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Depressive symptoms' association with smoking-related cognitions and their influence on smoking cessation behaviour

ES Smit*, H de Vries, L de Munter, C Hoving

Abstract

Introduction

Smokers with a past or current depression are less likely to quit smoking successfully than smokers without depression. However not many studies have investigated the reasons for this inequality. Therefore, the present study investigated the association of depressive symptoms with smoking-related cognitions and their influence on actual smoking cessation behaviour among Dutch adult smokers.

Materials and methods

Smokers ($N = 571$) in the control group of a randomised controlled trial investigating the effectiveness of a web-based smoking cessation intervention were included. Linear regression analyses were conducted to identify associations between depressive symptoms and the smoking-related cognitions attitude, social influence, self-efficacy and intention to quit. Logistic regression analyses were conducted to determine the influence of depressive symptoms on smoking abstinence measured two days after a set quit date and at six-week follow-up.

Results

The number of depressive symptoms was positively associated with the perceived pros ($\beta = .10$; $p < .05$) and cons ($\beta = .33$; $p < .001$) of non-smoking and perceived social modelling

($\beta = .09$; $p < .05$). A negative association was identified with perceived social support ($\beta = -.18$; $p < .01$) and level of self-efficacy ($\beta = -.22$; $p < .001$). No association was found between perceived social norm, intention to quit and smoking cessation behaviour. However, the level of self-efficacy predicted smoking abstinence at the first (OR = 1.14; $p < .001$) and second (OR = 1.12–1.22; $p < .001$) follow-up.

Conclusion

While the influence of depressive symptoms on smoking abstinence could not be replicated, significant associations between depressive symptoms and several smoking-related cognitions were identified. Most importantly, a strong negative association was found with smokers' self-efficacy to quit. As self-efficacy was the most important predictor of smoking abstinence, it might be important to investigate whether smokers with low levels of self-efficacy suffer from depressive symptoms and to treat these symptoms, if required, to increase the chances of a successful quit attempt.

Introduction

Tobacco smoking is the most preventable cause of illness and premature death worldwide^{1,2}. It is an important risk factor for a large number of physical illnesses, such as cancer, cardiovascular diseases and respiratory diseases² and has consistently been associated with psychological illnesses, such as depression^{3,4}. In the Netherlands, 18.5% of all daily smokers suffers from psychological complaints; this percentage is only 12% amongst non-smokers⁵. The

association between smoking and depression is likely to be bidirectional³: depression has been found to be a risk factor for smoking initiation, but smoking has also been found to be a risk factor for the onset of depression. With regard to smoking cessation, studies have shown that smokers with a past or current depression are often less successful in their attempt to quit smoking than smokers with no such history^{3,4}. While several studies have thus far aimed at mapping the association between depressive symptoms and smoking cessation behaviour, few studies have investigated whether this association might be linked to smoking-related cognitions. While one study found higher levels of depressive symptoms to be associated with higher motivation and with less self-efficacy to quit among Finnish smokers⁶, another study had suggested a negative association between depressive symptoms and peer social support⁷. So far, however, no studies have investigated the independent association between depressive symptoms and the smoking-related cognitions that have been consistently found to be predictive of smoking cessation behaviour, i.e. intention, attitude, self-efficacy and perceived social influence^{8–10}.

The present study aimed at providing insight into the independent associations between depressive symptoms and smoking-related cognitions and determining the influence of depressive symptoms on actual smoking cessation behaviour among a sample of Dutch adult smokers. To this end, the Integrated Change (I-Change) Model was used as a theoretical framework¹¹. The I-Change

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Model (Figure 1) is a theory of behavioural change, which incorporates theoretical concepts from several socio-cognitive models, e.g. the Transtheoretical Model (TTM)¹², the Theory of Planned Behaviour (TPB)¹³, Social Cognitive Theory (SCT)¹⁴ and the Health Belief Model (HBM)¹⁵. According to the I-Change Model, the most proximal predictor of behaviour is the intention to perform this behaviour, which can in turn be predicted by three motivational constructs: attitude, perceived social influence and self-efficacy. The concept of attitude entails both the perceived advantages (pros) and disadvantages (cons) of a specific behaviour. Perceived social influence refers to three related but distinct constructs: perceived social norms, social modelling and social pressure. Perceived social norms refer to the perceived opinions held by others in the person's social environment, such as a partner, family and friends. Social modelling refers to perceived behaviour of other people, while social pressure refers to perceived pressure or support from people in the social environment to perform the behaviour. Self-efficacy refers to a person's level of confidence that he can perform the target behaviour. It is hypothesised that the following factors have

a positive influence on the intention to quit smoking: a positive attitude towards smoking cessation, a high self-efficacy to quit, as well as a social environment, which is perceived as positive for smoking cessation. These hypotheses have found support in earlier studies^{9,10,16–18}. In turn, the motivational factors attitude, perceived social influence and self-efficacy are predicted by several pre-motivational factors, including different predisposing factors. These predisposing factors consist not only of behavioural, biological and socio-cultural factors, but also of psychological factors, such as the presence of depression or depressive symptoms. The I-Change Model proposes that the pre-motivational factors influence a person's behaviour by influencing attitudes, social influence perceptions and self-efficacy expectations. As the predisposing factors are considered external factors, however, these factors are additionally assumed to have a direct influence on the behaviour.

Based on this theoretical framework, several hypotheses were formulated on the associations between depressive symptoms and smoking-related cognitions. A negative association was expected between depressive symptoms and 1) smokers' attitude towards non-smoking (i.e.

associated with less perceived pros and more perceived cons of quitting); 2) smokers' self-efficacy to quit; 3) smokers' perceived social influence towards quitting (i.e. associated with less perceived non-smoking social norms, social support and social modelling) and 4) and smokers' intention to quit, though this association might be indirect and mediated by attitude, self-efficacy and social influence beliefs. Further, it was expected that depressive symptoms would have a negative influence on smoking abstinence rates measured after a brief follow-up period, independent of intention and smoking-related cognitions.

Materials and methods

This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to the institution in which it was performed. All subjects gave full informed consent to participate in this study.

Participants

Smokers were recruited to take part in a randomised controlled trial (RCT) investigating the effectiveness of a web-based computer-tailored smoking cessation programme among Dutch smoking adults. This study was approved by the Medical Ethics Committee of Maastricht University and the University Hospital Maastricht (MEC 08-3-037; NL22692.068.08) and is registered with the Dutch Trial Register (NTR1351).

Adult smokers were recruited from December 2009 to June 2010 by advertising this study in the mass media and on the Internet. Interested smokers were asked to sign up for the study on the study website (<http://www.persoonlijkstopadvies.nl>) and were eligible to participate when they were 18 years or older, motivated to quit smoking within six months and had access to the Internet. After providing online informed consent, participants were randomised into

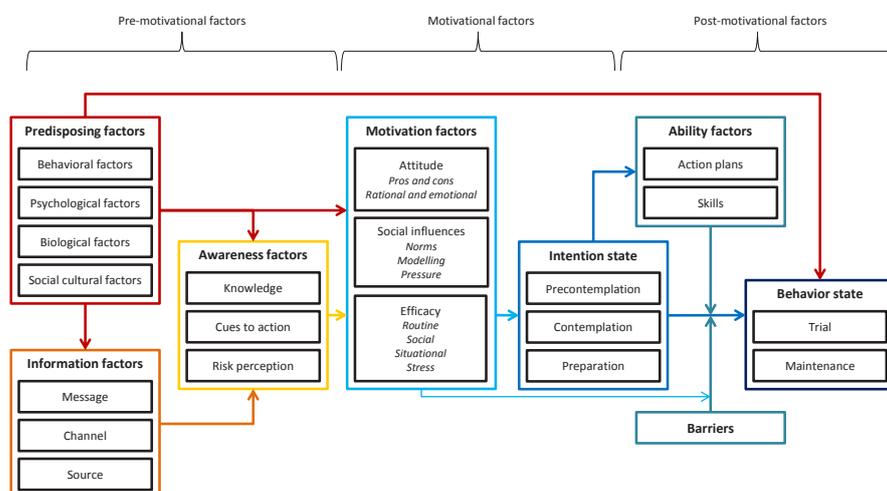


Figure 1: The I-Change model¹¹.

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the intervention group or the control group using a computer software randomisation device, allocating approximately 50% of all respondents to either group. Full details on the RCT can be found elsewhere¹⁹.

Measurements

All respondents were asked to complete a baseline questionnaire and two follow-up questionnaires: two days after the quit date they set for themselves while filling out the baseline questionnaire and six weeks after baseline. All questionnaires used in the present study were previously used and tested among Dutch smoking adults^{20–22}.

Baseline measurement

Whether respondents suffered from depressive symptoms was assessed using ten items from the validated Centre for Epidemiologic Studies–Depression scale (CES-D)²³. These ten items were measured on a four-point Likert scale, based on which a sum score for depressive symptoms was calculated (0 = no depressive symptoms; 30 = many depressive symptoms).

Four demographic variables were measured: age, gender (1 = male; 2 = female), ethnicity (1 = Dutch; 2 = non-Dutch) and educational level (1 = 'low': primary school/basic vocational school; 2 = 'medium': secondary vocational school/high school degree; 3 = 'high': higher vocational school/college degree/university degree).

Behavioural variables assessed were addiction level and the number of previous quit attempts. Addiction level was measured by the abbreviated Fagerström Test for Nicotine Dependence (FTND) (0 = not addicted; 10 = highly addicted)²⁴. The number of previous quit attempts was assessed with one item, asking the respondents how often they had tried to quit smoking in the past.

Attitude towards quitting was assessed by measuring the advantages (pros) and disadvantages (cons) of quitting. The pros of quitting were

measured by six items (Cronbach's $\alpha = .71$), with which a respondent could agree or disagree, measured on a five-point Likert scale (e.g. When I do not smoke, my condition will improve; 1 = no, does not improve; 2 = do not know; 3 = yes, will improve a bit; 4 = yes, will improve; 5 = yes, will improve a lot). The cons of quitting were also assessed by six items (Cronbach's $\alpha = .69$), with which a respondent could agree or disagree, measured on a five-point Likert scale (e.g. When I do not smoke, I will be less able to relax; 1 = no, I will not be less able to relax; 2 = do not know; 3 = yes, I will be a little less able to relax; 4 = yes, I will be less able to relax; 5 = yes, I will be a lot less able to relax).

Social influence of the respondent's partner, children and friends was measured by nine items: three items assessed social norms (e.g. My partner believes; 1 = that I should smoke; 2 = probably that I should smoke; 3 = neutral/I don't know; 4 = probably that I should not smoke; 5 = that I should not smoke), three items measured social support (e.g. My children support me not to smoke; 1 = no, my children do not support me; 2 = I don't know; 3 = my children support me a little; 4 = my children support me; 5 = my children support me a lot) and three items measured social modelling (e.g. How many of your friends smoke?; 1 = all; 2 = the majority; 3 = I don't know; 4 = the minority; 5 = none). As no reliable scale could be formed measuring these three social influence constructs, social norms, social modelling and social support were each included in the regression model separately as indices. These indices represented each type of social influence and ranged from 1 (smoking social norm; smoking social modelling; no social support to quit smoking) to 5 (non-smoking social norm; non-smoking social modelling; social support to quit smoking).

Self-efficacy was measured by nine items (Cronbach's $\alpha = .88$) measured

on a five-point Likert scale (e.g. Do you think you will manage not to smoke when taking a break? 1 = surely not; 2 = probably not; 3 = maybe yes, maybe no; 4 = probably yes; 5 = surely yes).

Intention to quit smoking was measured by one item asking the respondent whether or not he or she intended to quit smoking, on a seven-point Likert scale (1 = very surely not; 7 = very surely yes).

Follow-up measurement

Two days after their set quit date and at six-week follow-up, 24-hour point prevalence abstinence was assessed by asking whether the respondent had refrained from smoking during the last 24 hours (1 = no; 2 = yes). At six-week follow-up seven day and two-week point prevalence abstinence (1 = no; 2 = yes) were additionally assessed.

Statistical analysis

All analyses were conducted with SPSS version 19.0 and with respondents randomised to the control group only ($N = 571$).

First, descriptive analyses were conducted to determine the sample's characteristics.

Second, it was investigated whether the demographic and behavioural variables assessed were associated with the number of depressive symptoms. To this end, Pearson's correlation coefficients were calculated for pairs of continuous variables and for pairs of a dichotomous and a continuous variable²⁵. Spearman's correlations were calculated for pairs of an ordinal and a continuous/dichotomous variable²⁵. Additionally, to detect cases of multicollinearity correlations were explored between predictor variables included in the regression analyses.

Third, linear regression analyses (Enter method) were conducted to identify the independent association between depressive symptoms and smoking-related cognitions. With the dependent variables attitude, social

influence and self-efficacy, one model was tested consisting of the CES-D score and the factors that appeared to correlate significantly with CES-D score, i.e. gender, educational level and addiction level. With the dependent variable intention to quit, two models were tested: 1) a model consisting of the CES-D score, gender, educational level and addiction level and 2) a model consisting of the CES-D score, gender, educational level, addiction level, attitude, social influence and self-efficacy.

Fourth, logistic regression analyses (Enter model) were conducted to determine the association of the depressive symptoms with smoking cessation behaviour. For each dependent variable (i.e. 24-hour point prevalence abstinence at both follow-ups and seven-day and two-week point prevalence abstinence at six-week follow-up), three models were tested: 1) a model consisting of the CES-D score, gender, educational level and addiction level; 2) a model consisting of the CES-D score, gender, educational level and addiction level, attitude, social influence and self-efficacy and 3) a model consisting of the CES-D score, gender, educational level and addiction level, attitude, social influence, self-efficacy and intention to quit.

In all analyses, the significance level used was $p < .05$.

Results

Sample characteristics

The 571 respondents included had an average age of 48 years, while approximately half of them were female, almost half had a medium level of education and most (98%) were of Dutch ethnicity. See Table 1 for all sample characteristics.

Correlations between depressive symptoms, demographic and behavioural variables

The correlation matrix in Table 2 presents the correlations between CES-D score, demographic and behavioural variables. While the level of education was negatively associated with

Table 1 Baseline characteristics of the sample ($N = 571$)

Age (mean; SD)	48.4; 12.2
Gender	
Male (%; n)	49.4; 282
Female (%; n)	50.6; 289
Educational level	
Low (%; n)	22.8; 130
Medium (%; n)	47.5; 271
High (%; n)	29.8; 170
Ethnicity	
Dutch (%; n)	97.5; 557
Non-Dutch (%; n)	2.5; 14
Addiction level (mean; SD)	5.2; 2.4
Number of previous quit attempts (mean; SD)	5.7; 22.4

Table 2 Correlations between depressive symptoms, demographic and behavioural variables

	Age	Gender	Educational level	Ethnicity	Addiction level	Number of previous quit attempts	CES-D score
Age	1.00	-.13**	-.03	-.12**	.11**	.03	.07
Gender		1.00	-.02	.09*	-.07	-.00	.21**
Educational level			1.00	-.02	-.20**	.07	-.14**
Ethnicity				1.00	.03	-.11*	.11*
Addiction level					1.00	-.04	.17**
Number of previous quit attempts						1.00	.01
CES-D score							1.00

* $p < .05$; ** $p < .01$

depressive symptoms, female gender, non-Dutch ethnicity and addiction level were positively associated with CES-D score. Further, no signs of multicollinearity between predictor variables could be detected.

Depressive symptoms and smoking-related cognitions

Table 3 presents the results from linear regression analyses. The CES-D score

of respondents was positively associated with the perceived pros of non-smoking, the cons of non-smoking and the perceived level of social modelling. A negative association was identified between CES-D score and perceived social support and respondents' level of self-efficacy. No association was found between respondents' CES-D score and the perceived social norm and the intention to quit smoking.

Table 3 Independent associations between depressive symptoms and smoking-related cognitions in standardised β 's (β)

		Dependent variables						
		Pros	Cons	Self-efficacy	Social norm	Social support	Social modeling	Intention
Independent variables	CES-D score	.10*	.33***	-.22***	-.06	-.18**	.09*	-.08
	Gender ^a	.13**	.12**	-.06	-.04	-.03	.08	-.03
	Medium education ^b	-.05	-.09	.13*	-.04	-.08	-.09	-.06
	High education ^b	.04	-.05	.14*	.13*	-.02	-.22***	.02
	Addiction level	.01	.22***	-.23***	.05	.01	-.07	-.02
	CES-D score	-	-	-	-	-	-	.00
	Gender ^a	-	-	-	-	-	-	-.03
	Medium education ^b	-	-	-	-	-	-	-.07
	High education ^b	-	-	-	-	-	-	.01
	Addiction level	-	-	-	-	-	-	.04
	Pros	-	-	-	-	-	-	.15***
	Cons	-	-	-	-	-	-	-.07
	Self-efficacy	-	-	-	-	-	-	.24***
	Social norm	-	-	-	-	-	-	.01
	Social support	-	-	-	-	-	-	.15**
Social modelling	-	-	-	-	-	-	.11*	

^aMale gender is the reference category; ^bA low educational level is the reference category

* $p < .05$; ** $p < .01$; *** $p < .001$

Depressive symptoms and smoking cessation behaviour

No significant influence of depressive symptoms on smoking cessation behaviour was detected; neither two days after the quit date respondents set for themselves at baseline, nor after six weeks of follow-up. Self-efficacy consistently predicted smoking cessation behaviour: the higher respondents' self-efficacy level, the more likely were they able to report smoking abstinence. Further, the level of addiction negatively predicted 24-hour point prevalence abstinence measured two days after a respondent's set quit date, while respondents with a medium level of education were significantly less likely to report seven-day and two-week point prevalence abstinence at six-week follow-up than respondents with a low level of education. See Table 4 for further details.

Discussion

Main findings

The first hypothesis, that higher levels of depressive symptoms were associated with less perceived pros and more perceived cons of quitting, could partly be supported. Smokers with relatively more depressive symptoms indeed reported more perceived disadvantages of smoking cessation. However, with regard to the advantages of smoking cessation, the expected negative association with the level of depressive symptoms was not found; and it was found that higher levels of depressive symptoms were associated with more perceived pros of quitting. A potential explanation for this finding could be that the questionnaire used was based on previously developed questionnaires and potentially needs adjustment to current public

norms on smoking. That is, since several countries, such as Great Britain, Ireland and the Netherlands, have adopted a national smoking ban in public places, public norms are shifting towards non-smoking²⁶. Consequently, it is possible that other advantages of quitting are currently more relevant for smokers than those that were described in the questionnaire of this study. Besides conducting studies that aim at replicating the findings of this study with regard to the association between depressive symptoms and attitude towards quitting, the authors recommend to identify the potentially new salient outcome expectancies of smoking cessation.

The second hypothesis, that depressive symptoms were negatively associated with a smoker's self-efficacy to quit, was supported by

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Table 4 Depressive symptoms' influence on smoking cessation behaviour measures 2 days after a set quit date and at six-week follow-up

		Dependent variables							
		2 days after quit date (n=308)		Six-week follow-up (n=219)					
		24-hour ppa ^a		24-hour ppa ^a		7-day ppa ^a		2-week ppa ^a	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Independent variables	CES-D score	.98	.94–1.03	.98	.92–1.04	.97	.90–1.04	.97	.90–1.05
	Gender ^b	.95	.56–1.59	.84	.44–1.60	1.06	.51–2.21	.97	.45–2.13
	Medium education ^c	.82	.43–1.58	.48	.21–1.09	.36*	.14–.89	.28*	.11–.75
	High education ^c	1.16	.55–2.43	.81	.33–1.95	.62	.24–1.64	.57	.21–1.57
	Addiction level	.86**	.77–.96	.87	.76–1.00	.94	.80–1.09	.88	.75–1.04
	CES-D score	1.00	.95–1.06	1.01	.94–.08	1.03	.94–1.12	1.03	.94–1.13
	Gender ^b	.83	.47–1.47	.73	.35–1.52	1.13	.47–2.69	.86	.34–2.20
	Medium education ^c	.69	.33–1.40	.49	.19–1.22	.29*	.10–.85	.24*	.07–.76
	High education ^c	.94	.41–2.16	.80	.29–2.18	.46	.14–1.48	.43	.12–1.51
	Addiction level	.86*	.76–.98	.88	.75–1.03	.98	.81–1.18	.88	.72–1.08
	Pros	1.04	.97–1.11	.97	.89–1.05	.98	.89–1.08	1.03	.93–1.14
	Cons	1.05	.98–1.13	1.06	.97–1.16	1.04	.94–1.15	1.08	.97–1.21
	Self-efficacy	1.15***	1.09–1.21	1.14***	1.07–1.22	1.23***	1.13–1.34	1.23***	1.13–1.35
	Social norm	.98	.84–1.13	.86	.73–1.02	.88	.72–1.08	.83	.68–1.03
	Social support	.97	.86–1.09	1.17	1.00–1.36	1.18	.98–1.43	1.17	.95–1.43
	Social modeling	1.13	1.00–1.27	1.09	.94–1.27	.98	.82–1.17	1.01	.84–1.22
	CES-D score	1.00	.94–1.06	1.01	.94–1.09	1.03	.94–1.12	1.03	.94–1.13
	Gender ^b	.85	.47–1.51	.72	.34–1.50	1.12	.47–2.68	.86	.34–2.19
	Medium education ^c	.72	.35–1.49	.45	.18–1.15	.29*	.10–.87	.26*	.08–.84
	High education ^c	.99	.43–2.27	.76	.27–2.10	.46	.14–1.48	.44	.12–1.55
	Addiction level	.86*	.76–.97	.88	.75–1.03	.98	.81–1.18	.88	.71–1.08
	Pros	1.03	.96–1.10	.98	.90–1.06	.98	.89–1.08	1.02	.91–1.13
	Cons	1.06	.99–1.14	1.06	.97–1.15	1.04	.94–1.15	1.09	.97–1.22
	Self-efficacy	1.14***	1.08–1.20	1.15***	1.08–1.24	1.22***	1.12–1.34	1.22***	1.11–1.34
	Social norm	.97	.84–1.12	.87	.73–1.03	.88	.72–1.08	.83	.67–1.03
	Social support	.95	.84–1.08	1.18*	1.01–1.39	1.18	.98–1.43	1.15	.93–1.41
	Social modelling	1.12	.99–1.26	1.11	.95–1.3	.98	.82–1.17	.99	.82–1.21
	Intention	1.39	.96–2.02	.78	.50–1.23	1.04	.60–1.80	1.39	.74–2.61

^appa, point prevalence abstinence; ^bMale gender is the reference category; ^cLow education is the reference category

*p < .05; **p < .01; ***p < .001

the results from this study. Indeed, a negative relationship was found between the number of depressive symptoms and self-efficacy to quit smoking. This is in line with findings from an earlier study showing higher

depression scores to be associated with lower smoking cessation self-efficacy⁶ and also supports the earlier identification of a negative relationship between depressive symptoms and self-efficacy in general²⁷.

The third hypothesis that depressive symptoms were negatively associated with a person's perceived social influence towards quitting, could only partly be supported: a negative association was found between

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the number of depressive symptoms and the level of perceived support. Yet, no significant association was found with the perceived social norm and a positive association was found with social modelling. In earlier research, social support has been identified as an important moderator of the relationship between depression and smoking cessation; recently depressed women who had higher levels of perceived social support were as likely to quit as women who did not have a recent history of depression²⁸. Especially for smokers reporting depressive symptoms, smoking cessation interventions should hence aim at increasing social support levels, e.g. by making use of a buddy system²⁹. As no earlier research could be identified that could confirm or subside the findings of this study with regard to perceived social norms and social modelling, more research is required to replicate these findings before any definite conclusions are drawn on these associations.

