Published in final edited form as:

Addict Behav. 2019 April ; 91: 149–155. doi:10.1016/j.addbeh.2018.08.037.

Health Risk Perceptions and Reasons for Use of Tobacco Products among Clients in Addictions Treatment

Barbara K. Campbell^a, Thao Le^b, Noah R. Gubner^b, and Joseph Guydish^b

^aOHSU/PSU School of Public Health, Oregon Health and Sciences University, 3181 SW Sam Jackson Park Road, Portland, OR 97239-3098, USA

^bPhilip R. Lee Institute for Health Policy Studies, University of California San Francisco, 3333 California St., Ste. 265, San Francisco, CA 94118, USA

Abstract

Introduction: We examined rates of use, health risk perceptions and reasons for use of combustible and non-combustible tobacco products among clients enrolled in addictions treatment across the United States.

Methods: Participants (N= 1153) completed tobacco use surveys and rated health risk perception of all products. Users of non-cigarette products reported their main reason for use of each product. Logistic regression analyses examined associations between health risk perceptions and product use, including combustible cigarette use, and between reasons for use and non-cigarette product use.

Results: Cigarette smoking was reported by 77.5%, followed by use of e-cigarettes (26.6%), little filtered cigars (LFCs)/cigarillos (15.4%), smokeless tobacco (11.4%), and cigars (8.4%). Lower perceived health risk of cigarettes was associated with smoking cigarettes (OR=0.985, 95% CI: 0.975– 0.995, p=0.005). Lower perceived health risk of e-cigarettes was associated with e-cigarette use (OR=0.991, 95% CI: 0.984– 0.998, p=0.023). Users of cigars and users of LFC/ cigarillos (versus other product use) were more likely to report their main reason for use as “enjoying flavor/taste”, and smokeless tobacco users were more likely to report “at times when can’t smoke” as their main reason for use compared with other reasons. E-cigarette users were more likely to report to “reduce/quit cigarettes” as their main reason for use as compared to all other reasons except “reduce health risk”.

Conclusion: Treating smoking in addictions treatment should assess all tobacco product use, accuracy of health risk perceptions, and use of e-cigarettes to reduce/quit smoking, in order to promote cessation of combustible tobacco.

Keywords

tobacco products; smoking; health risk perception; addictions treatment

Correspondence concerning this article should be addressed to: Barbara K. Campbell, Ph.D., OHSU/PSU School of Public Health, Oregon Health and Sciences University, 3181 SW Sam Jackson Park Road, Portland, OR 97239-3098, Phone: 503-221-7074, drbarbaracampbell@earthlink.net.

Disclosure of Interest: The authors declare that they have no conflicts of interest.

1. Introduction

Although cigarette smoking among adults in the United States declined to a rate of 15.5% by 2016 (Jamal et al., 2018), there are vulnerable populations for whom smoking rates remain high. Individuals in substance use disorders (SUDs) treatment smoke at rates as high as 84% (Guydish, Passalacqua, et al., 2016) and die from tobacco-related illness at higher rates than the general population (Bandiera, Anteneh, Le, Delucchi, & Guydish, 2015). Addictions treatment programs have instituted policy and treatment changes over the last several decades to address this problem. By 2015, smoke-free policies were implemented by about a third of addictions treatment programs (Substance Abuse and Mental Health Services Administration, 2017) and approximately 30–40% of programs reported smoking cessation counseling services (Knudsen, 2017). Despite these modest advances, smoking rates remain high and cessation rates remain low among those in SUD treatment (Guydish et al., 2017). Innovative approaches are needed to strengthen current interventions strategies.

In July 2017, the United States Food and Drug Administration (US FDA) announced a “roadmap” to reduce tobacco-related mortality (FDA News Release, 2017). Based upon evidence that consumption of combustible tobacco incurs the greatest health risks, the FDA is formulating a strategy to reduce addiction to combustible cigarettes via reduction of nicotine content. It also delayed timelines for newly regulated tobacco products to encourage innovation that will, presumably, promote consumers switching to lower risk, non-combustible products.

Consumption of alternative tobacco products is rising, including increases in use of combustible products such as large cigars (Agaku et al., 2014) and flavored little cigars and cigarillos, which appeal to youth (Kostygina, Glantz, & Ling, 2016; Sterling, Fryer, & Fagan, 2015) and may be associated with cigarette smoking initiation (Bunnell et al., 2015). There is also increasing consumption of certain non-combustible products such as electronic cigarettes (e-cigarettes; Camenga et al., 2014; McMillen, Gottlieb, Shaefer, Winickoff, & Klein, 2015), new varieties of smokeless tobacco (e.g., snus; Delnevo et al., 2014), and, outside the US, heat-not-burn products, currently under FDA review for availability in the US (Caputi, Leas, Dredze, Cohen, & Ayers, 2017). Product use may be influenced by marketing and availability (Alpert, Koh, & Connolly, 2008; De, Hastings, & Angus, 2013) flavoring (Feirman, Lock, Cohen, Holtgrave, & Li, 2015; King, Tynan, Dube, & Arrazola, 2014), nicotine content (Alpert et al., 2008), popular appeal (Gilreath et al., 2016), attempts at smoking cessation (Popova & Ling, 2013), and health risk perceptions (Berg et al., 2015).

