



# HHS Public Access

Author manuscript

*Drug Alcohol Depend.* Author manuscript; available in PMC 2017 September 01.

Published in final edited form as:

*Drug Alcohol Depend.* 2016 September 1; 166: 93–99. doi:10.1016/j.drugalcdep.2016.06.035.

## Use of Multiple Tobacco Products in a National Sample of Persons Enrolled in Addiction Treatment

Joseph Gudysh<sup>a</sup>, Barbara Tajima<sup>a</sup>, Sowmya Pramod<sup>a</sup>, Thao Le<sup>a</sup>, Noah R. Gubner<sup>a</sup>, Barbara Campbell<sup>b</sup>, and Paul Roman<sup>c</sup>

<sup>a</sup>Philip R. Lee Institute for Health Policy Studies, University of California San Francisco, 3333 California St., Ste. 265, San Francisco, CA 94118

<sup>b</sup>Department of Public Health and Preventive Medicine, Oregon Health and Sciences University, 3181 SW Sam Jackson Park Road, Portland, OR 97239-3098

<sup>c</sup>Center for Research on Behavioral Health and Human Service Delivery, Owens Institute for Behavioral Research, 106 Barrow Hall, University of Georgia, Athens, GA 30602

### Abstract

**Objective**—To explore use of tobacco products in relationship to marketing exposure among persons in addiction treatment.

**Method**—A random sample of treatment programs was drawn from the National Institute on Drug Abuse (NIDA) Clinical Trials Network (CTN). Participants in each program completed surveys concerning use of tobacco products (N = 1,113). Exposure to tobacco marketing and counter-marketing, advertising receptivity, and perceived health risks of smoking were tested for their association with use of multiple tobacco products.

**Results**—Prevalence of combustible cigarette use was 77.9%. Weekly or greater use of other products was: e-cigarettes (17.7%), little filtered cigars (8.6%), smokeless tobacco (5.2%), and standard cigars (4.6%) with 24.4% using multiple tobacco products. Compared to single product users, multiple product users smoked more cigarettes per day (OR = 1.03, 95% CI 1.01 – 1.05,  $p < 0.001$ ), were more likely to have tried to quit (OR = 1.41, 95% CI 1.02 – 1.96,  $p = 0.041$ ), reported

---

Corresponding Author: Joseph Gudysh, Professor of Medicine and Health Policy, Philip R. Lee Institute for Health Policy Studies, University of California San Francisco, 3333 California St. Ste. 265, San Francisco, CA 94118, Phone: 415-476-0954, joseph.gudysh@ucsf.edu.

#### Conflict of Interest

No conflict declared.

#### Contributors

Joseph Gudysh conceived the study, had oversight of all implementation and analysis and drafted the paper. Barbara Tajima developed the survey and executed data collection. Sowmya Pramod and Thao Le managed data, conducted analyses presented, and contributed to data interpretation. Noah Gubner contributed to writing and interpretation particularly related to use of electronic cigarettes, and Barbara Campbell contributed to writing and interpretation in the areas of tobacco marketing and counter-marketing exposure. Paul Roman contributed to development of program sampling procedures, drew the sample of programs using data previously collected by his research team, and reviewed and revised the manuscript. All authors have read and approved of the submission of this manuscript to *Drug and Alcohol Dependence*.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

greater daily exposure to advertising for products other than combustible cigarettes (OR = 1.93, CI 1.35 – 2.75,  $p < 0.001$ ), and greater daily exposure to tobacco counter-marketing (OR = 1.70, 95% CI: 1.09 – 2.63,  $p = 0.019$ ).

**Conclusion**—Heavier smokers and those trying to quit may be more likely to use e-cigarettes, little filtered cigars, or smokeless tobacco and have greater susceptibility to their advertising. This highlights the importance of regulating advertising related to smoking cessation as their effectiveness for this purpose has not been demonstrated.

### Keywords

tobacco; nicotine; drug treatment; policy

---

## 1. INTRODUCTION

The Family Smoking Prevention and Tobacco Control Act (TCA) wrested control of tobacco products from corporations and assigned it to an agency with the charge to protect public health. Since the TCA became law in June, 2009, the Food and Drug Administration (FDA) banned most cigarette flavorings, restricted sale of tobacco products to children and adolescents, banned tobacco advertising with misleading terms (National Institutes of Health, 2012), and now plans to regulate e-cigarettes (U.S. Department of Health and Human Services, 2016).

Tobacco control efforts in the U.S. have driven smoking prevalence to 16.8% as of 2014 in the United States, a 20.9% decrease over the last decade (Jamal et al., 2015). Yet these strategies have left prevalence high in subgroups with mental health and substance use disorders (Guydish et al., 2011; Lasser et al., 2000). While tobacco company advertising, incentives and product development have targeted vulnerable populations (Apollonio and Malone, 2005), tobacco control strategies have not (Guydish, 2012). The FDA has recognized the intersection of tobacco use, marketing, and regulation in vulnerable populations, and called for research in these groups to inform its regulatory efforts.

Persons with substance abuse and dependence are vulnerable to tobacco use. As a group they smoke at higher rates (Kalman et al., 2005; McClure et al., 2014), smoke more heavily than the general population (Hughes, 2002; Ward et al., 2012), and are less successful in quitting than non-substance abusers (Drobes, 2002; Ferron et al., 2011; Stein et al., 2013). Alcohol and drug dependent persons die from smoking-related causes more frequently than from drug or alcohol-related causes (Bandiera et al., 2015; Hser et al., 1994; Hurt et al., 1996). Cigarette and alcohol consumption may be mutually reinforcing, with possible behavioral (Ait-Daoud et al., 2006, 2005; Sayette, 2002) and genetic components (Littleton and Little, 2002; Schlaepfer et al., 2008). Although most persons in addiction treatment also smoke, many are interested in quitting smoking (Saxon et al., 1997), and two studies have reported 10% quit rates for persons in addiction treatment even in the absence of cessation intervention (Chun et al., 2009; Kohn et al., 2003). However, even in the context of robust tobacco control strategies (Walsh and Gordon, 1986), the smoking prevalence among persons in addiction treatment has shown little change over time (Guydish et al., 2011, 2015b), highlighting the continued need to address tobacco use in this population.

