



Brief report

Personalized smoking environment cue reactivity in smokers with schizophrenia and controls: A pilot study

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ABSTRACT

Exposure to smoking cues increases craving to smoke and negatively changes mood in smokers with schizophrenia (SWS). This pilot study compared reactivity to real-world smoking environments versus neutral environments in SWS ($n = 10$) and non-psychiatric control smokers (CON; $n = 10$). Results indicate that both SWS and CON experienced increases in smoking urges when viewing images of their smoking environments and that SWS tended to report greater increases in withdrawal-related negative mood than CON when viewing images of their smoking environments. These findings signify that personalized smoking environments trigger smoking urges in SWS and suggest that extinguishing this reactivity may aid cessation efforts in this population.

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1. Introduction

Tobacco dependence is pervasive and difficult to treat in smokers with schizophrenia (SWS; Ziedonis et al., 2008). Identification of factors that precipitate smoking in SWS may help to improve treatment outcomes. One such factor is exposure to smoking-related stimuli (cues), which increases urge to smoke due to frequent associations over time between cues and nicotine effects (Carter and Tiffany, 1999). Furthermore, neurobiological deficits associated with schizophrenia may sensitize these individuals to the reinforcing effects of drugs and strengthen drug-cue associations (Chambers et al., 2001). Although previous studies have identified similarly strong urge responses to non-personalized smoking cues in SWS and non-psychiatric smokers (Fonder et al., 2005; Tidey et al., 2005; 2008), images of personalized real-world smoking environments may be more vivid and relevant than non-personalized cues (Conklin et al., 2010). This pilot study compared reactivity to personalized smoking environment cues in SWS and control smokers without psychiatric illness (CON). We hypothesized that SWS would have heightened cue reactivity compared to CON.

2. Methods

Participants, recruited from the community, were 18+ years old, smoked 20+ cigarettes per day and scored ≥ 6 on a modified Fagerström Test of Nicotine Dependence (FTND; Steinberg et al., 2005). Psychiatric diagnoses (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; DSM-IV) of schizophrenia or

schizoaffective disorder were confirmed. CON participants had no current or past Axis I disorder, and no first-degree relative with schizophrenia or schizoaffective disorder. After reporting the number of cigarettes and time spent smoking in locations where they typically smoke, participants were trained to use digital cameras to capture pictures of four primary smoking environments and four nonsmoking environments. Faces and smoking paraphernalia were excluded from all pictures.

Reactivity to these images was tested in a separate session. Participants smoked a cigarette upon arrival at the laboratory. After a 10-min relaxation period, participants viewed their smoking and non-smoking images in separate sessions, with cue set order balanced across participants and a 10-min relaxation period between sets. Each cue set consisted of 8 images, two from each environment, presented on a laptop computer for 30 s each. Participants were asked to concentrate on each image and imagine being in the environment. Before and after cue exposure, smoking urge was measured with the item "How strong is your urge to smoke a cigarette right now?" (0 = "No urge at all" to 10 = "Strongest urge you've ever had"), which is sensitive to cues in SWS (Tidey et al., 2005; 2008), and withdrawal-related negative mood was measured with the Minnesota Nicotine Withdrawal Scale (MNWS; Hughes and Hatsukami, 1986), which has been validated in SWS (Weinberger et al., 2007). The insomnia item was omitted from the scale.

Chi-square and one-way analysis of variance (ANOVA) tests were used to conduct between-groups comparisons. Urge and MNWS change scores (post-cue scores minus pre-cue scores) were analyzed using $2 \times 2 \times 2$ (Group \times Cue Order \times Cue Type) mixed-model repeated measures ANOVAs. Effect sizes (η^2) are reported for non-significant tests ($\eta^2 \leq 0.05$, small; $\eta^2 = 0.06$ – 0.14 , medium; $\eta^2 \geq 0.15$, large effects).

