

Original investigation

Adolescents' and Young Adults' Knowledge and Beliefs About Constituents in Novel Tobacco Products

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Abstract

Introduction: Novel tobacco products, such as little cigars, cigarillos, hookah, and e-cigarettes, and their smoke or aerosol contain chemicals which the FDA has determined to be Harmful or Potentially Harmful Constituents. We explored adolescents' and young adults' knowledge and beliefs about constituents in novel tobacco products and their smoke or aerosol, in order to inform risk communication messages.

Methods: Seventy-seven adolescents and young adults (ages 13–25) participated in 10 focus groups, including 47 novel tobacco product users and 30 susceptible nonusers. Participants were asked to discuss 10 pre-selected constituents found in novel tobacco products and their smoke or aerosol. The first author analyzed the discussion for emergent themes.

Results: Participants were generally familiar with arsenic, carbon monoxide, formaldehyde, and nicotine, but unfamiliar with acetaldehyde, acrolein, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), and N-nitrosornicotine (NNN). All participants had negative beliefs about most constituents, although users had positive beliefs about nicotine. "Unfamiliar" constituents were associated with similarly-sounding words (eg, acetaldehyde sounds like acetaminophen), and some participants recognized words in the chemical names of NNK/NNN (eg, "nitro"). "Familiar" constituents were associated with negative health effects and other common products the constituents are found in. All participants wanted more information about the constituents' health effects, toxicity, and other common products. Most participants were unaware the constituents discussed are in novel tobacco products and their smoke or aerosol.

Conclusions: Risk communication messages could capitalize on negative associations with familiar constituents, or attempt to educate about unfamiliar constituents, to discourage novel tobacco product use among adolescents and young adults.

Implications: The results of this study have implications for how the FDA and other agencies can communicate about the risks of novel tobacco products to the general public, which will be

particularly important once the Deeming Rule is finalized. Our findings suggest it may be effective to capitalize on the public's negative beliefs about and associations with familiar constituents, or to educate about unfamiliar constituents and their health effects, their concentration and toxicity in novel tobacco products and their smoke or aerosol, and other products they are found in.

Introduction

The 2009 Family Smoking Prevention and Tobacco Control Act requires tobacco manufacturers to report the levels of constituents in tobacco products and tobacco smoke to the FDA.¹ In 2012, the FDA released a reduced list of 18 Harmful and Potentially Harmful Constituents, selected for their representativeness of various chemical classes and for their established and widely available testing methods, on which tobacco manufacturers will be required to report.^{2,3} While this list applies only to currently regulated tobacco products, including cigarettes and cigarette smoke, smokeless tobacco, and roll-your-own tobacco, many of the constituents on the reduced list are also known to be in novel tobacco products and their smoke or aerosol, such as arsenic, carbon monoxide, and formaldehyde.⁴⁻⁸ Some novel tobacco products and their smoke, like little cigars, cigarillos, and hookah, often contain similar levels of constituents as cigarettes.⁴⁻⁸ While e-cigarettes and e-cigarette aerosol generally contain lower levels of and fewer constituents than other tobacco products,^{4,5} the effects of repeated, long-term exposure to low levels of many constituents are still unknown.

In April of 2014, the FDA issued a proposed rule to extend its regulatory authority to any product meeting the statutory definition of a "tobacco product," which would include novel tobacco products such as little cigars and cigarillos, hookah, and e-cigarettes.⁹ As part of this Deeming Rule, tobacco manufacturers will be required to disclose the quantities of constituents in novel tobacco products and their smoke or aerosol in the same manner as traditional tobacco products, and the FDA will be tasked with communicating this information to the public in "a format that is understandable and not misleading to a lay person."^{1,9} In order to best use this information to communicate with the public about the risks of novel tobacco products, the FDA will need a better understanding of public knowledge and beliefs about constituents in these products.