A body of evidence indicates that lower perceived health risk of smoking is associated with higher smoking initiation (Song et al., 2009) greater continuation of smoking (Mantler, 2013) and fewer quit attempts (Savoy et al., 2014) within the general population. Although less thoroughly studied, health risk perception of alternative tobacco products also appears to be associated with product use; use of a product is associated with lower risk perception for that product relative to non-use (Bernat, Ferrer, Margolis, & Blake, 2017; Nyman, Sterling, Majeed, Jones, & Eriksen, 2017; Wackowski & Delnevo, 2016).

Understanding how individuals perceive health risks associated with use of alternative tobacco products and documenting reasons for use, including use as a smoking cessation aid, may inform harm reduction efforts. Additionally, strengthening evidence regarding actual risks associated with different products, and conveying accurate information to consumers may help reduce tobacco-related deaths. An important message to convey is that combustion may be the greatest source of smoking-related illness. Notably, projections of reduced mortality associated with replacing cigarette with e-cigarette use over a 10-year period range from 1.6 million to 6.6 million fewer premature deaths (Levy et al., 2018).

Decreasing tobacco-related mortality by decreasing use of combustible tobacco is an approach worthy of study within vulnerable, high smoking populations such as individuals with SUDS. There is important, preliminary information to gather. Rates of use, reasons for use, and health risk perception of alternative products, both combustible and non-combustible, should be examined in this population.

Research to date has been limited. Multiple tobacco product use, reported by 24% of an addictions treatment sample, was associated with cigarette smoking, smoking quit attempts, and advertising exposure to tobacco products (Guydish, Tajima, et al., 2016). Rates of past 30-day e-cigarette use among addictions treatment clients ranged from 24% to 34%, with reducing/quitting smoking a commonly cited reason for use (Gubner, Andrews, Mohammad-Zadeh, Lisha, & Guydish, 2016; Peters et al., 2015; Stein et al., 2015). Lower perceived health risk of smoking was associated with being a smoker among SUD clients, a result that corresponds with general population findings (Campbell, Le, Andrews, Pramod, & Guydish, 2016). We did not identify any studies that examined health risk perceptions of non-cigarette, tobacco products within this population.

Our study sought to identify variables associated with use of combustible and non-combustible tobacco products among individuals with SUDs. Specifically, we examined rates of use, health risk perceptions and reasons for use of cigarettes, cigars, little filtered cigars (LFCs)/cigarillos, smokeless tobacco, and e-cigarettes among persons enrolled in addictions treatment across the United States.

2. Methods

2.1 Program Selection, Participant Recruitment and Procedures

The study was conducted during 2016 in 24 SUD treatment programs affiliated with the National Drug Abuse Treatment Clinical Trials Network (CTN), a nationwide network of research centers and affiliated treatment programs conducting community-based research to improve treatment outcomes. Participating programs were randomly selected, stratified by program type (inpatient/residential, methadone maintenance, outpatient), from among 48 possible programs within the CTN that met inclusion criteria (i.e., publicly-funded, treating adults over 18 only, and program size of at least 60 active patients). Research staff conducted site visits to collect survey data, after which participating programs received a \$2,000 incentive. All clients enrolled in treatment for at least 10 days and present the days the survey was conducted were eligible to participate. The number of participants recruited from each clinic ranged from 32–55 with a median of 31. Participants provided informed consent,

completed tobacco-use related surveys, and received a \$20.00 gift card following survey completion. Details of sampling design, program recruitment, and study procedures are reported in Guydish, Tajima et al. (2016). The University of California San Francisco Institutional Review Board approved all study procedures.

2.2 Measures

2.2.1 Demographics—Participants reported age, gender, race/ethnicity, and education. Treatment program type was categorized as residential, outpatient or methadone maintenance.

2.2.2 Tobacco Product Use—Current smoking was defined as reporting current smoking and lifetime smoking of at least 100 cigarettes. All participants were also asked whether they had used cigars, LFCs/cigarillos, smokeless tobacco and e-cigarettes/vape pens within the past 30 days (yes/no).

2.2.3 Reasons for Product Use—Participants who reported use of cigars, LFCs/cigarillos or smokeless tobacco in the last 30 days were asked to select a reason for use of that product (i.e., “If used in the past 30 days please select the reason why”) from among the following: use at times when you cannot smoke, to reduce health risks, to reduce or quit cigarette smoking, enjoy the flavor/taste, like the “buzz”, or “for a different reason”. We combined “like the buzz” and “different reason” into one “other reasons” category for our analyses in order to provide categories comparable with those for e-cigarette use. Participants who reported e-cigarette use were asked to select the main reason they use e-cigarettes from among the following response options: times when cannot smoke, to reduce health risks, to reduce or quit cigarette smoking, because they have good flavors, don’t leave you smelling badly, for smoke/cloud tricks, cost less than traditional cigarettes, curiosity, for a different reason. We combined smell, smoke/cloud tricks, cost, curiosity and different reason into one “other reasons” category in order to provide categories comparable with those asked for other products. Thus, there were five, mutually exclusive, main reasons for use of each product: at times when can’t smoke, to reduce health risks, to reduce or quit smoking, enjoy the flavor/taste, and other reasons.