While there are now developed literatures concerning smoking (Guydish et al., 2015a, 2011) and smoking cessation among persons in addiction treatment (Prochaska et al., 2004; Thurgood et al., 2016), little is known about their use of other tobacco products. For example, among 96 papers included in reviews of smoking prevalence in addiction treatment (Guydish et al., 2015a, 2011), only 7 papers reported on use of tobacco products other than cigarettes (Aubin et al., 1999; Basu et al., 2012; Ellingstad et al., 1999; Hurt et al., 1996; Patten et al., 2003; Richter et al., 2001; Rooban et al., 2009). Recently, e-cigarette use has been reported in addiction treatment samples (Peters et al., 2015; Stein et al., 2015). Similarly, there are few reports concerning the concurrent use of multiple tobacco products, or factors that may be associated with use of multiple products. One study found that 10.6% of US adults used multiple tobacco products, and that younger age, male gender, never having been married, and having tried to quit smoking were associated with multiple product use (Lee et al., 2014).

Based on their association with use of combustible cigarettes, a number of factors may also be associated with use of more than one tobacco product. Age, gender, education and race/ethnicity are associated with smoking prevalence in the general population (Centers for Disease Control and Prevention, 2015b; Garrett et al., 2011). Among those in drug treatment, smoking is more prevalent among opioid users (Stark and Campbell, 1993) and number of cigarettes per day (CPD) and use of tobacco cessation services have been associated with making a quit attempt (Martinez et al., 2015). Advertising receptivity predicts smoking initiation and maintenance (Henriksen et al., 2010), and advertising exposure has been associated with smoking initiation (Robertson et al., 2015). Counter-marketing campaigns to prevent smoking initiation and promote quitting can be successful (Davis et al., 2008), and messages focusing on negative health effects appear effective in increasing awareness of risks and facilitating quitting behavior (Durkin et al., 2012). While effects of tobacco advertising, counter-marketing, and risk perception have been explored in youth populations (Halpern-Felsher et al., 2004; Henriksen et al., 2010; Paynter and Edwards, 2009), they are little explored among adults engaged in addiction treatment.

This report describes findings from a national sample of persons enrolled in addiction treatment concerning their use of multiple tobacco products. We assessed factors associated with use of multiple tobacco products while controlling for demographic characteristics.

## 2. MATERIALS AND METHODS

### 2.1 Sampling Design

Addiction treatment programs were recruited in collaboration with the National Institute on Drug Abuse (NIDA) Clinical Trials Network (CTN), a national network of research centers or “nodes,” where each node included one or more university partners and a number of addiction treatment programs (National Institute on Drug Abuse, n.d.). There were 13 CTN nodes at the time the research was conducted. However, since its creation in 2000, the organizational membership of the CTN changes frequently, with both nodes and treatment programs entering and exiting with changing patterns of Federal funding and reciprocal willingness to continue to participate in the network. The CTN is dedicated to the conduct of clinical trials designed to improve addiction treatment (Nunes, 2011) and was used for this

research because it offers a national network of addiction treatment programs that are research experienced, and where challenges of field research were less likely to interfere with implementation. The population of programs used in the current study was the 2013 list of CTN-affiliated treatment programs (N = 166) identified in prior research (Roman et al., 2010).

## 2.2 Program Selection

Eligible for inclusion were CTN-affiliated programs that were: a) publicly-funded - defined as those receiving over 51% of their revenue from federal/state governmental sources; b) moderate or large in size - having at least 60 active patients, so that recruitment of the target 40 patients per program could be accomplished during a 1–3 day site visit; and c) willing to assign a staff liaison to coordinate data collection with the study team. Excluded were: a) privately funded programs; b) Veterans Administration (VA) programs; c) adolescent programs; and d) criminal justice or hospital-based programs that would require local IRB approval in addition to approval from the lead university. VA programs were excluded because they had standard policies on tobacco assessment and treatment, which differ from programs sampled from non-VA systems. Meeting eligibility criteria were 48 programs. The data collection plan was for a sample of 25 programs and, to allow for refusals, we drew a random sample of 33 programs stratified by program type. In this sample were outpatient (n = 15), residential (n = 13) and methadone (n = 5) programs.

## 2.3 Program Recruitment

The research team contacted the coordinator of each CTN node where selected programs were affiliated, and each “node coordinator” contacted programs in their node to assess interest. At this stage, six programs were no longer active in the CTN, two programs declined, and one was not needed to meet patient recruitment goals. Remaining in the sample were 9 outpatient, 10 residential and 5 methadone programs.

The research team then scheduled a phone meeting with each Program Director, in which the study was discussed the program was recruited. All programs contacted at this stage agreed to participate. In three instances Program Directors preferred that the study occur in a different program, within the same agency, than the program originally selected. This resulted in changes to the type of program where data were collected. One program changed from residential to methadone, one changed from outpatient to methadone, and one changed from outpatient to residential. The final sample included 7 outpatient, 10 residential, and 7 methadone programs. Programs were from 13 States (California, Ohio, Texas, Hawaii, Florida, Oregon, North Carolina, Pennsylvania, Vermont, Connecticut, South Carolina, New York, West Virginia), with at least 1 program from each of the 4 US census regions.

## 2.4 Participants

Clients in each program (including both smokers and non-smokers) were eligible to participate if they had been in treatment for at least 10 days. This ensured that they had time to become aware of tobacco policies and services in their program. To participate, clients had to be present in the program on the day of the site visit. In outpatient and methadone programs this procedure resulted in a systematic sample, while in residential programs it

yielded a census sample. In each program, the director reported current program census at the time of the survey. Combined capacity across the 24 programs was estimated at 6,801 persons. Methadone programs ranged in size from 200 to 1,000, outpatient program from 70 to 700, and residential programs from 40 to 125. Our sample of 1,113 represents 16.4% of the total active patients in participating programs. As data collection occurred in each program for 1 to 3 days, the maximum active patients seen would have been 3,649 ( $0.6 \times 6,081$ ), and in that case the sample represents 30% of all active patients in participating programs.

