Original investigation

Awareness and Use of Dissolvable Tobacco Products in the United States

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Abstract

Introduction: Little is known about dissolvable tobacco products (DTPs) compared with other alternative tobacco products (ATPs) like e-cigarettes and snus. We sought to understand US adults' awareness and use of DTPs.

Methods: A nationally representative sample of US adults (age ≥ 18 years, $N = 17\,522$) completed an online survey in March 2013 assessing their awareness and use of DTPs.

Results: Approximately 16% of all respondents were aware of DTPs. Few reported ever using DTPs (1.6%). DTP awareness among all respondents was greatest among males, younger adults, current and former smokers, never married respondents, blacks and Latinos, and those who used other ATPs. Among current smokers, DTP awareness was greatest for males, younger adults, blacks and Latinos, those who used other ATPs, and Southerners. DTP use among all respondents was greatest among males, younger adults, Lesbian, Gay, Bisexual, and Transgender (LGBT) respondents, former and current smokers, and those who used other ATPs. Among current smokers, DTP use was greatest among males, younger adults, LGBT respondents, those who used other ATPs, those who intended to quit, and those who received medical advice to quit.

Conclusions: DTP awareness and use have increased since 2009. DTPs are being used as smoking cessation aids thereby increasing risk of polytobacco use. Medical professionals should emphasize use of empirically-supported smoking cessation aids when advising patients to quit. Regulations are needed to prevent tobacco company promotion of DTPs as smoking cessation aids and to inform consumers of the risks associated with DTPs and polytobacco use. Increased national surveillance of DTP use is recommended.

Introduction

Tobacco company profits from US cigarette sales are dropping as smoking rates decline. This decline can be attributed to increasingly stringent government regulations, growing public awareness of the negative health effects of cigarettes, and changing social norms regarding cigarette smoking.^{1,2} To circumvent these obstacles, some tobacco companies have shifted their interests towards

the development and marketing of alternative tobacco products (ATPs) such as e-cigarettes, hookah, cigars, and novel smokeless tobacco products (NSTPs). NSTPs may reinforce smokers' nicotine dependence by encouraging NSTP use in circumstances where cigarette smoking is not allowed or would be met with social disapproval. NSTPs may also serve as a way to recruit and retain tobacco customers.^{1,3-8}

NSTPs include snus and dissolvable tobacco products (DTPs). Snus—a small teabag-like pouch that users place in their cheeks or between their teeth and gums and which does not require chewing or spitting—has been used in Sweden since the 19th century, and it became widely available in the United States in 2006.^{1,9} DTPs are made of finely milled tobacco that is often flavored and pressed into the form of orbs, thin strips, lozenges or sticks that resemble toothpicks which deliver nicotine as they dissolve in the user's mouth.^{8,10} Compared with snus, DTPs are newer and not as widely available in the United States.^{4,11}

DTPs are typically promoted as a safer alternative to cigarettes,^{7,12} but there is an ongoing debate about the potential public health impact of ATPs including DTPs. One camp emphasizes the potential for harm reduction, arguing that it is better for smokers to switch to an ATP than to continue smoking.^{1,13,14} Some maintain that ATPs may prove to be useful as smoking cessation aids.^{12,15} The other camp emphasizes the potential negative health effects of ATPs—they note that research on ATPs vis-à-vis harm reduction and cessation is in its infancy and that clinical practice guidelines do not recognize the use of ATPs for such purposes.¹² Indeed, some researchers have speculated^{1,10}—and findings from a recent longitudinal study suggest¹⁶—that ATP use may actually decrease the likelihood of cessation. Researchers in this camp further note that DTP marketing and packaging may entice never and former smokers to initiate tobacco use.⁴ In addition, analyses of snus and DTP samples have found levels of carcinogens (ie, tobacco-specific N-nitrosamines) that equal those found in traditional moist snuff.¹⁷ Moreover, some researchers who emphasize the potential negative health effects of ATPs are concerned the tobacco industry may promote polytobacco use by marketing ATPs including NSTPs as (1) smoking cessation aids (eg, Popova and Ling's¹ article depicts two ads explicitly promoting ATP use for cessation—one for a Camel NSTP that states “Break Free: No Ifs, Ands or Butts,” and the other by a top e-cigarette retailer that proclaims “Quit Smoking Now!”), (2) safer alternatives to cigarettes, and (3) a way for smokers to ingest nicotine in places where smoking is prohibited.^{1,4-7,18,19} Thus, while some researchers emphasize the potential harm reduction benefits for smokers who switch to using a single ATP,^{1,13,14} others focus on the potential for polytobacco use—they note that compared with exclusive cigarette use, polytobacco use is associated with increased nicotine exposure, more intractable nicotine dependence, and increased rates of cardiovascular disease and pancreatic and esophageal cancer.^{1,4}

