



UvA-DARE (Digital Academic Repository)

Predictors of successful and unsuccessful quit attempts among smokers motivated to quit

Smit, E.S.; Hoving, C.; Schelleman-Offermans, K.; West, R.; de Vries, H.

Published in:
Addictive Behaviors

DOI:
[10.1016/j.addbeh.2014.04.017](https://doi.org/10.1016/j.addbeh.2014.04.017)

[Link to publication](#)

Citation for published version (APA):

Smit, E. S., Hoving, C., Schelleman-Offermans, K., West, R., & de Vries, H. (2014). Predictors of successful and unsuccessful quit attempts among smokers motivated to quit. *Addictive Behaviors*, 39(9), 1318-1324. <https://doi.org/10.1016/j.addbeh.2014.04.017>

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <http://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

Published as:

Smit, E.S., Hoving, C., Schelleman-Offermans, K., West, R., de Vries H. (2014)
Predictors of successful and unsuccessful quit attempts among smokers motivated to quit,
Addictive Behaviors, 39(9), 1318-1324. DOI: 10.1016/j.addbeh.2014.04.017

Predictors of successful and unsuccessful quit attempts among smokers motivated to quit

Eline Suzanne Smit, PhD^{1,2*}, Ciska Hoving, PhD¹, Karen Schelleman-Offermans, PhD^{3,4}, Robert West, PhD⁵, Hein de Vries, PhD¹

¹Department of Health Promotion, Maastricht University/CAPHRI, P.O. Box 616, 6200 MD Maastricht, the Netherlands;

²Department of Communication Science, Amsterdam School of Communication Research/ASCoR, University of Amsterdam, Kloveniersburgwal 48, 1012 CX, Amsterdam, The Netherlands;

³Department of Health Services Research, Maastricht University/CAPHRI, P.O. Box 616, 6200 MD Maastricht, the Netherlands;

⁴Department of Research and Development, Public Health Service South Limburg, P.O. Box 2022, 6160 HA Geleen, the Netherlands;

⁵Cancer Research UK, Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, Gower Street, London WC1E 6BT, United Kingdom.

* Corresponding author; E.S.Smit@uva.nl

Word count: 3500 (max. 3500)

Word count abstract: 249 (max. 250)

Tables: 3

Figures: 1

Abstract

Introduction Despite their positive motivation to quit, many smokers do not attempt to quit or relapse soon after their quit attempt. This study investigated the predictors of successful and unsuccessful quit attempts among smokers motivated to quit smoking.

Methods We conducted secondary data analysis among respondents motivated to quit within six months, randomized to the control group (N=570) of a web-based smoking cessation intervention study. Using Chi-square tests and ANOVA with Tukey post hoc comparisons, we investigated baseline differences by smoking status (successful quitter/relapse/persistent smoker) assessed after six weeks (N=214). To identify independent predictors of smoking status, multivariate multinomial logistic regression analyses were conducted.

Results Successful quitters at six-week follow-up, (26%) had reported significantly higher baseline levels of self-efficacy than relapsers (45%) and persistent smokers (29%). Furthermore, both successful quitters and relapsers had reported a significantly higher baseline intention to quit than persistent smokers and successful quitters had reported significantly more preparatory planning at baseline than persistent smokers. Results from regression analyses showed that smokers' baseline intention to quit positively predicted quit attempts reported after six weeks, while self-efficacy positively predicted quit attempt success.

Conclusions Different factors appear to play a role in predicting quit attempts and their success. Whereas intention to quit only appeared to play a role in predicting quit attempts, self-efficacy was the main factor predicting quit attempt success. More research

is needed to determine the role of preparatory planning and plan enactment and to investigate whether these findings can be replicated on the long term.

Keywords: Smoking; quit attempt; quit attempt success; predictors; longitudinal research

1. Introduction

Effective interventions exist to aid smokers in the process of smoking cessation (Lancaster & Stead, 2008; Lancaster et al., 2000; Lancaster & Stead, 2005). These interventions mostly target smokers motivated to quit, as a positive motivation to quit is considered a necessary prerequisite for smokers to actually quit smoking (Hyland et al., 2006; Norman et al., 1999; Vangeli et al., 2011). This is not surprising as, next to intervention developers, smokers themselves also believe that is necessary to be motivated to quit smoking before it is worthwhile trying (Balmford & Borland, 2008). Despite using the motivation to quit as an inclusion criterion, however, smoking cessation intervention studies still show that many smokers do not make a quit attempt during the study period, or do make a quit attempt but relapse to smoking soon after their attempt (Hoving et al., 2010; Smit et al., 2012; Te Poel et al., 2009). It is therefore important to not only identify the predictors of undertaking a quit attempt, but also to investigate the predictors of quit attempt success among smokers participating in smoking cessation intervention studies.