## 2.5 Procedures

The research team visited each site between May, 2014 and February, 2015. One staff member in each program served as the study liaison and coordinated the site visit with the research team. At all sites, participants completed the surveys in groups of up to six, determined by the number of iPads available. In residential programs, the staff liaison used a sign-up sheet to recruit participants in multiple time slots during the site visit. The research team explained the study to assembled clients and completed informed consent procedures. In methadone clinics the team recruited clients during morning dosing hours. In outpatient programs the team visited day or evening groups with high concentrations of clients, and invited study participants either at the beginning or end of the clinical group session. No record was made of persons who had no interest in the study, and field staff reported that participants sometimes declined due to lack of time to complete the survey. Among those who began the consent process, none declined to participate. Site visits were completed in one day for residential and methadone clinics, and 2–3 days for outpatient clinics. The number of participants recruited per clinic ranged from 28 to 53, with a median of 50. Each respondent received a \$20 gift card, and each program received a \$2,000 incentive following the site visit. Procedures were approved by the University of California, San Francisco, Institutional Review Board.

## 2.6 Measures

**2.6.1 Demographic Characteristics and Use of Tobacco Products**—Demographic characteristics included age, gender, education, race/ethnicity, and treatment type (outpatient, residential, methadone). Current smokers were defined as having smoked more than 100 cigarettes in their lifetime and also reporting being a current smoker. Current smokers reported number of cigarettes per day (CPD), number of serious quit attempts (for at least 24 hours) made in the past year, and lifetime use of nicotine replacement therapy (NRT: patch, gum, lozenge, inhaler, or nasal spray).

With pictures of products embedded in the survey, respondents were asked whether they had ever used smokeless tobacco, standard cigars, little filtered cigars (LFCs), or e-cigarettes/vape pens. For each product, those reporting lifetime use were asked whether they had used the product in the past 30 days and, if so, the frequency of use (daily, 2–3 times a week, weekly, or less than once a week). Tobacco product use items were adapted from the Population Assessment of Tobacco and Health (PATH) survey (Ambrose et al., 2015).

All current smokers were classified as “users” of combustible cigarettes. Because use of other tobacco products (smokeless tobacco, cigars, LFCs, e-cigarettes) may be infrequent or experimental, we defined “current use” as having used the product at least weekly in the past 30 days. Respondents who reported current use of one product were classified as single product users, while those who used more than one product were classified as multiple product users.

**2.6.2 Exposure to Tobacco Advertising and Counter-Marketing**—Receptivity to tobacco advertising was measured using the 4 item Pierce advertising scale, a measure shown to be associated with progression of smoking in adolescents (Pierce et al., 1998). Questions assessed if participants had received a tobacco promotional item (e.g., cap or t-shirt), willingness to use an item, brand of a favorite cigarette advertisement, and brand of cigarette the respondent has seen advertised the most. Persons who had either received or were willing to use a promotional item were classified as highly receptive to tobacco advertising. While Pierce et al. classified individuals as having low or intermediate classifications based on two questions (brand of favorite advertisement and brand advertised the most), we found only 5% of respondents were in the low category, and collapsed low and moderate into one category.

As the Pierce advertising measure is specific to cigarettes, respondents were also asked whether they had seen advertisements in the past 30 days, and how often they had seen advertisements (0, < weekly, weekly, daily) for each of three other tobacco products (smokeless tobacco, e-cigarettes, LFCs). Among youth, current and future cigarette smoking are associated with marketing exposure (Braverman and Aaro, 2004; Unger et al., 2003).

Exposure to tobacco counter-marketing was measured using the FDA Real Cost campaign, launched in 2014 and directed toward youth (Food and Drug Administration, 2015). Using frame shots from television commercials to support understanding, participants were asked whether they had seen Real Cost ads in the past 30 days, and how often they had seen these ads (0, < weekly, weekly, daily).

**2.6.3 Perceived Health Risks of Smoking**—Respondents received a standard scenario of a one pack per day smoker who had smoked for 15 years, and estimated the chance (0–100%) that the smoker would: get lung cancer, have trouble catching his breath, have a heart attack, get mouth or lip cancer. For each participant, the mean of the four risk percentages represented the perceived health risks of smoking. Adolescents discriminate different levels of risk between different types of smokers (Rubinstein et al., 2003) and estimate risks differently based on their own smoking experience (Halpern-Felsher et al., 2004)

## 2.7 Data Analysis

We report demographic characteristics for the total sample (N = 1,113), followed by the proportion of participants who reported use of each individual tobacco product, and the proportion who reported use of multiple tobacco products. Second, we compare single tobacco product users to multiple product users on smoking behavior measures (cigarettes per day, quit attempts in the past year, and lifetime use of nicotine replacement therapy), on the marketing and counter-marketing exposure measures, and on the perceived health risk

measure. Third, we assessed factors associated with use of multiple tobacco products using multivariate logistic regression model, and controlling for demographic characteristics, type of program where recruited, and nesting of patients within program. As rates of missing data were very low, the multivariate model used complete case analysis in which 885 of 915 cases were included. Generalized estimating equation (GEE) methods were applied for correlated data. The GEE method was conducted in the GENMOD procedure with a logit link function and repeated statement. The variance inflation factor (VIF) and tolerance coefficient were used to assess multi-collinearity. All statistical analyses were performed using SAS 9.3.

### 3. RESULTS

Participants had a mean age of 38.3 (SD = 11.74), half (49.4%) were women, and most (75.8%) had a high school education or higher. Participants were 55.3% White, 19% African American, and 11.9% Hispanic (Table 1). Participants were nearly evenly drawn from each of the three treatment types, although somewhat more (38%) were recruited from residential programs. Many (77.9%) reported current weekly use of combustible cigarettes, and the next most frequently used product was e-cigarettes (17.7%). Most (82.2%) used at least one tobacco product on a weekly basis in the past month, and 24.4% used multiple products.

Table 2 compares participants who used one tobacco product to those using multiple products on three measures of smoking behavior (CPD, quit attempts, use of NRT), and on the marketing/counter-marketing and risk perception measures. Compared to single product users, multiple product users had higher mean CPD (13.7 v. 11.8,  $p = .002$ ) and more often reported any lifetime use of NRT (55.2% v. 46.6%,  $p = .018$ ). Compared to single product users, multiple product users were also more likely to have high receptivity to tobacco advertising, reported higher daily exposure to advertising of tobacco products other than combustible cigarettes, and more often reported high daily exposure to the FDA Real Cost counter-marketing campaign (See Table 2).