While a growing body of research describes the epidemiology and potential public health threat posed by snus and other ATPs,^{1,20-26} few nationally representative surveys have examined US adults' awareness and use of DTPs. First, the Styles 2009 survey—the only national survey to examine DTP awareness among US adults—found that 10.4% had heard of DTPs and 0.5% had ever used DTPs. Of adults who had heard of DTPs, 3.5% reported having tried them.⁸ Second, the Social Climate Survey of Tobacco Control conducted in 2010 found a DTP ever use rate of 0.6% among US adults.¹⁰ Third, a survey of adult current and former smokers conducted in 2011 found a DTP ever use rate of 2.9%.¹ Finally, the 2012–2013 National Adult Tobacco Survey found a DTP ever use rate of 0.4%.²⁷

The US FDA's²⁸ Tobacco Products Scientific Advisory Committee report noted the uncertain public health impact of DTPs due to the scarcity of research. The report stressed the need for further research on DTP use prevalence and the identification of potential risk factors for DTP use. In addition, the report specifically recommended research on the relationship between DTP use, cigarette use patterns,

and use of other ATPs. Given the uncertain public health impact of DTPs, there is a need to better understand the US public's awareness and use of these products. To this end, we examined DTP awareness and use rates in the Tobacco Control and the Media Environment survey, a 2013 national survey of US adults. We sought to examine associations between DTP awareness/use, cigarette use patterns, use of other ATPs, and demographic characteristics. Finally, we examined how DTP awareness and use among current smokers are associated with other ATP use, quit intentions, and previous quit attempts.

Methods

Sample

This study relied on data collected from US adults (age ≥18 years, $N = 17\,522$) in a March 2013 online survey as part of the Tobacco Control and the Media Environment study. Most respondents (75%) were members of KnowledgePanel, a nationally representative probability-based online survey panel constructed using random digit dialing supplemented by address-based sampling. KnowledgePanel was developed and is maintained by GfK.²⁹ See [Supplementary File 1](#) for further details. Our study was approved by the institutional review board at the University of Illinois at Chicago.

Measures

Participants were given a description of DTPs followed by generic images of dissolvables. They were then asked about their awareness of DTPs (“Have you ever heard of dissolvable tobacco?”: yes/no). Those participants who had heard of dissolvables were asked if they had ever used DTPs (“Have you ever used DTPs, such as Ariva, Stonewall, or Camel Orbs, Sticks, or Strips, even one time?”: yes/no). Participants were also asked if they had ever used e-cigarettes, cigars, cigarillos, and hookah. Responses to these items were recoded into a single item, “ever used other ATP?”

The survey assessed demographics ([Supplementary File 2](#)), cigarette smoking status, quit intentions among current smokers, and previous quit attempts among current smokers. Smoking status was determined by participants' responses to two items: (1) “Have you smoked at least 100 cigarettes in your life?” (yes/no) and (2) “Do you now smoke cigarettes every day, some days, or not at all?” Participants were classified as current smokers if they stated that they now smoke cigarettes some days or every day. Participants were classified as former smokers if they indicated they had smoked at least 100 cigarettes in their lifetime but do not currently smoke. Participants were classified as nonsmokers if they had not smoked at least 100 cigarettes in their lifetime. Quit intentions were assessed with the following item: “Do you plan to quit smoking for good ...?: in the next seven days, in the next 30 days, in the next six months, in the next year, more than one year from now, or I do not plan to quit smoking for good”. Responses were collapsed into three categories (no intentions to quit, plan to quit within 1 year, plan to quit more than 1 year from now).

