

Increasing Effectiveness of Messages about Chemicals in Cigarette Smoke

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Objectives: Federal law requires informing the public on toxic chemicals in cigarette smoke. We sought the public's advice about communicating information about these chemicals. **Methods:** Adolescents, young adults, and adults (N = 59), including smokers and non-smokers, participated in 9 focus groups that discussed inclusion of messages about toxic chemicals on cigarette packs, in media campaigns, and on a website. We transcribed, coded, and analyzed focus group audio-recordings. **Results:** Participants had 3 suggestions for message content to increase the impact of messages about cigarette smoke chemicals. First, they wanted to see messages rotated more frequently to increase message novelty. Second, they recommended using stories and pictures to help connect people to the abstract idea of chemicals in smoke. Third, they cautioned against making messages that might seem overblown and could appeal to the rebellious nature of adolescents. Some participants mentioned that chemical information on a website might discourage people from smoking; others mentioned that people might use it to choose which brand to smoke. **Conclusions:** Legislation provides the impetus to design new chemical disclosure messages for cigarette packs and other media. Our findings can help increase the impact of these messages.

Key words: tobacco; constituents; chemicals; health communication; health messages

Tob Regul Sci.™ 2018;4(4):50-62

DOI: <https://doi.org/10.18001/TRS.4.4.6>

Smoking is the leading cause of preventable death in the United States (US) and globally.¹ The negative health impacts of cigarette smoking are largely attributable to the effects of harmful constituents (ie, the chemical compounds in combusted tobacco) that people inhale, ingest, or absorb into their bodies through exposure to cigarette.² Cigarette smoke contains over 7000 constituents when it is burned.²⁻⁴ The Food and Drug Administration (FDA) has identified 93 constituents as harmful and potentially harmful because they are known to be associated with one or more of

the 5 most serious health consequences of cigarette smoking: cancer, cardiovascular disease, respiratory effects, reproductive problems, and addiction.⁴

The Family Smoking Prevention and Tobacco Control Act gives the FDA the authority to regulate tobacco products, including cigarettes.⁵ The legislation requires the FDA to disseminate information on the amounts of harmful constituents in cigarettes by brand and sub-brand (eg, Marlboro Gold and Silver) in a format that is “understandable” and “not misleading to a lay person.”⁵ These disclosures are distinct from graphic warnings, which the To-

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bacco Control Act covers in a different section.

The FDA can: (1) require disclosures on cigarette packs that communicate constituent information; (2) disseminate constituent information through media campaigns; and (3) release it online. Some constituent messages or disclosures have appeared in the US on packs (ie, SURGEON GENERAL'S WARNING: Cigarette smoke contains carbon monoxide)⁶ and in media campaigns (ie, Every time you smoke there's a mix of 7000 chemicals coming for you).⁷ Other countries also have included constituent messages on packs (eg, Tobacco smoke contains benzene, a chemical that causes cancer).⁸ Due to the large number of brands, sub-brands and constituents, we believe an online resource hosted by the FDA is a plausible way to fulfill this charge.⁹ These messages can increase understanding of constituents in cigarettes and cigarette smoke and may change behavior.¹⁰

Increasing awareness is important because higher awareness of some constituents (and their associated health effects) is associated with discouragement from smoking.¹¹⁻¹³ Also, the public often misunderstands numerical information about constituents such as tar and nicotine yields.^{10,15-17} Much of the current research about constituents has used quantitative research methods and focused on whether or not participants are aware of constituents in cigarettes and cigarette smoke and their attitudes and beliefs about the chemicals. However, little information exists about what constituent information the public wants or how they would want to receive it. Consequently, large gaps remain in our understanding of how to effectively communicate constituent information to the public.

We sought to expand on previous research by providing in-depth qualitative information about smokers' and non-smokers' advice for what and how to communicate about cigarette smoke constituents. Specifically, we sought to explore what messages participants want to see about tobacco constituents on packs and in media campaigns (message content), where and from who participants want to get this information (channels and sources), and what advice they have for releasing this information online by brand and sub-brand.