Results of the multivariate logistic regression model of single v. multiple product use are summarized in Table 3. Compared to single product users, multiple product users had higher CPD (OR = 1.03, 95% CI: 1.01 – 1.05,  $p < 0.001$ ), greater odds of having made a serious smoking quit attempt (OR = 1.41, 95% CI: 1.02 – 1.96,  $p = 0.041$ ), and more often reported high exposure to daily advertising for products other than combustible cigarettes (OR = 1.93, 95% CI: 1.35 – 2.75,  $p = < 0.001$ ). Multiple product users also reported greater daily exposure to the Real Cost counter-marketing campaign (OR = 1.70, 95% CI: 1.09 – 2.63,  $p = 0.019$ ). Age, entered as a control variable, showed that younger age was associated with use of multiple products (OR = 0.97, CI 0.95 – 0.98,  $p < 0.001$ ). Multi-collinearity was evaluated using VIF and tolerance coefficient. For the variables in the model, the VIF are small ( $< 1.13$ ) and the tolerance coefficients are greater than 0.88. These indicators suggest that multicollinearity does not threaten the model.

## 4. DISCUSSION

The rate of combustible cigarette smoking in this study (77.9%) is comparable to the median annual smoking prevalence rate (76.3%) reported in a prior literature review (Guydish et al., 2011). This smoking rate is slightly higher than estimates derived from National Survey on Drug Use and Health data from 2006 – 2011, which ranged from 72.6% to 74.5% (Guydish et al., 2015b). Nevertheless, these data show high and unremitting smoking prevalence among persons enrolled in addiction treatment. The first consideration, for addiction treatment, tobacco control, and FDA regulatory authority, is that tobacco use and associated health effects are concentrated in this population.

Most frequently used among other tobacco products were e-cigarettes (17.7%), similar to 17% reported among addiction treatment outpatients in Baltimore (Peters et al., 2015) and lower than the 33.8% reported among opiate dependent patients in Massachusetts (Stein et al., 2015). Our definition of current use was weekly or greater in the past month, while both Peters et al. and Stein et al. defined current use as any use in the past month. Use of smokeless tobacco (5.2%) and cigars (4.6%) in this sample were close to US adult population figures of 3.6% and 5.4%, respectively (U.S. Department of Health and Human Services, 2014). Prevalence of LFC use is not broken out in CDC reports (Corey et al., 2014), so a direct comparison with population data is not possible. However use of LFCs by 8.6% in the current sample exceeds the national prevalence of cigar use (4.6%), and suggests a high rate of LFC use in this population. LFCs capture only 4% of the cigar market, however the use of flavorings in these products and reduced taxation may make them appealing to low income smokers (Centers for Disease Control and Prevention, 2015a). Most users of smokeless, LFC and cigar products in the current sample also used combustible cigarettes (79.3%, 91.7%, 92.2%, respectively).

While e-cigarettes may help some individuals quit smoking, a recent review concluded that use of e-cigarettes was associated with lower odds of quitting smoking (Kalkhoran and Glantz, 2016). Nevertheless, e-cigarette advertisements often claim that these products are helpful in quitting smoking (Grana and Ling, 2014). As with e-cigarettes, manufacturers of smokeless tobacco have made claims that that these products may help reduce or quit smoking (Mejia and Ling, 2010). Regulatory strategies concerning e-cigarettes, smokeless tobacco, cigars and LFCs should limit advertising and product packaging to avoid claims that they are helpful to stop smoking, or require statements that these products have not been shown effective in smoking cessation.

A substantial proportion of this sample (24.4%) used multiple tobacco products. When controlling for demographic variables and program type, persons with higher CPD and more past year quit attempts were more likely to use multiple tobacco products. This suggests that multiple product users had both greater nicotine addiction and greater interest in quitting, and is consistent with findings that persons intending to quit smoking are more likely to use other tobacco products (Popova and Ling, 2013), and multiple tobacco products (Lee et al., 2014). Daily exposure to advertising for products other than cigarettes was also associated with use of multiple products. This finding is consistent with literature indicating the effectiveness of tobacco advertising (e.g., Henriksen et al., 2010; Paynter and Edwards,



2009) although causal inferences cannot be drawn. There may exist a reciprocal effect, in which advertising encourages multiple product use, and multiple product users pay more attention to tobacco advertising. Regardless, if industry advertising encourages multiple product use, it may increase nicotine addiction, by promoting the use of non-combustible products where smoking is banned and make it more difficult to quit. At the same time, daily exposure to the Real Cost counter-marketing campaign was also associated use of multiple products. This association is not previously reported and warrants replication, but it may be that more heavily dependent tobacco users who are interested in quitting also attend more to counter-marketing messages in the environment.

Generalizability is a potential study limitation. We selected a random sample of addiction treatment programs within the NIDA CTN. We encountered challenges in recruiting randomly selected programs including some programs that were no longer active in the CTN, or that declined participation, and cases where the program director suggested conducting the study in a different program within the same agency. CTN programs, and patients in those programs, may also differ from non-CTN programs and patients. A comparison of methadone programs within and outside the CTN found that CTN programs were more likely to be non-profit programs, to have more employees and a higher patient census, and to have patient populations that were more often on Medicaid, unemployed, and involved in the criminal justice system (Ducharme and Roman, 2009). In a comparison of participants enrolled in CTN clinical trials to those receiving treatment in usual care settings, those enrolled in a CTN clinical trials were more likely to have full-time jobs and higher levels of education (Susukida et al., 2016). For these reason the sample may not be nationally representative. As an additional limitation, these cross-sectional data do not permit observation of change over time or causal attribution.