Current smokers were also asked about previous quit attempts. One item assessed past year quit attempts (“During the past year, have you stopped smoking for one day or longer because you were trying to quit smoking for good?”: yes/no). Two items asked about quit attempts during the past 3 months: (1) “Thinking of your more recent past, during the past 3 months, how many times have you stopped smoking for one day or longer because you were trying to quit smoking for good?” and (2) “During the past 3 months, how

many times have you tried to stop smoking for good, but stopped for less than a day?" Participants with responses greater than zero for either item were coded as having made a past 3-month quit attempt. Finally, current smokers were asked two questions about their previous quit attempts: (1) "During the past 12 months, did any medical doctor or other health professional advise you to stop smoking?": (yes/no), and (2) "Thinking back to the last time you tried to quit smoking in the past 3 months: Did you use dissolvable tobacco products (orbs, strips, or sticks) to help you quit?": (yes/no). We conducted cognitive interviews with 16 participants during survey item development and pre-tested the revised items with 160 respondents.

Data Analysis

All analyses were conducted using Stata Version 13³⁰ and accounted for the complex survey design and weights. We conducted multivariable logistic regressions using all respondents with DTP awareness and DTP use as the outcomes to examine associations with cigarette smoking status, other ATP use and demographics and estimated adjusted odds ratios. We then conducted multivariable logistic regressions with DTP awareness and DTP use as the outcomes to estimate adjusted odds ratios for other ATP use, quit intentions, past year quit attempt, past year medical advice to quit smoking, and demographics, limited to current smokers using an unconditional subpopulation approach.³¹ The assumptions of logistic regression were met for each model.

Results

Approximately 16% (95% confidence interval [CI] = 14.9, 16.6) of all respondents reported being aware of DTPs, and 1.6% (95% CI = 1.4, 1.9) of all respondents reported ever using DTPs. Approximately 10% (10.3%) of respondents who had heard of DTPs reported ever using DTPs. Among current smokers who ever used DTPs, 50% reported using DTPs in the past 3 months as a smoking cessation tool. See [Supplementary File 3](#) for details of demographics and other respondent characteristics.

DTP Awareness

Cigarette Smoking Status, Other ATP Use and Demographics

[Table 1](#) shows results of the multivariable logistic regression with DTP awareness among all respondents as the outcome variable. First, compared with never smokers, the adjusted odds of DTP awareness were higher among former smokers (odds ratio [OR] = 1.23, 95% CI = 1.02, 1.49) and current smokers (OR = 2.81, 95% CI = 2.38, 3.32). Next, the adjusted odds of DTP awareness were higher for respondents who have used other ATPs compared with those who have not used other ATPs (OR = 1.28, 95% CI = 1.09, 1.48). Gender was significantly associated with DTP awareness after adjusting for other factors, with males having greater odds of DTP awareness compared with females (OR = 1.83, 95% CI = 1.60, 2.11). Age was also significantly associated with DTP awareness; for every 1-year increase in age the odds of DTP awareness were 2% lower. In terms of annual income, the odds of DTP awareness were significantly lower for respondents earning \$50 000 to \$84 999 compared with those earning less than \$25 000/y (OR = 0.79, 95% CI = 0.64, 0.98). The odds of DTP awareness were lower for never married respondents (OR = 0.83, 95% CI = 0.69, 0.99) compared with married/partnered respondents. Finally, compared with white respondents, the odds of DTP awareness were lower among African American

respondents (OR = 0.54, 95% CI = 0.43, 0.70) and Hispanic/Latino respondents (OR = 0.69, 95% CI = 0.54, 0.87).