METHODS

Participants and Recruitment

We recruited participants for 9 focus groups us-

ing purposive sampling methods in the Triangle region of North Carolina in 2014. Smokers were defined as individuals who reported having smoked at least 100 cigarettes in their lifetimes and were currently smoking cigarettes "every day" or "some days." Adolescent (ages 13-17), young adult (ages 18-25) and adult (ages 26-65) cigarette smokers and non-smokers, who were able to read and understand English and did not have cognitive or visual impairments, were eligible for participation. The inclusion of adolescents and young adults is particularly important because almost all smokers start smoking by age 26. Non-smoking adults make up the majority of the US adult population and still have conversations with smokers about information on their packs.¹⁸ For this reason, we wanted to understand their opinions about potential messages or a website. Further details regarding recruitment, design methods, and other findings appear in Moracco et al¹⁶ and Byron et al.¹⁹

We disseminated the study's promotional materials through a variety of methods including newspaper, radio, and TV spots, e-mail listservs, Craigslist, and in-person recruitment (eg, local schools and recreation centers). Recruitment materials encouraged individuals (adult and adolescents; tobacco product users and non-users) interested in participating in a research study about peoples' opinions about cigarettes and other tobacco products to visit the study recruitment website to learn more about the study and complete an eligibility screener (online or by phone). A staff person contacted potential participants to confirm eligibility and schedule the focus group sessions. We formed focus groups based on age and smoking status, adolescent non-smokers (one group), adolescent susceptible non-smokers (one group), adolescent smokers (one group), young adult nonsmokers (one group), young adult smokers (2 groups), adult nonsmokers (one group), and adult smokers (2 groups). We recruited about 12 people per group, which we estimated would result in focus groups with 7-10 participants.

Procedures

A 3-person team made up of a moderator, co-moderator, and note-taker conducted each 90-minute focus group. The note-taker took detailed case notes during the focus group discussions, recording

the main ideas and opinions as well as key terms used. We also audio-recorded focus group sessions. Prior to beginning the young adult and adult focus groups, we obtained written informed consent from participants. Adolescents gave written assent prior to the beginning of the focus group. We also obtained consent from their parents without study staff disclosing the smoking status of their child.

Moderators guided participants through each of the planned questions and used probes to elicit deeper discussion. At the end of each focus group, we gave participants a 2-page handout that provided information about cigarette smoke constituents, the danger and harms of smoking, and resources for quitting smoking. Participants received a \$50 Amazon gift card for participation in the focus group.

Measures

We developed a moderator guide with 14 open-ended questions based on the extant literature and findings from our pilot studies on knowledge and perceptions about cigarette smoke constituents. The moderators discussed the FDA abbreviated list of 18 cigarette smoke constituents (eg, carbon monoxide, ammonia, and crotonaldehyde), and asked for participants' advice on creating messages about the constituents. Because one of the cigarette pack warnings in the US at the time of the study had a constituent message (ie, SURGEON GENERAL'S WARNING: Cigarette smoke contains carbon monoxide), the moderators showed participants this warning and asked about their personal experiences with and opinions about cigarette warnings on packs to provide insight about constituent messages on packs. The moderators instructed participants to imagine that the FDA had created warnings about constituents (which were previously discussed). Then, the moderators asked participants where they would like to see messages about constituents in cigarettes, and what advice they had for what the messages should include. Where needed, moderators probed for specific channels and sources to gain more detailed responses. We pilot-tested the moderator's guide with 6 adult volunteers, to ensure that the wording of the questions was clear, verify that we had allotted enough time for each section of the discussion, and explore whether to add questions or probes.

Because the FDA could release constituent information by brand and sub-brand online, the moderators also asked participants to share their thoughts about what they would like to see on a website.

Data Analysis

Three of the authors (JCM, JRM, DEK) coded the transcripts. We reviewed the moderator guide to identify codes related to the research questions and developed a draft codebook based on our initial review. We used ATLAS.ti 7.0, a qualitative data analysis program,²⁰ to code one of the transcripts independently using the preliminary codebook, while also inductively identifying codes not already included in the codebook. We then met to review the results of the coding, and consolidated, eliminated, and added codes as necessary to address the research questions. We also reconciled any coding discrepancies by consensus among the coders and finalized the codebook. We recoded the transcript using the final codebook and finished coding the remaining 8 transcripts. After the 3 coders independently reviewed the transcripts, we reconciled any coding discrepancies by consensus to create a final coded dataset.

