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Tobacco Product Initiation is Correlated with Cross-Product Changes in Tobacco Harm Perception and Susceptibility: Longitudinal Analysis of the Population Assessment of Tobacco and Health Youth Cohort

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Abstract

Youth initiation with one tobacco product is associated with risk of using additional tobacco types. How use of one product potentially encourages use of others could result from changing tobacco-related perceptions. This study aimed to evaluate how tobacco product initiation correlates with changes in susceptibility (curiosity and willingness) and perceived harm of other tobacco products. For each of cigarettes, e-cigarettes, hookah, and smokeless tobacco, youth (ages 12–16; N=8,005) rated perceived harm, curiosity, and willingness to try in Waves 1 and 2 of the Population Assessment of Tobacco and Health (United States, 2013–2015). For each product, we estimated associations between decreased harm rating, increased curiosity, or increased willingness with initiation (from never- to ever-use) of cigarettes, e-cigarettes, hookah, smokeless tobacco, or other combustible products using multivariate (multiple outcomes) regression, adjusting for other tobacco risk factors. Tobacco product initiation was associated with decreased perceived harm for that product and with decreased perceived harm, increased curiosity, and increased willingness in some, but not all, cross-product combinations. Most cross-product combinations of initiation and susceptibility yielded positive associations. For example, trying e-cigarettes was associated with concomitant increases in curiosity about cigarettes (OR: 5.69; 95% CI: 3.68, 8.79) and hookah (OR: 4.19; 95% CI: 2.55, 6.88) and with increased willingness to try cigarettes (OR: 9.61; 95% CI: 5.67, 16.3), hookah (OR: 8.46; 95% CI: 4.76, 15.0), and smokeless tobacco (OR: 3.48; 95% CI: 1.75, 6.94). New use of one tobacco product may catalyze subsequent use of others through cross-product changes in perceptions and susceptibility.

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Keywords

adolescents; prospective studies; cigarettes; electronic cigarettes; smokeless tobacco; tobacco waterpipe; risk factors; susceptibility; harm perceptions

Introduction

Tobacco product use among US adolescents has shifted in recent years: the prevalence of using only combustible cigarettes has declined simultaneously with increasing use of non-cigarette products and dual- or poly-use of multiple forms of tobacco together.[1] Although use of 2 tobacco products declined in 2016,[2] among US high school students who currently use tobacco, nearly half reported using multiple tobacco product types,[2,3] and more than twice as many reported use of 2 products as used cigarettes alone.[4] Given the increasing diversity in youth tobacco behaviors, understanding how exposure to one type of tobacco or nicotine product may impact adolescents' perceptions and attitudes regarding other product types would inform appropriate tobacco regulation and public communication.

In a recent national study, youth use of any form of non-cigarette tobacco product, including e-cigarettes, tobacco waterpipe (hookah), non-cigarette combustibles, and smokeless tobacco, was independently associated with future cigarette smoking initiation.[5] Additional studies, summarized by meta-analysis,[6] have also shown that e-cigarette use is positively associated with subsequent cigarette smoking. Likewise, prospective studies have shown positive associations with youth smoking for other non-cigarette products, including smokeless tobacco[7] and hookah.[8] While these associations have been replicated consistently across the literature, the possible mechanisms underlying longitudinal transitions in youth tobacco use have not been examined extensively with empirical data.

Many health behavior models place attitudes and beliefs as antecedents to behavioral decision-making,[9,10] and for adolescents, these beliefs are associated with substance use.[11] In-turn, tobacco-related attitudes and beliefs are themselves plausibly shaped by past and present behavioral experiences. Specifically, youth that try one type of tobacco product, based on that experience, may reevaluate their expectations related to other tobacco or nicotine products. In a proposed catalyst model, for example, characteristics of e-cigarettes, such as lower perceived health risks, taste, and peer acceptance, were hypothesized to attract youth initially to e-cigarettes before a later reassessment of tobacco products in light of increased nicotine familiarity, gained experience, and peer connections enable progression to cigarette smoking.[12] We drawn on this model to hypothesize that adolescents' tobacco-related experiences with one product shape their views of other tobacco or nicotine products.

Two studies suggest that e-cigarette use precedes changes in attitudes or social environments related to cigarette smoking. In a follow-up study of 12th-grade students, cigarette never-smokers who used e-cigarettes at baseline were more likely than e-cigarette non-users to report a decrease in their perceived risk of cigarette smoking one year later.[13] Among students in Hawaii, having more positive expectancies about smoking, affiliating with friends who smoke cigarettes, and marijuana use, were all found to mediate the association between e-cigarette use and cigarette smoking onset.[14] However, beyond existing studies of

e-cigarette use as a potential influence on cigarette smoking, few prospective studies consider other tobacco products as catalysts of cross-product changes in tobacco susceptibility or harm perceptions.