2.2.4 Health Risk Perception—Participants were asked to estimate health risks associated with cigarette smoking using a standard, third-person, scenario (i.e., “Tom is a current smoker. He has smoked 1 pack of cigarettes per day for the last 15 years. As a current smoker, what is the chance (0–100%) he will... ?”). Three negative health outcomes were assessed (i.e., get lung cancer, have trouble catching breath, have a heart attack). Participants also estimated health risks of these three health conditions separately for cigars, LFCs/cigarillos and e-cigarettes. The mean of the 3 responses was used as the health risk perception score for each product (Cronbach’s $\alpha = .90$). Estimated health risks for smokeless tobacco included these 3 health problems and one additional condition, get mouth/lip cancer. The mean of the 4 responses was used as the health risk perception score for smokeless tobacco (Cronbach’s $\alpha = .84$). The risk perception measure was adapted from measures shown to discriminate among categories of smokers (e.g., casual, addicted;

Rubinstein, Halpern-Felsher, Thompson, & Millstein, 2003) and among adolescents' intentions and experiences of smoking (Halpern-Felsher, Biehl, Kropp, & Rubinstein, 2004).

2.3 Analyses

There were 1153 survey respondents in our sample. Four respondents who reported that they were current smokers but smoked less than 100 cigarettes lifetime were excluded from the analysis of risk perception and smoking status. All participants who reported using at least one alternative product (cigars, LFCs/cigarillos, smokeless tobacco, and/or e-cigarettes; $n = 484$) were included in the analyses of associations between reasons for use and product use.

We used standard descriptive statistics - means and standard deviations for continuous variables and frequencies and percentages for categorical variables - to summarize demographics, program type, use, and health risk perception for each product. Frequencies for main reason for using cigars, LFCs/cigarillos, smokeless tobacco, and e-cigarettes in the past 30 days were also calculated.

Next, we examined associations between health risk perception of each product and use (yes/no) of that product via logistic regression analyses. All models controlled for demographic variables (age, gender, race/ethnicity, and education) and program type. Because the data were collected from 24 clinics, the models also accounted for nesting of participants within clinic via generalized estimating equation (GEE) models for correlated data.

Then, we examined associations between reason for use and non-cigarette, tobacco product use in separate comparisons for each product. These analyses included all participants who reported using at least one product (cigars, LFCs/cigarillos, smokeless tobacco, and/or e-cigarettes) in the past 30 days. Separate logistic regression analyses were performed between each product and reasons for use of that product. The dependent variable was a dichotomous variable, use of the product versus use of other products in the past 30 days. The independent variable of interest was reason for use (when can't smoke, to reduce health risks, to reduce/quit cigarettes, enjoy the taste/flavor, other reasons). The models controlled for demographic variables (age, gender, race/ethnicity, and education) and program type. Because each participant could use multiple products and could be entered in the model more than once with a reason for use associated with each product used, we further adjusted for nesting of products within participant and participants within clinic via GEE models for correlated data. We compared reasons for use, selecting the most likely reason for use of the product (i.e., reason having the largest odds) as the reference group for each comparison. Thus, in each comparison, we examined whether the most likely reason for use of a product was significantly associated with use of that product versus use of other products compared with each other reason for use.

In total, 21 associations were examined. We applied the False Discovery Rate procedure for all 21 comparison tests to control for possible type I error rate inflation. As the rate of missing data was low (3%), the multivariable models used complete case analysis. All analyses were conducted using SAS version 9.4.

3. Results

3.1 Descriptive Statistics

Table 1 shows the demographic characteristics of our total sample, and by each tobacco product. As shown in Table 2, 77.5% of participants were current cigarettes smokers. Among cigarette smokers, 44.4% reported use of at least one other tobacco product in the last 30 days. Use of other products in the past 30 days ranged from 8.4% for cigars to 26.6% for e-cigarettes. The majority of other product users also smoked cigarettes, ranging from 78.2% of e-cigarette users to 92.6% of LFC/cigarillo users. Regarding reasons for use, “other reasons” were cited most by cigar (40.6%) and LFC/cigarillo users (43.4%), “when can’t smoke” was reported most by smokeless users (48.1%) and “to reduce/quit cigarettes” was the most cited reason by e-cigarette users (29.3%). The highest perceived health risk was for cigarettes (mean % score = 61.8, s.d.19.8) and the lowest perceived risk was for e-cigarettes (mean % score = 40.0, s.d. 23.0).

3.2 Associations Between Health Risk Perception and Product Use

Results of multivariable regression models evaluating associations between health risk perception and use of each tobacco product are summarized in Table 3. Lower perceived health risk of cigarettes was significantly associated with current cigarette use (OR=0.985, 95% CI: 0.975– 0.995, $p=0.005$). Lower perceived health risk of e-cigarettes was significantly associated with e-cigarette use in the past 30 days (OR=0.991, 95% CI: 0.984– 0.998, $p=0.023$).

3.3 Association Between Reasons for Use and Product Use

Table 4 shows results of multivariable regression models examining associations for each non-cigarette product (cigars, LFCs/cigarillos, smokeless tobacco, and e-cigarettes) between reason for use and use of that product versus use of other non-cigarette products in the past 30 days. Participants using cigars reported “enjoy the flavor/taste” as the most likely reason for use (highest odds). This reason was significantly more likely for cigar use versus other product use than “when can’t smoke” ($p = 0.002$) and “to reduce/quit cigarettes” ($p < 0.001$). “Enjoy the flavor/taste” was the most likely reason for use of LFC/cigarillos versus other product use. This reason was more likely than “when can’t smoke”, “to reduce health risk”, and “to reduce/quit cigarettes” (all p -values < 0.002). Smokeless tobacco users reported “when can’t smoke” as the most likely reason for use relative to all other reasons (all p -values < 0.016). The reason “to reduce/quit cigarettes” was the most likely reason for e-cigarette use (versus use of other products) when compared with all other reasons (p -values < 0.001), except for “to reduce health risk” (p -value = 0.431).