We performed "code and retrieve" analyses, in which we assigned codes to sections of the transcripts, retrieved text excerpts by code, and compared these codes across utterances. This process allowed us to compare how adolescents, young adults, and adults discussed the topics. After reviewing text associated with each of the codes, we created a summary table that contained the codes, a description of the sub-codes related to each code, and quotes to illustrate sub-codes. All coders reviewed the summary table, and detailed themes were discussed until consensus was met to confirm all themes. We retained some themes, consolidated others, and deleted others we considered minor or secondary from the final table of narrative summaries. This process led to a finalized code table and narrative summaries of each code.

RESULTS

Participant Characteristics

We conducted 9 focus groups, 3 in each age category, 5 with smokers and 4 with non-smokers, with a total of 59 participants. The mean age of focus group participants was 26; 49% of the participants

were female; and 49% were smokers (Table 1). We examined our findings for differences by smoking status and age group. We found some differences among ages groups, which we mention below, but there were few differences by smoking status. Unless specifically noted in the results, there were no differences to report.

Messages on Cigarette Packs

One way the FDA can communicate about cigarette smoke constituents is putting messages on cigarette packs.

Problems with the current pack warnings. When we asked participants about the current Surgeon General's warning, they noted several shortcomings. Adolescents highlighted problems with the timing of their exposure to the warnings. Because cigarettes are frequently displayed for sale with only the front of the pack showing, potential consumers do not see the warning until after they have already purchased the cigarettes. One adolescent non-smoker said: "When you go to a gas station to get cigarettes, they have them behind, so they take them out and put them down and then check you out, so you don't even look at the box before you take it." Furthermore, adolescents noted that you may only see the warning once you are purchasing packs for yourself, which may be too late for the warning to have an effect.

Young adults and adults claimed to be desensitized to the warnings. Having seen the same 4 warnings repeatedly for such a long time made them easy to ignore. One young adult smoker said: "I kind of don't care about the ones on the box anymore because I've seen them so many times. I was just like, huh, I know." One woman even mentioned that she laughs when she reads one of these warnings while she is smoking.

Advice for new pack warnings or messages. Much of the advice for new warnings or messages offered corrections for problems identified with the current messages, strategies to make them more noticeable on the packs, and suggestions for rotating and creating new messages more frequently (Table 2).

"What I was thinking is that as a society, we have a tendency to become desensitized to stuff. I feel these warnings when they were put on the

Table 1
Participant Characteristics

Characteristic	N (%)
Age	
13-17 (mean age 16)	19 (32%)
18-25 (mean age 21)	20 (34%)
26-65 (mean age 41)	20 (34%)
Mean (SD)	26 (13)
Sex	
Female	29 (49%)
Male	30 (51%)
Ethnicity	
Non-Hispanic	52 (88%)
Hispanic	7 (12%)
Race	
White	39 (66%)
Black	11 (19%)
Asian	4 (7%)
Other	5 (9%)
Current smoking status	
Smoker	29 (49%)
Non-smoker	30 (51%)

box were really effective in whenever that was enacted when my dad was a kid or something. I'm sure they were like, oh my, gosh, I had no clue. Or when they first started telling people cigarette smoking was bad, obviously a lot of people have decreased from that, but now I'm super desensitized to anything you tell me is bad about cigarettes... I'm sure that scared me once or twice, but after a while that's going to... Keep changing it."
Young adult smoker

Participants emphasized the need for simple messages that did not overwhelm them with words, and also recommended visuals as a way to increase the ability for a message to convey complex ideas more easily. This theme is exemplified by the following quotation:

"I think a picture's worth 1000 words. If they put a visual on the side of the box that was not for the pro-smoking side, but if they put something that showed kind of the aftermath of what smoking can do on the side of the box, not many people want to read amino, whatever that word is, so just looking at a picture'd be a lot easier."