Little research has explored what the public knows and believes about harmful constituents in tobacco products and tobacco smoke. A study by Hall and colleagues¹⁰ found that among US adult smokers and nonsmokers ages 18 and above, awareness of a majority of constituents was very low. Constituents which were familiar to a majority of the participants, such as arsenic, carbon monoxide, and ammonia, were also the constituents which elicited the most worry and produced the greatest discouragement from wanting to smoke. Similarly, analysis of data from the International Tobacco Control Four Country Survey (ITC-4) has shown that across Canada, Australia, the United States, and the United Kingdom, smokers were mostly aware that tobacco smoke contains carbon monoxide, but were less aware that it contains arsenic, cyanide, and mercury.^{11,12}

Even less research has examined the public's knowledge and beliefs about constituents in novel tobacco products and their smoke or aerosol. One recent study by Sanders-Jackson and colleagues¹³ presented US young adults with the statement "E-cigarettes do not contain any of the toxic chemicals that can be found in combustible cigarettes" and asked them to indicate whether the statement was true or false. Nearly 32% of young adults incorrectly answered that

the statement was true, and almost half (48%) responded "don't know," while only 20% of young adults correctly answered that the statement was false.¹³

Data from the 2014 National Youth Tobacco Survey¹⁴ showed high rates of use of each of these products among high school students across the nation; in the past 30 days, 8.2% had smoked a cigar product, 9.4% had smoked hookah, and 13.4% had used an e-cigarette. Similarly high rates were found for young adults; data from the 2012–2013 National Adult Tobacco Survey¹⁵ showed that in the past 30 days, 8.9% had smoked a cigar product, 18.2% had smoked hookah, and 8.3% had used an e-cigarette. Given the high rates of novel tobacco product use among adolescents and young adults, and the widespread lack of knowledge about the constituents present in novel tobacco products and their smoke or aerosol, the purpose of this study was to acquire more information about adolescent and young adults' knowledge and beliefs about harmful constituents found in novel tobacco products and their smoke or aerosol. We employed a qualitative approach to address three specific research questions: (1) What do adolescents and young adults know about or associate with constituents? (2) What do adolescents and young adults want to know about the constituents in novel tobacco products? (3) What do adolescents and young adults think about the constituents being in novel tobacco products?

Methods

Ten focus groups were conducted in and around Chapel Hill, North Carolina from February to April 2014 as formative work for a larger study to develop effective risk communication messages to inform adolescents and young adults about the risks of using novel tobacco products.

Participants

We recruited adolescent (ages 13–17) and young adult (ages 18–25) focus group participants using purposive sampling methods across the Triangle region of North Carolina. Participants were recruited through a variety of methods, including in-person recruitment, emails to various listservs, Craigslist advertisements, advertisements in college and local newspapers, and radio and TV spots. In person recruitment was conducted at tobacco retail outlets, recreation centers, bars, coffee shops, colleges, and high schools. Recruitment materials encouraged individuals to visit a recruitment website and complete an eligibility screener. Respondents who reported any novel tobacco product use (including electronic cigarettes, hookah, cigarillos, cigars, or smokeless tobacco) in the past 30 days were categorized as "users" and were considered eligible for the focus groups. Respondents who reported they were willing to try any novel tobacco products, based on items adapted from Pierce's Susceptibility to Smoking measure^{16,17} were categorized as "susceptible nonusers" and were considered eligible for the focus groups, given that susceptibility to using tobacco products has been shown to predict future use of tobacco products.¹⁷⁻¹⁹ Respondents who were unwilling to try any novel tobacco products were categorized as "nonsusceptible

nonusers” and were excluded from the focus groups, since nonusers are typically not targets for risk communication campaigns. Eligible respondents were invited to participate in one of 10 focus groups, stratified by age (adolescents or young adults) and novel tobacco product use status (users or susceptible nonusers). Target enrollment for each focus group was approximately 7–10 participants, with a total target enrollment of 42–60 users and 28–40 susceptible nonusers.

