hagtvet, & Kovac, 2014; Warner et al., 2018; Yzer & Van Den Putte, 2014). It is likely that the negative effects of self-efficacy might be less present in a sample consisting entirely of smokers who want to quit. However, they were not analyzed in these previous studies.

The present study contributes to understanding why people often do not form the intention to quit smoking or form weak intentions to quit, but the present data did not allow the investigation of the possibly complicated mutual influences of self-efficacy, risk perception, and intention to quit smoking.

The findings of the present study did not show a moderating effect of dependence, which was assessed using the number of cigarettes smoked per day as a proxy measure. A previous study found that the subjective feeling of dependence was not necessarily related to objective dependence (Heather, Rollnick, & Winton, 1983). However, the subjective feeling of dependence might still have a moderating effect on the association of self-efficacy with risk perception or with the intention to quit.

It might be argued that the results of the present study depend on the specific measure of self-efficacy used. The measure of self-efficacy in this study referred to confidence about not smoking in specific difficult situations (Velicer et al., 1990). Smokers may be convinced that they can abstain from smoking in certain situations but not be convinced that they can quit smoking. However, many studies have investigated the association of self-efficacy with not smoking and quitting using Velicer et al.'s (1990) self-efficacy scale (e.g., Blevins, Farris, Brown, Strong, & Abrantes, 2016; Brown et al., 2003). In a meta-analytic study, Gwaltney et al. (2009) confirmed that self-efficacy scales measuring context-specific self-efficacy judgments, such as the one developed by Velicer et al. (1990), which was used in the present study, were valid instruments for measuring self-efficacy regarding smoking cessation.

The temporal development of the behavioral processes and the actual smoking cessation behavior were not investigated. Nonetheless, intention strongly influences behavior (Godin & Kok, 1996). It is thus reasonable to assume that the processes found for the relation between self-efficacy and intention to quit also hold for self-efficacy and smoking cessation and that these

findings explain why self-efficacy among current smokers did not predict smoking cessation in previous research (e.g., Gwaltney et al., 2009).

3.3. Implications for future research

Because the present study data are from a cross-sectional survey, future studies should verify the association between self-efficacy and risk perception by examining the direction of the causal relationship—for example, by conducting experiments and manipulating self-efficacy expectations. However, in previous studies, manipulations to increase smokers' self-efficacy were not very successful. For instance, after Gwaltney et al. (2009) found no relationship between self-efficacy and smoking cessation, Shadel, Martino, Setodji, Cervone, and Witkiewitz (2017) wanted to provide experimental evidence for this relationship. Self-efficacy expectations were manipulated by providing bogus feedback about smokers' chances of quitting: Smokers were told that they had the same chances of quitting as everyone else in the study or that they had a greater chance of quitting compared with anyone else in the study. However, in this previous study, the experimental condition was not significantly related to changes in self-efficacy, and self-efficacy was not significantly related to quitting success (Shadel et al., 2017). These results provide no experimental confirmation, but the results confirm the present study's findings.

Longitudinal studies are another possibility for gaining a clearer understanding of these processes. Measuring smokers' self-efficacy and then investigating their behavior change, as well as possible changes in their self-efficacy and risk perception, might help to understand the possible mutual influences of all of these factors and the temporal development of the processes. Future longitudinal studies should also investigate whether the processes found in this study hold not only for the intention to quit but also for smoking cessation.

The results of the present study might be valid not only regarding smoking behavior, but also for other addictive behavior, such as alcohol or drug use. Thus, future studies might investigate whether the psychological processes found in this study also hold for other addictive behaviors.

The present study did not find any moderating effects of dependence. However, future work might find different results for the moderating effect of dependence by including the subjective feeling of dependence or a measure of dependence other than cigarettes smoked per day, such as the Fagerström test of nicotine dependence (Fagerström, 1978).

Future studies might investigate the effects of further possible moderators. For instance, smokers who have already become ill from smoking are more realistic about their health-related risk than are smokers who have not become ill (McCoy et al., 1992). It can therefore be assumed that medically ill smokers are less optimistically biased regarding their health risks. It is thus likely that, if they manage to increase their self-efficacy regarding stopping smoking, they will try to stop smoking. Thus, the relationship between self-efficacy and intention to quit might be more positive for medically ill smokers. Moreover, models of health-related behavior, such as the health belief model (Janz & Becker, 1984) or the health action process approach (Schwarzer, 2008), consider outcome expectancies as a further important component of behavior change. Gwaltney, Shiffman, Balabanis, and Paty (2005) emphasized that outcome expectancies are only predictive of smoking cessation when self-efficacy is high. Thus, if smokers think that quitting smoking would reduce their probability of contracting smoking-related illnesses (Janz & Becker, 1984) and/or that quitting would have other favorable outcomes, such as improved senses of smell and taste (Velicer, DiClemente, Prochaska, & Brandenburg, 1985), the relationship between self-efficacy and intention to quit might be more positive. Furthermore, previous attempts to quit and the subjective interpretation of relapse (e.g., Gwaltney et al., 2005; Staring & Breteler, 2004) might determine both the amount of self-efficacy and its subsequent effects (French, 2013).

Thus, future studies should investigate the model proposed in this study, including other measures of dependence, medical illness, outcome expectancies, and quit attempts as possible moderators for the relationship between self-efficacy and risk perception and for the relationship between self-efficacy and intention to quit.

3.4. Implications for practical interventions

In terms of practical implications, it is useful to consider how the undesirable effects of self-efficacy on intention to quit—found in the present study—might be reduced. Prior research recommends the combination of personalized fear appeals and detailed self-efficacy information because people need information on how to prevent risky behavior (Ruiter, Kessels, Peters, & Kok, 2014; Witte, 1992). The results of the present study suggest that the effectiveness of the aforementioned combination could also be seen from another perspective. The present study implies that self-efficacy appeals alone in tobacco prevention campaigns, as well as in other practical interventions, might contribute to reduced risk perceptions of personal smoking-related health risk and thus might have an effect contrary to the intended one. Fear appeals may counteract this process by increasing smokers' risk perceptions regarding their personal health risks, so the attenuating effect of self-efficacy on risk perception might be reduced when health risks are made salient alongside interventions designed to build self-efficacy. Thus, adding information about the risks of the behavior (i.e., fear appeals) when self-efficacy-enhancing information is given, is recommended.

The results of the present study suggest that information or appeals about self-efficacy and health risks not only have to be combined, but also balanced carefully, respecting the baseline risk perception and self-efficacy of the recipient to prevent possible negative effects of self-efficacy on risk perception and on the intention to quit smoking.

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The authors declare no competing interest

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Note

1. When sex, education and age were included as covariates, the influence of cigarettes per day on risk perception was $b = 0.145$, $SE = .0052$, $p < .01$.

Correction

This article has been republished with minor changes. These changes do not impact the academic content of the article.

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