Rates of smoking and other tobacco use reported in this study may adequately represent publicly-funded non-profit programs serving uninsured patients or patients covered by Medicaid. However, private, for-profit addiction treatment programs that serve employed and insured patients would likely have lower rates of smoking and other tobacco use. Moreover, patients in this sample were drawn from outpatient (30.9%), residential (38%) and methadone maintenance (31.1%) programs, while patients in addiction treatment programs nationally are distributed differently (59.6%, 7.8%, 26.4%, respectively; Substance Abuse and Mental Health Services Administration, 2014). The current sample over-represents residential patients, where smoking rates tend to be higher as compared to outpatients (Guydish et al., 2015b). While programs meeting inclusion criteria were randomly selected, patients within programs represent either a census sample (in residential programs) or a systematic sample (in outpatient and methadone programs). Regarding measurement, the FDA Real Cost campaign was designed for youth. The CDC Tips from Former Smokers campaign was designed for adult smokers (Centers for Disease Control and Prevention, 2012) and may be a more suitable measure of counter-marketing exposure among adults.

Based on a national sample of persons enrolled in addiction treatment, the prevalence of combustible cigarette smoking was found to be high and, as a corollary, health and economic costs of smoking are concentrated in this population. The rate of multiple product use in this

addiction treatment sample was 24.4%, compared to 10.6% in the general population (Lee et al., 2014), and appears to be associated with interest in quitting smoking. While other tobacco products are often marketed as ways to reduce health risks or quit smoking, most multiple product users continued to smoke combustible cigarettes. An estimated 4 million persons receive some form of addiction treatment each year (Substance Abuse and Mental Health Services Administration, 2009) and, using an 82% rate of tobacco use, 3.2 million of those are tobacco users. Intervention with this number of users, whether through policy, regulatory or individual tobacco cessation intervention, can meaningfully reduce health and economic costs of tobacco use at the population level.

## Acknowledgments

### Role of Funding Source

Research reported in this publication was supported by grant number R01 DA 036066 from the National Institute on Drug Abuse and the Food and Drug Administration Center for Tobacco Products. The content is solely the responsibility of the authors and does not represent the official views of the NIH or the Food and Drug Administration.

The authors gratefully acknowledge the Directors, staff and patients enrolled in the participating addiction treatment programs.

## References

- Ait-Daoud N, Lynch WJ, Penberthy JK, Breland AB, Marzani-Nissen GR, Johnson BA. Treating smoking dependence in depressed alcoholics. *Alcohol Res Health*. 2006; 29:213–220. [PubMed: 17373412]
- Ait-Daoud N, Wiesbeck GA, Bienkowski P, Li MD, Pfutzer RH, Singer MV, Lesch OM, Johnson BA. Comorbid alcohol and nicotine dependence: from the biomolecular basis to clinical consequences. *Alcohol Clin Exp Res*. 2005; 29:1541–1549. [PubMed: 16156051]
- Ambrose BK, Day HR, Rostron B, Conway KP, Borek N, Hyland A, Villanti AC. Flavored tobacco product use among US youth aged 12–17 Years, 2013–2014. *JAMA*. 2015; 314:1871–1873. [PubMed: 26502219]
- Apollonio DE, Malone RE. Marketing to the marginalised: tobacco industry targeting of the homeless and mentally ill. *Tob Control*. 2005; 14:409–415. [PubMed: 16319365]
- Aubin HJ, Laureaux C, Tilikete S, Barrucand D. Changes in cigarette smoking and coffee drinking after alcohol detoxification in alcoholics. *Addiction*. 1999; 94:411–416. [PubMed: 10605869]
- Bandiera FC, Anteneh B, Le T, Delucchi K, Guydish J. Tobacco-related mortality among persons with mental health and substance abuse problems. *PLoS One*. 2015; 10:e0120581. [PubMed: 25807109]
- Basu D, Aggarwal M, Das PP, Mattoo SK, Kulhara P, Varma VK. Changing pattern of substance abuse in patients attending a de-addiction centre in north India (1978–2008). *Indian J Med Res*. 2012; 135:830–836. [PubMed: 22825602]
- Braverman MT, Aaro LE. Adolescent smoking and exposure to tobacco marketing under a tobacco advertising ban: findings from 2 Norwegian national samples. *Am J Public Health*. 2004; 94:1230–1238. [PubMed: 15226148]
- Centers for Disease Control and Prevention. Increases in quitline calls and smoking cessation website visitors during a national tobacco education campaign--March 19–June 10, 2012. *MMWR*. 2012; 61:667–670. [PubMed: 22932300]
- Centers for Disease Control and Prevention. CDC Fact Sheet - Cigars - Smoking and Tobacco Use. 2015a. Retrieved December 16, 2015, from [http://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/tobacco\\_industry/cigars/#overview](http://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/cigars/#overview)