A systematic review investigating the predictors of attempts to quit smoking and their success found that having made a quit attempt in the past year and motivation to quit were highly predictive of quit attempts whereas only measures of tobacco dependence were consistently predictive of the success of these attempts (Vangeli et al., 2011). Similarly, a study among Canadian young adults found that intention to quit predicted quit attempts, whereas low addiction levels and high self-efficacy levels predicted 30-day smoking abstinence (Diemert et al., 2013). In other previous studies, self-efficacy has also been found to be an important predictor of quit attempts' success (Gwaltney et al.,

2009; Ockene et al., 2000; Vangeli et al., 2011). Most of these studies, however, only included respondents from general population samples of smokers. For intervention developers, however, it might be most informative to know whether these results are generalizable to samples of smokers who voluntarily participate in smoking cessation intervention studies and can be expected to have at least some motivation to quit smoking. Some studies conducted among smokers participating in smoking cessation intervention studies identified lower nicotine dependence (Bailey et al., 2011) as a predictor of quit attempts, and gender (Bailey et al., 2011), higher self-efficacy levels (Elfeddali et al., 2012b), the use of bupropion (Hoving et al., 2006) and preparatory planning (Elfeddali et al., 2012b; Hoving et al., 2006) as predictors of smoking abstinence.

Yet, as the evidence to date on the predictors of quit attempts and their success among smokers motivated to quit is ambiguous, the present study aimed to identify the predictors of successful and unsuccessful quit attempts assessed after a six-week follow-up period among smokers motivated to quit within six months. In this study, we used the Integrated Change (I-Change) Model (De Vries et al., 2003) as a theoretical framework. According to the I-Change Model (De Vries et al., 2003), the most proximal predictor of behaviour is the intention to perform this behaviour, which is predicted by three motivational constructs: attitude, consisting of the perceived advantages (pros) and disadvantages (cons) of the behaviour; perceived social influence, including perceived social norms, social modelling and social pressure; and self-efficacy, or a person's level of confidence to perform the behaviour. The I-Change Model (De Vries et al., 2003) also includes several pre- motivational and post-motivational factors, it recognizes the gap

between intention and behaviour (e.g. (Armitage & Conner, 2001)). While perceived barriers to change might increase this intention-behaviour gap, ability factors as skills and the formation of action plans (including both preparatory planning and coping planning) are assumed to bridge this gap. Based on the I-Change Model and previous research findings, we hypothesized that cognitive factors such as attitude, social influence, self-efficacy and the intention to quit smoking would predict initial behaviour change, or attempts to quit smoking, and that ability factors such as action planning, (perceived) skills and barriers (e.g. the level of nicotine dependence), would predict the success of these attempts.

2. Methods

Secondary analyses were conducted among respondents in the no intervention control group (N=570) of a randomized controlled trial (RCT) investigating the effectiveness of a web-based computer-tailored smoking cessation program.

2.1 Participants

The RCT 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). Dutch adult smokers were recruited from December 2009 until June 2010 by advertising the RCT in the mass media and on the

Internet. Several press releases were sent to regional Dutch newspapers, most of which advertised our study on their website, published an item about the study in the written edition of their newspaper, or mentioned the study on their local radio and/or television channel. In addition, we advertised our study on a Dutch online social network website (Hyves) and on multiple online smoking cessation forums, and published an advertisement in a free national newspaper. Interested smokers could 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, were motivated to quit smoking within six months and had access to the Internet. As we aimed to recruit regular smokers, potential respondents were excluded from participation when they indicated to not have smoked in the past seven days. On the study website, participants were informed that the Dutch Cancer Society financially supported the study and that the study was conducted by researchers from Maastricht University in collaboration with the Dutch Expert Center on Tobacco Control (STIVORO). Besides, the website consisted of information on study's objectives, the randomization procedure and the incentive (i.e. a €10 gift voucher) respondents would obtain when completing all questionnaires. After providing online informed consent, participants were randomized into the intervention group or the no intervention control group using a computer software randomization device, allocating approximately 50% of respondents to either group. Full details about the RCT can be found elsewhere (Smit et al., 2012).

2.2 Measurements

All measures used in the present study were based on the I-Change Model (De Vries et al., 2003) and have previously been used successfully to understand and change smoking behaviour (Elfeddali et al., 2012a; Hoving et al., 2010; Te Poel et al., 2009).

2.3 Baseline measurement

2.3.1 Pre-motivational factors

Three demographic variables were measured: age in years, gender and educational level.

Behavioural variables assessed were addiction level and the number of previous quit attempts. Addiction level was measured by the abbreviated Fagerström Test for Cigarette Dependence (FTCD) (0=not addicted; 10=highly addicted) (Fagerstrom, 2012; Heatherton et al., 1991). 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.