Adolescent non-smoker

Table 2
Recommendations for Constituent Messages on Packs and in Campaigns

Recommendation	Specific Action	Illustrative Quotes
Increase Novelty	Rotate messages to increase interest and attention	<p>“Those people probably have seen that a million times, every time they buy a pack of cigarettes they obviously don’t care.” <i>Adolescent smoker</i></p> <p>“Not very many people who smoke look at the warning labels.” <i>Adolescent smoker</i></p> <p>“It doesn’t really resonate with you because it’s just kind of like a tired old idea that you’ve heard a million times.” <i>Adolescent non-smoker</i></p>
Use Trusted, Relevant Sources	Use these spokespeople <ul style="list-style-type: none"> •Real smokers or ex-smokers •Personal friends and family members •An individual’s doctor •Celebrities 	<p>“They have celebrities talking about it. So if you look up to that person, then you would respect their opinion more.” <i>Adolescent non-smoker</i></p> <p>“I know that talking to my family or my close friends or loved ones make an impact or have an impact on me, and I have an impact on them.” <i>Adolescent non-smoker</i></p> <p>“I don’t really think the FDA does a really good job just in general especially with food, so I don’t really trust them with keeping us safe from cigarettes.” <i>Adolescent susceptible non-smoker</i></p> <p>“Where this information should be? Maybe more so with primary care physicians, maybe if they were a little more vocal.” <i>Adult smoker</i></p> <p>“If you have an actor that quit smoking, you know how they give like messages at the end of some shows. Say you have an episode about someone being a smoker or something, at the end you could say I have recently quit smoking. I have so much more money left in my paycheck and all that because they’re already getting paid and then without the smoking, I have more money to spend.” <i>Adolescent susceptible non-smoker</i></p>
Use Appropriate Channel	Use these media <ul style="list-style-type: none"> •Billboards •TV ads •Social media (Facebook, Instagram, YouTube, Twitter) •Health class •Cigarettes packs 	<p>“I think like especially You Tube because you’re stuck there. If you want to watch a You Tube video and stuff and there’s a commercial for at least like – actually most of the time you have to watch the whole thing. You can’t skip that. It’s awful. I really dislike that they have that but I think if they were doing something positive like that like you can’t get away from it.” <i>Adolescent non-smoker</i></p> <p>“I think you have something with words on it like this, ‘Hey, here’s a pack of Newport, flip it over on the back. This is what’s in that Newport.’” <i>Adult smoker</i></p>

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Table 2 (continued)
Recommendations for Constituent Messages on Packs and in Campaigns

Recommendation	Specific Action	Illustrative Quotes
Evoke Emotions and Include Information that is Accessible	<p>Communicate about constituents by evoking emotions, making constituents seem more relatable</p> <ul style="list-style-type: none"> • Explaining the process or telling the story of how constituents affect an individual • Effect of constituent on health • Explain common products constituents are found in 	<p>“Everyone knows – if I smoke cigarettes, I might get lung cancer or gum cancer or anything like that. They’d just know the ending of it because they don’t know the process. I feel the process is a lot scarier than the end result. It’s that smoke causing welts in your throat, that’s a lot scarier sounding than knowing I’m going to get lung cancer.” <i>Adolescent smoker</i></p> <p>“If you were to make a commercial, don’t make it depressing, make it more inspiring.” <i>Adolescent smoker</i></p> <p>“I guess there’s just a shock factor in it, like how you can relate it other things. So like when I had heard the advertisement about ammonia, knowing that can be found in toilet bowl cleaner, formaldehyde used in the embalming process, I think that has a way of sticking to the brain, as does crotonaldehyde. So I guess it’s just being able to relate it to something else that just doesn’t seem natural makes sense. I mean, I’m sure some of these can be found in like flame retardants or something, I don’t know, but basically whatever it can draw connections with and how dangerous that is in that way.” <i>Young adult non-smoker</i></p> <p>“I think that’s [pictures] a better idea, and probably why they won’t do this is because nobody would buy a carton of cigarettes if it had a deformed baby on it. I mean, it’s very off putting, I would say; I would hope you think that.” <i>Young Adult non-smoker about messages on packs</i></p>
Avoid Reactance	<p>Avoid making messages that could encourage teens who are already rebellious.</p> <p>Create relatable messages</p> <ul style="list-style-type: none"> • Smokers may ignore pack messages or be reactant to current messages if they do not relate to the message, or believe it. 	<p>“Teenagers are rebellious. If you hear something bad, you’re going to try to do it.” <i>Adolescent smoker</i></p> <p>“So everyone’s telling you this is bad, this is wrong. It’s cool. Maybe I’ll try it, and then it becomes that thing where it becomes the niche thing to do and you’re the kid, you’re like John Franco, that kind of guy.” <i>Young adult smoker</i></p> <p>“I’m probably going to laugh at it [constituent message], to be honest. I’ll be like, look at that... I would look at the box and it will read and it’ll be this is killing you. I’m like, I know, and then I’ll continue doing it.” <i>Young adult smoker</i></p> <p>“Sometimes if I’m smoking, a cigarette warning, ‘Cigarette smoke contains carbon monoxide.’ I’m going to laugh. I really am. It’s kind of like if I’m smoking and then a cigarette commercial comes on, I’m going to think it’s funny. Like I said, it goes to the whole they assume I’m stupid, and it feels like they’re undermining my intelligence, so I’m going to laugh at it.” <i>Young adult smoker</i></p> <p>YASm1: “It’s like parental advisory warning...” YASm2: “They’re like, oh, cool. I want this skull and crossed bones.” YASm1: “...they sold more records. They didn’t stop it.” <i>Conversation between 2 young adult smokers comparing warnings on cigarette packs to warning labels on CDs</i></p>