4. Discussion

Among 1153 clients in addictions treatment, 77.5% described themselves as current cigarette smokers, and 26.6% reported e-cigarette use within the past 30 days. The high rate of cigarette smoking among clients with SUD disorders is consistent with previous findings (Guydish, Passalacqua, et al., 2016) and far exceeds the U.S. general population rate of 15.5% in 2015 (Jamal et al., 2018). Rates of e-cigarette use in this sample were also higher

than reports in the general population. (Schoenborn & Gindi, 2015). Similarly, our sample reported higher rates of use of other tobacco products (cigars, LFCs/cigarillos, and smokeless) than reports from the general population (Agaku et al., 2014; Kasza et al., 2017). Moreover, a large majority of alternative product users reported also currently smoking cigarettes. Although direct comparisons are not possible, potentially higher rates of alternative tobacco product use, including multiple product use (Guydish, Tajima, et al., 2016), in this high-smoking population of individuals with SUDs, add to the complexity of addressing combustible tobacco use and nicotine addiction in this population.

Perceived health risks of cigarettes were significantly associated with cigarette smoking; those reporting lower perceived health risk of cigarettes were more likely to be current smokers than non-smokers. This finding corresponds to findings from an earlier sample of clients in addictions treatment, and with findings from smokers in the general population, strengthening the evidence that smokers perceive lower health risk from smoking than non-smokers do, an inaccurate and concerning perception (Bernat et al., 2017; Campbell et al., 2016; Krosnick et al., 2017; Weinstein, Marcus, & Moser, 2005). Participants who rated e-cigarettes as having lower health risks were more likely to have used e-cigarettes in the past 30 days, findings which are also consistent with those within the general population of e-cigarette consumers (Amrock, Zakhar, Zhou, & Weitzman, 2014; Bernat et al., 2017). Health risk perceptions of other tobacco products were not associated with use of those products in the current study, in contrast with research that has shown lower health risk perception to be associated with product use (Bernat et al., 2017; Nyman et al., 2017; Wackowski & Delnevo, 2016). Possible reasons for this difference range from methodological differences (e.g., different risk perception questions) to actual population differences (i.e., individuals in addictions treatment may have different perceptions of health risks of tobacco products than those in the general population).

Use of different tobacco products was associated with different reasons for using the product. Smokeless users were more likely to report using at times when they can't smoke, while LFC/cigarillo and cigar users were more likely to report using for flavor/taste relative to certain other reasons. Concerns about the rise in sales of cigarillos and cigars associated with the appeal of flavoring appear to be supported by the latter findings; tighter regulation of flavoring should occur.

Reducing/quitting smoking was the main reason for use associated with e-cigarettes versus other products when compared to all other reasons except for "to reduce health risks". Although many e-cigarette users report using in order to reduce or quit smoking, and the shift from smoking cigarettes to e-cigarettes may reduce health risks (Farsalinos & Polosa, 2014; Shahab et al., 2017), evidence that e-cigarette use promotes smoking cessation remains inconclusive (Kalkhoran & Glantz, 2016; Rahman, Hann, Wilson, Mnatzaganian, & Worrall-Carter, 2015). Most reviews agree that there is a need for randomized, controlled trials comparing e-cigarettes with standard smoking cessation interventions, including nicotine replacement therapies (Kalkhoran & Glantz, 2016; Malas et al., 2016; Rahman et al., 2015). It is important to strengthen evidence regarding the effectiveness of e-cigarettes for smoking cessation, and to continue investigation of their long-term health risks, since e-

cigarettes are marketed as a smoking cessation aid (De Andrade, Hastings, & Angus, 2013), and used as such by consumers (Pepper & Brewer, 2014).

Current results provide preliminary evidence that may inform innovations in smoking cessation interventions in addictions treatment. First, given the relatively high rates of use of alternative products, programs should ask clients about cigarette smoking, as well as use of other tobacco products. Information regarding use of other combustible tobacco products, use of non-combustible tobacco, and whether such use involves attempts to decrease or stop smoking may be important for harm reduction assistance. Second, accurate health information about different products should be provided. Finally, providers should inquire about client use of e-cigarettes to reduce or stop smoking. Although current evidence is not strong enough to support initiating smoking cessation interventions employing e-cigarettes, harm reduction may be enhanced by clinical support of efforts already underway by clients to switch from combustible cigarettes to e-cigarettes. The issue of addressing nicotine addiction itself remains and may be particularly relevant within a population of individuals with additional substance use disorders that impede quality of life. Despite the harm reduction potential of non-combustible tobacco products, questions regarding health risks of long term use of non-combustible products are not fully resolved. Additionally, the effect of ongoing nicotine use and/or addiction on recovery from other substances should be investigated.