Quit Intentions/Attempts, Other ATP Use, and Medical Advice to Quit Among Smokers

[Table 1](#) shows the results from the multivariable logistic model with DTP awareness among current smokers as the outcome variable. Among current smokers, quit intentions, quit attempts and past year medical advice to quit smoking were not significantly associated with DTP awareness, controlling for demographic characteristics. However, the odds of DTP awareness were greater for respondents who used other ATPs compared with those who did not use ATPs (OR = 1.68, 95% CI = 1.29, 2.20). In addition, the odds of DTP awareness were greater for male smokers compared with female smokers (OR = 1.71, 95% CI = 1.43, 2.05). Compared with white smokers, the odds of DTP awareness were lower for African Americans smokers (OR = 0.55, 95% CI = 0.40, 0.75) and Hispanics/Latino smokers (OR = 0.69, 95% CI = 0.51, 0.96).

DTP Ever Use

Cigarette Smoking Status, Other ATP Use and Demographics

[Table 2](#) shows the adjusted ORs for cigarette smoking status, other ATP use and demographics with DTP ever use among all respondents as the outcome. Compared with never smokers, the odds of DTP ever use were more than three times greater for former smokers (OR = 3.51, 95% CI = 1.58, 7.76) and current smokers (OR = 20.00, 95% CI = 10.35, 38.60). The odds of DTP ever use were greater for respondents who used other ATPs compared with those who did not use ATPs (OR = 4.04, 95% CI = 2.18, 7.49). The odds of DTP ever use were greater for males compared with females (OR = 2.24, 95% CI = 1.66, 3.02) and Lesbian, Gay, Bisexual, and Transgender (LGBT) respondents compared with non-LGBT respondents (OR = 1.66, 95% CI = 1.18, 2.34). For every 1-year increase in age the odds of DTP ever use was 5% less likely ($P \leq .001$).

Quit Intentions/Attempts, Other ATP Use, and Medical Advice to Quit Among Smokers

[Table 2](#) shows the adjusted ORs for DTP ever use among current smokers in association with quit intentions, quit attempts, other ATP use, past year medical advice to quit and demographics among current smokers. Respondents who intended to quit within the next year had higher odds of DTP ever use compared with respondents who never intended to quit (OR = 1.58, 95% CI = 1.05, 2.39). Next, the odds of DTP ever use for respondents who ever used other ATPs were more than four times the odds for those who did not ever use other ATPs (OR = 4.50, 95% CI = 1.68, 12.09). In addition, receiving medical advice to quit smoking during the past year was significantly associated with DTP ever use among current smokers (OR = 1.59, 95% CI = 1.15, 2.18). As for demographics, male smokers had greater odds of DTP ever use compared with female smokers (OR = 2.20, 95% CI = 1.59, 3.02), and LGBT smokers had greater odds of DTP ever use compared with non-LGBT smokers (OR = 1.70, 95% CI = 1.16, 2.51). For every 1-year increase in age, the odds of DTP ever use was 4% less likely ($P \leq .001$).

Discussion

This study examined the prevalence of DTP awareness and use in a nationally representative sample of US adults and identified risk factors associated with DTP involvement. We found that approximately

Table 1. Multivariable Logistic Models for DTP Awareness Among All Respondents and Current Smokers