2.3.2 Motivational factors

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 $\alpha = .71$), measured on a 5-point Likert scale (e.g. When I do not smoke, my health 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 $\alpha = .69$), measured on a 5-point Likert scale (e.g. When I do not smoke, I will gain weight; 1=no, I will not gain weight; 2=do not know; 3=yes, I will

gain a little weight; 4=yes, I will gain weight; 5=yes, I will be gain a lot of weight). For both the pros and cons of quitting, a sum score was calculated to be included in further analyses.

Self-efficacy was measured by nine items (Cronbach's $\alpha = .89$) measured on a 5-point Likert scale (e.g. Do you think you will manage not to smoke when you're at a party?; 1=certainly not; 2=probably not; 3=maybe yes, maybe no; 4= certainly yes; 5=surely yes). For further analyses, these nine items were combined into a sum score.

Three sub concepts of social influence were measured: social norms, social support and social modelling. Social norms were assessed by three items (i.e. My partner/friends/children believe; 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; 9=not applicable). Social support was measured by three items (i.e. My partner/friends/children support(s) me not to smoke; 1=no, do(es) not support me; 2=I don't know; 3= support(s) me a little; 4= support(s) me; 5= support(s) me a lot; 9=not applicable). Similarly, social modelling was also assessed by three items (i.e. Does your partner smoke?; 1=yes; 5=no; 9=not applicable; How many of your friends/children smoke?; 1=all; 2=the majority; 3=I don't know; 4=the minority; 5=none; 9=not applicable). For none of the three sub concepts, a reliable scale could be formed; therefore, all items were transformed into three-category indices ranging from -1 (smoking social norm; smoking social modelling; no social support to quit smoking) to 0 (neutral/don't know; don't know; not applicable) and 1 (non-smoking social norm; non-smoking social modelling; social support to quit smoking) before inclusion in the analyses.

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

2.3.3 Post-motivational factors

Preparatory planning was assessed by five items, asking whether a respondent planned to undertake a certain action to prepare for a quit attempt, e.g. to remove all smokers' requisites from the home (1=very certainly not; 5=very certainly yes). Since preparatory plans can be quite distinct (De Vries et al., 2013) and the reliability was relatively low (Cronbach's $\alpha = .49$), the average score for preparatory planning should be interpreted as an index rather than a scale.

Coping planning was assessed by nine items (Cronbach's $\alpha = .77$), asking whether a respondent wanted to make a specific plan to cope with a potentially difficult situation once quit, e.g. when taking a break (1=no; 2=yes). When respondents indicated to want to make a plan for a situation, a subsequent open-ended question helped them to formulate this plan in the form of an implementation intention (Gollwitzer & Sheeran, 2006) (e.g. If I take a break, then ... [open-ended; to be completed by respondent]).

2.4 Follow-up measurement

Smoking status at six-week follow-up was determined by asking respondents whether they had made a serious quit attempt (i.e. refrained from smoking for at least 24 hours)

since the previous measurement and whether they had refrained from smoking during the last 24 hours (24-hour point prevalence abstinence). Based on the data obtained, respondents were categorized into one of three categories: 1) persistent smokers (no quit attempt and current smoker); 2) relapsers (quit attempt, but current smoker); and 3) quitters (quit attempt and current non-smoker).

2.5 Analyses

First, descriptive analyses were conducted to determine the sample's characteristics. Second, we explored correlations between predictor variables as measured at baseline to be included in the regression analyses to check for multicollinearity. Third, to determine whether persistent smokers, relapsers and quitters differed regarding the potential predictors of (successful) quit attempts studied, Chi-square tests and one-way ANOVA's with Tukey's HSD post hoc comparisons were conducted. Fourth, to identify independent predictors of smoking status after six weeks, multinomial logistic regression analyses were conducted.

To test the robustness of the results, a sensitivity analysis was conducted consisting of two types of analysis: 1) with smoking status calculated similarly as described earlier, but based on quit attempts and seven-day point prevalence abstinence instead of based on quit attempts and 24-hour point prevalence abstinence; and 2) with missing values on the outcome measures replaced using a negative scenario, i.e. by considering all drop-outs as smokers.

All analyses were conducted with SPSS version 19.0.

3. Results

3.1 Sample characteristics and correlation matrix

The sample consisted of respondents with an average age of 48.4 years (SD=12.2). Almost half of the sample had a medium level of education and about half of the respondents were male. Moreover, respondents had an average addiction level of 5.2 (SD=2.4) and reported on average six (SD=23) previous quit attempts.

The inter-correlations amongst predictor variables are presented in table 1; even though many significant inter-correlations were identified, no signs of multicollinearity between any combinations of predictor variables could be detected.