When recommending the use of images and pictures in messaging, many participants, especially adolescents and young adults, mentioned graphic warnings on cigarette packs in other countries. The participants felt that the disturbing pictures and severe messages are memorable and effective. One young adult smoker said: "...when you buy cigarettes in Russia, instead of little label that says, 'Surgeon General's warnings', there's an enormous square that takes up most the pack that says, 'smoking kills.'"

Media Campaign Messages

A second way the FDA can communicate about constituents is through media campaigns.

Channels. Participants identified several channels that could reach smokers. The most commonly mentioned were billboards, TV ads, point of sale/retailers, and QR codes which are boxes similar to a barcode that can be scanned with cellphones and take people to a specific webpage. Adolescents and young adults also mentioned social media sites like Facebook, Reddit, and Twitter as potential ways to reach people, especially younger audiences, with constituent messages. Participants thought that health agencies should use different social media platforms to disseminate messages. For example, one adolescent smoker said: "Maybe if it you have a Twitter page and you put a fact up every day about cigarettes and then the website you might get some more viewers of it." They also mentioned purchasing advertisement spots on social media as a way to increase exposure to the messages.

"Just like having an ad on your social media. They do that on Instagram now. You scroll down, and you see a picture from Taco Bell. It could be a picture from probably like the FDA or something that smoking is bad or stuff like that."

Adolescent susceptible non-smoker

One other benefit of social media is the opportunity for information to spread rapidly online or "go viral" One participant mentioned a video that had been shared on Facebook, and thought that using the viral nature of social media to expose many people quickly and simply to messages could be successful in the US.

"...where these children were going up with cigarettes in their mouths or in their hands and saying, 'Hey, can I have a light,' to an adult. They were, of course, actors, and they went up to adults asking if they could have a light, and they're like, 'You're too young to smoke. Do you know what smoking does to you?' and stuff, and they said that it's just like gone crazy over there, where the hotlines are getting a lot more calls, like anti-smoking hotlines, or how to quit smoking or something. So taking that and bringing that over here may not be such a bad thing, either."

Adolescent non-smoker

Another common channel for information that was brought up among all the age groups was school health classes. Some participants thought their curricula had done a good job making them aware of the dangers of smoking and thought constituent information would be a natural fit. Some thought that it was a good channel if the current tobacco curricula for the health classes was improved to be more informational and less focused on just the end result.

AdolSm1: *"I feel in health class, they skim through drugs and alcohol and ..."*

AdolSm2: *"They just touch on each one and don't go into detail."*

AdolSm1: *"... and then just give you the ending -- alcohol, if you drink and drive you'll kill somebody; cigarettes, you'll get this and this and this; if you have sex you're going to get STDs. They don't go through everything and actually ..."*

AdolSm2: *"Explain it."*

Conversation between 2 adolescent smokers

Others felt health classes were ineffective because students were required to be there, and therefore some may not be motivated to learn.

"In school, you're kind of forced to learn it because you can't graduate from high school if you don't take a health class. It's not like you're really interested in it. You just go to class because you have to. You're not going to class to learn about it."

Adolescent smoker

Sources. The most highly recommended spokesperson for risk messages were specific types of trusted individuals. Participants mentioned using both current and former smokers to lend credibility to the mass media messages, and another identified an individual's doctor as a trustworthy source. Some mentioned that personal friends and family were the most persuasive sources of information. The adolescents and young adults highlighted the influence of celebrities as credible sources for smoking messages,

“If you're watching sports and then maybe having like an athlete talking about it, then it would be more effective than having the Kardashians talk about it. But if you were watching something where you'd see the Kardashians, then having the Kardashians there.”