	DTP awareness among all respondents ^a	DTP awareness among current smokers ^b
	OR (95% CI)	OR (95% CI)
Cigarette smoking status		
Never smoker ^c	Ref.	
Former smoker ^d	1.23 (1.02, 1.49)*	
Current smoker ^e	2.81 (2.38, 3.32)***	
Ever used other ATPs		
No	Ref.	Ref.
Yes	1.28 (1.09, 1.48)**	1.68 (1.29, 2.20)***
Intentions to quit		
No plans to quit		Ref.
Within 1 year		0.92 (0.74, 1.16)
>1 year		0.87 (0.66, 1.16)
Quit smoking ≥ 1 day in past year		
No		Ref.
Yes		0.87 (0.72, 1.07)
Past year medical advice to quit		
No		Ref.
Yes		0.99 (0.83, 1.19)
Gender		
Female	Ref.	Ref.
Male	1.83 (1.60, 2.11)***	1.71 (1.43, 2.05)***
Age	0.98 (0.97, 0.98)***	0.98 (0.97, 0.99)***
Education		
Less than high school	Ref.	Ref.
High school	1.05 (0.77, 1.44)	0.99 (0.67, 1.45)
Some college	1.10 (0.81, 1.50)	1.02 (0.71, 1.47)
Bachelor's degree or higher	1.27 (0.91, 0.75)	1.22 (0.82, 1.21)
Employment status		
Employed	Ref.	Ref.
Unemployed, not in labor force	0.94 (0.78, 1.13)	0.85 (0.66, 1.11)
Unemployed, in labor force	0.85 (0.70, 1.03)	0.89 (0.70, 1.12)
Household income		
<\$25 000	Ref.	Ref.
\$25 000 to \$49 999	0.94 (0.77, 1.15)	0.98 (0.77, 1.24)
\$50 000 to \$84 999	0.79 (0.64, 0.98)*	1.00 (0.77, 1.30)
\$85 000 or more	0.98 (0.78, 1.23)	1.06 (0.79, 1.44)
Sexual orientation		
Heterosexual/non-transgender	Ref.	Ref.
LGBT	1.10 (0.86, 1.40)	1.28 (0.96, 1.71)
Marital/partnership status		
Married/living with partner	Ref.	Ref.
Never married	0.83 (0.69, 0.99)*	1.03 (0.82, 1.30)
Widowed/divorced/ separated	0.99 (0.82, 1.18)	1.03 (0.82, 1.29)
Race/ethnicity		
White	Ref.	Ref.
Black	0.54 (0.43, 0.70)***	0.55 (0.40, 0.75)***
Latino	0.69 (0.54, 0.87)**	0.69 (0.51, 0.96)*
Other	0.78 (0.60, 1.03)	0.93 (0.65, 1.32)
Region		
Northeast	Ref.	Ref.
Midwest	1.14 (0.94, 1.39)	1.27 (0.97, 1.66)
South	1.02 (0.84, 1.23)	1.10 (0.84, 1.43)
West	1.01 (0.82, 1.25)	1.38 (1.04, 1.83)
Household internet access		
No	Ref.	Ref.
Yes	0.99 (0.15, 1.34)	1.10 (0.72, 1.69)

ATP = alternative tobacco product; CI = confidence interval; DTP = dissolvable tobacco product; OR = odds ratio.

^a*n* = 17 124.^b*n* = 6399.^cSmoked fewer than 100 cigarettes in lifetime.^dSmoked 100 or more cigarettes in lifetime but does not currently smoke.^eSmokes cigarettes some days or every day.**P* ≤ .05, ***P* ≤ .01, ****P* ≤ .001.

Table 2. Multivariable Logistic Models of DTP Ever Use Among All Respondents and Current Smokers