- Centers for Disease Control and Prevention. Current cigarette smoking among adults – United States. 2015b. Retrieved March 31, 2016, from [http://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/adult\\_data/cig\\_smoking/](http://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/)
- Chun J, Haug NA, Guydish JR, Sorensen JL, Delucchi K. Cigarette smoking among opioid-dependent clients in a therapeutic community. *Am J Addict.* 2009; 18:316–320. [PubMed: 19444736]
- Corey CG, King BA, Coleman BN, Delnevo CD, Husten CG, Ambrose BK, Apelberg BJ. Centers for Disease C and Prevention. Little filtered cigar, cigarillo, and premium cigar smoking among adults--United States, 2012–2013. *MMWR.* 2014; 63:650–654. [PubMed: 25078654]
- Davis, RM.; Gilpin, E.; Loken, B.; Viswanath, K.; Wakefield, M. *The Role Of The Media In Promoting And Reducing Tobacco Use.* U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; Bethesda, MD: 2008. Contract No.: NIH Pub. 1994 (07-6242)
- Drobes DJ. Cue reactivity in alcohol and tobacco dependence. *Alcohol Clin Exp Res.* 2002; 26:1928–1929. [PubMed: 12500123]
- Ducharme LJ, Roman PM. Opioid treatment programs in the Clinical Trials Network: representativeness and buprenorphine adoption. *J Subst Abuse Treat.* 2009; 37:90–94. [PubMed: 19004597]
- Durkin S, Brennan E, Wakefield M. Mass media campaigns to promote smoking cessation among adults: an integrative review. *Tob Control.* 2012; 21:127–138. [PubMed: 22345235]
- Ellingstad TP, Sobell LC, Sobell MB, Cleland PA, Agrawal S. Alcohol abusers who want to quit smoking: implications for clinical treatment. *Drug Alcohol Depend.* 1999; 54:259–265. [PubMed: 10372799]
- Ferron JC, Brunette MF, He X, Xie H, McHugo GJ, Drake RE. Course of smoking and quit attempts among clients with co-occurring severe mental illness and substance use disorders. *Psychiatr Serv.* 2011; 62:353–359. [PubMed: 21459985]
- Food and Drug Administration. The Real Cost Campaign. Oct 21. 2015 Retrieved December 18, 2015, from <http://www.fda.gov/TobaccoProducts/PublicHealthEducation/PublicEducationCampaigns/TheRealCostCampaign/default.htm>
- Garrett BE, Dube SR, Trosclair A, Caraballo RS, Pechacek TF. Centers for Disease C and Prevention. Cigarette smoking - United States, 1965–2008. *MMWR Supplements.* 2011; 60:109–113. [PubMed: 21430635]
- Grana RA, Ling PM. “Smoking revolution”: a content analysis of electronic cigarette retail websites. *Am J Prev Med.* 2014; 46:395–403. [PubMed: 24650842]
- Guydish, J. Opinion: Anti-smoking effort for substance abusers is ‘anemic’. *CNN Health.* 2012. <http://www.cnn.com/2012/03/27/health/guydish-smoking-mental-disorders/index.html>
- Guydish J, Passalacqua E, Pagano A, Martinez C, Le T, Chun J, Tajima B, Docto L, Garina D, Delucchi K. An international systematic review of smoking prevalence in addiction treatment. *Addiction.* 2015a; 111:220–230. [PubMed: 26392127]
- Guydish J, Passalacqua E, Tajima B, Chan M, Chun J, Bostrom A. Smoking prevalence in addiction treatment: a review. *Nicotine Tob Res.* 2011; 13:401–411. [PubMed: 21464202]
- Guydish J, Yu J, Le T, Pagano A, Delucchi K. Predictors of tobacco use among New York State addiction treatment patients. *Am J Public Health.* 2015b; 105:e57–e64. [PubMed: 25393179]
- Halpern-Felsher BL, Biehl M, Kropp RY, Rubinstein ML. Perceived risks and benefits of smoking: differences among adolescents with different smoking experiences and intentions. *Prev Med.* 2004; 39:559–567. [PubMed: 15313096]
- Henriksen L, Schleicher NC, Feighery EC, Fortmann SP. A longitudinal study of exposure to retail cigarette advertising and smoking initiation. *Pediatrics.* 2010; 126:232–238. [PubMed: 20643725]
- Hser YI, McCarthy WJ, Anglin MD. Tobacco use as a distal predictor of mortality among long-term narcotics addicts. *Prev Med.* 1994; 23:61–69. [PubMed: 8016035]
- Hughes J. Do smokers with current or past alcoholism need different or more intensive treatment? *Alcohol Clin Exp Res.* 2002; 26:1934–1935. [PubMed: 12500126]
- Hurt RD, Offord KP, Croghan IT, Gomez-Dahl L, Kottke TE, Morse RM, Melton LJ 3rd. Mortality following inpatient addictions treatment. Role of tobacco use in a community-based cohort. *JAMA.* 1996; 275:1097–1103. [PubMed: 8601929]

- Jamal A, Homa DM, O'Connor E, Babb SD, Caraballo RS, Singh T, Hu SS, King BA. Current cigarette smoking among adults - United States, 2005–2014. *MMWR*. 2015; 64:1233–1240. [PubMed: 26562061]
- Kalkhoran S, Glantz SA. E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *Lancet Respir Med*. 2016; 4:116–128. [PubMed: 26776875]
- Kalman D, Morissette SB, George TP. Co-morbidity of smoking in patients with psychiatric and substance use disorders. *Am J Addict*. 2005; 14:106–123. [PubMed: 16019961]
- Kohn CS, Tsoh JY, Weisner CM. Changes in smoking status among substance abusers: baseline characteristics and abstinence from alcohol and drugs at 12-month follow-up. *Drug Alcohol Depend*. 2003; 69:61–71. [PubMed: 12536067]
- Lasser K, Boyd JW, Woolhandler S, Himmelstein DU, McCormick D, Bor DH. Smoking and mental illness: a population-based prevalence study. *JAMA*. 2000; 284:2606–2610. [PubMed: 11086367]
- Lee YO, Hebert CJ, Nonnemaker JM, Kim AE. Multiple tobacco product use among adults in the United States: cigarettes, cigars, electronic cigarettes, hookah, smokeless tobacco, and snus. *Prev Med*. 2014; 62:14–19. [PubMed: 24440684]
- Littleton J, Little H. Interactions between alcohol and nicotine dependence: a summary of potential mechanisms and implications for treatment. *Alcohol Clin Exp Res*. 2002; 26:1922–1924. [PubMed: 12500121]
- Martinez C, Guydish J, Le T, Tajima B, Passalacqua E. Predictors of quit attempts among smokers enrolled in substance abuse treatment. *Addict Behav*. 2015; 40:1–6. [PubMed: 25218064]
- McClure EA, Acquavita SP, Dunn KE, Stoller KB, Stitzer ML. Characterizing smoking, cessation services, and quit interest across outpatient substance abuse treatment modalities. *J Subst Abuse Treat*. 2014; 46:194–201. [PubMed: 23988192]
- Mejia AB, Ling PM. Tobacco industry consumer research on smokeless tobacco users and product development. *Am J Public Health*. 2010; 100:78–87. [PubMed: 19910355]
- National Institute on Drug Abuse. Clinical Trials Network (CTN). n.d. from <http://www.drugabuse.gov/about-nida/organization/cctn/ctn>
- National Institutes of Health. What is the Tobacco Control Act?. 2012. Retrieved October 15, 2012, from <http://dcccps.nci.nih.gov/nih-fda/about.htm>
- Nunes EV. The design and analysis of multisite effectiveness trials: a decade of progress in the National Drug Abuse Clinical Trials Network. *Am J Drug Alcohol Abuse*. 2011; 37:269–272. [PubMed: 21854267]
- Patten CA, Hurt RD, Offord KP, Croghan IT, Gomez-Dahl LC, Kottke TE, Morse RM, Joseph Melton L. Relationship of tobacco use to depressive disorders and suicidality among patients treated for alcohol dependence. *Am J Addict*. 2003; 12:71–83. [PubMed: 12623742]
- Paynter J, Edwards R. The impact of tobacco promotion at the point of sale: a systematic review. *Nicotine Tob Res*. 2009; 11:25–35. [PubMed: 19246438]
- Peters EN, Harrell PT, Hendricks PS, O'Grady KE, Pickworth WB, Voci FJ. Electronic cigarettes in adults in outpatient substance use treatment: awareness, perceptions, use, and reasons for use. *Am J Addict*. 2015; 24:233–239. [PubMed: 25809200]
- Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Berry CC. Tobacco industry promotion of cigarettes and adolescent smoking. *JAMA*. 1998; 279:511–515. [PubMed: 9480360]
- Popova L, Ling PM. Alternative tobacco product use and smoking cessation: a national study. *Am J Public Health*. 2013; 103:923–930. [PubMed: 23488521]
- Prochaska JJ, Delucchi K, Hall SM. A meta-analysis of smoking cessation interventions with individuals in substance abuse treatment or recovery. *J Consult Clin Psychol*. 2004; 72:1144–1156. [PubMed: 15612860]
- Richter KP, Gibson CA, Ahluwalia JS, Schmelzle KH. Tobacco use and quit attempts among methadone maintenance clients. *Am J Public Health*. 2001; 91:296–299. [PubMed: 11211643]
- Robertson L, McGee R, Marsh L, Hoek J. A systematic review on the impact of point-of-sale tobacco promotion on smoking. *Nicotine Tob Res*. 2015; 17:2–17. [PubMed: 25173775]
- Roman PM, Abraham AJ, Rothrauff TC, Knudsen HK. A longitudinal study of organizational formation, innovation adoption, and dissemination activities within the National Drug Abuse