4.1 Limitations

Our study's cross-sectional survey design prohibits inferences about causality. Another limitation regards the measurement of health risk perception. Tobacco-related, health risk perception research has used various measures, limiting the ability for direct comparisons across studies. Different measures assess absolute risk, as was done in our study, attributable risk or relative risk. Relative risk perception (i.e., likelihood of disease associated with use relative to no use) may be more strongly associated with smoking cessation than absolute risk perception, thus be a more informative measure (Krosnick et al., 2017). We assessed only one reason for product use, limiting interpretation of findings, given it is likely that users have multiple reasons for use. Additionally, variables associated multiple product use were not addressed in our study. Generalizability limitations of our study include: (a) random selection of publicly-funded, treatment programs within the CTN whose client population and tobacco-use rates may differ from clients in private, for-profit addictions treatment; (b) survey participants who were self-selected and may not accurately reflect the full, treatment program sample; and (c) participants who were enrolled in addictions treatment and may differ from the large number of individuals with SUDs who do not engage in treatment (National Institute on Drug Abuse, 2018).

5. Conclusion

The current study provides important information about rates of use, reasons for use and perceived health risks of a range of tobacco products in a sample of individuals in addictions treatment from a vulnerable, high smoking population. Findings that both cigarette smoking and e-cigarette use were associated with lower perceived health risk for each product and

that e-cigarettes use relative to other product use was associated with using in order to reduce/quit smoking are compatible with the FDA's direction encompassing cessation and harm reduction for combustible tobacco. Smokers who perceive low risk are likely to continue smoking cigarettes unless other interventions occur. Switching to e-cigarettes may lower their health risks. Promoting non-combustible, less lethal, nicotine delivery systems may be an additional strategy that decreases smoking rates and improves health in the population of individuals with SUDs for whom smoking remains an intractable problem.

Acknowledgements:

The authors wish to thank clients and staff from all the participating treatment programs.

Funding: Funding for this study was provided by grant number R01 DA 036066 from the National Institute on Drug Abuse (NIDA) and the Food and Drug Administration Center for Tobacco Products.

References

- Agaku IT, King BA, Husten CG, Bunnell R, Ambrose BK, Hu SS, ... Prevention. (2014). Tobacco product use among adults—United States, 2012–2013. *MMWR Morb Mortal Wkly Rep*, 63(25), 542–547.
- Alpert HR, Koh H, & Connolly GN (2008). Free nicotine content and strategic marketing of moist snuff tobacco products in the United States: 2000–2006. *Tobacco Control*, 17(5), 332–338. [PubMed: 18669556]
- Amrock SM, Zakhar J, Zhou S, & Weitzman M (2014). Perception of e-cigarette harm and its correlation with use among US adolescents. *Nicotine & Tobacco Research*, 17(3), 330–336. [PubMed: 25125321]
- Bandiera FC, Anteneh B, Le T, Delucchi K, & Guydish J (2015). Tobacco-related mortality among persons with mental health and substance abuse problems. *PloS one*, 10(3), e0120581. [PubMed: 25807109]
- Berg CJ, Stratton E, Schauer GL, Lewis M, Wang Y, Windle M, & Kegler M (2015). Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: marijuana, hookah, and electronic cigarettes win. *Substance use & misuse*, 50(1), 79–89. [PubMed: 25268294]
- Bernat JK, Ferrer RA, Margolis KA, & Blake KD (2017). US adult tobacco users' absolute harm perceptions of traditional and alternative tobacco products, information-seeking behaviors, and (mis) beliefs about chemicals in tobacco products. *Addictive Behaviors*, 71, 38–45. [PubMed: 28259026]
- Bunnell RE, Agaku IT, Arrazola RA, Apelberg BJ, Caraballo RS, Corey CG, ... King BA (2015). Intentions to smoke cigarettes among never-smoking US middle and high school electronic cigarette users: National Youth Tobacco Survey, 2011–2013. *Nicotine & Tobacco Research*, 17(2), 228–235. [PubMed: 25143298]
- Camenga DR, Delmerico J, Kong G, Cavallo D, Hyland A, Cummings KM, & Krishnan-Sarin S (2014). Trends in use of electronic nicotine delivery systems by adolescents. *Addict Behav*, 39(1), 338–340. doi:10.1016/j.addbeh.2013.09.014 [PubMed: 24094920]
- Campbell BK, Le T, Andrews KB, Pramod S, & Guydish J (2016). Smoking among patients in substance use disorders treatment: associations with tobacco advertising, anti-tobacco messages, and perceived health risks. *The American journal of drug and alcohol abuse*, 42(6), 649–656. [PubMed: 27314450]
- Caputi TL, Leas E, Dredze M, Cohen JE, & Ayers JW (2017). They're heating up: Internet search query trends reveal significant public interest in heat-not-burn tobacco products. *PloS one*, 12(10), e0185735.
- De AM, Hastings G, & Angus K (2013). Promotion of electronic cigarettes: tobacco marketing reinvented? *Bmj*, 347.

