Brief Report

Craving among long-abstinent smokers: An Internet survey

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Abstract

Introduction: This survey estimated the prevalence and correlates of craving among long-abstinent smokers.

Methods: We surveyed 403 former smokers (abstinent 1–10 years) via an Internet consumer sample (www.zoomerang.com).

Results: Although the majority (59%) of former smokers reported a desire to smoke in the last year, this desire appeared to be clinically significant in only 11%. Those with significant prolonged craving were more nicotine dependent and appeared to have more mental health problems but did differ from other former smokers on demographics or family history of smoking.

Discussion: A minority of smokers appears to continue to struggle with cravings long after cessation. Replications in larger more generalizable surveys are needed. In addition, whether prolonged craving indicates risk for relapse needs to be determined.

Introduction

Although craving after abstinence is clearly not short lived (Tiffany, Warthen, & Goedecker, 2009), the incidence or prevalence of “prolonged craving” (defined herein as craving that occurs after 6 months of abstinence from tobacco) is not known. Continued craving could be due to a prolonged withdrawal syndrome (Satel, Kosten, Schuckit, & Fischman, 1993; Schuckit, Kosten, & Fischman, 1994); however, in smokers, nicotine receptors appear to return to their normal state in 6–12 weeks of abstinence (Cosgrove et al., 2009) and prolonged nicotine withdrawal does not appear to exist (Hughes, 1994). In fact, after 6 months, most smokers report less psychological distress than when smoking (U.S. Department of Health and Human Services, 1990). Despite this, it is still possible that exposure to certain smoking cues could continue to elicit craving for many months after abstinence (Bevins & Palmatier, 2004; Tiffany et al.). Some animal models suggest that craving due to smoking cues many never fully extinguish (Bouton, 2002).

An early study of British physicians who quit on their own reported that 19% of those abstinent for 5 years or more

reported “occasional” craving and 2% “persistent” craving (Fletcher & Doll, 1969). A study of New Years quitters reported that 17% craved after 6 months (Gritz, Carr, & Marcus, 1991). In contrast, the author found that 51% and 74% of smokers volunteering for a study reported craving for cigarettes in the last 24 hr at 6-month follow-up (Hughes, 1992; Hughes, Gust, Skoog, Keenan, & Fenwick, 1991). Probably the best description of prolonged craving is from the International Tobacco Control (ITC) Four Country Survey, a population-based cohort study of 2,502 smokers who were abstinent on at least one of the four waves of the study (2002–2007; Herd & Borland, 2009). In that survey, 13% of those abstinent for more than 6 months reported daily “strong urges.”

The objectives of the current study were (a) to estimate the prevalence of prolonged craving among smokers who have been abstinent for some time; (b) to estimate the clinical significance of such craving, that is, its severity and frequency and whether it has lead to near relapses; and (c) to determine whether prolonged craving is associated with smoking history, severity of prior nicotine dependence, family history, density of smoking cues, current and past psychiatric history, or continued use of medication. The study is a systematic replication test of prior estimates of the prevalence of prolonged craving that adds more detailed information on this phenomenon.

Methods

We recruited former smokers from a database from the Zoomerang Web site (www.zoomerang.com). Zoomerang is an online Internet survey site that has recruited 3 million U.S. consumers to complete online surveys in return for points that can be redeemed for services and merchandise. Zoomerang invited a random subsample of former smokers to participate by logging on to a Web site. The invitation did not state the focus of the interview (i.e., on craving). Interested former smokers were asked the following inclusion criteria: (a) aged 18 years or above, (b) former smoker who stopped 1–10 years ago, and (c) had not smoked for more than 7 consecutive days (Hughes et al., 2003) in the last year. We limited duration of abstinence to 10 years to improve recall. Consent was implied when eligible participants read a lay summary and moved on to the survey. The survey asked demographics, smoking history, family history

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of smoking (Drobes, Munafo, Leigh, & Saladin, 2005), and a mental health screener (Berwick et al., 1991). Smokers were then asked "Have you had a desire for a cigarette in the last year?" To prevent confusion (Kozlowski, Mann, Wilkinson, & Poulos, 1989), we used the term "desire" rather than "craving." Those who answered yes were asked more questions about this desire. The survey is available at www.uvm.edu/hbpl. The 58-question survey took 10–20 min to complete, and participants were reimbursed with Zoomerang points that were worth <\$10. Out of range values and missing information prompted requests to enter data again. Software prevented duplicate entries by the same participant. This study was approved by the University of Vermont Committee on the Use of Human Subjects.