3. Results

Ten SWS and 10 CON enrolled in and completed this study. Demographic and smoking variables did not differ between groups (Table 1). Neither group had difficulty using the digital camera. Participants in both groups reported that the majority of daily cigarettes were smoked in the living room, porch/yard, kitchen and bedroom (SWS = 99%, CON = 94%). On an average day, SWS spent 14.1 ± 5.0 ($M \pm S.D.$) h and smoked 29.8 ± 14.2 cigarettes and CON spent 11.9 ± 5.7 h and smoked 23.2 ± 10.7 cigarettes in one of these

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Table 1
Participant characteristics and cue reactivity change scores, *M* (S.D.) or %.

	Schizophrenia (<i>n</i> = 10)	Control (<i>n</i> = 10)
Gender (% female)	20	40
Age (years)	44.5 (5.1)	52.6 (13.4)
Education (years)	10.8 (1.9)	11.7 (2.3)
Hispanic ethnicity (%)	0	0
European American (%)	80	60
African American (%)	10	40
Native American/Alaskan (%)	10	0
Currently Married (%)	10	20
Employed full- or part-time (%)	10	30
Cigarettes per day	30.1 (9.3)	24.8 (7.4)
Nicotine dependence score (FTND)	7.60 (1.6)	6.80 (1.3)
PANSS positive	10.40 (2.6)	
PANSS negative	10.50 (3.9)	
PANSS general	22.30 (6.0)	
Antipsychotic medication	80% atypical, 20% typical	
	Smoke	Neutral
Single-item urge	9.0 (12.0)	–4.0 (13.5)
MNWS negative mood	0.32 (0.68)	–0.04 (0.42)
	Smoke	Neutral
	Smoke	Neutral
	12.0 (16.2)	0.0 (12.5)
	–0.02 (0.25)	0.05 (0.22)

Note: Change scores are calculated by subtracting the pre-cue condition from the post-cue condition. FTND, Fagerström Test of Nicotine Dependence; PANSS, Positive and Negative Syndrome Scale; MNWS, Minnesota Nicotine Withdrawal Scale, MAP, Mean arterial pressure.

environments. SWS reported smoking more cigarettes in their primary smoking environment (14.40 ± 7.8) than CON (8.60 ± 3.1 ; $F(1, 18) = 4.83, p < 0.05$).

Pre-cue urge scores were not different between groups (SWS: 44.5 ± 19.9 ; CON: 41.0 ± 16.5). Smoking cues, but not neutral cues, significantly increased urge to smoke across groups ($F(1, 16) = 8.17, p = 0.01$). MNWS scores differed between groups (SWS: 1.18 ± 0.79 ; CON: 0.42 ± 0.60 ; $F(1, 18) = 5.86, p < 0.05$). A trend-level Cue Type \times Group interaction on MNWS score suggested that, in SWS but not CON, smoking cues tended to increase MNWS score whereas neutral cues did not ($F(1, 16) = 2.86, p = 0.11, \eta^2 = 0.15$). A significant Cue Type \times Order on MNWS score indicated that MNWS scores increased following presentation of the first cue set when smoking cues were presented first ($F(1, 16) = 6.07, p < 0.05$). No other main effects or interactions among variables were observed.

4. Discussion

In this first study of reactivity to personalized smoking environment cues in SWS, images of smoking environments increased smoking urges, thus extending the findings of Conklin et al. (2010) to SWS. Results indicate that urge responses of SWS to cues are similar to those of non-psychiatric smokers, as seen previously with non-personalized cues (Fonder et al., 2005; Tidey et al., 2005; 2008). SWS also tended to respond to smoking cues with increases in MNWS score. SWS report reduction of negative affect as their most important smoking expectancy (Tidey and Rohsenow, 2009). Furthermore, preliminary evidence indicates that SWS experience greater negative mood and greater urge to smoke to reduce negative mood than CON during continuous 72-h smoking abstinence (Tidey and Colby, 2011), suggesting that negative mood may be a more significant antecedent of smoking in SWS than in CON.

Limitations of this study include its small sample size and majority European-American male sample. Furthermore, counterbalancing cue order resulted in carry-over of subjective effects induced by the smoking cues, as noted previously (Monti et al., 1987). Finally, the task required imagining oneself in the environment, an ability that may be impaired in schizophrenia. However, images of real-world smoking environments, tailored for each smoker, may be more vivid and relevant than non-personalized cues (Conklin et al., 2010). Furthermore, the specific

increases in urge in response to smoking cues but not neutral cues support the validity of these findings.