Treatment Clinical Trials Network. *J Subst Abuse Treat.* 2010; 38(Suppl 1):S44–52. [PubMed: 20307795]

- Rooban T, Rao A, Joshua E, Ranganathan K. The prevalence of oral mucosal lesions in alcohol misusers in Chennai, south India. *Indian J Dent Res.* 2009; 20:41–46. [PubMed: 19336859]
- Rubinstein ML, Halpern-Felsher BL, Thompson PJ, Millstein SG. Adolescents discriminate between types of smokers and related risks: evidence from nonsmokers. *J Adolescent Res.* 2003; 18:651–663.
- Saxon AJ, McGuffin R, Walker RD. An open trial of transdermal nicotine replacement therapy for smoking cessation among alcohol- and drug-dependent inpatients. *J Subst Abuse Treat.* 1997; 14:333–337. [PubMed: 9368209]
- Sayette M. The effects of alcohol on cigarette craving. *Alcohol Clin Exp Res.* 2002; 26:1925–1927. [PubMed: 12500122]
- Schlaepfer IR, Hoft NR, Ehringer MA. The genetic components of alcohol and nicotine co-addiction: from genes to behavior. *Curr Drug Abuse Rev.* 2008; 1:124–134. [PubMed: 19492010]
- Stark MJ, Campbell BK. Drug use and cigarette smoking in applicants for drug abuse treatment. *J Subst Abuse.* 1993; 5:175–181. [PubMed: 8400839]
- Stein MD, Caviness CM, Grimone K, Audet D, Borges A, Anderson BJ. E-cigarette knowledge, attitudes, and use in opioid dependent smokers. *J Subst Abuse Treat.* 2015; 52:73–77. [PubMed: 25483740]
- Stein MD, Caviness CM, Kurth ME, Audet D, Olson J, Anderson BJ. Varenicline for smoking cessation among methadone-maintained smokers: a randomized clinical trial. *Drug Alcohol Depend.* 2013; 133:486–493. [PubMed: 23953658]
- Substance Abuse and Mental Health Services Administration. Results from the 2008 National Survey on Drug Use and Health: National findings. Office of Applied Studies; Rockville, MD: 2009. NSDUH Series H-36, HHS Publication No. SMA 09–4434
- Substance Abuse and Mental Health Services Administration. Data on Substance Abuse Treatment Facilities. Substance Abuse and Mental Health Services Administration; Rockville, MD: 2014. National Survey of Substance Abuse Treatment Services (N-SSATS): 2013. BHSIS Series S-73, HHS Publication No. (SMA) 14-4890pp. Table 3.2
- Susukida R, Crum RM, Stuart EA, Ebnesajjad C, Mojtabei R. Assessing sample representativeness in randomized control trials: application to the National Institute of Drug Abuse Clinical Trials Network. *Addiction.* 2016; Epub ahead of print. doi: 10.1111/add.13327
- Thurgood SL, McNeill A, Clark-Carter D, Brose LS. A systematic review of smoking cessation interventions for adults in substance abuse treatment or recovery. *Nicotine Tob Res.* 2016; 18:993–1001.
- U.S. Department of Health and Human Services. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; Atlanta, GA: 2014.
- U.S. Department of Health and Human Services. Deeming Tobacco Products To Be Subject to the Federal Food, Drug, and Cosmetic Act, as Amended by the Family Smoking Prevention and Tobacco Control Act; Restrictions on the Sale and Distribution of Tobacco Products and Required Warning Statements for Tobacco Products. Food and Drug Administration; 2016. (Vol HHS 21 CFR Parts 1100, 1140, and 1143, [Docket No. FDA-2014-N-0189], RIN 0910-AG38. Document Number: 2016–10685. Available at: <https://federalregister.gov/a/2016-10685>)
- Unger JB, Schuster D, Zogg J, Dent CW, Stacy AW. Alcohol advertising exposure and adolescent alcohol use: a comparison of exposure measures. *Addict Res Theory.* 2003; 11:177–193.
- Walsh DC, Gordon NP. Legal approaches to smoking deterrence. *Annu Rev Public Health.* 1986; 7:127–149. [PubMed: 3521640]
- Ward KD, Kedia S, Webb L, Relyea GE. Nicotine dependence among clients receiving publicly funded substance abuse treatment. *Drug Alcohol Depend.* 2012; 125:95–102. [PubMed: 22542293]

### Highlights

- Prevalence of smoking cigarettes is very high among persons in drug treatment.
- Electronic cigarettes are widely used in this population.
- Persons in drug treatment use multiple tobacco products, possibly to quit smoking.
- Tobacco products such as e-cigarettes are not shown to be effective cessation aids.
- Regulation of other tobacco products should prohibit marketing as cessation aids.