Adolescent non-smoker

This adolescent speaks not just of celebrities as sources, but the importance of being cognizant to use targeted sources, making sure you have the right source for the right audience.

An alternative source discussed by participants was government entities and agencies like the Surgeon General and the FDA. Some felt these entities were trustworthy because of name recognition and therefore good sources of information. Additionally, because of the mistrust of tobacco companies, some felt it was important to know that constituent information was not coming from the tobacco companies.

Interestingly, all ages seem to recommend targeting children early, before they try and become addicted to cigarettes. Many adult smokers seemed to believe that they themselves are a “lost cause” but did mention that we should focus on targeting the groups younger than they are.

Content. Throughout the focus groups, many participants mentioned messages that they liked included stories, sometimes called narrative messages. One adolescent smoker offered the following example:

“The personal stories [...], they're probably the strongest things to prevent people from smoking. For example, I read a story about a girl doing

crack. That testament was probably stronger than all my years learning about crack, whether it's in psych or health class.”

Adolescent smoker

Similarly, one adolescent smoker felt messages that included information about how the chemicals affected them was important: “I feel the process is a lot scarier than the end result. It's that smoke causing welts in your throat, that's a lot scarier sounding than knowing I'm going to get lung cancer.” By explaining the process, and not just the end result, the story would be able to evoke emotions such as fear or worry which can make the message more salient and effective.

Young adults and adolescents talked about how current and past campaigns that used “shock and disgust” approaches were effective at discouraging smoking. They specifically mentioned ads that were part of the FDA's The Real Cost Campaign, where a girl peels skin off her face to pay for cigarettes, and several talked about a constituent ad put out by The Truth Campaign described by one participant here:

“Those smoking commercials that they have where they have the dog poop and the cat pee in New York City. I don't know if you all have seen those. I felt like those are more relatable and scary like you're smoking some dog poop. Whereas, say, you're smoking some benzopyrene, like, okay.”

Young adult smoker

However, not all participants were in favor of emotional appeals. Some expressed a desire just to be presented the information in a factual, objective manner. Participants expressed a desire for descriptive information about the chemicals, such as the specific health effects or what else the chemicals were found in. Participants emphasized that simply providing basic constituent information was not enough, and that they wanted to know how the constituents would affect them.

“The other reason is because merely listing the chemicals isn't going to do – we need the next step, which is okay, so we've got isoprene in there. What does isoprene do to me, as a person? Tell me about

isoprene. Because otherwise I go -- oh, good; it's got isoprene. So we need to get to the point where not only will they look it up, but they can quickly get to -- either because you tell them, or you have a link to something -- describes what it is and what it can do to you."

Adult non-smoker

Current warnings and campaigns mentioned in the focus groups seemed to evoke emotions, both positive and negative. Many mentioned that trying to make people feel shame was not particularly effective, and they wanted to see messages and warnings that took a more positive spin, like mentioning the health improvements that would occur by quitting and reducing exposure to constituents,

"I think it's important to let people know that there is some positive comings their way. One of the most effective cigarette ads I've ever seen was in a doctor's office and it just listed the timeframes of how long it takes your body to recover after smoking cigarettes."

Young adult non-smoker

Smokers echoed a desire for less depressing ads, indicating that sad ads just make them "want a cigarette."

Adolescents and young adults mentioned needing to be aware of teenagers wanting to be rebellious and not making messages that could trigger that sort of rebellion. One adolescent non-smoker advised emphasizing choices in messages:

"I think that when I'm told not to do something, it makes me want to do it, so I think that getting the allowance of saying it is your decision, you can do what you want. We're not trying to stop you. We just want to inform you that it's a really dangerous thing to do."

Adolescent non-smoker

An adult smoker reflected on when she started smoking and thought constituent messages might discourage cigarette use as an outlet for teenage rebellion saying the following about the message:

"[The messages could] be better for new smokers or younger people than for people that are already smoking. [Because], maybe if I had known more specifically that kind of thing [constituent information], it wouldn't have been my choice of I'm going to rebel and go buy a pack of cigarettes. It be might have been more of a deterrent at the beginning."