As SWS smoked more of their daily cigarettes in their primary smoking location than controls, future studies may investigate whether smoking relapse occurs more frequently in the primary smoking environment in SWS compared to CON. Future studies should also investigate whether extinguishing reactivity to real-world smoking contexts aids cessation efforts (Gunther et al., 1998). Extinction training in SWS may be easier to accomplish given that only a small group of environments account for the vast majority of cigarette use.

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References

- Carter, B.L., Tiffany, S.T., 1999. Meta-analysis of cue-reactivity in addiction research. *Addiction* 94, 327–340.
- Chambers, R.A., Krystal, J.H., Self, D.W., 2001. A neurobiological basis for substance use comorbidity in schizophrenia. *Biological Psychiatry* 15, 71–83.
- Conklin, C.A., Perkins, K.A., Robin, N., McClernon, F.J., Salkeld, R.P., 2010. Bringing the real world into the laboratory: personal smoking and nonsmoking environments. *Drug and Alcohol Dependence* 111, 58–63.
- Fonder, M.A., Sacco, K.A., Termine, A., Boland, B.S., Seyal, A.A., Dudas, M.M., Vessicchio, J.C., George, T.P., 2005. Smoking cue reactivity in schizophrenia: effects of a nicotinic receptor antagonist. *Biological Psychiatry* 57, 802–808.
- Gunther, L.M., Denniston, J.C., Miller, R.R., 1998. Conducting exposure treatment in multiple contexts can prevent relapse. *Behaviour Research and Therapy* 36, 75–91.
- Hughes, J.R., Hatsukami, D., 1986. Signs and symptoms of tobacco withdrawal. *Archives of General Psychiatry* 43, 289–294.
- Monti, P.M., Binkoff, J.A., Abrams, D.B., Zwick, W.R., Nirenberg, T.D., Liepmann, M.R., 1987. Reactivity of alcoholics and nonalcoholics to drinking cues. *Journal of Abnormal Psychology* 96, 1–5.
- Steinberg, M.L., Williams, J.M., Steinberg, H.R., Krejci, J.A., Ziedonis, D.M., 2005. Applicability of the Fagerström test for nicotine dependence in smokers with schizophrenia. *Addictive Behaviors* 30, 49–59.
- Tidey, J.W., Colby, S.M., 2011. Characterization of 72-hr abstinence effects in smokers with schizophrenia and controls. Paper presented at the annual meeting of the Society for Research on Nicotine and Tobacco, Toronto, Canada.
- Tidey, J.W., Rohsenow, D.J., 2009. Smoking expectancies and intention to quit in smokers with schizophrenia, schizoaffective disorder and non-psychiatric controls. *Schizophrenia Research* 115, 310–316.

- Tidey, J.W., Rohsenow, D.J., Kaplan, G.B., Swift, R.M., 2005. Subjective and physiological responses to smoking cues in smokers with schizophrenia. *Nicotine & Tobacco Research* 7, 421–429.
- Tidey, J.W., Rohsenow, D.J., Kaplan, G.B., Swift, R.M., Adolfo, A.B., 2008. Effects of smoking abstinence, smoking cues and nicotine replacement in smokers with schizophrenia versus controls. *Nicotine & Tobacco Research* 10, 1047–1056.
- Weinberger, A.H., Sacco, K.A., Creeden, C.L., Vessicchio, J.C., Jatlow, P.I., George, T.P., 2007. Effects of acute abstinence, reinstatement, and mecamylamine on biochemical and behavioral measures of cigarette smoking in schizophrenia. *Schizophrenia Research* 91, 217–225.
- Ziedonis, D., Htsman, B., Beckham, J., Zvolensky, M., Adler, L., Audrain-McGovern, J., Breslau, N., Brown, R., George, T., Williams, J., Calhoun, P., Riley, W., 2008. Tobacco use and cessation in psychiatric disorders: National Institute on Mental Health report. *Nicotine & Tobacco Research* 10, 1691–1715.