3.2 Differences in potential predictors by smoking status

At six-week follow-up, 62 (29%) respondents could be categorized as persistent smokers, while 97 (45%) were categorized relapsers and 55 (26%) could be considered successful quitters. Table 2 shows that no differences were identified between the three groups of respondents with regard to their demographic or behavioural variables. However, quitters had significantly higher baseline levels of self-efficacy than relapsers and persistent smokers, and reported significantly more preparatory planning than persistent smokers. Furthermore, quitters and relapsers had a significantly higher intention to quit than persistent smokers.

Sensitivity analyses with smoking status defined based on quit attempts and seven-day point prevalence abstinence categorized slightly more smokers as relapsers, but the differences found between the three groups were similar as those resulting from the primary analysis. Results from the sensitivity analyses with missing values replaced based on a negative scenario were also similar, though additionally showed a significant difference with regard to the level of addiction between persistent smokers and successful quitters and between persistent smokers and relapsers, respectively. In both cases, persistent smokers reported significantly higher levels of addiction.

3.3 Predictors of smoking status

Table 3 presents the results from multinomial regression analyses conducted with smoking status at six-week follow-up as the dependent variable. In total, 192 respondents were included in these analyses as some of the 214 respondents had missing values on any of the predictor variables and were thus excluded. These results showed that a positive intention to quit significantly predicted whether respondents made a quit attempt. Yet, successful quitter status was only positively predicted by respondents' levels of self-efficacy.

Results from sensitivity analyses with smoking status defined based on quit attempts and seven-day point prevalence abstinence were similar as the results from the primary analysis. Sensitivity analyses with missing values replaced using a negative scenario also showed relatively similar results. Different was that self-efficacy also appeared to positively predict whether a quit attempt was made and that preparatory

planning was positively predictive of being a successful quitter rather than a persistent smoker.

4. Discussion

This study aimed to identify the predictors of successful and unsuccessful quit attempts as assessed after a six-week follow-up period among smokers motivated to quit within six months.

4.1 Main findings

Several differences were found between smokers who quit successfully ('quitters'), who made a quit attempt but relapsed ('relapsers') and smokers who did not attempt to quit smoking at all ('persistent smokers'). That is, quitters and relapsers had a significantly higher baseline intention to quit than persistent smokers, and quitters had significantly higher baseline levels of self-efficacy than relapsers and persistent smokers. These findings found support in the results from multinomial regression analyses, suggesting that different factors play a role in predicting attempts to quit and their success: while intention to quit only appeared to play a role in predicting whether smokers made a quit attempt, smokers' self-efficacy was the main factor that played a role when predicting the success of these attempts.

The finding that intention significantly predicted quit attempts but not their success is in line with previous research findings showing that motivation or intention

predicted attempts to quit smoking, but was not or even negatively related to the success of these attempts (Hoving et al., 2006; Vangeli et al., 2011). The intention to quit smoking thus appeared not to be a sufficient precondition for successful smoking cessation, which is also in line with earlier research findings (Borland et al., 2010; Hyland et al., 2006). Although it remains important to focus on increasing smokers' intention to quit smoking to increase the number of quit attempts, relapse prevention efforts should additionally focus on other factors.

Our finding that self-efficacy was an important predictor of quit attempts' success also finds support in previous research findings (Elfeddali et al., 2012b; Gwaltney et al., 2009; Ockene et al., 2000; Vangeli et al., 2011). These findings may imply that efforts should be made to ensure that smokers' self-efficacy levels are sufficiently high to overcome barriers they might encounter once they have made a quit attempt. Before the quit attempt, besides aiding smokers in their action planning, a strategy suggested based on Self-Determination Theory (Ryan & Deci, 2000) to enhance perceived competence – or self-efficacy – is to offer effectance-relevant feedback (Williams et al., 2011): providing smokers with information on how cigarettes work, the nature of nicotine addiction, the effects of tobacco use on weight, and how medications work to relieve withdrawal symptoms – provided in a non-judgemental manner. After the quit attempt, a promising strategy maintain high self-efficacy levels might be to use ecological momentary assessment (EMA) - which entails the real-time collection of data using handheld devices, such as mobile phones. Next to more real-time research possibilities, EMA offers the possibility for a computerized intervention to instantly react when a low level of self-efficacy is detected by, for instance, sending electronic reminders of

smokers' self-made action plans and providing tips for coping with difficult situations. The integration of EMA in existing, effective web-based smoking cessation interventions might be a promising tool for increasing self-efficacy, and for ultimately preventing relapse and achieving long-term abstinence. Future research should aim to further explore the possibilities of integrating EMA within a web-based intervention context and determine its effectiveness.

A factor that warrants further investigation is preparatory planning. While univariate analyses revealed that successful quitters at baseline reported significantly more preparatory planning than persistent smokers, in multivariate analyses only a trend was identified of preparatory planning being predictive of successful quitting rather than persistent smoking. This weak effect might be explained by the fact that we did not assess the impact of preparatory planning enactment. Recent findings suggest that whereas action planning is important for successful smoking cessation, the enactment of these plans is of even greater importance (De Vries et al., 2013). As the amount of explained variance in the present study can be considered relatively low, further investigation of the influence of preparatory planning enactment and other factors not studied in the present study deserves recommendation.