We chose a sample size of 400 because if the prevalence of prolonged craving was as small as the 13% reported in the prior survey (Herd, Borland, & Hyland, 2009), this would still provide us with 52 who continued to crave. Also, with a sample size of 400, our 95% CIs would range from $\pm 2\%$ to $\pm 4\%$ depending on the base rate (Fleiss, 1981).

The initial survey was completed in March 2009 and was interrupted after 101 participants were enrolled. Examination of these results suggested clarifications, additions, and deletions of a few questions. A revised survey was then completed in September 2009 by an additional 302 participants. The target number of participants was obtained within 6 days with each of the two invitations to enroll. We are not able to obtain from Zoomerang the number of E-mail invitations nor the number who did not fill out the entire survey and, thus, cannot report a response or completion rate.

Results

Among the 403 participants, 50% were men, 3% were Hispanics, 7% were non-White, 60% were married, and 55% had a high school education or less. Only 1% were 18–23 years old, 66% were 24–59 years, and 33% were 60 years or older. Almost all (95%) stopped 1–5 years ago. Only 4% were currently using a smoking cessation medication and 3% non-cigarette tobacco. Few (18%) began smoking before they were 15 years old and 39% after age 17. In the past, almost all (91%) were daily smokers. On the days they smoked, 54% smoked less than 20 cigarettes/day and 28% smoked more than 20 cigarettes/day. In the past, 52% smoked within 15 min of arising and 68% smoked light or ultra-light cigarettes. Their mean (*SD*) Fagerström Test for Nicotine Dependence (FTND; Heatherston, Kozlowski, Frecker, & Fagerstrom, 1991) score was 4.5 (2.5). On a 1–10 scale, they rated their addiction when smoking as 7.7 (2.2) and difficulty quitting when they last quit (i.e., the successful quit attempt) as 5.8 (3.0). These sample characteristics are similar to long-term former smokers in the 2007 National Health Interview Survey (NHIS; Hughes & Callas, 2009) except that it had fewer non-Whites (7% vs. 19% in the NHIS).

Most (59%) long-term former smokers reported a desire for cigarettes in the last year. Among those with a desire, the most commonly endorsed triggers were depressed mood (47%), seeing someone smoke (43%), alcohol use (37%), and being in a place they used to smoke (32%). The last desire occurred within the last week in 42%. Among those who reported a desire, 26% (or 15% of the total sample) reported that the strongest desire

was either "strong" or "very strong—a craving" and 16% (or 9% of total) stated that it either came very close or did cause them to take a puff of a cigarette. Desires occurred less than monthly in 49% (or 28% of total), monthly in 25% (18% of total), weekly in 21% (12% of total), and most days in 5% (3% of total) of those with a desire.

If we define clinically significant prolonged craving as a strong desire/craving that occurs at least monthly, then 11% ($n = 45$) of the entire sample would meet this definition. That this definition includes clinically significant craving is illustrated by the fact that 100% of these participants stated that they either came very close or did have a puff due to a craving in the last year, whereas only 9% of the smokers who had a nonclinically significant desire, or no desire, to smoking in the last year did so.

We compared those with significant prolonged craving versus all others on 17 variables in a series of bivariate analyses (using Fisher's exact test for ordinal variables and logistic regression for continuous variables). Given this was an exploratory study of a small group, we made no corrections for multiple testing nor did we attempt multiple regression.

Those with clinically significant prolonged craving had started smoking earlier ($p = .03$, 33% of prolonged cravers vs. 17% of noncravers had begun before age 15), used to smoke more ($p < .001$, 89% vs. 64% smoked more than a pack per day), rated themselves as more addicted when they smoked ($p < .001$, 8.9 vs. 7.6 on a 10-point scale), had higher FTND scores ($p < .001$, 5.8 vs. 4.3), and tended to have a shorter time to first cigarette ($p = .09$). They rated their successful quit as more difficult ($p < .001$, 7.9 vs. 5.5) and had more often used nicotine replacement on that quit ($p = .01$, 58% vs. 38%). None of those abstinent for 6–10 years ($n = 22$) reported clinically significant cravings versus 12% of those abstinent for 1–5 years ($n = 381$, $p = .07$). Prolonged cravers more often stated that they were still addicted ($p < .001$, 55% vs. 22%) and would "possibly relapse" ($p < .001$, 17% vs. 4%). Prolonged cravers scored more poorly on the Mental Health Inventory ($p < .001$, 12.0 vs. 9.7). They did not differ from noncravers on age, sex, race, education, current use of nicotine replacement therapy, proportion of first-degree relatives who ever smoked, and proportion of first-degree relatives who ever smoked and who quit smoking.

Discussion

Although over half of long-term former smokers reported craving, only 1 in 10 reported significant craving; that is, a significant desire to smoke that occurs monthly. This result replicates the results of the ITC population-based survey (Herd et al., 2009) and the two studies of self-quitters (Fletcher & Doll, 1969; Gritz et al., 1991) that found that 13%–19% reported prolonged craving after 6 months or more. The current results contradict our prior studies that found that more than 50% did so (Hughes, 1992; Hughes et al., 1991). One explanation is that the samples of our two prior studies were of smokers volunteering for a study, and such smokers are typically more dependent smokers (Fortmann & Killen, 1994).

The findings of the current study suggest that we can inform smokers about to quit that there is about a 50% chance that they will have some craving every now and then for several years and a

10% chance that they will have monthly strong cravings. None of those abstinent for more than 5 years reported significant craving, suggesting that cravings may eventually extinguish; however, this finding is based on only 22 longer abstinent smokers and, thus, requires replication. Prolonged cravers were consistently more nicotine dependent across several convergent measures. They also appeared to have more mental health problems. Unfortunately, we did not ask about other possible correlates, such as density of smoking in their environs and use of alcohol or drugs.

Craving early on in abstinence predicts relapse (Killen & Fortmann, 1997; Tiffany et al., 2009). In the only analysis of prolonged craving on relapse, a secondary analysis of the ITC survey found that strong urges were especially predictive of relapse when they occurred daily or more after 3 months of abstinence (Herd et al., 2009). Although this requires replication, it does suggest that late craving could be used as a marker to continue treatment or add new treatments.

The major limitation of our survey was its use of an Internet sample. Internet samples have bias, for example, they include fewer older and less educated smokers (Stoddard & Augustson, 2006). On the other hand, 75% of the U.S. adults use the Internet (www.pewinternet.org), plus Internet samples appear to produce outcomes similar to those of other recruitment methods (Etter & Perneger, 2001). In addition, the alternative—traditional phone-based population-based samples—are becoming biased themselves due to lower response rates, no-call lists, and exclusive use of cell phones (Blumberg, Luke, & Cynamon, 2006). Another limitation of this study is the small sample of clinically significant prolonged cravers ($n = 45$), which limits the accuracy of our estimates and could have caused false-positive or false-negative results.

Given the above, replications of this study's results using larger more representative samples are needed. In addition, better explorations of nondependence correlates of prolonged craving (e.g., amount of smoking in the environs) are needed. Finally, and most importantly, further tests of whether prolonged craving predicts later relapse are needed. For example, clinical trials could collect craving at 3- and 6-month follow-ups and see if they predict relapse by 1-year follow-ups.

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Declaration of Interests

The author is currently employed by The University of Vermont and Fletcher Allen Health Care. Since 1 January 2007, he has received research grants from the National Institute on Health and Pfizer; the latter develops and sells smoking cessation medications. During this time, he has accepted honoraria or consulting fees from several nonprofit and for-profit organizations and companies that develop, sell, or promote smoking cessation products or services or educate/advocate about smoking cessation: Abbot Pharmaceuticals; Acrux; Aradigm; American Academy of Addiction Psychiatry; American Psychiatric Association; Begbies Traynor; Cline, Davis, and Mann; Constella Group; Consultants in Behavior Change; Dean Foundation, DLA Piper, EPI-Q, European Respiratory Society,

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References

- Berwick, D. M., Murphy, J. M., Goldman, P. A., Ware, J. E., Barsky, A. J., & Weinstein, M. C. (1991). Performance of a five-item mental health screening test. *Medical Care*, 29, 169–176.
- Bevins, R. A., & Palmatier, M. I. (2004). Extending the role of associative learning processes in nicotine addiction. *Behavioral and Cognitive Neuroscience Reviews*, 3, 143–158.
- Blumberg, S., Luke, J., & Cynamon, M. (2006). Telephone coverage and health survey estimates: Evaluating the need for concern about wireless substitution. *American Journal of Public Health*, 96, 926–931.
- Bouton, M. (2002). Context, ambiguity, and unlearning: Sources of relapse after behavioral extinction. *Biological Psychiatry*, 52, 976–986.
- Cosgrove, K., Batis, J., Bois, F., Maciejewski, P., Esterlis, I., & Kloczynski, T. (2009). β_2 -Nicotinic acetylcholine receptor availability during acute and prolonged abstinence from tobacco. *Archives of General Psychiatry*, 66, 666–676.
- Drobes, D., Munafo, M., Leigh, F., & Saladin, M. (2005). A family smoking index to capture genetic influence in smoking: Rationale and two validation studies. *Nicotine & Tobacco Research*, 7, 41–46.
- Etter, J. F., & Perneger, T. V. (2001). A comparison of cigarette smokers recruited through the Internet or by mail. *International Journal of Epidemiology*, 30, 521–525.
- Fleiss, J. L. (1981). *Statistical methods for rates and proportions*. New York: John Wiley & Sons.
- Fletcher, P. D., & Doll, R. (1969). A survey of doctors' attitudes to smoking. *British Journal of Preventive Social Medicine*, 23, 145–153.
- Fortmann, S. P., & Killen, J. D. (1994). Who shall quit? Comparison of volunteer and population-based recruitment in two minimal-contact smoking cessation studies. *American Journal of Epidemiology*, 140, 39–51.
- Gritz, E. R., Carr, C. R., & Marcus, A. C. (1991). The tobacco withdrawal syndrome in unaided quitters. *British Journal of Addiction*, 86, 57–69.

- 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, 1119–1127.
- Herd, N., & Borland, R. (2009). The natural history of quitting smoking: Findings from the International Tobacco Control (ITC) Four Country Survey. *Addiction*, 104, 2075–2087.
- Herd, N., Borland, R., & Hyland, A. (2009). Predictors of smoking relapse by duration of abstinence: Findings from the International Tobacco Control (ITC) Four Country Survey. *Addiction*, 104, 2088–2099.
- Hughes, J. R. (1992). Tobacco withdrawal in self-quitters. *Journal of Consulting and Clinical Psychology*, 60, 689–697.
- Hughes, J. R. (1994). Protracted withdrawal. *American Journal of Psychiatry*, 151, 785–786.
- Hughes, J., & Callas, P. (2009). Data to assess the generalizability of samples from studies of adult smokers. *Nicotine & Tobacco Research*, 12, 73–76.
- Hughes, J. R., Gust, S. W., Skoog, K., Keenan, R., & Fenwick, J. W. (1991). Symptoms of tobacco withdrawal: A replication and extension. *Archives of General Psychiatry*, 48, 52–59.
- Hughes, J. R., Keely, J., Niaura, R., Ossip-Klein, D., Richmond, R., & Swan, G. (2003). Measures of abstinence from tobacco in clinical trials: Issues and recommendations. *Nicotine & Tobacco Research*, 5, 13–25.
- 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.
- Kozlowski, L. T., Mann, R. E., Wilkinson, D. A., & Poulos, C. X. (1989). “Cravings” are ambiguous: Ask about urges or desires. *Addictive Behaviors*, 14, 443–445.
- Satel, S. L., Kosten, T. R., Schuckit, M. A., & Fischman, M. W. (1993). Should protracted withdrawal from drugs be included in DSM-IV? *American Journal of Psychiatry*, 150, 695–704.
- Schuckit, M., Kosten, T., & Fischman, M. (1994). Protracted abstinence syndromes in alcohol, opioids, and stimulants. In T. Widiger, A. Frances, H. Pincus, M. First, R. Ross & W. Davis (Eds.), *DSM-IV sourcebook* (Vol. 1, pp. 145–158). Washington, DC: American Psychiatric Association.
- Stoddard, J., & Augustson, E. (2006). Smokers who use internet and smokers who don’t: Data from the Health Information and National Trends Survey (HINTS). *Nicotine & Tobacco Research*, 8, S77–S85.
- Tiffany, S., Warthen, M., & Goedecker, K. (2009). The functional significance of craving in nicotine dependence. *Nebraska Symposium on Motivation*, 55, 171–197.
- U.S. Department of Health and Human Services. (1990). Psychological and behavioral consequences and correlates of smoking cessation. In *Health benefits of smoking cessation: A report of the US surgeon general* (pp. 517–578), Rockville, MD: Office on Smoking & Health.