- De Andrade M, Hastings G, & Angus K (2013). Promotion of electronic cigarettes: tobacco marketing reinvented? *Bmj*, 347, f7473. [PubMed: 24361526]
- Delnevo CD, Wackowski OA, Giovenco DP, Manderski MT, Hrywna M, & Ling PM (2014). Examining market trends in the United States smokeless tobacco use: 2005–2011. *Tob Control*, 23(2), 107–112. doi:10.1136/tobaccocontrol-2012-050739 [PubMed: 23117999]
- Farsalinos KE, & Polosa R (2014). Safety evaluation and risk assessment of electronic cigarettes as tobacco cigarette substitutes: a systematic review. *Therapeutic advances in drug safety*, 5(2), 67–86. [PubMed: 25083263]
- FDA News Release. (2017). FDA announces comprehensive regulatory plan to shift trajectory of tobacco-related disease, death. [Press release]. Retrieved from <https://www.fda.gov/newsevents/newsroom/pressannouncements/ucm568923.htm>.
- Feirman SP, Lock D, Cohen JE, Holtgrave DR, & Li T (2015). Flavored tobacco products in the United States: a systematic review assessing use and attitudes. *Nicotine & Tobacco Research*, 18(5), 739–749. [PubMed: 26315475]
- Gilreath TD, Leventhal A, Barrington-Trimis JL, Unger JB, Cruz TB, Berhane K, ... Howland S (2016). Patterns of alternative tobacco product use: Emergence of hookah and e-cigarettes as preferred products amongst youth. *Journal of Adolescent Health*, 58(2), 181–185.
- Gubner NR, Andrews KB, Mohammad-Zadeh A, Lisha NE, & Guydish J (2016). Electronic-cigarette use by individuals in treatment for substance abuse: a survey of 24 treatment centers in the United States. *Addictive behaviors*, 63, 45–50. [PubMed: 27423097]
- Guydish J, Passalacqua E, Pagano A, Martínez C, Le T, Chun J, ... Delucchi K (2016). An international systematic review of smoking prevalence in addiction treatment. *Addiction*, 111(2), 220–230. [PubMed: 26392127]
- Guydish J, Tajima B, Pramod S, Le T, Gubner NR, Campbell B, & Roman P (2016). Use of multiple tobacco products in a national sample of persons enrolled in addiction treatment. *Drug and alcohol dependence*, 166, 93–99. [PubMed: 27449271]
- Guydish J, Yip D, Le T, Gubner NR, Delucchi K, & Roman P (2017). Smoking-related outcomes and associations with tobacco-free policy in addiction treatment, 2015–2016. *Drug & Alcohol Dependence*, 179, 355–361. [PubMed: 28844012]
- Halpern-Felsher BL, Biehl M, Kropp RY, & Rubinstein ML (2004). Perceived risks and benefits of smoking: differences among adolescents with different smoking experiences and intentions. *Preventive medicine*, 39(3), 559–567. [PubMed: 15313096]
- Jamal A, Phillips E, Gentzke AS, Homa DM, Babb SD, King BA, & Neff LJ (2018). Current Cigarette Smoking Among Adults—United States, 2016. *Morbidity and Mortality Weekly Report*, 67(2), 53. [PubMed: 29346338]
- Kalkhoran S, & Glantz SA (2016). E-cigarettes and smoking cessation in real-world and clinical settings: a systematic review and meta-analysis. *The Lancet Respiratory Medicine*, 4(2), 116–128. [PubMed: 26776875]
- Kasza KA, Ambrose BK, Conway KP, Borek N, Taylor K, Goniewicz ML, ... Green VR (2017). Tobacco-product use by adults and youths in the United States in 2013 and 2014. *New England Journal of Medicine*, 376(4), 342–353.
- King BA, Tynan MA, Dube SR, & Arrazola R (2014). Flavored-little-cigar and flavored-cigarette use among US middle and high school students. *Journal of Adolescent Health*, 54(1), 40–46.
- Knudsen HK (2017). Implementation of smoking cessation treatment in substance use disorder treatment settings: a review. *American Journal of Drug and Alcohol Abuse*, 43(2), 215–225. doi: 10.1080/00952990.2016.1183019
- Kostygina G, Glantz SA, & Ling PM (2016). Tobacco industry use of flavours to recruit new users of little cigars and cigarillos. *Tob Control*, 25(1), 66–74. doi:10.1136/tobaccocontrol-2014-051830 [PubMed: 25354674]
- Krosnick JA, Malhotra N, Mo CH, Bruera EF, Chang L, Pasek J, & Thomas RK (2017). Perceptions of health risks of cigarette smoking: A new measure reveals widespread misunderstanding. *PloS one*, 12(8), e0182063. [PubMed: 28806420]
- Levy DT, Borland R, Lindblom EN, Goniewicz ML, Meza R, Holford TR, ... Niaura R (2018). Potential deaths averted in USA by replacing cigarettes with e-cigarettes. *Tobacco control*, 27.