Procedure

Prior to each focus group, participants provided written informed consent (young adults) or assent (adolescents). Parents of adolescent participants were sent an informational letter about the study prior to the focus group, and given the opportunity to respond within 5 days if they did not want their child to participate. The Institutional Review Board at Wake Forest School of Medicine approved this study. Additional privacy protection was secured by the issuance of a Certificate of Confidentiality by the Department of Health and Human Services.

The focus groups lasted approximately 90 minutes and were facilitated by a three-person team, including a moderator, co-moderator and note taker. The moderators were MA and PhD-level qualitative research specialists with more than 15 years of experience conducting focus groups with young adults and adolescents. A semi-structured interview guide (Table 1) was used to facilitate discussion in all groups, and probes were used as necessary to clarify and evoke additional detail. The interview guide was developed based on a literature review and prior pilot work, and focused on generating discussion around the three a priori research questions noted above. To address these research questions, participants were asked about 10 constituents from FDA’s reduced list of Harmful and Potentially Harmful Constituents, including acetaldehyde, acrolein, arsenic, benzene, cadmium, carbon monoxide, formaldehyde, nicotine, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), and N-nitrosornicotine (NNN). We selected these constituents because they have been found to be present in novel tobacco products.^{4–8} Participants were shown a list of these constituents and asked whether they had heard of or knew anything about each constituent. Participants were also asked what they would like to know about these constituents. Finally, participants were shown and asked to respond to additional lists indicating which of the 10 constituents are found in each novel tobacco product (little cigars and cigarillos, hookah, and e-cigarettes) and its smoke or aerosol.

At the conclusion of each focus group, we provided participants with a handout of information about novel tobacco products, including constituents found in these products. The handout was adapted from similar information sheets from the Campaign for Tobacco-Free Kids, the American Lung Association, the American Cancer Society, and the National Cancer Institute. Participants received a \$50 Amazon gift card for their participation.

Analysis

The primary aim of our focus groups was descriptive and focused on understanding participant’s knowledge and beliefs about constituents found in novel tobacco products and their smoke or aerosol. Thus, our analytic approach was similar to grounded theory methods,^{20,21} in that the findings are “grounded” in the data and were developed inductively and in constant interaction with the data. Although we identified a priori research questions, we did not develop or test specific hypotheses.

Focus groups were digitally recorded and transcribed verbatim by an independent transcriptionist. Using the semi-structured interview guide, codes were developed for each question in the interview guide which addressed an a priori research question (eg, a “more information” code was applied to each group’s discussion of additional information they would like to know about the constituents [Research Question #2]). The codebook was piloted by the authors using two randomly selected transcripts, and adjustments were made to create the final codebook. Two pairs of coders used the final codebook to independently code five out of the 10 transcripts using Atlas.ti 7.0, a qualitative data analysis software program. After the initial round of coding, the coders met and discussed discrepancies to ensure consistent application of codes. Once discrepancies were resolved, the codes were merged into a master file for data analysis. The first author reviewed the codes and conducted interpretative analysis to identify emergent and recurrent themes related to the research questions. The first author created written summaries of themes related to each research question, and met with co-authors to discuss and synthesize themes across age groups and novel tobacco product user status.

Results

Overall, findings were consistent across focus groups (adolescents and young adults, and novel tobacco product users and nonusers), with only a few differences noted below.

Participant Characteristics

A total of 77 individuals (27.3% adolescents [$N = 21$] and 73.7% young adults [$N = 56$]; 61.0% users [$N = 47$] and 39.0% susceptible nonusers [$N = 30$]) participated in the focus groups. See Table 2 for participant characteristics by age group and novel tobacco product use status (herein referred to as “users” and “nonusers”). Across all 10 focus groups, the majority of participants were Non-Hispanic (91%), and white (57%) or black (26%). Just over half the participants were female (56%). The mean age of adolescent participants was 15.8 years old, and the mean age of young adult participants was 20.5 years old.