In the present study, we used prospective data from the first two waves of the Population Assessment and Health (PATH) youth sample to examine how initiation with one type of tobacco may be associated with cross-product changes in susceptibility and perceived harm of all other forms of tobacco. Specifically, our objectives were to evaluate how initiating use of cigarettes, e-cigarettes, hookah, smokeless tobacco, or other combustible tobacco (e.g., cigars) was correlated with prospective changes in: 1) perceived harm of those same products, and 2) perceived harm and susceptibility of each of the other tobacco or nicotine product types. We hypothesized that initiation with one type of product would be associated with less perceived harm and greater susceptibility to trying other tobacco product types.

Methods

This longitudinal cohort study used data from Waves 1 and 2 of PATH youth sample.[15] Briefly, PATH is a nationally representative household survey featuring a stratified, four-stage, address-based area-probability design with oversampling for tobacco users, African Americans, and young adults. Sample weights adjusted for oversampling and non-response to be representative of the US noninstitutionalized civilian population, based on US Census Bureau data. Wave 1 occurred from September 2013 to December 2014, with Wave 2 follow-up one year later (October 2014 to October 2015). Individuals in selected households first completed a screener questionnaire. Weighted response percentages were 54.0% for the household screener and 74.0% for the full adult survey (once screened). The PATH youth sample included up to two adolescents (age 12–17) per household whose parents enrolled in the PATH adult sample (youth response: 78.4%). In both waves, the PATH youth questionnaire was administered using in-home, in-person computer-assisted interviews. Participants were asked about their behaviors and perceptions related to eight types of tobacco and nicotine products. Further details regarding demographic characteristics and tobacco use in the Wave 1 sample were published elsewhere.[16] Unweighted one-year retention to Wave 2 among all Wave 1 youth participants, including those who were age 18 at follow-up, was 87.9% (11,996/13,651).

Eligible for the present analysis were those PATH participants who completed the youth questionnaire in both Waves 1 and 2 and had never used tobacco at Wave 1 (N = 8005). Excluded were youth who had ever used a tobacco product (or don't know or missing) at Wave 1 (N = 2076) and those who "aged-up" to the adult survey by reaching age 18 before Wave 2 (N = 1915) due to substantial wording differences in the harm perception and susceptibility questions between youth and adult questionnaires. Individual statistical models included fewer participants (N = 7349–7370) due to missing values for some study variables.

New use (initiation) of a tobacco product was defined as reporting never use in Wave 1 and ever use in Wave 2. Product types were combustible cigarettes, e-cigarettes, hookah, smokeless tobacco (conventional moist snuff, chewing tobacco, snus, or dissolvable), and

other combustible tobacco (premium cigars, little cigars, cigarillos, pipes, bidis, or kreteks). The Wave 2 questionnaire introduced the umbrella term "electronic nicotine products," of which "e-cigarettes (including vape pens and personal vaporizers)" were presented as a subset. For the present analysis, only initiation of e-cigarettes specifically was considered.

Separately for each of cigarettes, e-cigarettes, hookah, and smokeless tobacco, perceived harm was measured in each wave in response to "How much do you think people harm themselves when they [use product]?" Answer choices were "no harm," "a little harm," "some harm," "a lot of harm," or "don't know." Decrease in perceived harm was defined choosing a lower level of harm at Wave 2 than at Wave 1 (e.g., "some" to "a little"), with "don't know" responses excluded. Participants who stated they had never heard of a tobacco produced were not shown Wave 1 harm perception items for that product.

For participants who had heard of a given tobacco product but never tried it, two measures of susceptibility were posed identically in Waves 1 and 2: curiosity and willingness. For each of cigarettes, e-cigarettes, hookah, and smokeless tobacco, curiosity was assessed via responses to "Have you ever been curious about [using product]?" Response options were "very curious," "somewhat curious," "a little curious," "not at all curious," or "don't know." Similarly, the willingness item asked, "If one of your best friends were to offer you [product], would you [use it]?" with the response options "definitely yes," "probably yes," "probably not," "definitely not," or "don't know." Increase in curiosity and increase in willingness were defined as choosing a higher level of susceptibility in Wave 2 than chosen at Wave 1 (e.g., "probably not" to "probably yes"), with "don't know" responses excluded. A robustness check that incorporated changes to and from the "don't know" response category revealed no meaningful differences in estimated coefficients.

Statistical analysis

Baseline participant characteristics were summarized as weighted percentages using balanced repeated replication and Wave 2 weights. For descriptive analyses only, perceived harm, curiosity and willingness for each product and wave were summarized as average scores (i.e., response categories coded from 1 to 4).

For the primary analyses, we modeled associations between the dichotomous dependent variables decrease in perceived harm, increase in curiosity, and increase in willingness and the independent initiation variables (i.e., new use of cigarettes, e-cigarettes, hookah, smokeless tobacco, and other combustibles). Rather than fit separate models for each product (i.e., cigarettes, e-cigarettes, hookah, and smokeless tobacco), multivariate models were used to model the harm perception or susceptibility outcomes for the four products simultaneously in one model. The multivariate approach accounted for intra-participant correlation among the four tobacco products in evaluating the associations between initiation and changes in harm perception (or susceptibility) in a single model.