	DTP ever use among all respondents ^a	DTP ever use among current smokers ^b
	OR (95% CI)	OR (95% CI)
Cigarette smoking status		
Never smoker ^c	Ref.	Ref.
Former smoker ^d	3.51 (1.58, 7.76)**	
Current smoker ^e	20.00 (10.35, 38.60)***	
Ever used other ATPs		
No	Ref.	Ref.
Yes	4.04 (2.18, 7.49)***	4.50 (1.68, 12.09)**
Intentions to quit		
No plans to quit		Ref.
Within 1 year		1.58 (1.05, 2.39)**
>1 year		1.21 (0.65, 2.26)
Quit smoking ≥ 1 day in past year		
No		Ref.
Yes		1.37 (0.99, 1.90)
Past year medical advice to quit		
No		Ref.
Yes		1.59 (1.15, 2.18)**
Gender		
Female	Ref.	Ref.
Male	2.24 (1.66, 3.02)***	2.20 (1.59, 3.02)***
Age	0.95 (0.94, 0.96)***	0.96 (0.94, 0.97)***
Education		
Less than high school	Ref.	Ref.
High school	0.80 (0.41, 1.54)	0.55 (0.28, 1.11)
Some college	0.71 (0.38, 1.34)	0.58 (0.29, 1.13)
Bachelor's degree or higher	1.16 (0.60, 2.26)	1.09 (0.53, 2.23)
Employment status		
Employed	Ref.	Ref.
Unemployed, not in labor force	0.70 (0.41, 1.20)	0.64 (0.36, 1.13)
Unemployed, in labor force	0.75 (0.49, 1.17)	0.71 (0.43, 1.19)
Household income		
<\$25 000	Ref.	Ref.
\$25 000 to \$49 999	0.94 (0.58, 1.52)	0.98 (0.57, 1.67)
\$50 000 to \$84 999	1.18 (0.73, 1.90)	1.36 (0.78, 2.37)
\$85 000 or more	1.28 (0.75, 2.19)	1.48 (0.81, 2.71)
Sexual orientation		
Heterosexual/non-transgender	Ref.	Ref.
LGBT	1.66 (1.18, 2.34)**	1.70 (1.16, 2.51)**
Marital/partnership status		
Married/living with partner	Ref.	Ref.
Never married	0.84 (0.60, 1.19)	1.04 (0.73, 1.48)
Widowed/divorced/ separated	1.11 (0.70, 1.74)	0.87 (0.55, 1.37)
Race/ethnicity		
White	Ref.	Ref.
Black	0.98 (0.59, 1.62)	0.92 (0.54, 1.57)
Latino	0.98 (0.67, 1.45)	1.13 (0.73, 1.74)
Other	1.05 (0.68, 1.62)	1.06 (0.65, 1.73)
Region		
Northeast	Ref.	Ref.
Midwest	0.97 (0.62, 1.52)	0.81 (0.50, 1.32)
South	0.91 (0.59, 1.40)	0.84 (0.53, 1.32)
West	1.30 (0.84, 2.06)	1.51 (0.93, 2.45)
Household internet access		
No	Ref.	Ref.
Yes	0.69 (0.35, 1.39)	1.09 (0.57, 2.09)

ATP = alternative tobacco product; CI = confidence interval; DTP = dissolvable tobacco product; OR = odds ratio.

^a*n* = 17 112.^b*n* = 6389.^cSmoked fewer than 100 cigarettes in lifetime.^dSmoked 100 or more cigarettes in lifetime but does not currently smoke.^eSmokes cigarettes some days or every day.***P* ≤ .01; ****P* ≤ .001.

16% of the respondents in our sample had heard of DTPs and that 1.6% had ever used DTPs. Just over 10% of the participants who had heard of DTPs had ever used them.

We observed an increase in prevalence of DTP awareness and use since the Styles 2009 survey provided the first nationally representative estimates (Supplementary File 4). One possible explanation for this growth is that manufacturers instituted greater promotional efforts of DTPs starting in 2009; for example, Southwell and colleagues⁴ reported that national magazine advertising for Camel dissolvables increased by 78% between 2009 and 2010. Another contributing factor may be greater public awareness of DTPs due to the introduction of DTPs into additional test markets in 2011 by R.J. Reynolds and Altria.¹¹ Although Ariva and Stonewall—they were the first DTPs to enter US markets—were discontinued by the manufacturer and as of January 2013 were no longer on the market,^{11,32} this change likely had minimal impact on our study's estimates of DTP awareness and ever use prevalence because our data were collected in March 2013.

Consistent with prior research on ATPs and smoking cessation,¹ our results suggest that some smokers may be using DTPs as cessation aids despite a lack of evidence supporting such use. We observed that half of current smokers who reported DTP ever use had used DTPs in an unsuccessful quit attempt in the past 3 months. In addition, we did not identify a significant association between DTP ever use and a past year quit attempt that lasted for at least 1 day. Furthermore, our data showed that smokers who had received advice to quit from a medical provider in the past year were more likely to have ever used DTPs compared with smokers who had not received medical advice to quit. Indeed, 58.6% of participants who used DTPs as a smoking cessation aid for their latest quit attempt in the past 3 months had received advice to quit in the past year from a medical provider. Taken together, these results suggest that some smokers who are trying to quit may be turning to DTPs in lieu of existing medical treatments. Perhaps some smokers view DTPs as being equivalent to and more accessible than FDA-approved over-the-counter nicotine replacement therapies and prescription drugs—it may be easier for some smokers to pay the approximately \$4.00 for one package of DTPs on an as-needed basis than it is for them to pay approximately \$45.00 at once for a 1-month supply of nicotine gum or patches.