4.2 Limitations

A first limitation of the present study is that it suffered from relatively high drop-out rates; at six-week follow-up a little over 60% of respondents had dropped out. Therefore, according to the Russell standard (West et al., 2005) we replaced missing values on the

outcome measures with a negative scenario (i.e. respondents lost to follow-up were considered to still be smoking) and conducted analyses both with missing values replaced and with complete-cases only. Results from both types of analyses were relatively similar, indicating their robustness of the results presented. As high attrition rates are, however, a common phenomenon in web-based intervention studies (Blankers et al., 2010; Eysenbach, 2005; McKay et al., 2008; Shahab & McEwen, 2009; Webb, 2009; West et al., 2005), it is important to identify strategies that prevent smokers from dropping out of these studies.

Another limitation is the relatively short follow-up period. Although most relapse is known to occur in the first eight days after a quit attempt (Hughes et al., 2004), it has been argued that a sustained period of abstinence is required to provide confidence that it will continue long-term (West et al., 2005). As we had access to data collected after six months, the same analyses were conducted using these data (data not reported). The results from these analyses showed similar trends for intention and self-efficacy. However, due to high attrition rates these analyses had not sufficient power to draw any firm conclusions. While the results from these additional analyses yielded further confidence in the results presented, we recommend that future studies aim to replicate these findings using a longer follow-up period.

A last limitation that should be noted is the coding of the social influence items, as the answering options of neutral/don't know, don't know and not applicable were grouped into one, neutral score. While we believe that when a respondent has provided one of these answers this implies that their answer cannot be considered missing and that not knowing whether to perceive a social norm/social modelling/social support towards

quitting is a more positive situation than perceiving a social norm/social modelling/social support to continue smoking, this coding approach should be kept in mind when interpreting the results.

4.3 Conclusions

As in general population samples of smokers, different factors appear to play a role in predicting quit attempts and their success among smokers motivated to quit within six months. Intention to quit smoking only appeared to predict whether smokers made a quit attempt, whereas self-efficacy was the main factor that appeared to predict their success. Therefore, smoking cessation interventions should first enhance smokers' intention to quit and subsequently prevent relapse by paying attention at increasing smokers' level of self-efficacy.

References

- Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *British Journal of Social Psychology, 40*(Pt 4), 471-499.
- Bailey, S. R., Bryson, S., & Killen, J. D. (2011). Predicting successful 24-hr quit attempt in a smoking cessation intervention. *Nicotine and Tobacco Research, 13*(11). doi: DOI: 10.1093/ntr/ntr151
- Balmford, J., & Borland, R. (2008). What does it mean to want to quit? *Drug and Alcohol Review, 27*(1), 21-27. doi: DOI: 10.1080/09595230701710829
- Blankers, M., Koeter, M. W., & Schippers, G. M. (2010). Missing data approaches in eHealth research: simulation study and a tutorial for nonmathematically inclined researchers. *Journal of Medical Internet Research, 12*(5), e54. doi: DOI: 10.2196/jmir.1448
- Borland, R., Yong, H. H., Balmford, J., Cooper, J., Cummings, K. M., O'Connor, R. J., . . . Fong, G. T. (2010). Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four country project. *Nicotine and Tobacco Research, 12 Suppl*, S4-11. doi: DOI: 10.1093/ntr/ntq050
- De Vries, H., Eggers, M., & Bolman, C. (2013). The role of action planning and enactment for smoking cessation. *BMC Public Health, 13*, 393. doi: DOI: 10.1186/1471-2458-13-393
- De Vries, H., Mudde, A., Leijts, I., Charlton, A., Vartiainen, E., Buijs, G., . . . Kremers, S. (2003). The European Smoking prevention Framework Approach (EFSA): an example of integral prevention. *Health Education Research, 18*(5), 611-626. doi: DOI: 10.1093/her/cyg031
- Diemert, L. M., Bondy, S. J., Brown, K. S., & Manske, S. (2013). Young adult smoking cessation: predictors of quit attempts and abstinence. *American Journal of Public Health, 103*(3). doi: DOI: 10.2105/AJPH.2012.300878
- Elfeddali, I., Bolman, C., Candel, M. J., Wiers, R. W., & de Vries, H. (2012a). Preventing smoking relapse via Web-based computer-tailored feedback: a randomized