Specifically, a logistic multivariate model was used for the dichotomous decrease in perceived harm outcomes (e.g., lower harm rating at Wave 2 vs. no decrease) using all available data (i.e., observations maintained if the outcome was measured for at least one of the four products, as opposed to a complete case analysis requiring observations for all four

products). In all multivariate models, new use of each tobacco product and baseline covariates were included as fixed effects, participants nested in sampling strata were included as random effects, and the final Wave 2 sample weight was used to account for study design and nonresponse. For the outcomes increase in curiosity and increase in willingness, we used similar logistic multivariate models. Associations were expressed as odds ratios (OR) and their 95% confidence intervals (CI).

All models included the following Wave 1 variables as fixed-effects to adjust for confounding: gender (female vs. male), age group (15–17 vs. 12–14 years, as categorized in the source dataset), race/ethnicity (Hispanic/Latino, Non-Hispanic Black, Non-Hispanic White, other), US Census region (Northeast, Midwest, South, West), sensation seeking[17] (composite score of liking frightening things, willingness to break rules, and preferring exciting and unpredictable friends), home tobacco use (living in the same household as someone who uses tobacco, yes/no), alcohol ever use (yes/no), tobacco advertisement receptivity[18] (able to recall brand of favorite tobacco advertisement, yes/no), and parental education attainment (at least some college vs. less). Additionally, we included baseline measures of perceived harm, curiosity, and willingness for the respective models and products. Missing covariate data were not imputed, affecting 3.9%–5.3% of otherwise eligible observations (depending on the outcome variable). A robustness check using multiple imputation and standard logistic regression models (not multivariate) revealed no meaningful differences in estimated coefficients.

Ethics review

De-identified PATH public use files were available on the Internet. The PATH study had obtained an NIH certificate of confidentiality and ethical approval from the Westat institutional review board. Parents or guardians provided informed consent for youth participants, who received $25 for questionnaire completion.

Results

Among baseline tobacco never-users who completed the Wave 2 youth survey, 10.4% reported new use of at least one tobacco or nicotine product between Wave 1 and 2 (Table 1). The most commonly tried product was e-cigarettes (6.9%), and 3.2% of participants initiated use of more than one product type. Characteristics of the follow-up sample are shown in Table 1.

Hookah was the tobacco product for which observed changes in perceptions and susceptibility were most likely: 26.0% reported a lower harm perception category for hookah at Wave 2 than at Wave 1, while 18.1% reported a higher level of curiosity, and 19.8% reported a higher level of willingness to try (Table 1). Cigarettes were the tobacco product for which a decrease in perceived harm was least likely (10.2%). Increases in curiosity (4.7%) and willingness (6.0%) were least likely for smokeless tobacco (Table 1).

In pair-wise, unadjusted analyses (Table 2), new initiation of any one tobacco product was associated with decreased perceived harm of that product and of other products. For example, those youth who initiated cigarette use were more likely to have a decrease in the

perceived harm of cigarettes (30.2%) than those who did not initiate (9.6%). Trying other products was also associated with decreased perceived harm of cigarettes, including trying e-cigarettes (decreased cigarette harm if tried: 19.5% vs. did not try: 9.5%), hookah (21.5% vs. 10.0%), other combustibles (29.1% vs. 9.7%), and smokeless tobacco (23.6% vs. 10.0%). Furthermore, new use of tobacco was also positively associated with increased curiosity and increased willingness toward other product types (Table 2).

In multivariate models for the outcome decreased perceived harm (Table 3), after adjustment for Wave 1 confounders, new use of each tobacco or nicotine product type was associated with decreased perceived harm of that product. Additionally, initiation of e-cigarettes was associated with decreased perceived harm of cigarettes (OR: 1.50; 95% CI: 1.04, 2.16), initiation of hookah was associated with decreased perceived harm of e-cigarettes (OR: 1.76; 95% CI: 1.07, 2.91), and initiation of other combustibles was associated with decreased perceived harm of cigarettes (OR: 1.25; 95% CI: 1.29, 3.92), hookah (OR: 1.81; 95% CI: 1.02, 3.21), and smokeless tobacco (OR: 1.82; 95% CI: 1.01, 3.29). One cross-product association (smokeless initiation and e-cigarette harm) was inverse in direction (Table 3).

The vast majority of cross-product combinations of initiation and increased tobacco susceptibility yielded positive associations (Tables 4 and 5). In adjusted multivariate models for the outcome increase in curiosity (Table 4), new use of one tobacco or nicotine product was positively associated with increased curiosity about other product types. For example, cigarette initiation was positively associated with increased curiosity about e-cigarettes (OR: 2.84; 95% CI: 1.12, 7.22) and hookah (OR: 3.36; 95% CI: 1.58, 7.18) among those who had not yet tried e-cigarettes and hookah, respectively (Table 4). Likewise, trying e-cigarettes was positively associated with increased curiosity about conventional cigarettes (OR: 5.69; 95% CI: 3.68, 8.79) and hookah (OR: 4.19; 95% CI: 2.55, 6.88). Both inverse associations involved initiation of smokeless tobacco, which was associated with lower odds of increased cigarette curiosity (OR: 0.25; 95% CI: 0.07, 0.95) and hookah curiosity (OR: 0.43; 95% CI: 0.10, 1.94).