Adult smoker

By providing information about constituents in cigarettes, especially if crafted in a way that does not come across as parental, or paternalistic, it may serve as an effective deterrent for smoking and decrease the appeal of cigarettes as a means of rebellion.

Online Resource

A third way the FDA can communicate about constituents, is by releasing the information by brand and sub-brand. Because of the amount of information to communicate, a plausible way to do this is releasing the information on a website.

Access. Participants generally liked the idea of an FDA website, but stressed the need for the website to be heavily promoted to drive traffic to it, as few people would be looking for this information without prompting. Participants advised us that because no one likes to type in Web addresses, to use hyperlinks or QR codes. One adolescent non-smoker said, "maybe you could put a QR code on the packaging because they're really small."

Look and feel. Similar to the advice about warning labels, participants emphasized that the website should be simple and not overwhelming to people. They mentioned needing to make the information tangible and easy to find. Others mentioned the need for innovative features like interactive information, quizzes, or games. One young adult smoker suggested: "You make it into a little game where you get points and stuff if you learn about tobacco."

"I think if the FDA is going to make these companies do that, it needs to have a nice interface, because I'm just imagining there's going to have a link to one page that are just like lists [of constituents] that aren't even separated in columns."

They're going to do it in the worst ways."

Young adult smoker

Using the constituent information. When participants heard about a website with constituent information by brand and sub-brand, they wanted easy ways to understand how constituents and amounts of constituents are linked to specific health effects. Some smokers felt strongly that they would not look for information about chemicals in cigarettes because they did not want to know. One adolescent smoker said they wouldn't want to know: "It's like... after you see them, you get a little bit worried about, I've been smoking for so many years. I've been letting that stuff go into my body." Some said they were brand loyal, meaning they did not care about the amounts of constituents, and did not think they would change their smoking behavior even when provided with constituent information. Other smokers thought they would be interested in constituent information because it would allow for comparison among brands.

"I wouldn't change. A person who is a new smoker might. I don't think it's irrelevant information. Someone who is a hardened smoker does not care, but a new smoker or someone who is thinking about smoking might go to a different brand. If they were going to pick up a pack of cigarettes, if they saw it had less formaldehyde or less carbon monoxide or whatever."

Young adult smoker

Both smokers and non-smokers mentioned that this information could be useful in persuading people to stop smoking. However, it is of particular importance and interest that some smokers mentioned that others might use this information to switch to cigarettes with less chemicals, or less of a particular chemical.

DISCUSSION

In our paper, we sought to explore how the public wants to be informed about constituents in cigarettes and cigarette smoke, where they want to see this information, who they want to hear it from, and what they would do with constituent information released by brand and sub-brand. Discus-

sions with smokers and non-smokers suggested 3 problems with current messages about constituents that are addressable. First, participants mentioned seeing messages "a million times" and becoming desensitized to the lone constituent message they have been exposed to for years (ie, Cigarette smoke contains carbon monoxide). By rotating messages frequently, and introducing new message content, such messages may have greater impact. Novelty is one way in which warnings work, as in the months following the implementation of new warnings, increases in attention (and other indicators of warning effectiveness) often occur.²¹ No matter how effective a message is, however, its effects will diminish over time.

Second, many participants wanted information that would make constituents more personally relevant and engaging. One tactic they suggested was including images and stories, and another was including specific information about the health effects caused by constituents, or common products that also had constituents. This advice is consistent with research suggesting that pairing constituents with a health effect or common product are more likely to discourage people from wanting to smoke, compared to constituent-only messages.^{22,23} These tactics help give emotional weight to the information, make it more relatable, and help the public grasp and care about the relatively abstract idea of chemicals in cigarette smoke. The advice to use images and evoke emotions is consistent with other research suggesting that helping people connect to constituents makes the messages more memorable and more effective, and that emotions can help add meaning to facts.^{16,17,24-26}

Third, several participants cautioned that scare tactics and having an authority figure tell them not to do something could cause people, especially adolescents, to smoke as a form of rebellion. This is related to the concept of reactance, which involves perceived threat to freedom, anger, and counterarguing, and may undermine the impact of health messages.^{27,28} Previous work has found that message reactance to pictorial warnings on cigarette packs weakened the effect of pictorial warnings.²⁸ However the weakening effect was small, and more importantly, the pictorial warnings still increased quit intentions and quit attempts on the whole.²⁹ The authors concluded that reactance was unlikely to

undo the positive effects of warnings.²⁸

Throughout the focus group discussions, participants also stressed the importance of hearing information from trusted and relatable sources. Whereas this is important in health communication generally, it is particularly important when thinking about communication about cigarette smoke constituents because both smokers and non-smokers expressed distrust of tobacco companies throughout their conversations. Given the history of the tobacco industry misleading,^{30,31} it is especially important that message recipients know who the information is coming from, and that the sources are trusted.