- Malas M, van der Tempel J, Schwartz R, Minichiello A, Lightfoot C, Noormohamed A, ... Ferrence R (2016). Electronic cigarettes for smoking cessation: a systematic review. *Nicotine & Tobacco Research*, 75(10), 1926–1936.
- Mantler T (2013). A systematic review of smoking Youths' perceptions of addiction and health risks associated with smoking: Utilizing the framework of the health belief model. *Addiction Research & Theory*, 27(4), 306–317.
- McMillen RC, Gottlieb MA, Shaefer RM, Winickoff JP, & Klein JD (2015). Trends in Electronic Cigarette Use Among U.S. Adults: Use is Increasing in Both Smokers and Nonsmokers. *Nicotine Tob Res*, 77(10), 1195–1202. doi:10.1093/ntr/ntu213
- National Institute on Drug Abuse. (2018). Principles of Drug Addiction Treatment: A Research-Based Guide (Third Edition). Retrieved from <https://www.drugabuse.gov/publications/principles-drug-addiction-treatment-research-based-guide-third-edition>
- Nyman AL, Sterling KL, Majeed BA, Jones DM, & Eriksen MP (2017). Flavors and Risk: Perceptions of Flavors in Little Cigars and Cigarillos Among US Adults, 2015. *Nicotine & Tobacco Research*, ntx153.
- Pepper JK, & Brewer NT (2014). Electronic nicotine delivery system (electronic cigarette) awareness, use, reactions and beliefs: a systematic review. *Tobacco control*, 23(5), 375–384. [PubMed: 24259045]
- Peters EN, Harrell PT, Hendricks PS, O'grady KE, Pickworth WB, & Voci FJ (2015). Electronic cigarettes in adults in outpatient substance use treatment: Awareness, perceptions, use, and reasons for use. *The American Journal on Addictions*, 24(3), 233–239. [PubMed: 25809200]
- Popova L, & Ling PM (2013). Alternative tobacco product use and smoking cessation: a national study. *American journal of public health*, 103(5), 923–930.
- Rahman MA, Hann N, Wilson A, Mnataganian G, & Worrall-Carter L (2015). E-cigarettes and smoking cessation: evidence from a systematic review and meta-analysis. *PloS one*, 10(3), e0122544. [PubMed: 2582251]
- Rubinstein ML, Halpern-Felsher BL, Thompson PJ, & Millstein SG (2003). Adolescents discriminate between types of smokers and related risks: Evidence from nonsmokers. *Journal of Adolescent Research*, 18(6), 651–663.
- Savoy E, Reitzel LR, Scheuermann TS, Agarwal M, Mathur C, Choi WS, & Ahluwalia JS (2014). Risk perception and intention to quit among a tri-ethnic sample of nondaily, light daily, and moderate/heavy daily smokers. *Addictive behaviors*, 39(10), 1398–1403. [PubMed: 24926907]
- Schoenborn CA, & Gindi RM (2015). Electronic cigarette use among adults: United States, 2014: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- Shahab L, Goniewicz ML, Blount BC, Brown J, McNeill A, Alwis KU, ... West R (2017). Nicotine, Carcinogen, and Toxin Exposure in Long-Term E-Cigarette and Nicotine Replacement Therapy Users: A Cross-sectional Study. *E-Cigarettes and Toxin Exposure. Annals of internal medicine*, 166(6), 390–400. [PubMed: 28166548]
- Song AV, Morrell HE, Cornell JL, Ramos ME, Biehl M, Kropp RY, & Halpern-Felsher BL (2009). Perceptions of smoking-related risks and benefits as predictors of adolescent smoking initiation. *American journal of public health*, 99(3), 487–492. [PubMed: 19106420]
- Stein MD, Caviness CM, Grimone K, Audet D, Borges A, & Anderson BJ (2015). E-cigarette knowledge, attitudes, and use in opioid dependent smokers. *Journal of Substance Abuse Treatment*, 52, 73–77. [PubMed: 25483740]
- Sterling KL, Fryer CS, & Fagan P (2015). The most natural tobacco used: a qualitative investigation of young adult smokers' risk perceptions of flavored little cigars and cigarillos. *Nicotine & Tobacco Research*, 18(5), 827–833. [PubMed: 26175458]
- Substance Abuse and Mental Health Services Administration. (2017). National Survey of Substance Abuse Treatment Services (N-SSATS): 2010 Data on substance abuse treatment facilities. (HHS publication no. (SMA) 17–5031). Rockville, MD.
- Wackowski OA, & Delnevo CD (2016). Young adults' risk perceptions of various tobacco products relative to cigarettes: results from the National Young Adult Health Survey. *Health Education & Behavior*, 43(3), 328–336. [PubMed: 26304709]

Weinstein ND, Marcus SE, & Moser RP (2005). Smokers' unrealistic optimism about their risk. *Tobacco control*, 14(1), 55–59. [PubMed: 15735301]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1.

Demographics and treatment program among clients in additions treatment

	Mean (SD) or n (%)					
	All clients (N=1,153)	Cigarette user ¹ (N=890)	Cigar user ² (N=96)	LFC/cigarillo user ² (N=176)	Smokeless user ² (N=131)	E-cigarette user ² (N=304)
Age	38.1 (11.9)	37.5 (11.3)	37.3 (10.2)	36.9 (11.2)	34.9 (10.2)	34.0 (9.4)
Sex						
- Male	595 (51.7%)	452 (50.8%)	70 (72.9%)	108 (61.4%)	101 (77.1%)	156 (51.3%)
- Female	546 (47.4%)	432 (48.5%)	26 (27.1%)	68 (38.6%)	30 (22.9%)	147 (48.4%)
- Others	11 (0.9%)	6 (0.7%)				1 (0.3%)
Race/ethnicity						
- Hispanic	153 (13.3%)	115 (12.9%)	15 (15.6%)	35 (19.9%)	6 (4.6%)	34 (11.2%)
- Non- Hispanic Black	179 (15.5%)	133 (14.9%)	14 (14.6%)	23 (13.1%)	9 (6.9%)	13 (4.3%)
- Non-Hispanic White	657 (57.0%)	517 (58.1%)	54 (56.3%)	87 (49.4%)	91 (69.5%)	204 (67.1%)
- Others	164 (14.2%)	125 (14.0%)	13 (13.5%)	31 (17.6%)	25 (19.1%)	53 (17.4%)
Education						
- Less than high school/GED	245 (21.3%)	202 (22.8%)	24 (25.0%)	40 (22.9%)	24 (18.5%)	51 (16.8%)
- High school/GED	427 (37.1%)	335 (37.7%)	36 (37.5%)	69 (39.4%)	54 (41.5%)	109 (36.0%)
- More than high school/GED	479 (41.6%)	351 (39.5%)	36 (37.5%)	66 (37.7%)	52 (40.0%)	143 (47.2%)
Program type						
- Residential	456 (39.6%)	385 (43.3%)	42 (43.8%)	84 (47.7%)	75 (57.3%)	106 (34.9%)
- Methadone	357 (31.0%)	282 (31.7%)	30 (31.3%)	52 (29.6%)	31 (23.7%)	111 (36.5%)
- Outpatient	340 (29.5%)	223 (25.1%)	24 (25.0%)	40 (22.7%)	25 (19.1%)	87 (28.6%)