Constituent Knowledge

Participants had varying levels of knowledge about the constituents. Almost all participants were familiar with arsenic, carbon monoxide,

Table 1. Focus Group Semi-Structured Interview Guide

Research question	Domain	Interview guide questions
#1	Knowledge	Which chemicals have you heard of? What do you know about or associate with [constituent]?
#2	Desired knowledge	What would you like to know about these chemicals?
#3	Constituents in novel tobacco products	What do you think about these chemicals being in [product smoke or aerosol]?

Table 2. Demographic Information by Novel Tobacco Product Use and Age Group

	Total (N = 77)	Novel tobacco product use		Age group	
		Susceptible nonusers (N = 30)	Users (N = 47)	Adolescents (N = 21)	Young adults (N = 56)
Mean age	19.2	18.9	19.4	15.8	20.5
Gender					
Female	43 (56%)	18 (60%)	25 (53.2%)	12 (57.1%)	31 (55.4%)
Male	34 (44%)	12 (40%)	22 (46.8%)	9 (42.9%)	25 (44.6%)
Ethnicity					
Non-Hispanic	70 (91%)	28 (93.3%)	42 (89.4%)	20 (95.2%)	50 (89.3%)
Hispanic	7 (9%)	2 (6.7%)	5 (10.6%)	1 (4.8%)	6 (10.7%)
Race					
White	44 (57%)	18 (60%)	25 (53.2%)	14 (66.7%)	29 (51.8%)
Black	20 (26%)	6 (20%)	14 (29.8%)	0 (0%)	20 (35.7%)
Other	13 (17%)	6 (20%)	8 (17%)	7 (33.3%)	7 (12.5%)

formaldehyde, and nicotine. Some participants were familiar with benzene and cadmium, with young adults being more likely than adolescents to have heard of these constituents. Almost no participants were familiar with acetaldehyde, acrolein, NNK, or NNN.

Table 3 describes participant's knowledge about specific constituents. Knowledge about arsenic, carbon monoxide, formaldehyde, and nicotine was fairly similar between adolescents and young adults, with most participants knowing basic information about these constituents, such as that they are harmful chemicals and are often found in other products. For example, most participants knew arsenic is used as a poison. One young adult nonuser said, "I think it's [arsenic] a poison that has been used to silently poison people over time. Like wives that hate their husbands cook arsenic into their food and then they'll just slowly get weaker and weaker and eventually die." All participants also knew that nicotine is addictive and can make you sick in high doses; however, there was confusion about exactly how nicotine affects the body. For example, one young adult nonuser said, "I know what nicotine is, but I don't honestly know that much about it."

Discussion revealed that participants had varying sources of knowledge about these constituents. Many participants attributed their familiarity with certain constituents, such as benzene and formaldehyde, to taking chemistry in high school. One young adult nonuser said, "I remember it [formaldehyde] in chemistry class, but I don't remember what we did with it. I remember it smelled bad." Others attributed their knowledge of certain constituents to their portrayal in popular media. For example, some participants knew arsenic is a poison because it is commonly used in movies and TV shows. One adolescent nonuser said, "Maybe because I watched a whole bunch of crime shows, but people poison each other, trying to kill their spouse."

Beliefs About Constituents

In general, participants had negative beliefs about most of the constituents. Almost all participants were worried about the health effects of the constituents, and tended to assume a constituent had negative health effects, even if they didn't know what it was. One young adult user said, "Because all these look like chemicals or toxins and something that's poisonous; that's not good for you." Many participants believed the constituents sounded artificial, and many said the constituents sounded dangerous. For example, one young adult user said, "Normally, from what I've learned in science, anything that ends with 'hyde' or 'ide' would kind of throw up red flags, I can say, as far as health reasons."