The fourth and fifth hypotheses could both not be confirmed based on the results from the study; depressive symptoms were neither significantly associated with the intention to quit nor of significant influence on smoking abstinence rates measured at the two follow-ups. One explanation for this finding might be the use of the CES-D questionnaire, as this measurement instrument is intended to be used as a depression screening tool in the general population²³. As such, it can be used to detect groups at risk for depression, but not to diagnose a clinical depression within individuals. While the relationship of smoking cessation behaviour with (a history of) clinical depression has been well-established^{3,4}, its relationship with depressive symptoms has been less well-researched and can be expected to be weaker. Another explanation for this finding might be that smokers were free to use any smoking cessation aids during the study period. Especially if smokers had decided to use

the original anti-depressant bupropion as a smoking cessation drug, it might have both decreased their number of depressive symptoms as well as increased their likelihood of becoming abstinent from smoking³⁰. As bupropion is the most frequently used smoking cessation drug in the Netherlands³¹, it is not unlikely that this drug was indeed used by respondents in the sample of this study, potentially having biased the results presented. However, as no assessment was done on whether the smokers participating in this study did in fact use such medication during their quit attempt, future research might want to investigate this further. Nonetheless, self-efficacy was consistently found to be predictive of smoking cessation behaviour, which is in line with findings from earlier research^{9,32}. Even though depressive symptoms might thus not be of direct influence on smoking cessation behaviour, the results presented suggest that it might be important to investigate whether smokers with low levels of self-efficacy suffer from depressive symptoms and vice versa. Based on the results from this study, it could be argued that these smokers might benefit from reducing their depressive symptoms before or simultaneously with their participation in a smoking cessation programme as a reduction in depressive symptoms might be associated with an increase in self-efficacy levels. In line with this idea, it has recently been suggested that healthcare providers should consider encouraging their smoking patients with depression to simultaneously seek smoking cessation help and obtain behavioural mood management³³.

Limitations

The present study had some limitations. First, the study was partly of cross-sectional nature. That is, depressive symptoms and smoking-related cognitions were assessed at the same measurement point. Consequently, no conclusions could be

drawn on the causality of the associations found. The results presented could, however, be valuable in guiding future longitudinal studies aimed to identify whether causal relationships exist between the number of depressive symptoms and smoking-related cognitions.

Second, self-reported measures of smoking abstinence were used as outcome measures, while it has previously been suggested that biochemical validation is warranted to test whether self-reported behaviour is accurate³⁴. However, previous studies have shown that self-reported smoking status is often a fairly accurate measure of actual smoking status^{34,35} and it is therefore not expected that the use of biochemically validated outcome measures would have led to significantly different results.

Third, Dutch adult smokers were recruited to take part in an RCT investigating the effectiveness of a web-based smoking cessation programme. It is conceivable that smokers suffering from many depressive symptoms were not keen to participate, which is reflected in most respondents not reporting many depressive symptoms (mean score of 8.4; standard deviation 5.7). While this might be a good representation of the smoking population in general, the current sample might be less representative of smokers with depressive symptoms, and future research might therefore aim at replicating the findings presented within a sample of smokers reporting the full range (0–30) of depressive symptoms.

Conclusion

To the knowledge of the authors, this study was the first to investigate the association of depressive symptoms with smoking-related cognitions and their influence on actual smoking cessation behaviour. While this study could not replicate the association between the number of depressive symptoms and smoking cessation behaviour, it did identify significant

associations between depressive symptoms and several smoking-related cognitions. Most importantly, a strong negative association was found between the number of depressive symptoms and smokers' level of self-efficacy to quit smoking. As self-efficacy appeared to be the most important predictor of smoking abstinence, it might be important to investigate whether smokers with low levels of self-efficacy suffer from depressive symptoms and to treat these symptoms, if required, to increase the chances of a successful quit attempt.

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Competing interests

Hein de Vries is scientific director of Vision2Health, a company that licenses evidence-based innovative computer-tailored health communication tools.

Abbreviations list

CES-D, Centre for Epidemiologic Studies–Depression scale; FTND, Fagerström Test for Nicotine Dependence; HBM, Health Belief Model; RCT, randomised controlled trial; SCT, Social Cognitive Theory; TPB, Theory of Planned Behaviour; TTM, Transtheoretical Model.

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