¹Current use and lifetime use of at least 100 cigarettes for cigarettes²Use in the past 30 days

Table 2.

Tobacco product use, reasons for use, and health risk perceptions among clients in addictions treatment

	n (%) or Mean (SD)				
	Cigarettes	Cigars	LFC/cigarillo	Smokeless	E-cigarettes
Tobacco product use ¹	890 (77.5%)	96 (8.4%)	176 (15.4%)	131 (11.4%)	304 (26.6%)
Also current cigarette smoker		85 (88.5%)	163 (92.6%)	113 (86.3%)	237 (78.2%) ²
Reasons for product use in the past 30 days					
- At times when can't smoke		10 (10.4%)	30 (17.1%)	63 (48.1%)	76 (25.0%)
- To reduce health risk		7 (7.3%)	9 (5.1%)	9 (6.9%)	34 (11.2%)
- To reduce/quit cigarettes		8 (8.3%)	16 (9.1%)	15 (11.5%)	89 (29.3%)
- Enjoy the flavor/taste		32 (33.3%)	44 (25.1%)	20 (15.3%)	32 (10.5%)
- Other reasons		39 (40.6%)	76 (43.4%)	24 (18.3%)	73 (24.0%)
Health risk perception ³	61.8 (19.8)	58.8 (23.8)	58.4 (22.5)	41.6 (22.5)	40.0 (23.0)

¹ Current use and lifetime use of at least 100 cigarettes for cigarettes and use in the past 30 days for other tobacco products (cigars, LFCs/cigarillos, smokeless, e-cigarettes)

² Missing current cigarette smoking status for 1 e-cigarette user; n =303

³ Score = mean % perceived chance of tobacco-related health problems

Table 3.

Associations between health risk perception and use of each tobacco product

	Perceived health risk	
	OR (95% CI) ¹	p ^{1,2}
Current cigarette use	0.985 (0.975, 0.995)	0.005
Cigar use in the past 30 days	0.993 (0.985, 1.002)	0.166
LFC/cigarillo use in the past 30 days	0.993 (0.985, 1.001)	0.106
Smokeless use in the past 30 days	0.995 (0.988, 1.002)	0.188
E-cigarette use in the past 30 days	0.991 (0.984, 0.998)	0.023

¹Adjusted for demographics (age, gender, race/ethnicity, and education) and program type; also controlled for nesting participants within clinics²Controlled for multiple comparison tests

Table 4.

Associations between reasons for use and use of each product

	Use of the product vs. use of other products	
	OR (95% CI) ¹	p ^{1,2}
Reasons for cigar use		
- Enjoy the flavor/taste (Ref)	1	
- At times when can't smoke	0.39 (0.22, 0.69)	0.002
- To reduce health risks	0.54 (0.26, 1.12)	0.130
- To reduce/quit cigarettes	0.23 (0.11, 0.49)	<0.001
- Other reasons	0.72 (0.44, 1.17)	0.202
Reasons for LFC/cigarillo use		
- Enjoy the flavor/taste (Ref)	1	
- At times when can't smoke	0.42 (0.27, 0.67)	<0.001
- To reduce health risks	0.23 (0.09, 0.54)	0.002
- To reduce/quit cigarettes	0.36 (0.22, 0.61)	<0.001
- Other reasons	0.98 (0.67, 1.42)	0.906
Reasons for smokeless use		
- At times when can't smoke (Ref)	1	
- To reduce health risks	0.38 (0.19, 0.79)	0.016
- To reduce/quit cigarettes	0.27 (0.15, 0.49)	<0.001
- Enjoy the flavor/taste	0.32 (0.19, 0.55)	<0.001
- Other reasons	0.21 (0.12, 0.37)	<0.001
Reasons for E-cigarette use		
- To reduce/quit cigarettes (Ref)	1	
- At times when can't smoke	0.30 (0.19, 0.49)	<0.001
- To reduce health risks	0.75 (0.38, 1.48)	0.431
- Enjoy the flavor/taste	0.14 (0.08, 0.25)	<0.001
- Other reasons	0.25 (0.15, 0.40)	<0.001

¹ Adjusted for demographics (age, gender, race/ethnicity, and education) and program type; also controlled for nesting of product within participants and participants within clinics

² Controlled for multiple comparison tests