Table 3. Participants' Knowledge about Familiar Constituents

Constituent	Participants' Knowledge
Arsenic	Poison Can kill you Used in movies/TV shows to murder people
Carbon Monoxide	Found in foods in small amounts Colorless and odorless gas Comes from car exhaust Detectors in homes People kill themselves in garages Known as the "silent killer"
Formaldehyde	Preserves dead things Very strong odor
Nicotine	Addictive Can make you sick in high doses Alters brain chemistry Uncertainty about how it affects the body
Benzene	Chemical in gasoline
Cadmium	An element A heavy metal

Nicotine differed from the other constituents, with users and nonusers having different beliefs. Nonusers typically had negative beliefs about nicotine; they were worried about nicotine and the fact that it can lead to addiction. One adolescent nonuser said, "So that's [nicotine] also a concern because there's a risk of dependence." On the other hand, users typically had positive beliefs about nicotine; they mentioned that nicotine is a good stress reliever and it boosts concentration. For example, one young adult user said, "...I feel like nicotine, I don't know, it helps me concentrate a lot. Like if I'm stressed out, it's a good de-stresser..."

Most participants tended to associate familiar constituents with common products or uses. For example, the majority of participants associated arsenic with rat poison, carbon monoxide with car exhaust, and formaldehyde with embalming fluid. These associations typically induced negative reactions from participants, as they imagined ingesting the common product while using novel tobacco products. For example, one young adult user said of cadmium, "I feel like I don't want it [a metal] in my body." Participants were generally in agreement that familiar constituents were particularly worrisome, due to these negative associations with other common products. For example, one young adult user said they would worry about arsenic and carbon monoxide "... because they're both so closely connected to death."

When participants had not previously heard of a constituent, or had heard of it but knew nothing about it, they tended to associate the constituent with similarly sounding words. For example, one young adult participant said of acetaldehyde, "It makes me think of acetaminophen because it starts the same way." This type of association was typically negative, although adolescents had positive associations with cadmium because it sounded like things with which they had positive associations. For example, one adolescent nonuser said, "It just doesn't sound bad. Isn't there a chocolate company that's like... Cadbury?" This pattern held true for all the constituents except NNK and NNN. For these constituents, participants noticed words they recognized within the chemical name, such as "amino," "meth," and "nicotine." Participants disagreed about whether they were worried about a constituent they had never heard of before. Some participants were concerned by not knowing what a constituent was. For example, one adolescent nonuser said, "It looks more familiar, but I still don't know what it is. Therefore, it's scary." Others were less worried by not knowing what a constituent was. One young adult user said, "I'm completely neutral. I have no idea what this stuff is."

Desired Knowledge

Almost all participants wanted to know about the health effects of the constituents. Most participants assumed the constituents were dangerous, but wanted to be able to link specific constituents to specific health problems. For example, one adolescent user said, "I want to know what each one does to your body, specifically."

Almost all participants were also interested in knowing the concentrations of the constituents within novel tobacco products and their smoke or aerosol. Many believed product packaging should display concentration information for the constituents, and one participant suggested a "chemical nutrition label." Some users indicated they might switch to brands that have lesser concentration of certain constituents. For example, one young adult user said, "I'd also like to know which brands carry more of which chemicals."

Along with concentration, most participants were interested in understanding the toxicity of the constituents. Several participants knew that the FDA and other agencies deem safe thresholds for constituents and wanted to know how close the concentrations in novel tobacco products and their smoke or aerosol come to those thresholds. For example, one young adult nonuser said, "What amount is in the product? Just like with arsenic, there's a toxic level. So how close to the toxic level are you talking?"

Additionally, most participants expressed interest in learning other common uses for the constituents. Some participants expressed that they knew common uses for some of the constituents such as arsenic being in rat poison, but that they would also want this information for other constituents. One young adult nonuser said, "Like maybe common uses of them... like formaldehyde, we know that's used for storage of dead animals and stuff like that."