In adjusted multivariate models for the outcome increased willingness (Table 5), initiation of cigarettes, e-cigarettes, hookah, or other combustible products was associated with greater willingness to try every other tobacco product type (Table 5). For example, new use of e-cigarettes was associated with concomitant increases in willingness to try conventional cigarettes (OR: 9.61; 95% CI: 5.67, 16.3), hookah (OR: 8.46; 95% CI: 4.76, 15.0), and smokeless tobacco (OR: 3.48; 95% CI: 1.75, 6.94).

In sensitivity analyses using the outcome variables increase in harm perceptions, decrease in curiosity, and decrease in willingness (i.e., the opposite change directions as the primary analyses), there were not consistent associations between new use of a product and increased perceived harm (Supplemental Table 1). However, for curiosity and willingness, compared to the primary analyses, associations were mostly in the opposite direction (as expected), with new use of one tobacco product (other than smokeless tobacco) associated with lower odds of decreased curiosity or willingness (Supplemental Table 1).

Discussion

In this national cohort of US adolescents, initiation with one type of tobacco or nicotine product was positively associated with concomitant increases in susceptibility and decreases in perceived harm of other forms of tobacco. These results provide potential mechanistic explanations to observed youth progression from one form of tobacco to another[5–8] and support a proposed behavioral model in which gained familiarity with one product type contributes to greater acceptance and susceptibility to other forms of nicotine or tobacco.[12]

Several cross sectional studies considered associations between using one type of tobacco product and perceptions of others. Among US Air Force recruits, use of hookah was associated with having more friends who smoke cigarettes,[19] while among US middle and high school students, hookah use was associated with willingness to try a cigarette.[20] Portnoy and colleagues[21] reported positive cross-product correlations in US middle and high school students' curiosity about cigarettes, cigars, and smokeless tobacco. US youth who had ever tried combustible tobacco were more curious about e-cigarettes,[22] and those who had ever tried e-cigarettes were more susceptible to cigarette use.[23] Meanwhile, greater exposure to e-cigarette advertising was positively associated with ever and past 30-day use of cigarettes, hookah, cigars, and tobacco poly-use.[24] To our knowledge, the present study is the first to examine such associations prospectively and comprehensively across tobacco product types.

Existing longitudinal studies largely focused on the potential influence of e-cigarette use on combustible cigarette perceptions. Non-smoking youth who used e-cigarettes were more likely to develop lower perceptions of cigarette harm,[13] positive cigarette smoking expectancies,[14] and affiliations with friends who smoke.[14] Positive initial tobacco experiences or emerging nicotine dependence could be factors that facilitate a transition from use of e-cigarettes to conventional cigarettes,[12] a hypothesis supported by recent evidence that youth who use higher concentrations e-cigarette liquid are more likely to achieve a higher intensity of cigarette smoking six months later.[25] In the present study, new use of a tobacco product was defined as ever use within one year, which, although an important youth behavioral milestone, likely includes only some nicotine-dependent users; thus, the relative contribution of nicotine (compared to psychosocial influences) in explaining the observed associations is unclear. Also, the observed changes in perceptions and susceptibility do not necessarily indicate that youth will adopt long-term tobacco poly-use: many could transition from one product type to another or engage in multiple-product experimentation without establishing long-term use.

The present study considers all potential cross-product permutations of tobacco initiation and changes in harm perception or susceptibility in a longitudinal setting. Few prior studies considered changes in tobacco-related perceptions as outcomes of trying a different product. The numerous positive associations between use of one tobacco product and evolving attitudes about others may help explain the observed rise in tobacco poly-use prevalence among adolescents from 1999 to 2014;[1] although, recent data showed a poly-use decline from 2015 to 2016.[2] Study findings are relevant for youth tobacco prevention efforts in that youth who experiment with one form of tobacco should be considered at heightened

susceptibility for subsequent initiation with other tobacco types. Findings were largely consistent whether considering associations between trying a high-risk product (e.g., cigarettes) and perception changes for lower risk products (e.g., e-cigarettes) or between lower risk product use and high-risk product perceptions. For potential tobacco control policy and regulation, findings suggest that estimating the total health impact of any tobacco product should account for plausible effects on youth susceptibility to additional forms of tobacco.

While nearly all associations demonstrated a positive correlation between initiation and cross-product decreased perceived harm and increased susceptibility, new use of smokeless tobacco was associated with less curiosity about cigarettes. While confidence intervals were wide due to the smaller number of participants who initiated smokeless tobacco use, it is plausible that youth who use smokeless tobacco develop negative feelings about cigarettes. Perceived differences in the harm and social acceptability of smokeless versus combustible tobacco may at least partly reinforce adolescents' desire to use smokeless products.[26,27] However, smokeless tobacco initiation was positively associated with increased curiosity about e-cigarettes.

Study Limitations and Strengths

Tobacco use was by self-report. Responses in the home-based PATH interviews could differ from school-based surveys, but it is unknown how the observed associations would be affected. Associations were adjusted for multiple tobacco use risk factors, including baseline perception and susceptibility levels; however, residual confounding cannot be ruled out. Specifically, changes in risk factors during follow-up (e.g., from never to ever alcohol use) were not included in statistical adjustment. Additionally, this analysis was restricted to participants who remained eligible for the youth version of PATH questionnaire at both time points (i.e., age <18 at follow-up), yielding an analytic sample that was smaller in number and younger than the overall PATH cohort. Young adulthood is also an important life period for tobacco initiation, and future studies of cross-product influences on tobacco-related perceptions in this age group are warranted. Finally, at the time of data collection, first-generation "ciga-like" devices were the dominant type of e-cigarette used; separate analysis by device type was not feasible.

While the present analysis was longitudinal, it included only two survey waves; thus, the temporal sequence between change in use status and changes in perceptions and susceptibility is uncertain. It is possible that some youth changed their perceptions of all tobacco products prior to trying any one. Although, susceptibility measures were asked only of individuals who had not yet tried a given product. Also, dichotomizing outcome measures into increase or decrease on a 4-level category may not fully capture change patterns over time; more detailed future analyses, including in upcoming PATH waves, is recommended.

Advantageously, this analysis featured a large, nationally representative sample that was assembled specifically for detailed assessment of tobacco-related behaviors and perceptions. The study had a prospective design with excellent retention between survey waves. Use of multivariate models served as a parsimonious approach for incorporating correlated outcomes (e.g., harm perceptions of four different tobacco products) into a single model.

Conclusion

Youth initiation with any form of tobacco was associated with parallel increases in susceptibility to additional tobacco products. This finding provides mechanistic insight into previously reported prospective relationships between use of one tobacco product and initiation of another. Associations should be interpreted cautiously: analysis was longitudinal, but the timing of product initiation and perception changes was uncertain within the follow-up period. However, taken as a whole, the results suggest that youth who initiate use of one type of tobacco or nicotine product are later at elevated risk of initiating use of additional tobacco products, as well.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Highlights

New tobacco use was associated with less perceived harm of that product 1 year later

New tobacco use was associated with reduced perceived harm of other tobacco products

New tobacco use was associated with increased susceptibility to other tobacco products

In youth, trying one tobacco product correlates with changed susceptibility to others

Table 1

Characteristics of Study Population

Variable	n[1]	Weighted[2] %
Gender		
Female	3964	49.6
Male	4021	50.4
Age at Wave 1		
12–14 years	5270	65.2
15–17 years	2735	34.8
Race/Ethnicity		
Hispanic/Latino	3827	22.4
Non-Hispanic Black	1117	14.1
Non-Hispanic White	3827	54.1
Other/Missing	714	9.4
Parental education		
Less than college	3001	33.8
At least some college	4958	66.2
Home tobacco use: any family member		
None	5508	70.4
At least 1 family member	2427	29.6
Alcohol use		
Never	5909	73.2
Ever	2057	26.8
Tobacco advertisement receptivity: any		
Not receptive	7370	95.9
Receptive	486	6.1
US Census region		
Northeast	1169	17.1
Midwest	1741	21.4
South	3003	37.6
West	2092	24.0
New tobacco product use[3] (Wave 1 to Wave 2)		
Cigarettes	241	3.0
E-cigarettes	544	6.9
Hookah	170	2.1
Other combustibles	172	1.3
Smokeless	98	2.2
At least one product	806	10.4
More than one	251	3.2
Change in perceived harm (Wave 1 to Wave 2)		
Cigarettes		
Decrease	814	10.2

Variable	n[1]	Weighted[2] %
No change	6377	80.2
Increase	793	9.5
E-cigarettes		
Decrease	1394	21.2
No change	3335	50.0
Increase	1953	28.9
Hookah		
Decrease	1051	26.0
No change	2081	50.9
Increase	944	23.2
Smokeless		
Decrease	900	15.8
No change	3550	63.6
Increase	1168	20.6
Change in curiosity (Wave 1 to Wave 2)		
Cigarettes		
Decrease	848	10.7
No change	5935	76.9
Increase	954	12.5
E-cigarettes		
Decrease	521	8.6
No change	4642	75.2
Increase	1020	16.2
Hookah		
Decrease	500	12.2
No change	2841	69.7
Increase	748	18.1
Smokeless		
Decrease	290	5.0
No change	5133	90.3
Increase	264	4.7
Change in willingness (Wave 1 to Wave 2)		
Cigarettes		
Decrease	496	6.3
No change	6400	83.2
Increase	854	10.5
E-cigarettes		
Decrease	495	7.9
No change	4741	77.0
Increase	953	15.1
Hookah		
Decrease	373	8.8

Variable	n[1]	Weighted[2] %
No change	2887	71.4
Increase	373	19.8
Smokeless		
Decrease	240	4.2
No change	5105	89.8
Increase	349	6.0

[1]Number of observations vary due to missing values: for instance, curiosity and willingness items were asked only of those who had heard of the product and not used it at both time points.

[2]Percentages are weighted using balanced repeated replication and Wave 2 weights.

[3]New use categories not mutually exclusive

Setting: Population Assessment of Tobacco and Health, United States, 2013–2015

Table 2

Perceived Tobacco Product Harm, Curiosity, and Willingness: Mean Scores and Percent with Longitudinal Change

New Use of:		Perceived Harm (Cigarettes)				Curiosity (Cigarettes)				Willingness (Cigarettes)			
		n	Mean Scores		%[a] who decreased	n	Mean Scores		%[a] who increased	n	Mean Scores		%[a] who increased
			Wave 1	Wave 2			Wave 1	Wave 2			Wave 1	Wave 2	
Cigarettes	yes	240	3.75	3.51	30.2	_b	_b	_b	_b	_b	_b	_b	_b
	no	7735	3.83	3.83	9.6	7730	1.25	1.27	12.0	7743	1.13	1.18	10.6
E-cigarettes	yes	542	3.78	3.69	19.5	416	1.48	1.65	29.6	414	1.31	1.53	27.0
	no	7407	3.83	3.83	9.5	7288	1.24	1.25	11.4	7302	1.12	1.16	9.6
Hookah	yes	169	3.79	3.68	21.5	122	1.50	1.65	25.3	121	1.28	1.51	31.0
	no	7806	3.82	3.83	10.0	7607	1.25	1.26	12.2	7622	1.13	1.17	10.3
Other combustibles	yes	172	3.75	3.49	29.1	104	1.43	1.53	26.4	105	1.31	1.53	28.6
	no	7899	3.83	3.83	9.7	7555	1.25	1.27	12.2	7566	1.13	1.17	10.2
Smokeless	yes	98	3.59	3.46	23.6	67	1.40	1.32	9.8	67	1.23	1.46	27.5
	no	7742	3.83	3.83	10.0	7531	1.25	1.27	12.5	7544	1.13	1.17	10.4

New Use of:		Perceived Harm (E-cigarettes)				Curiosity (E-cigarettes)				Willingness (E-cigarettes)			
		n	Mean Scores		%[a] who decreased	n	Mean Scores		%[a] who increased	n	Mean Scores		%[a] who increased
			Wave 1	Wave 2			Wave 1	Wave 2			Wave 1	Wave 2	
Cigarettes	yes	226	2.66	2.61	31.8	75	1.49	1.77	33.0	75	1.34	2.04	52.1
	no	6450	2.95	3.05	20.8	6103	1.22	1.31	16.0	6109	1.17	1.25	14.6
E-cigarettes	yes	501	2.63	2.37	37.6	_b	_b	_b	_b	_b	_b	_b	_b
	no	6152	2.96	3.09	19.8	6173	1.22	1.32	16.5	6179	1.18	1.26	15.0
Hookah	yes	151	2.66	2.50	33.4	_c	_c	_c	_c	_c	_c	_c	_c
	no	6526	2.94	3.05	20.9	6127	1.22	1.31	16.1	6133	1.17	1.25	14.7
Other combustibles	yes	155	3.75	3.49	29.1	55	1.43	1.53	26.4	55	1.58	2.08	43.5
	no	6465	3.83	3.83	9.7	6078	1.25	1.27	12.2	6083	1.17	1.25	14.9
Smokeless	yes	88	2.50	2.59	25.6	_c	_c	_c	_c	_c	_c	_c	_c
	no	6491	2.94	3.04	21.1	6048	1.22	1.32	16.2	6054	1.17	1.26	15.0

Perceived Harm / Curiosity / Willingness (Cigarettes) — column group headers (n, Mean Scores [Wave 1 / Wave 2], %[a] who decreased / increased). Data rows for this group are not present on this page.

New Use of:		Perceived Harm (Hookah) n	Wave 1	Wave 2	%[a] who decreased	Curiosity (Hookah) n	Wave 1	Wave 2	%[a] who increased	Willingness (Hookah) n	Wave 1	Wave 2	%[a] who increased
Cigarettes	yes	161	2.96	2.79	37.1	126	1.74	1.98	36.4	126	1.70	2.24	46.6
Cigarettes	no	3912	3.18	3.15	25.5	3960	1.33	1.40	17.5	3955	1.26	1.38	19.0
E-cigarettes	yes	378	2.93	2.81	31.7	337	1.62	1.88	32.6	338	1.60	2.03	40.8
E-cigarettes	no	3683	3.20	3.17	25.3	3737	1.31	1.37	16.7	3731	1.24	1.35	17.9
Hookah	yes	138	2.67	2.37	37.1	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Hookah	no	3934	3.19	3.17	25.6	4085	1.34	1.42	18.3	4080	1.27	1.41	19.9
Other combustibles	yes	130	2.83	2.62	40.4	107	1.82	2.01	34.6	107	1.72	2.34	51.1
Other combustibles	no	3910	3.19	3.16	25.5	3950	1.33	1.40	17.6	3943	1.25	1.38	19.0
Smokeless	yes	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Smokeless	no	3980	3.17	3.14	26.0	3998	1.34	1.42	18.2	3993	1.26	1.41	19.9