Finally, when discussing how people would use constituent information presented by brands and sub-brands, some participants brought up the idea of comparing different brands and using the information about constituents to make a choice. In addition to the information discouraging people from smoking, the public (especially people thinking about smoking for the first time) may use it to find a cigarette with fewer constituents, or less of a particular constituent. It is critical that disseminators of constituent information not repeat practices now known to be harmful. In the past, allowing cigarettes to be described as “low tar” or “light” likely led smokers to see them as less harmful and switch to these products rather than quitting.³² If studies show that releasing constituent information by brand and sub-brand would do more harm than good, FDA should consider instead messaging about constituents in other ways such as pack disclosures and media campaigns.

Understanding our study’s limitations and strengths may help readers better place the findings in context. Participants were diverse with respect to race, Hispanic ethnicity and age. However, the sample was relatively small and recruited by convenience from only North Carolina (US). The generalizability of our findings to other adolescent and adult smokers and nonsmokers remains to be established. Since we conducted our study, the number of electronic cigarette users has remained the same in the US, even as the number of people who have ever tried them has risen.³³⁻³⁵ News coverage and marketing of this product occasionally focuses on chemicals and specific constituents. Furthermore, the Real Cost Campaign has aired advertise-

ments that highlight chemicals in cigarettes.⁷ Such activities may have improved people’s understanding of chemicals in tobacco products. This qualitative research features depth over breadth, insight over generality.³⁶

To mitigate subjectivity and increase the reliability of our study results, we used systematic research strategies, including using experienced interviewers, a standardized interview guide and common codebook, audio-recording and transcription of interviews, Atlas.ti software to manage the coding of transcripts, documenting coding decisions, and duplicate coding and systematic review of coded transcripts. Study strengths include gathering in-depth qualitative information about creating and distributing messages about high-priority tobacco smoke constituents from both smokers and non-smokers that complements the results of previous quantitative and qualitative research.^{11,16} Another important limitation is that perceived message effectiveness has its limitations at predicting messages that are actually effective.^{37,38} We support the use of experimental work to build on these findings as Baig et al²² have done.

Our paper adds to the body of literature about cigarette smoke constituents and is one of the first qualitative studies to examine health messaging and communication strategies about constituents in cigarette smoke. Understanding the complex ways that cigarette smoke constituent information impacts and motivates smoking behaviors should be a high priority for future research. This research should explore how this kind of information can be used to increase quitting behaviors and prevent initiation of smoking. Given that these are 2 unique actions, future research that seeks to delve deeper into how constituent information can motivate these distinct behaviors would be valuable.

IMPLICATIONS FOR TOBACCO REGULATION

Our findings provide general advice on creating effective constituent messages and can be used to inform future research. Specifically, they suggest the FDA should: (1) disseminate a variety of constituent messages and refresh them from time to time, as it has done with its *The Real Cost* public media campaign for youth; (2) pair constituent information with content that evokes emotions in

order to increase the effectiveness of constituent disclosures; (3) ensure that the release of constituent information by brand and sub-brand does not lead to people falsely believing there are safer cigarettes. Recent legislation provides an opportunity to design new informational pack messages and communication campaigns about constituents, and these findings can be used to inform researchers and message designers about ways to increase the efficacy and salience of constituent messages.

Human Subjects Statement

This study meets the ethical standard outlines in Helsinki Declaration of 1975 as revised in 2000. The University of North Carolina Institutional Review Board approved the study procedures.

Conflicts of Interest Statement

NTB has served as a paid expert consultant in litigation against tobacco companies. The other authors declare no conflicts of interest.

Acknowledgements

Research reported in this publication was supported by grant number P50CA180907 from the National Cancer Institute and the FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration.

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