**Table 1**

Demographic Characteristics and Use of Tobacco Products among Persons Enrolled in Addiction Treatment  
(N = 1,113)

Variable	Mean (SD) or n (%)
<b>Age</b>	38.3 (11.74)
<b>Gender</b>	
Male	558 (50.2%)
Female	549 (49.4%)
Other	5 (0.5%)
<b>Education</b>	
Less than high school/GED	269 (24.2%)
High school/GED	363 (32.6%)
More than high school/GED	480 (43.2%)
<b>Race/Ethnicity</b>	
Hispanic	132 (11.9%)
Black/African American	211 (19.0%)
White	615 (55.3%)
American Indian/Alaska Native	54 (4.9%)
Asian/Pacific Islander	17 (1.5%)
Other/Multiple	83 (7.5%)
<b>Treatment Type</b>	
Outpatient	344 (30.9%)
Residential	423 (38.0%)
Methadone	346 (31.1%)
<b>Weekly Use of Tobacco Products<sup>1,2</sup></b>	
Cigarettes	867 (77.9%)
e-Cigarettes	197 (17.7%)
Smokeless Tobacco	58 (5.2%)
Little Filtered Cigars	96 (8.6%)
Cigars	51 (4.6%)
Weekly use of at least one product	915 (82.2%)
<b>Multiple Product Use<sup>1</sup></b>	
No product	198 (17.8%)
One product only	644 (57.9%)
Multiple products	271 (24.4%)

<sup>1</sup>Self-report use of tobacco products at least weekly in the past 30 days

<sup>2</sup>Percentages add to more than 100% due to multiple product use

**Table 2**

Tobacco Use Measures among Current Tobacco Users (N = 915)

	<b>Mean (SD) or n (%)</b>			<b>P-value</b>
	<b>Total (N=915)</b>	<b>One Tobacco Product (N=644)</b>	<b>Multiple Tobacco Products (N=271)</b>	
<b>Cigarettes per Day (CPD)</b>	12.4 (8.28)	11.8 (7.82)	13.7 (9.18)	<b>0.002</b>
<b>Any quit attempts in past year</b>	428 (46.8%)	291 (45.2%)	137 (50.6%)	0.137
<b>Ever used nicotine replacement therapy (NRT)</b>	445 (49.2%)	296 (46.6%)	149 (55.2%)	<b>0.018</b>
<b>Pierce Advertising Receptivity</b>				<b>0.035</b>
High	612 (66.9%)	417 (64.8%)	195 (72.0%)	
Low/Moderate	303 (33.1%)	227 (35.2%)	76 (28.0%)	
<b>Exposure to advertising of other tobacco products</b>				<b>&lt;0.001</b>
No	194 (21.2%)	157 (24.4%)	37 (13.7%)	
< Weekly	180 (19.7%)	129 (20.0%)	51 (18.8%)	
Weekly	246 (26.9%)	174 (27.0%)	72 (26.6%)	
Daily	295 (32.2%)	184 (28.6%)	111 (41.0%)	
<b>Exposure to Real Cost counter-marketing campaign</b>				<b>0.001</b>
No	439 (48.1%)	321 (49.9%)	118 (43.7%)	
< Weekly	171 (18.7%)	127 (19.8%)	44 (16.3%)	
Weekly	165 (18.1%)	117 (18.2%)	48 (17.8%)	
Daily	138 (15.1%)	78 (12.1%)	60 (22.2%)	
<b>Perceived health risks of smoking</b>	59.4 (20.25)	59.5 (20.08)	59.1 (20.67)	0.785



**Table 3**

Multiple Logistic Regression Analysis of Factors Associated With Use of Multiple Tobacco Products among Current Tobacco Users<sup>1</sup>

Variable	Adjusted OR (95%CI)	p
<b>Age</b>	0.97 (0.95–0.98)	<b>&lt;0.001</b>
<b>Gender</b>		
Male (Ref)	1	
Female	0.87 (0.58–1.28)	0.473
<b>Education</b>		
More than high school/GED (Ref)	1	
Less than high school/GED	1.09 (0.69–1.72)	0.725
High school/GED	0.93 (0.64–1.35)	0.702
<b>Race</b>		
Hispanic (Ref)	1	
Black/African American	0.97 (0.49–1.91)	0.925
White	0.92 (0.48–1.78)	0.812
Other	0.67 (0.30–1.51)	0.336
<b>Program type</b>		
Residential (Ref)	1	
Outpatient	1.05 (0.63–1.75)	0.837
Methadone	1.08 (0.61–1.91)	0.803
<b>Cigarettes per Day (CPD)</b>	1.03 (1.01–1.05)	<b>&lt;0.001</b>
<b>Any quit attempts in past year</b>		
No (Ref)	1	
Yes	1.41 (1.02–1.96)	<b>0.041</b>
<b>Ever used nicotine replacement therapy (NRT)</b>		
No (Ref)	1	
Yes	1.44 (0.96–2.15)	0.076
<b>Pierce Advertising Receptivity</b>		
Low/Moderate (Ref)	1	
High	1.40 (0.92–2.14)	0.114
<b>Exposure to advertising of other tobacco products</b>		
No (Ref)	1	
< Weekly	1.53 (0.96–2.44)	0.077
Weekly	1.41 (0.82–2.44)	0.213
Daily	1.93 (1.35–2.75)	<b>&lt;0.001</b>
<b>Exposure to Real Cost counter- marketing campaign</b>		
No (Ref)	1	
< Weekly	0.88 (0.57–1.38)	0.586
Weekly	0.91 (0.54–1.56 )	0.738
Daily	1.70 (1.09–2.63)	<b>0.019</b>
<b>Perceived health risk of smoking</b>	1.00 (0.99–1.00)	0.244

<sup>1</sup>The multiple logistic regression model included all variables listed in the table, and controlled for nesting of participants within program. As rates of missing data were very low, the multivariate model used complete case analysis in which 885 of 915 cases were included.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript