Does Exposure to Habitual Smoking Contexts Before Smoking Cessation Reduce Relapse? Results From a Pilot Study

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A variety of cues have been proven to elicit reactivity in nicotine-dependent individuals. Since such reactivity has been shown to form a source of relapse, treatments aim at extinguishing this reactivity. Yet, typically, in cue-exposure treatments a very limited range of relevant stimuli is used, usually focusing only on proximal stimuli (e.g., a cigarette) rather than on contextual cues that trigger craving (e.g., a bar). The restriction to proximal cues may be one of the reasons for the low efficacy of cue-exposure treatments. In the current pilot study ($N = 88$), we aimed to evaluate the effect on relapse rates of exposure to contextual cues prior to quitting smoking, by varying the degree of exposure/extinction to habitual smoking contexts prior to quitting between groups. Results suggest that context exposure prior to smoking cessation indeed reduces relapse. However, since dropout rates were high, this finding needs replication with a larger sample.

■ **Keywords:** smoking cessation, context exposure, renewal, craving

Cue reactivity, that is, drug-related cues eliciting subjective, physiological and/or behavioural reactions that can be conceptualised as conditioned responses, is assumed to play a central role in the development and maintenance of addiction and in the occurrence of lapse and relapse after treatment (e.g., Killen & Fortmann, 1997). Cue-exposure treatments, based on the procedure of extinction, aim to reduce and extinguish cue-reactivity responses by exposing drug-dependent individuals to cues (conditioned stimuli or CSs) associated with drug use, while preventing them from using the drug (no unconditioned stimulus or US). However, despite initial successes of such treatments (e.g., Drummond, Tiffany, Glautier, & Remington, 1995), Conklin and Tiffany (2002) pointed to their limited long-term efficacy. The authors reviewed five studies on cue exposure in the treatment of nicotine dependency; in none of them were beneficial effects of cue-exposure treatment on relapse rates to be found. This does not mean that we should give up on cue-exposure treatment just yet. Conklin and Tiffany (2002) rather argue that ‘cue-exposure

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researchers should be prepared to exploit the wealth of animal extinction research that can directly guide their attempts to extinguish addictive behavior' (p. 165).

Because of its obvious implications for cue-exposure treatments, the authors most notably draw attention to the renewal effect. 'Renewal' refers to the return of conditioned responding (cue reactivity) after successful extinction (exposure), when the conditioned stimulus (e.g., a cigarette) is presented in a context different from the extinction context (Bouton, 1994). In human clinical literature on addiction, Wikler (1948) was the first to mention this effect, although not in these terms. He described former heroin addicts who received an apparently successful treatment in a clinic. When they returned home they reported experiencing withdrawal symptoms in certain environments, although the physiological withdrawal had long been abated, and proximal drug cues were not even present. Mere contexts in which patients formerly used the drug-evoked reactivity and motivated them into drug-seeking behaviour. This is a clear demonstration of how the renewal effect can pose a threat to the efficacy of cue-exposure treatments for addiction, and also of how contexts in themselves can elicit reactivity in the absence of proximal drug cues. Evidence for the latter also comes from a study by Conklin (2006), who found that pictures of environments that were associated with smoking could indeed function as conditioned stimuli evoking subjective urge in abstinent smokers in the absence of proximal cues like cigarettes.

The renewal phenomenon suggests that exposure treatments could benefit from paying more attention to the role of contexts that are associated with drug use. Yet typically, in cue-exposure treatments a very limited range of relevant stimuli is used, usually focusing on proximal stimuli (e.g., a cigarette) rather than on contextual cues that may trigger craving (e.g., a bar). As Kavanagh, Andrade and May (2004) argue, this could be one of the reasons for the low efficacy of such treatments.

In the present pilot treatment-outcome study, we investigated whether manipulating the degree of exposure/extinction to habitual smoking contexts when restricting smoking behaviour before the actual quit date had an effect on relapse rates. The rationale behind this manipulation was that a higher degree of exposure to habitual smoking contexts would result in a reduced potential of these contexts to elicit craving and thereby trigger relapse. The degree to which gradual reduction of smoking prior to complete abstinence conveys an advantage over abrupt abstinence from cigarettes ('cold turkey') in terms of relapse rates seems to vary. Whereas some authors report minimal if any effects of gradual reduction in improving treatment outcome (e.g., Fiore, Smith, Jorenby, & Baker, 1994), some techniques of smoking reduction before the actual quit date appear to have a beneficial effect on relapse rates (Cinciripini, Wetter, & McClure, 1997). In particular, Cinciripini et al. (1995) showed that scheduled reduction of smoking, in which smoking rate is progressively reduced and the inter-cigarette interval is progressively increased, reduced relapse rates relative to nonscheduled reduction (or abrupt cessation). It remains unclear why exactly scheduled smoking reduction improves relapse rates. Cinciripini et al. (1997) offer a number of speculative mechanisms through which scheduled reduction may improve abstinence. One intriguing possibility they present is that scheduled reduction may make smoking be less associated with preferred smoking times and situations.

So, although our study was modelled after the Cinciripini et al. study (1995), our focus was not on manipulating time intervals between cigarettes in the cessation phase, but rather on manipulating the degree of exposure/extinction to habitual

smoking contexts between groups in a cessation phase. All smokers who participated in our studies were instructed to smoke only 50% of their usual number of cigarettes per day, and this during two weeks, until the target date. In condition *All*, no restrictions were given regarding the contexts in which to smoke, whereas in condition *Some*, we excluded a range of contexts in which participants were allowed to smoke. We aimed at a minimal extinction of usual smoking contexts in the first condition and maximal extinction in the second condition, hypothesising that the latter group would show greater abstinence rates at follow-up.

Method

Participants

This pilot was carried out in collaboration with the Christelijke Mutualiteiten (CM), the largest health insurance company in Belgium, who have a long tradition of offering smoking cessation programs to the general public. CM recruited 88 smokers (56% women) in total through an advertisement in their member magazine. Participants were on average 47.29 years old (*SD* = 9.71), ranging from 20 to 75 years of age and came from 4 out of 5 Flemish provinces. Six groups of participants were run, containing at least 11 and at most 19 smokers per group. CM asked participants a financial contribution (€75 for members, €150 for non-members). Our intervention was imbedded in the CM cessation program. We semi-randomly assigned participants of each group to one of two conditions, balanced for age, gender and other variables (see Table 1).

Procedure

Participants attended a series of group sessions, split up in four phases: (a) baseline assessment, (b) cessation phase (pre-target date), (c) relapse prevention (post-target date), and (d) follow-up.

Baseline assessment. Before the group sessions started, participants were informed that the smoking cessation program was embedded in a research project administered by the University of Leuven. They were told that they could decide whether

TABLE 1
Overview of Balancing of Conditions

	Condition <i>All</i>	Condition <i>Some</i>	
<i>n</i>	43	45	
Gender (M/F)	19/24	20/25	$\chi^2(1) < .01, p = .98$
Help (Yes/No)	14/23	12/26	$\chi^2(1) = .32, p = .57$
	M (<i>SD</i>)	M (<i>SD</i>)	
Age	46.98 (10.26)	47.60 (9.26)	$F < 1$
FTND	5.38 (2.68)	5.86 (2.60)	$F < 1F$
# of cig/day	16.03 (7.67)	14.44 (4.95)	$F < 1$

Note: Condition *All* = smoking allowed in all contexts (50% reduction in amount of cigarettes), Condition *Some* = smoking allowed in some contexts only (50% reduction in amount of cigarettes), Help = use of any form of aid (nicotine substitution or pharmacotherapy), FTND = Fagerström Test for Nicotine Dependence at baseline, # of cig/day = mean number of cigarettes smoked per day at baseline.

or not to participate in the research part of the study and that they could stop their involvement in the study at any time. Those who were interested (nobody refused to participate) were asked for written informed consent. Next, they were instructed to record their current smoking behaviour during two week days and two weekend days. For this purpose, they received a chart on which they had to record for every cigarette: (a) the time of consumption, (b) the context in which they smoked the cigarette, (c) a description of the situation in which they were at that time, (d) the strength of their craving (from 0 to 4), (e) the strength of their enjoyment (from 0 to 4) and (f) the type of feeling they experienced right before smoking the cigarette (for more information on this chart and an overview of contexts in which people smoke see Van Gucht, Van den Bergh, Beckers, & Vansteenwegen, 2010).

Cessation phase. During every session, a cognitive-behavioural training was implemented (as part of the program offered by the CM), identical for both conditions. Additionally, at the time of the first group session, all participants were told that from the end of that session onward they should limit their number of cigarettes per day. Between that time and the target quit-date (two weeks later), they could smoke only 50% of their usual number of cigarettes per day. Half of the participants were allowed to smoke these cigarettes in all of their usual contexts (condition *All*); in this group we aimed at a minimal extinction to habitual smoking contexts. The other half of the participants (condition *Some*) was instructed to smoke their cigarettes in some contexts only; we excluded a number of their usual smoking contexts. In condition *All*, participants were told to smoke anywhere they liked and we emphasised that they should not change anything about their usual smoking behaviour apart from reducing their overall amount of cigarettes by half. In condition *Some*, we specifically banned smoking in contexts that participants could not avoid. The no-smoking contexts were individually selected for each participant, on the basis of the chart he or she had completed. For example, if a participant had to take his or her car to work, and this was one of his or her usual smoking contexts, we disallowed smoking in it, but emphasised that they should keep taking that car to go to work. In condition *Some*, we targeted a maximal extinction to a number of participants' habitual smoking contexts. We expected this group to perform better at follow-up than participants in condition *All*.

Relapse prevention. Those who had quit successfully were encouraged; the others were encouraged to undertake a new attempt at stopping. Participants learned to assess high-risk situations and how to deal with them step by step. They were trained to use different techniques and were educated about lapses and relapses and how to deal with setbacks.

Follow-up moments. At 1, 2, 6 and 12 months post-quit day participants returned. These sessions were used to evaluate everyone's progress and abstinence, repeat the assessments described below and refresh the relapse prevention techniques.

Assessments

Participants completed the six-item Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) at baseline and some questions about their abstinence status at every contact. Expired carbon monoxide (CO) was also determined at every contact using the 'Bedfont piCO

FIGURE 1

Percentage of nonattendees, abstainers and nonabstainers at different moments.

Note: Stop = quit week; F1 = Follow-Up 1, 1 month after stop; F2 = Follow-Up 2, 2 months after stop; F3 = Follow-Up 3, 6 months after stop; F4 = Follow-Up 4, 12 months after stop.

Smokerlyzer' an apparatus (calibrated regularly) that indicates the exact amount of CO expired by the participant.

In the quit week, participants who refrained from smoking in the 24 hours prior to the group session were classified as abstainers. At the follow-up moments, participants who noted they had not smoked more than one cigarette on fewer than five occasions and whose level of CO was less than 7 ppm, were considered abstainers. Those who exceeded those levels, or failed to attend the session, were classified as nonabstainers (see also Cinciripini et al., 1995).

Results

It appeared that dropout was considerable; 47.7%, 31.8%, 61.4% and 70.5% of the participants did not return, for the four follow-up moments, respectively (see also Figure 1).

CM reports similar dropout numbers for their regular programs (i.e., programs that were run prior to the implementation of our intervention). Note that participation in the research part of the program was completely voluntary and secondary to the main goal of the program, and that participants received no compensation for their participation. When contacted by phone, participants who stopped attending the sessions did not report the intervention as the reason. Importantly, no significant differences were observed between participants who did and did not return at the one year follow-up as regards condition, $\chi^2(1) = .11$, $p = .74$, age, $F(1, 84) = 2.64$, $p = .11$, number of cigarettes smoked per day at baseline, $F < 1$, mean craving score at baseline, $F < 1$, mean enjoyment score at baseline, $F < 1$, or FTND score, $F(1, 85) = 1.46$, $p = .26$. Still, the high drop-out rate, however a-select, may limit the generalisability of our findings.

Percentage of Abstainers

Figure 1 shows the overall percentages of abstainers at different moments, as well as the percentages of nonabstainers and nonattendees. One year after the quit-date, only 14% of participants was still abstinent. However, we classified all nonattendees as nonabstainers, which may in part explain the low rates of abstainers.

Effect of Context Manipulation

From the second follow-up moment on, participants in condition *Some* expired less CO than participants in condition *All*, although the differences did not reach significance (see Figure 2; note the decreasing n values across the different moments in the study).

When we only take into account the CO values of those participants who returned one year later, we found that in condition *All*, the expired CO-scores at one-year follow-up were not different from the CO-scores at the time of the stop session, $F < 1$ (see Figure 3), whereas in condition *Some*, a significant decrease was observed, $F(1, 24) = 4.95, p < .05$ (Cohen's $d = .72$, indicating a medium to large effect size).

Although the interaction failed to reach significance (perhaps due to the large dropout), $F(1, 24) = 2.32, p = .14$, the effect size as measured via partial eta-squared (.09) is medium (Stevens, 1992). This difference did not result from a difference in dependence at baseline: Condition *All* and condition *Some* did not differ in their distribution of participants' FTND scores, $F < 1$.

Predicting Abstinence

In order to identify variables associated with differences in abstinence rates among participants, we conducted linear regressions in the case of continuous predictors and

FIGURE 2

Mean amount of expired carbon monoxide (+SE) at different moments for Condition *All* (first n value) and Condition *Some* (second n value).

Note: Stop = quit week; F1 = follow-up 1, 1 month after stop; F2 = follow-up 2, 2 months after stop; F3 = follow-up 3, 6 months after stop; F4 = follow-up 4, 12 months after stop.

FIGURE 3

Mean amount of expired carbon monoxide (+SE) from quit week (stop) to 1-year follow-up (F4) for Condition *All* ($n = 12$) and Condition *Some* ($n = 14$), for those participants who attended the 1-year follow-up.

one-way ANOVAs in the case of categorical predictors, with the amount of expired CO at the different moments in the study as the dependent variable. Results are presented in Table 2.

Males were worse at maintaining an abstinent status at two different moments in the study, namely at Follow-Up 1 and at Follow-Up 3. Age, whether any form of aid (nicotine substitution or pharmacotherapy) was used, number of sessions attended and craving and enjoyment scores at baseline were no significant predictors of abstinence rates. The mean number of cigarettes smoked at baseline was a significant predictor of abstinence in the quit week only. Similarly, the FTND score at baseline, although a significant or nearly significant predictor at all other moments, was not a significant predictor of abstinence a year after the quit date. That is, dependence at baseline did predict how quickly participants would relapse, but not whether they would relapse.

Discussion

The primary aim of our study was to investigate whether a treatment that included an explicit context-exposure component prior to the quit date would be more successful if it involved exposure to habitual smoking contexts. We compared two groups that differed in the degree of exposure/extinction to habitual contexts. We hypothesised that the participants experiencing exposure with response prevention in some of their most habitual smoking contexts (condition *Some*) would do better in the long term than the group that was allowed to smoke in all contexts (condition *All*). When we compared the amount of expired CO from the stop session to the last follow-up session, we did find an effect of the context manipulation: Participants in condition *Some* expired significantly less CO one year post-cessation

TABLE 2

Results of Linear Regressions (in Case of Continuous Variables) and One-Way ANOVAs (in Case of Categorical Variables) to Test the Predictive Value of Several Potential Predictors for Abstinence Rates at Different Moments

Predictors	Stop	Moment			
		F1	F2	F3	F4
Gender	$F(1, 80) = 1.85$ $p = .18$	$F(1, 44) = 4.96$ $p < .05$	$F < 1$ $F < 1$	$F(1, 32) = 6.06$ $p < .05$	$F < 1$
Age	$F(1, 78) = 1.56$ $p = .22$	$F < 1$	$F < 1$	$F < 1$	$F(1, 24) = 1.08$ $p = .31$
Help	$F(1, 71) = 1.53$ $p = .22$	$F(1, 41) = 2.0$ $p = .16$	$F(1, 53) = 1.27$ $p = .26$	$F(1, 28) = 2.95$ $p = .10$	$F(1, 24) = 1.16$ $p = .24$
# Sessions	$F < 1$	$F(1, 30) = 3.24$ $p = .08$	$F < 1$	$F < 1$	$F < 1$
FTND	$F(1, 78) = 9.33$ $p < .01$	$F(1, 43) = 3.90$ $p = .06$	$F(1, 57) = 2.86$ $p = .10$	$F(1, 32) = 4.12$ $p = .05$	$F(1, 24) = 1.60$ $p = .22$
# cig/day	$F(1, 47) = 14.99$ $p < .001$	$F < 1$	$F(1, 33) = 2.04$ $p = .16$	$F < 1$	$F < 1$
Craving	$F < 1$	$F < 1$	$F < 1$	$F < 1$	$F(1, 10) = 3.34$ $p = .10$
Enjoyment	$F < 1$	$F < 1$	$F < 1$	$F < 1$	$F < 1$

Note. Help = use of any form of aid (nicotine substitution or pharmacotherapy); FTND_W1 = Fagerström Test for Nicotine Dependence at baseline; # cig/day_W1 = mean number of cigarettes smoked per day at baseline; Craving = mean reported craving score at baseline; Enjoyment = mean reported enjoyment score at baseline; Stop = quit week; F1 = Follow-Up 1, 1 month after stop; F2 = Follow-Up 2, 2 months after stop; F3 = Follow-Up 3, 6 months after stop; F4 = Follow-Up 4, 12 months after stop.

than at the start of treatment, whereas for participants in condition *All* there was no such decrease. We should note, though, that the Condition $\times$ Moment interaction did not reach significance, but the effect size was still medium. Increasing the sample size by improving follow-up session attendance would likely lead to more robust results. Also, to further validate the present results, a comparison of the present pre-cessation reduction groups with a group that does not receive any smoking restrictions before quitting to smoke completely would be valuable.

The present study also shows that even when following a group treatment program, a considerable number of smokers fail to quit by the end of that program, despite their intention at the start. Already one month after the end of the program, ex-smokers started to relapse, and 6 to 12 months later, the majority was no longer abstinent. This is in itself not a surprising observation: It is well documented that the majority (80%) of ex-smokers relapse within a year post-cessation (e.g., Curry & McBride, 1994). Our study seems to point to even higher relapse rates. However, because all nonattendees after one year were classified as having relapsed, the number reported here is likely to be an overestimation.

There were no significant differences between participants who did and participants who did not take part in follow-up on any of the relevant variables at baseline. Still, in light of the high rate of drop-out, the present results should be considered tentative, and their interpretation can only be speculative. Still, the beneficial effect of context exposure in condition *Some* in comparison to the simple smoking reduction manipulation conducted in condition *All*, if corroborated in future studies, would be rather intriguing. It would suggest that it is beneficial to dissociate exposure treatment from withdrawal. After all, participants in condition *All* who stayed abstinent in the cessation phase also experienced unreinforced exposure to their habitual smoking contexts from the cessation date on. It seems highly unlikely that the difference in abstinence at one-year follow-up would merely be due to the small difference in sheer amount of overall exposure to habitual smoking contexts. It would rather seem that (context) exposure may be particularly effective when conducted prior to the actual quit date, at a time when one is not experiencing withdrawal effects yet. Quite plausibly, the experience of success at abstaining in usual smoking contexts, at a moment when abstinence was not being hindered by strong withdrawal yet (i.e., precessation), could result in an increase in self-efficacy in condition *Some*, rendering participants less vulnerable to relapse. Participants in condition *Some* were requested to keep exposing themselves to certain habitual smoking contexts and were, on the one hand, prohibited to actually smoke in some of those contexts, while on the other hand they were allowed to smoke 50% of their usual amount of cigarettes. This situation, which does probably not exceed participants' capacities, may result in a subjective experience of success and an increase in abstinence self-efficacy. Previous research has shown that people with stronger abstinence self-efficacy are indeed less prone to relapse (Gwaltney et al., 2001).

As argued by Shiffman (1993, p.366), research on smoking cessation treatments tends to focus on 'tinkering with the details of existing approaches' rather than on developing new approaches to smoking cessation. The apparent lack of improvement in treatment success over the years may well be due in part to a lack of novel treatment techniques being developed; it is imperative that researchers keep investigating innovative approaches for smoking cessation (Cinciripini et al., 1997). If the present findings can be replicated and the proposed mechanism

corroborated in more strictly controlled research, precessation exposure to habitual smoking contexts may turn out to be one such innovative approach.

References

- Bouton, M.E. (1994). Context, ambiguity and classical conditioning. *Current Directions in Psychological Science*, 3, 49–53.
- Cinciripini, P.M., Lapitsky, L., Seay, S., Wallfisch, A., Kitchens, K., & Van Vunakis, H. (1995). The effects of smoking schedules on cessation outcome: Can we improve on common methods of gradual and abrupt nicotine withdrawal? *Journal of Consulting and Clinical Psychology*, 63, 388–399.
- Cinciripini, P.M., Wetter, D.W., & McClure, J. B. (1997). Scheduled reduced smoking: Effects on smoking abstinence and potential mechanisms of action. *Addictive Behaviors*, 22, 759–767.
- Conklin, C.A. (2006). Environments as cues to smoke: Implications for human extinction-based research and treatment. *Experimental and Clinical Psychopharmacology*, 14, 12–19.
- Conklin, C.A., & Tiffany, S.T. (2002). Applying extinction research and theory to cue-exposure addiction treatments. *Addiction*, 97, 155–167.
- Curry, S.J., & McBride, C.M. (1994). Relapse prevention for smoking cessation: Review and evaluation of concepts and interventions. *Annual Review of Public Health*, 15, 345–366.
- Drummond, D.C., Tiffany, S., Glautier, S., & Remington, B. (Eds.). (1995). *Addictive behaviour: Cue exposure theory and practice*. New York: Wiley.
- Fiore, M.C., Smith, S.S., Jorenby, D.E., & Baker, T.B. (1994). The effectiveness of nicotine patch for smoking cessation. *Journal of the American Medical Association*, 271, 1940–1947.
- Gwaltney, C.J., Shiffman, S., Norman, G.J., Paty, J.A., Kassel, J.D., Gnys, M., et al. (2001). Does smoking abstinence self-efficacy vary across situations? Identifying context-specificity within the relapse situation efficacy questionnaire. *Journal of Consulting and Clinical Psychology*, 69, 516–527.
- Heatherton, T.F., Kozlowski, L.T., Frecker, R.C., & Fagerström, K.O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction*, 86, 1119–1127.
- Stevens, J.C. (1992). *Applied multivariate statistics for the social sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Kavanagh, D.J., Andrade, J., & May, J. (2004). Beating the urge: Implications of research into substance-related desires. *Addictive Behaviors*, 29, 1359–1372.
- Killen, J.D., & Fortmann, S.P. (1997). Craving is associated with smoking relapse: Findings from three prospective studies. *Experimental and Clinical Psychopharmacology*, 5, 137–142.
- Shiffman, S. (1993). Smoking cessation treatment: Any progress? *Journal of Consulting and Clinical Psychology*, 61, 718–722.
- Van Gucht, D., Van den Bergh, O., Beckers, T., & Vansteenwegen, D. (2010). Smoking behavior in context: Where and why do people smoke? *Journal of Behavior Therapy and Experimental Psychiatry*, 41, 172–177.
- Wikler, A. (1948). Recent progress in research on the neurophysiologic basis of morphine addiction. *American Journal of Psychiatry*, 105, 329–338.