- controlled trial. *Journal of Medical Internet Research*, 14(4), e109. doi: DOI: 10.2196/jmir.2057
- Elfeddali, I., Bolman, C., Candel, M. J., Wiers, R. W., & De Vries, H. (2012b). The role of self-efficacy, recovery self-efficacy, and preparatory planning in predicting short-term smoking relapse. *British Journal of Health Psychology*, 17(1), 185-201. doi: DOI: 10.1111/j.2044-8287.2011.02032.x
- Eysenbach, G. (2005). The law of attrition. *Journal of Medical Internet Research*, 7(1), e11. doi: DOI: 10.2196/jmir.7.1.e11
- Fagerstrom, K. (2012). Determinants of tobacco use and renaming the FTND to the Fagerstrom Test for Cigarette Dependence. *Nicotine and Tobacco Research*, 14(1), 75-78. doi: DOI: 10.1093/ntr/ntr137
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation Intentions and Goal Achievement: A Meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119. doi: DOI: 10.1016/S0065-2601(06)38002-1
- Gwaltney, C. J., Metrik, J., Kahler, C. W., & Shiffman, S. (2009). Self-efficacy and smoking cessation: a meta-analysis. *Psychology of Addictive Behaviors*, 23(1), 56-66. doi: DOI: 10.1037/a0013529
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K. O. (1991). The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, 86(9), 1119-1127. doi: DOI: 10.1111/j.1360-0443.1991.tb01879.x
- Hoving, C., Mudde, A. N., Dijk, F., & de Vries, H. (2010). Effectiveness of a computer-generated tailored smoking cessation expert system in Dutch community pharmacy and general practice setting. *Health Education*, 110(1), 17-29. doi: DOI: 101108/09654281011008726
- Hoving, E. F., Mudde, A. N., & de Vries, H. (2006). Predictors of smoking relapse in a sample of Dutch adult smokers; the roles of gender and action plans. *Addictive Behaviors*, 31(7), 1177-1189. doi: DOI: 10.1016/j.addbeh.2005.09.002

- Hughes, J. R., Keely, J., & Naud, S. (2004). Shape of the relapse curve and long-term abstinence among untreated smokers. *Addiction, 99*(1), 29-38. doi: DOI: 10.1111/j.1360-0443.2004.00540.x
- Hyland, A., Borland, R., Li, Q., Yong, H. H., McNeill, A., Fong, G. T., . . . Cummings, K. M. (2006). Individual-level predictors of cessation behaviours among participants in the International Tobacco Control (ITC) Four Country Survey. *Tobacco Control, 15 Suppl 3*, iii83-94. doi: DOI: 10.1136/tc.2005.013516
- Lancaster, T., & Stead, L. (2008). Physician advice for smoking cessation. *Cochrane Database of Systematic Reviews*(4), Cd000165. doi: DOI: 10.1002/14651858.CD000165.pub3
- Lancaster, T., Stead, L., Silagy, C., & Sowden, A. (2000). Effectiveness of interventions to help people stop smoking: findings from the Cochrane Library. *British Medical Journal, 321*(7257), 355-358. doi: DOI: 10.1136/bmj.321.7257.355
- Lancaster, T., & Stead, L. F. (2005). Self-help interventions for smoking cessation. *Cochrane Database of Systematic Reviews*(3), 1-91. doi: DOI: 10.1002/14651858.CD001118.pub2
- McKay, H. G., Danaher, B. G., Seeley, J. R., Lichtenstein, E., & Gau, J. M. (2008). Comparing two web-based smoking cessation programs: randomized controlled trial. *Journal of Medical Internet Research, 10*(5), e40. doi: DOI:10.2196/jmir.993
- Norman, P., Conner, M., & Bell, R. (1999). The theory of planned behavior and smoking cessation. *Health Psychology, 18*(1), 89-94. doi: DOI: 10.1037/0278-6133.18.1.89
- Ockene, J. K., Emmons, K. M., Mermelstein, R. J., Perkins, K. A., Bonollo, D. S., Voorhees, C. C., & Hollis, J. F. (2000). Relapse and maintenance issues for smoking cessation. *Health Psychology, 19*(1 Suppl), 17-31. doi: DOI: 10.1037//0278-6133.19.1
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American Psychologist, 55*(1), 68-78.