New Use of:		Perceived Harm (Smokeless) n	Wave 1	Wave 2	%[a] who decreased	Curiosity (Smokeless) n	Wave 1	Wave 2	%[a] who increased	Willingness (Smokeless) n	Wave 1	Wave 2	%[a] who increased
Cigarettes	yes	197	3.43	3.37	23.7	181	1.14	1.18	8.0	181	1.16	1.36	20.9
Cigarettes	no	5417	3.55	3.60	15.5	5502	1.09	1.09	4.5	5509	1.07	1.08	5.5
E-cigarettes	yes	449	3.43	3.44	21.4	426	1.16	1.14	6.8	426	1.15	1.23	14.0
E-cigarettes	no	5150	3.55	3.61	15.3	5241	1.09	1.09	4.5	5248	1.06	1.08	5.3
Hookah	yes	125	3.36	3.29	24.9	122	1.18	1.21	8.8	122	1.18	1.33	16.4
Hookah	no	5491	3.55	3.60	15.6	253	1.09	1.09	4.6	5570	1.07	1.09	5.8
Other combustibles	yes	134	3.40	3.24	30.3	117	1.25	1.26	9.6	117	1.20	1.46	22.9
Other combustibles	no	5450	3.55	3.61	15.5	5535	1.09	1.09	4.5	5540	1.07	1.08	5.6

New Use of:		n	Perceived Harm (Cigarettes)				Curiosity (Cigarettes)				Willingness (Cigarettes)			
			Mean Scores		%[a] who decreased	n	Mean Scores		%[a] who increased	n	Mean Scores		%[a] who increased	
			Wave 1	Wave 2			Wave 1	Wave 2			Wave 1	Wave 2		
Smokeless	yes	71	3.19	2.94	38.0	_b	_b	_b	_b	_b	_b	_b	_b	
	no	5481	3.55	3.61	15.5	5616	1.09	1.09	4.6	5621	1.07	1.09	5.9	

Results are weighted means and percentages (Wave 2 balanced repeated replicate weights). Greater mean scores indicate greater perceived harm, curiosity, or willingness to try that product (scale: 1 to 4).

Setting: Population Assessment of Tobacco and Health, United States, 2013–2015

[a] Percent of individuals (weighted) whose perception scores were lower at Wave 2 (e.g., from "a lot of harm" to "no harm") or whose curiosity or willingness scores were higher at Wave 2 (e.g., from "not at all curious" to "very curious"); dichotomous

[b] Individuals who had used a product by Wave 2 were no longer asked about their curiosity or willingness to try that product.

[c] Number of individuals who initiated this product and provided outcome response is below the PATH reporting threshold.

Table 3

Associations Between Tobacco Product Initiation and Perceived Tobacco Product Harm (Multivariate Model)

New Use of:	Decreased Perceived Harm of:	Odds Ratio (95% CI)
Cigarettes	Cigarettes	2.70 (1.64, 4.44)
	E-cigarettes	1.11 (0.69, 1.77)
	Hookah	1.20 (0.70, 2.04)
	Smokeless tobacco	1.08 (0.62, 1.88)
E-cigarettes	Cigarettes	1.50 (1.04, 2.16)
	E-cigarettes	2.90 (2.12, 3.97)
	Hookah	1.29 (0.90, 1.85)
	Smokeless tobacco	1.30 (0.90, 1.88)
Hookah	Cigarettes	1.55 (0.86, 2.78)
	E-cigarettes	1.76 (1.07, 2.91)
	Hookah	1.60 (0.93, 2.75)
	Smokeless tobacco	1.41 (0.75, 2.65)
Smokeless tobacco	Cigarettes	1.37 (0.71, 2.73)
	E-cigarettes	0.69 (0.33, 1.43)
	Hookah	1.02 (0.42, 2.49)
	Smokeless tobacco	3.48 (1.67, 7.28)
Other combustible tobacco	Cigarettes	2.25 (1.29, 3.92)
	E-cigarettes	1.50 (0.87, 2.58)
	Hookah	1.81 (1.02, 3.21)
	Smokeless tobacco	1.82 (1.01, 3.29)

Analytic sample includes individuals with harm perception recorded in Wave 1 and Wave 2 for at least one tobacco product and complete data on adjustment variables (N=7370).

Adjustment variables: gender (female vs. male), age group (15–17 vs. 12–14 years), race/ethnicity (Hispanic/Latino, Non-Hispanic Black, Non-Hispanic White, other), US Census region (Northeast, Midwest, South, West), sensation seeking score (range: 3–15), home tobacco use (yes/no), alcohol ever use (yes/no), tobacco advertisement receptivity (yes/no), parental education attainment (at least some college vs. less), baseline perceived harm, and initiation of each other tobacco product type.

Smokeless tobacco includes conventional moist snuff or chewing tobacco, snus, and dissolvable tobacco. Other combustible tobacco includes cigars, pipes, bidis, and kreteks.

Abbreviation: CI = confidence interval

Setting: Population Assessment of Tobacco and Health, United States, 2013–2015

Table 4

Associations Between Tobacco Product Initiation and Tobacco Product Curiosity (Multivariate Model)

New Use of:	Increased Curiosity About:	Odds Ratio (95% CI)
Cigarettes	E-cigarettes	2.84 (1.12, 7.22)
	Hookah	3.36 (1.58, 7.18)
	Smokeless tobacco	1.17 (0.44, 3.09)
E-cigarettes	Cigarettes	5.69 (3.68, 8.79)
	Hookah	4.19 (2.55, 6.88)
	Smokeless tobacco	1.41 (0.70, 2.84)
Hookah	Cigarettes	2.41 (1.07, 5.43)
	E-cigarettes	2.39 (0.73, 7.78)
	Smokeless tobacco	1.65 (0.52, 5.28)
Smokeless tobacco	Cigarettes	0.25 (0.07, 0.95)
	E-cigarettes	5.07 (1.49, 17.25)
	Hookah	0.43 (0.10, 1.94)
Other combustible tobacco	Cigarettes	2.36 (0.97, 5.75)
	E-cigarettes	4.30 (1.50, 12.36)
	Hookah	2.62 (1.13, 6.06)
	Smokeless tobacco	2.77 (0.97, 7.84)

Analytic sample includes individuals with curiosity recorded in Wave 1 and Wave 2 for at least one tobacco product and complete data on adjustment variables (N=7349). Individuals who had used a product by Wave 2 were no longer asked about their curiosity regarding that product.

Adjustment variables: gender (female vs. male), age group (15–17 vs. 12–14 years), race/ethnicity (Hispanic/Latino, Non-Hispanic Black, Non-Hispanic White, other), US Census region (Northeast, Midwest, South, West), sensation seeking score (range: 3–15), home tobacco use (yes/no), alcohol ever use (yes/no), tobacco advertisement receptivity (yes/no), parental education attainment (at least some college vs. less), baseline curiosity, and initiation of each other tobacco product type.

Smokeless tobacco includes conventional moist snuff or chewing tobacco, snus, and dissolvable tobacco. Other combustible tobacco includes cigars, pipes, bidis, and kreteks.

Abbreviation: CI = confidence interval

Setting: Population Assessment of Tobacco and Health, United States, 2013–2015

Table 5

Associations Between Tobacco Product Initiation and Tobacco Product Willingness to Try (Multivariate Model)

New Use of:	Increased Willingness to Try:	Odds Ratio (95% CI)
Cigarettes	E-cigarettes	24.24 (8.56, 68.68)
	Hookah	6.94 (2.72, 17.66)
	Smokeless tobacco	3.33 (1.30, 8.50)
E-cigarettes	Cigarettes	9.62 (5.67, 16.33)
	Hookah	8.46 (4.76, 15.03)
	Smokeless tobacco	3.48 (1.75, 6.94)
Hookah	Cigarettes	6.80 (2.69, 17.23)
	E-cigarettes	15.37 (4.41, 53.59)
	Smokeless tobacco	2.41 (0.77, 7.57)
Smokeless tobacco	Cigarettes	3.04 (0.89, 10.36)
	E-cigarettes	2.70 (0.56, 12.92)
	Hookah	1.23 (0.20, 7.47)
Other combustible tobacco	Cigarettes	2.73 (1.02, 7.29)
	E-cigarettes	6.16 (1.74, 21.89)
	Hookah	7.28 (2.63, 20.12)
	Smokeless tobacco	4.64 (1.46, 14.71)

Analytic sample includes individuals with curiosity recorded in Wave 1 and Wave 2 for at least one tobacco product and complete data on adjustment variables (N=7352). Individuals who had used a product by Wave 2 were no longer asked about their willingness to try that product.

Adjustment variables: gender (female vs. male), age group (15–17 vs. 12–14 years), race/ethnicity (Hispanic/Latino, Non-Hispanic Black, Non-Hispanic White, other), US Census region (Northeast, Midwest, South, West), sensation seeking score (range: 3–15), home tobacco use (yes/no), alcohol ever use (yes/no), tobacco advertisement receptivity (yes/no), parental education attainment (at least some college vs. less), baseline willingness, and initiation of each other tobacco product type.

Smokeless tobacco includes conventional moist snuff or chewing tobacco, snus, and dissolvable tobacco. Other combustible tobacco includes cigars, pipes, bidis, and kreteks.

Abbreviation: CI = confidence interval

Setting: Population Assessment of Tobacco and Health, United States, 2013–2015