The use of DTPs as a smoking cessation aid may be problematic given concerns articulated in the Tobacco Products Scientific Advisory Committee report and by other researchers^{1,4,5,10} that use of ATPs including DTPs may lead to polytobacco use. Our findings may be cautiously interpreted as lending some credence to these concerns. For example, we found that DTP awareness and ever use were significantly associated with ever using other ATPs in multivariable logistic models based on the full sample and in models limited to current smokers. We also observed that current smokers were more likely than never smokers to be aware of and to have ever used DTPs. Finally, we found that smokers who intended to quit within a year were more likely to report DTP ever use compared with smokers who did not intend to quit.

Furthermore, we found that whites were more likely to be aware of DTPs compared with African Americans and Latinos. This finding differs with results from the Styles 2009 survey which found that African Americans were more likely to be aware of DTPs compared with whites.⁸ One possible reason for this discrepancy is that until 2011, DTPs were available mainly in three test markets: Columbus, Ohio; Indianapolis, Indiana; and

Portland, Oregon.³ The cities of Columbus and Indianapolis were included in a US Census Bureau³³ listing of the 10 cities with the largest number of African Americans, which may have contributed to the discrepancy. Our data were collected in 2013, 2 years after DTPs were introduced into additional US test markets. Consistent with prior research,⁸ we observed greater DTP awareness among males, younger people, and those with lower incomes. In addition, we found greater odds of DTP ever use among males, younger people and LGBT respondents across multivariate models, consistent with previous studies on ATP use in general and DTP use in particular.^{9–11,34,35}

The current study has several limitations. First, the cross-sectional design precludes causal inferences. For example, despite suggestions that ATP use may inhibit smoking cessation,^{1,10,16} we cannot determine conclusively if DTP use in particular inhibits smoking cessation. Second, we were unable to examine prevalence of awareness and use of DTPs within test markets versus outside of test markets. Third, our survey only inquired about DTP ever use; it did not ask respondents about current DTP use, when they initiated DTP use, or their frequency of DTP use. We were therefore unable to distinguish current DTP users from DTP ever users, an important distinction given that some studies have found that many NSTP trial users only experiment with the products and do not become current NSTP users.^{8,36} Future research should distinguish between current use and ever use to provide a better understanding of the relationship between DTP use and smoking behaviors. Fourth, the lack of more detailed questions regarding DTP use (eg, current DTP use, frequency of DTP use) prevented us from gaining a more precise understanding of polytobacco use among DTP users. Fifth, the magnitude of the increase in DTP ever use rates observed in our study compared with previous nationally-representative surveys should be interpreted with caution due to methodological differences across surveys (eg, differing sampling schemes). Finally, future research should examine why some smokers view DTPs as potentially effective smoking cessation aids. Using future waves, we will be able to study whether those who used DTPs as a quitting method successfully quit.

Our study nevertheless has implications for policy and future research. Our finding that half of current smokers who ever used DTPs used them as cessation aids within the previous 3 months is potentially concerning because of possible health risks (eg, presence of carcinogens, polytobacco use).^{1,17} Existing regulations could be enforced to prevent the marketing of NSTPs as smoking cessation aids and to counter any public misperception of DTPs as such. Specifically, the Family Smoking Prevention and Tobacco Control Act of 2009 granted the FDA the authority to regulate all tobacco products, and the FDA already requires ATP manufacturers to obtain authorization before marketing their products as “modified risk” products.^{16,37} The FDA could further require warnings on DTP packaging regarding potential health risks and a statement that DTPs are not an FDA-approved smoking cessation treatment. Finally, our finding that DTP ever use has increased since 2009 may provide further support for the Tobacco Products Scientific Advisory Committee's recommendations for greater surveillance of DTP use and incorporating DTP use questions into existing national health surveys.

Supplementary Material

Supplementary Files 1–4 can be found online at <http://www.ntr.oxfordjournals.org>

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Declaration of Interests

None declared.

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