- Shahab, L., & McEwen, A. (2009). Online support for smoking cessation: a systematic review of the literature. *Addiction, 104*(11), 1792-1804. doi: DOI:10.1111/j.1360-0443.2009.02710.x
- Smit, E. S., De Vries, H., & Hoving, C. (2012). Effectiveness of a web-based multiple computer tailored smoking cessation program: a randomized controlled trial among Dutch adult smokers. *Journal of Medical Internet Research, 14*(3), e82. doi: DOI: 10.2196/jmir.1812
- Te Poel, F., Bolman, C., Reubsæet, A., & de Vries, H. (2009). Efficacy of a single computer-tailored e-mail for smoking cessation: results after 6 months. *Health Education Research, 24*(6), 930-940. doi: DOI:10.1093/her/cyp036
- Vangeli, E., Stapleton, J., Smit, E. S., Borland, R., & West, R. (2011). Predictors of attempts to stop smoking and their success in adult general population samples: A systematic review. *Addiction, 106*(12), 2110–2121. doi: DOI: 10.1111/j.1360-0443.2011.03565.x
- Webb, T. L. (2009). Commentary on Shahab & McEwen (2009): Understanding and preventing attrition in online smoking cessation interventions: a self-regulatory perspective. *Addiction, 104*(11), 1805-1806. doi: DOI: 10.1111/j.1360-0443.2009.02751.x
- West, R., Hajek, P., Stead, L., & Stapleton, J. (2005). Outcome criteria in smoking cessation trials: proposal for a common standard. *Addiction, 100*(3), 299-303. doi: DOI: 10.1111/j.1360-0443.2005.00995.x
- Williams, G. C., Patrick, H., Niemiec, C. P., Ryan, R. M., Deci, E. L., & Lavigne, H. M. (2011). The smoker's health project: a self-determination theory intervention to facilitate maintenance of tobacco abstinence. *Contemporary Clinical Trials, 32*(4), 535-543.

Figures

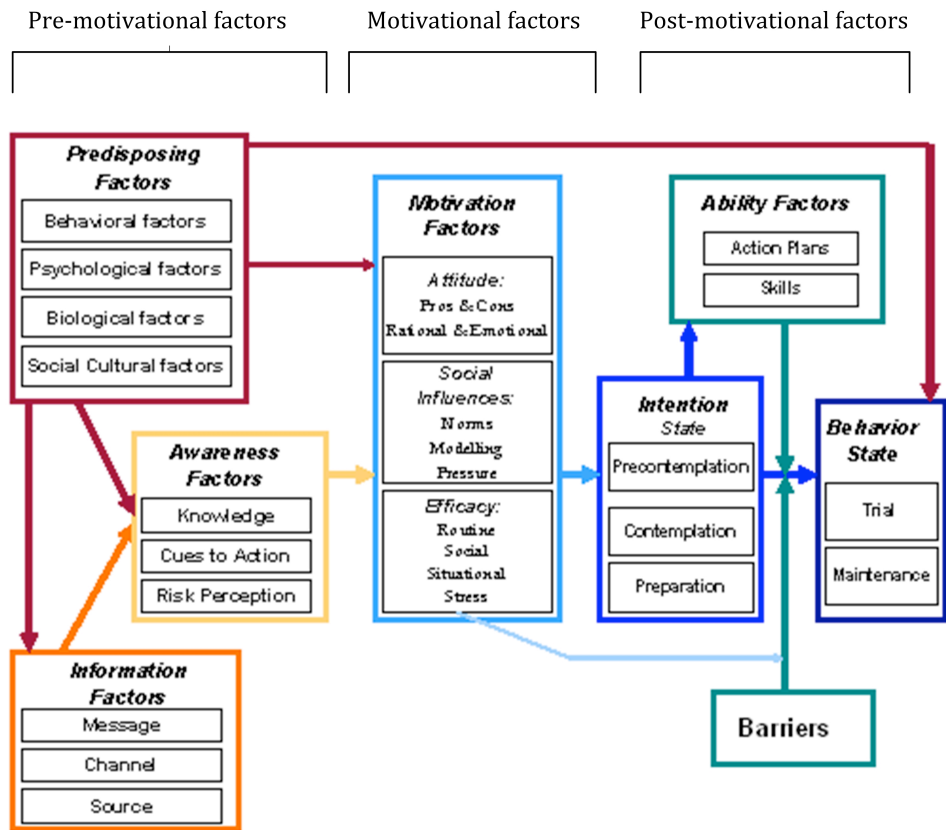


Figure 1. The I-Change Model

Tables

Table 1. Bivariate correlations between potential predictors of smoking status assessed at baseline