Constituents in Novel Tobacco Products

Overall, participants were aware novel tobacco products and their smoke or aerosol contain a variety of chemicals, but were surprised to learn which particular constituents were in the products and their smoke or aerosol. For example, one young adult nonuser said, "It's kinda surprising to me that all these chemicals are in hookah smoke." One adolescent user said, "I just thought there were a couple [chemicals], not several." A few participants indicated they were surprised to learn that novel tobacco products and their smoke or aerosol

contain these constituents because they believed novel tobacco products are healthier than cigarettes. For example, one adolescent user discussed how they thought little cigars were more natural than cigarettes "because they're wrapped in the leaf... and the stuff inside just looks more earthy than cigarettes." Almost all participants were also surprised to learn that novel tobacco products and their smoke or aerosol contain these constituents because they are not currently disclosed on product packaging. For example, one young adult user expressed frustration, saying, "Because they give you the Surgeon General's warning that says you may get cancer, but they don't say 'oh, by the way, there's ammonia in there, a little bit of benzene.'"

Discouragement

Many participants, both users and nonusers, indicated that learning these constituents are in novel tobacco products and their smoke or aerosol would discourage them from using or trying the products. One young adult user said, "This list actually makes me feel less good about hookah. It definitely pauses me for a second to take a look at something closer." One adolescent nonuser said, "It kind of lets me know that hookah is probably just as bad as smoking a cigarette. Because when I read that, I didn't believe it. But now it's like - oh, that looks pretty bad."

However, other participants indicated their opinions would depend on the amount of the constituents in the novel tobacco products. For example, some participants understood that constituents may not be harmful in low doses which are below safety thresholds. One adolescent nonuser said, "But there can't be that much arsenic in hookah smoke to be a major concern. Because there's arsenic in water. But it's such low concentrations that it doesn't really harm you."

Discussion

The current study yielded several insights about adolescents' and young adults' knowledge and beliefs about harmful constituents in novel tobacco products and their smoke or aerosol. Evidence from previous quantitative work¹⁰⁻¹² has shown that adult smokers and nonsmokers are familiar with some constituents, such as arsenic, carbon monoxide, and ammonia, but unfamiliar with others. Our findings show that adolescents and young adults, both novel tobacco product users and nonusers, also report similar awareness of constituents. Our work adds to the existing literature by highlighting that adolescents and young adults tend to make associations between known constituents and their health effects and other common products, and between unknown constituents and similarly-sounding words (or recognize words within the chemical names of the constituents). Participants in our study held mostly negative beliefs about constituents, except for nicotine. Novel tobacco product users in particular held positive beliefs about nicotine and discussed its positive benefits, which has also been found in other qualitative work.²²

The current work also reveals that adolescents and young adults are generally unaware that these constituents are found in novel tobacco products and their smoke or aerosol, which confirms previous work by Sanders-Jackson and colleagues,¹³ who found that young adults were unaware that e-cigarettes contain some of the same chemicals found in cigarettes. Our findings indicate that this may be due to misperceptions about the relative risk of novel tobacco products, and the fact that novel tobacco products typically do not have product warnings or disclosures.

Additionally, previous work¹⁰ has demonstrated that constituents which were familiar to a majority of adults were also the constituents which elicited the most worry and produced the greatest discouragement from wanting to smoke cigarettes. Our findings indicate that adolescents and young adults may be divided on whether known constituents elicit discouragement from using novel tobacco products. For example, while some participants were discouraged by known constituents such as arsenic, others indicated their opinions would depend on the concentrations of the constituents, because they were aware that some constituents may not be harmful in low doses which are below safety thresholds. This is an area that future research needs to address both with quantitative and qualitative research.

Implications

The results of this study have implications for how the FDA and other agencies can communicate about the risks of novel tobacco products to the general public, which will be particularly important once the Deeming Rule is finalized. Risk communication campaigns are effective when formative research occurs to identify the intended audiences' general understanding of the issue.²³ The current work provides formative data to help create campaigns by understanding what people know about harmful constituents, as well as what they want to know. Providing this novel information to the public will help increase campaign effectiveness because campaigns that present new information are generally more effective than campaigns that provide similar information that is already known.²⁴ Our findings suggest it may be effective to capitalize on the public's negative beliefs about and associations with familiar constituents. For example, participants in our study knew arsenic is found in rat poison and is used to kill people. Participants indicated that these types of associations would discourage them from using novel tobacco products, and risk messages about novel tobacco products could attempt to make these associations very salient.

Our findings also suggest it may be effective to message about constituents which are unfamiliar to the public. Constituents such as NNN and NNK were particularly worrisome to participants, especially when they were shown the long, complex chemical name. Many participants expressed that not knowing anything about these constituents would discourage them from using novel tobacco products. Others who were less discouraged by the constituents themselves wanted to know additional information about the constituents, such as their health effects, their concentration and toxicity, and other products they are found in. Risk messaging campaigns could explore how best to educate the public about these unfamiliar constituents and what type of information is most effective in discouraging novel tobacco product use.

Additionally, our findings reveal that adolescents and young adults do want more information about the constituents in novel tobacco products and their smoke or aerosol. The FDA and other agencies have an opportunity to educate the public about these constituents, but should be careful about how they share information about these constituents. Traditionally, the tobacco industry communicated constituent information to the public through the reporting of emission levels for specific constituents, like tar, nicotine, and carbon monoxide, on the side of cigarette packaging (eg, "10 mg Tar, 0.9 mg Nicotine, 10 mg Carbon Monoxide"). Previous research has shown that quantitative emission labels are often misinterpreted by the public and are used to justify brand switching in order to mitigate risk.²⁵⁻²⁷ For example, although constituent quantities do not directly relate to a tobacco

products' risk, research has shown that consumers generally equate lower levels of constituents with lower levels of risk.²⁵⁻²⁷ Indeed, participants in the current study exhibited the same misinterpretation, saying they would like to see "chemical nutrition labels" and would switch to brands which contain less of a certain constituent.

Although quantitative emissions labels are popularly endorsed by the public, research has shown that descriptive warnings can be more effective for communicating about harmful constituents. For example, Australia has implemented descriptive statements on cigarette packs such as "Smoking exposes you to more than 40 harmful chemicals." Hammond and White²⁸ found that adults, both smokers and nonsmokers, rated descriptive statement packaging as easier to understand than quantitative emission packaging, and that the descriptive statement packaging was less likely to be used to compare brands to make incorrect assumptions about risk. This suggests that in order to develop risk messaging campaigns and to publicly display constituent information to the public in "a format that is understandable and not misleading to a lay person,"^{1,9} the FDA and other agencies should consider taking a communication approach which is more descriptive, rather than quantitative.

Limitations

Because qualitative research emphasizes depth rather than breadth, our relatively small convenience sample prohibits us from generalizing our findings to all adolescents and young adults. Qualitative research also involves subjectivity and an element of expert judgment. Nevertheless, our study was strengthened by our use of several qualitative research strategies to mitigate subjectivity and increase the dependability and validity of our study results. For example, our focus groups were conducted by experienced moderators using a standardized interview guide, and were coded by two independent coders who coded the transcripts using a standardized codebook and a protocol for resolving coding differences. Additionally, the first author met with the co-authors to discuss and synthesize emergent themes.

The current study was also limited by the state of the science about constituents in novel tobacco products and their smoke or aerosol, which was relatively sparse at the time we conducted the focus groups and limited the particular constituents we were able to discuss with our participants. Since the focus groups were conducted, new research has continued to expand the list of constituents found in novel tobacco products and their smoke or aerosol, especially for e-cigarettes.^{4,5}

Conclusions

The current research provides a rich descriptive understanding of what adolescents and young adults know and believe about constituents found in novel tobacco products and their smoke or aerosol, and has implications for the development of risk messaging campaigns by agencies such as the FDA. Future research studies should continue to assess knowledge and beliefs about constituents with quantitative and qualitative studies, and also begin to test specific risk messages about harmful constituents in both experimental and real-world settings.

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Declaration of Interests

None declared.

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