Previous quit attempts	1.00	Previous quit attempts		Pros	.149**	Cons	.033	Self-efficacy	.020	Norms	.084	Modelling	.052	Support	.025	Intention	.155**	Preparatory planning	.053	Coping planning	.052		
Addiction level		Addiction level	1.00	Pros	.028	Cons	.250**	Self-efficacy	-.312**	Norms	-.011	Modelling	-.099*	Support	.025	Intention	-.043	Preparatory planning	-.007	Coping planning	.172**		
Pros				Pros	1.00	Cons	.145**	Self-efficacy	-.005	Norms	.188**	Modelling	.057	Support	.158**	Intention	.165**	Preparatory planning	.184**	Coping planning	.233**		
Cons				Cons		Cons	1.00	Self-efficacy	-.343**	Norms	-.028	Modelling	-.007	Support	-.050	Intention	-.147**	Preparatory planning	.004	Coping planning	.268**		
Self-efficacy				Self-efficacy		Self-efficacy		1.00	Self-efficacy	1.00	Norms	.016	Modelling	.094*	Support	.099*	Intention	.198**	Preparatory planning	.163**	Coping planning	-.317**	
Norms				Norms		Norms			1.00	Norms	1.00	Modelling	.117**	Support	.421**	Intention	.055	Preparatory planning	.068	Coping planning	.005		
Modelling				Modelling		Modelling				1.00	Modelling	1.00	Modelling	.111**	Support	-.059	Intention	.054	Preparatory planning	-.067	Coping planning		
Support				Support		Support					1.00	Support	1.00	Support	1.00	Intention	.134**	Preparatory planning	.168**	Coping planning	.055		
Intention				Intention		Intention						1.00	Intention	1.00	Intention	1.00	Intention	.238**	Preparatory planning	-.048	Coping planning		
Preparatory planning				Preparatory planning		Preparatory planning							1.00	Preparatory planning	1.00	Preparatory planning	1.00	Preparatory planning	1.00	Preparatory planning	.043	Coping planning	
Coping planning				Coping planning		Coping planning															1.00	Coping planning	

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

Table 2. Differences in baseline characteristics of the three groups defined by smoking status at six-week follow-up

Variables	1. Persistent smokers (N=62)	2. Relapsers (N=97)	3. Quitters (N=55)	χ^2	F	Tukey HSD
Gender (% male); n=214	46.8	47.4	50.9	.30	.	
Age (Mean; S.D.); n=213	49.4 (12.1)	51.0 (12.0)	46.3 (11.1)	.	2.79	
Educational level; n=214				.89	.	
Low (%)	27.4	20.6	25.5			
Medium (%)	48.4	54.6	38.2			
High (%)	24.2	24.7	36.4			
Addiction level (Mean; S.D.); n=201	5.2 (2.4)	5.1 (2.5)	4.3 (2.4)	.	2.38	
Number of previous quit attempts (Mean; S.D.); n=214	3.6 (2.9)	4.8 (6.1)	4.1 (3.6)	.	1.20	
Attitude						
Pros (Mean; S.D.); n=214	20.9 (4.6)	22.2 (5.1)	21.2 (4.3)	.	1.62	
Cons (Mean; S.D.); n=214	15.1 (4.7)	14.6 (4.5)	14.7 (4.6)	.	.22	
Self-efficacy (Mean; S.D.); n=214	26.5 (5.8)	28.4 (6.3)	32.4 (6.0)	.	14.31	1,2<3***
Social influence						
Norms (Mean; S.D.); n=207	1.9 (1.0)	1.8 (1.2)	1.7 (1.2)	.	.80	
Modelling (Mean; S.D.); n=203	-.2 (1.2)	-.4 (1.3)	-.4 (1.1)	.	.48	
Support (Mean; S.D.); n=207	1.6 (1.2)	1.7 (1.1)	1.8 (1.1)	.	.58	
Intention to quit (Mean; S.D.); n=214	5.8 (.9)	6.3 (.8)	6.2 (.9)	.	7.82	1<2***; 1<3*
Preparatory plans (Mean; S.D.); n=214	16.4 (3.5)	16.9 (3.9)	18.4 (3.4)	.	4.40	1<3*; 2<3^
Coping plans (Mean; S.D.); n=214	13.7 (2.8)	13.9 (2.6)	13.4 (2.4)	.	.72	

Note: . = not applicable; ^p<.1; *p < 0.05; ***p < .001.

Table 3. Predictors of smoking status after a six-week follow-up period (N=192)

	Relapser ^a			Quitter ^a			Quitter ^b		
	OR	95% CI		OR	95% CI		OR	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper
No. of previous quit attempts	1.05	.95	1.16	1.02	.91	1.14	.97	.90	1.05
Addiction level	1.03	.87	1.21	.92	.76	1.12	.90	.76	1.06
Pros	1.04	.96	1.14	1.02	.92	1.13	.98	.90	1.07
Cons	1.01	.92	1.10	1.06	.95	1.18	1.05	.96	1.15
Self-efficacy	1.05	.98	1.13	1.18***	1.08	1.29	1.13**	1.05	1.22
Norms	.84	.59	1.20	.75	.50	1.13	.89	.64	1.24
Modelling	.92	.68	1.25	.82	.57	1.17	.89	.65	1.21
Support	1.07	.76	1.51	1.22	.80	1.88	1.15	.79	1.67
Intention	1.91**	1.18	3.08	1.22	.70	2.12	.64	.38	1.08
Preparatory planning	.96	.86	1.07	1.07	.94	1.21	1.11	1.00	1.24
Coping planning	1.03	.88	1.20	1.02	.85	1.22	.99	.84	1.17

Note: $R^2 = .26$; ** $p < 0.01$; *** $p < 0.001$; ^aPersistent smokers are the reference category; ^bRelapers are the reference category.