Supplement Article

Effects of Framing Nicotine Reduction in Cigarettes on Anticipated Tobacco Product Use Intentions and Risk Perceptions Among US Adult Smokers

Lucy Popova PhD[1], Daniel Owusu DrPH[1], Amy L. Nyman MA[1],
Scott R. Weaver PhD[1], Bo Yang PhD[2], Jidong Huang PhD[1],
David L. Ashley PhD[1]

[1]School of Public Health, Georgia State University, Atlanta, GA; [2]Department of Communication, University of Arizona, Tucson, AZ

Corresponding Author: Lucy Popova, PhD, School of Public Health, Georgia State University, P.O. Box 3995, Atlanta, GA 30302, USA. E-mail: lpopova1@gsu.edu

Abstract

Introduction: In 2017, the US Food and Drug Administration (FDA) proposed lowering the amount of nicotine in combusted cigarettes to minimally addictive levels. If used, to encourage cessation and maximize the benefits of this action, the FDA needs to determine the most effective way to communicate to the public the practical impact of this nicotine tobacco product standard.
Methods: Data were collected in 2018 from a nationally representative, online probability sample of 1198 adult smokers (aged ≥18 years old) in the United States. Smokers were randomly assigned one of five versions of the question regarding what they would most likely do if nicotine in cigarettes was reduced (nicotine levels were reduced by 95%; the government reduced nicotine levels by 95%; cigarettes were no longer addictive; cigarettes no longer relieved cravings; cigarettes were changed so that you would be able to quit more easily). Effects of framing on anticipated tobacco use intentions and perceived risk of very low nicotine cigarettes (VLNCs) were evaluated with multinomial logistic regressions.
Results: Framing the nicotine tobacco product standard as cigarettes no longer relieved cravings resulted in the highest proportion of smokers reporting they intend to quit in response to this standard (43.9%), lowest proportions reporting anticipated intentions to continue using combusted tobacco products (45.3%), and lowest proportion believing that VLNCs are less harmful than regular cigarettes (26%).
Conclusions: Different frames of nicotine reduction in cigarettes differentially affected smokers' anticipated tobacco use intentions and perceived risk of VLNCs. Presenting reduction as making cigarettes unable to relieve cravings might be particularly effective at motivating cessation.
Implications: This study investigated effects of different framings of reduced nicotine in combusted cigarettes. Framing the nicotine tobacco product standard as "cigarettes no longer relieved cravings" resulted in the highest proportion of smokers reporting they intend to quit in response to this standard, lowest proportions reporting anticipated intentions to continue using combusted tobacco products, and lowest proportion believing that very low nicotine cigarettes are less harmful than regular cigarettes. This framing might be a promising way to communicate to the public the practical impact of the nicotine tobacco product standard.

Introduction

In 2017, the US Food and Drug Administration (FDA) announced a new plan to reduce tobacco-related death and disease by lowering the amount of nicotine in combusted cigarettes to minimally addictive levels.[1] The Family Smoking Prevention and Tobacco Control Act[2] gives FDA the authority through setting product standards to limit the maximum nicotine content in tobacco products to a minimally or nonaddictive level as long as it does not require the reduction of nicotine yields to zero. This approach differs fundamentally from reductions in nicotine delivery in mainstream smoke, which resulted in tobacco companies marketing "light" and "ultralight" cigarettes based on machine-smoking results but still facilitated delivery of addictive levels of nicotine to smokers.[3] The nicotine tobacco product standard would drastically reduce nicotine content so that the products were minimally or nonaddictive irrespective of a smoker's use behavior. Previous studies have shown that use of nonnicotine cigarettes can reduce craving because of sensory cues,[4–6] but the reward value of these cues is extinguished over time when the reinforcing effects of nicotine are removed.[7,8]

Reducing nicotine in cigarettes is an unprecedented tobacco control strategy that could save millions of lives.[9] A simulation model based on empirical evidence and expert opinions estimated that this policy could result in approximately 5 million additional smokers quitting within a year of the policy's implementation.[9] Yet the same article acknowledged that magnitude of effects is difficult to establish because public reactions to such a policy are hard to anticipate and there may be some unintended consequences. For example, misperceptions held by around 50%[10] of US adults that very low nicotine cigarettes (VLNCs) are less harmful than regular cigarettes[11,12] might result in increased initiation in youth and young adults and in smokers believing that VLNCs are substantially safer, leading to reduced willingness to quit smoking.[12]

As part of the strategy to use the regulation, the FDA will need to determine the most effective way to communicate to the public the practical impact of the nicotine tobacco product standard. So far, very little research has examined different ways to describe nicotine reduction in cigarettes and how those might influence smokers' perceptions and behavior.[11,13,14] Most of this extant research has been conducted in the context of experimental studies where smokers were given VNLCs and told that these cigarettes contained either "very low nicotine" or "average nicotine."[13] More participants were interested in quitting when being informed the only cigarettes for purchase in the future were "very low nicotine" cigarettes rather than "average nicotine" cigarettes.[11] However, these studies did not measure other behavioral intentions, such as likelihood of switching or dual use, nor did they assess the framing of the nicotine reduction.

Framing refers to highlighting different aspects of an issue, resulting in different issue interpretations or responses.[15] For instance, opinions about climate change varied depending on whether the issue was framed as "global warming" or "climate change."[16] In tobacco communications, framing has been used to understand how news media portray tobacco products[17–19] and how perceptions about a tobacco product change as a result of exposure to different media frames. For instance, smokers' interest in trying snus was higher when they read news framing snus as a safer alternative to cigarettes than when they read news emphasizing snus risks.[20] However, no published research to date has examined the framing of nicotine reduction in cigarettes. Our study fills this gap by assessing US smokers' perceived relative harm of VLNCs and anticipated behavioral intentions to use tobacco products in response to different framing of the nicotine tobacco product standard.

Methods

Participants and Procedure

Data come from the 2018 Tobacco Products and Risk Perceptions Survey conducted annually since 2014 by the Georgia State University Tobacco Center of Regulatory Science. This is a cross-sectional survey of a probability sample and representative oversample of pre-identified cigarette smokers drawn from GfK's KnowledgePanel, a web panel representative of noninstitutionalized US adults. Participants were adults aged 18 and older and selected with probabilities proportional to size after application of the panel demographic post-stratification weight. Recruited panelists who did not have internet access were provided a computer with internet access. Data collection occurred in October–December 2018 and participants received a cash-equivalent of $5 for their participation. This study was approved by the Georgia State University Institutional Review Board.

In total, 7997 KnowledgePanel members were invited to participate in the survey: 7104 members from the general population sample, of which 76.9% completed the screener and 5458 qualified for the survey; and 893 members from the smoker oversample, of which 67.7% completed the screener and 560 qualified for the main survey by confirming their current smoking status. Of the 6018 qualified completers, 10 cases were removed because of refusing to answer more than half of the questions and 19 were removed for low survey duration, yielding an analytic sample of 5989 cases. A final stage completion rate of 74.9% was obtained. A study-specific post-stratification weight was computed using an iterative proportional fitting procedure to adjust for survey nonresponse and oversampling of smokers. Demographic and geographic distributions from the most recent Current Population Survey were benchmarks for adjustment and included sex, age, race/ethnicity, education, household income, census region, and metropolitan area. The analytic sample for this study is the 1185 current smokers (defined as those who smoked at least 100 cigarettes in their lifetime and were currently smoking "every day" or "some days") who provided a response to the question on nicotine reduction in cigarettes.

Framing of Nicotine Reduction in Cigarettes

Current smokers were randomly assigned one of five versions of a nicotine reduction question: "What would you most likely do if [FRAMING]?" where the FRAMING was (1) "nicotine levels were reduced by 95% in all cigarettes for sale"; (2) "the government reduced nicotine levels by 95% in all cigarettes for sale"; (3) "all cigarettes for sale were changed so that they were no longer addictive"; (4) "all cigarettes for sale were changed so that they no longer relieved your cravings"; or (5) "all cigarettes for sale were changed so that you would be able to quit more easily?" We selected different framings to cover various ways the nicotine tobacco product standard can be communicated: (1) the literal description; (2) mention of the government's role in using the standard because people have different levels of trust in the government's regulation of tobacco products[21–23]; and explanations of what reduced nicotine in cigarettes means in practice: (3) reduced addictiveness, (4) the negative outcome of cigarettes no longer being able to relieve cravings, and (5) the benefit of being able to quit more easily.

Main Outcome: Anticipated Tobacco Use Intentions

Following the framing exposure, participants selected their most probable tobacco use intentions among seven options: (1) "Smoke the new cigarettes and use no other nicotine or tobacco products," (2) "Smoke the new cigarettes and use some other nicotine or tobacco products," (3) "Quit smoking cigarettes and use no other nicotine or tobacco products," (4) "Quit smoking cigarettes and use some other nicotine or tobacco products," (5) "Find a way to get the cigarettes I smoke now, even if they are no longer legally for sale (for example, buying online or purchasing from a different location where normal nicotine content cigarettes are allowed)," (6) "Modify the new cigarettes to make them more like the cigarettes I smoke now," or (7) "Do something else (specify)." Text responses for the (7) "Do something else" category (*n* = 73) were examined and recoded into the above categories if the open-ended answers matched one of the above categories (eg, "stop smoking" was coded as "quit smoking"). The open-ended responses that were not recategorized were treated as missing data in the logistic regression analyses (eg, "don't know," "chew gum," "smoke weed," *n* = 38). Smokers who selected, (2) "Smoke the new cigarettes and use some other nicotine or tobacco products" or (4) "Quit smoking cigarettes and use some other nicotine or tobacco products" were subsequently asked which other nicotine or tobacco products they would use: "electronic vapor products"; "smokeless products, such as chew, dip, or snus"; "cigars or cigarillos"; or "other (specify)." Participants were able to select multiple products from the product list. Text responses for "other (specify)" (*n* = 12) were further coded into "combustible," "non-combustible," and "other" categories, with "other" treated as missing data (*n* = 2). For the primary analyses, we recoded the anticipated tobacco use intentions variable into a three-level categorical variable: (1) intention to quit using all tobacco products (response options 3 and 7 if 7 was recoded into "quit smoking"); (2) intention to switch to noncombusted tobacco products (response options 4 and 7 if 7 indicated use of only noncombusted tobacco products); and (3) intention to continue using combusted tobacco (response options 1, 2, 4 if 4 indicated use of combusted tobacco, 5, 6, and 7 if 7 indicated use of combusted tobacco; Table 2).

Secondary Outcome: Perceived Risk

Perceived risk of VLNCs was measured by asking "If the level of nicotine in cigarettes was reduced to a very low level, but the number of cigarettes smoked was the same, how would these low-nicotine cigarettes compare with regular cigarettes?" with responses that were categorized into (1) somewhat or much less harmful than regular cigarettes (referred to in the Results as "less harmful"), (2) equally harmful, or somewhat or much more harmful than regular cigarettes (equally/more harmful), and (3) do not know.

Covariates

Nicotine dependence was assessed by the short form of the Patient-Reported Outcomes Measurement System Nicotine Dependence scale, which has shown acceptable reliability and validity.[24,25] Example item: "I drop everything to go out and buy cigarettes" with responses on a 5-point Likert scale (*never*, *rarely*, *sometimes*, *often*, or *always*). Responses to the four items were summed (range 4–20).

E-cigarette use status was determined by asking, "Have you ever used electronic vapor products, even one or two times?" Participants who responded "no" were classified as never users. Those who answered "yes" were then asked, "Do you now use electronic vapor products every day, some days, rarely, or not at all?" "Every day," "some days," or "rarely" users were classified as current users, and those who answered "not at all" were categorized as former users.

Intention to quit smoking. Before the framing exposure, participants were asked "What best describes your plans regarding quitting smoking cigarettes?" Responses were (1) intend to quit in the next 7 days, (2) intend to quit in the next month, (3) intend to quit in the next 6 months, (4) intend to quit in the next year, (5) intend to quit someday but not in the next year, (6) never plan to quit. For analyses, the first three categories were combined into "Intend to quit in the next 6 months."

Demographic characteristics included sex, age, race/ethnicity, and education level. These data were obtained from profile surveys administered by GfK to KnowledgePanel members.

Statistical Analyses

We first conducted descriptive analyses to estimate weighted proportions of anticipated tobacco use intentions by nicotine reduction question framing. Next, we conducted weighted multinomial regression analyses to examine the effect of reduced nicotine question framing on (1) anticipated tobacco use intentions and (2) perceived risk of VLNCs while controlling for covariates (age, sex, race/ethnicity, education, intention to quit smoking, e-cigarette use, and nicotine dependence). We conducted pairwise post-hoc comparisons between the different frames using a Bonferroni correction. All analyses were completed in SAS, version 9.4 (SAS Institute, Cary, NC).

Results

Participant characteristics are reported in Table 1. The average nicotine dependence score was 10.4 (SE = 0.15) on a 4–20 scale. Irrespective of the question framing, 30.5% of the participants indicated they would quit using all tobacco products, 61.0% indicated they would smoke VLNCs or other combusted tobacco, and 5.8% intended to switch to noncombusted tobacco products (Table 2). The proportion of participants intending to quit all tobacco products was highest (43.9%) and intending to use combusted tobacco was lowest (45.3%) when nicotine reduction was framed as cigarettes "no longer relieved your cravings" (Table 2).

When compared to participants for whom the framing was "nicotine levels were reduced by 95%" (referent), participants for whom the framing was "cigarettes were changed so that they no longer relieved your cravings" were more likely to indicate anticipated intention to quit using all tobacco/nicotine products (adjusted odds ratio = 3.6, 95% confidence interval = 1.7 to 7.4) than to indicate anticipated intention to smoke combusted tobacco. Responses to the other frames did not significantly differ from responses to the referent frame (*p*s > .05). Pairwise comparisons of the frames showed that all frames were similar to one another in their effects on anticipated tobacco use intentions, except the question framed as "no longer relieved your cravings." Compared to other frames, this frame was associated with higher odds of anticipated intention to quit using tobacco or nicotine products than to smoke combusted tobacco (Table 3).

Overall, 35% of participants believed that VLNCs were less harmful than regular cigarettes, and the proportion was lowest in the "no longer relieved your cravings" group (Supplementary Table 1). This framing resulted in significantly lower odds of indicating that VLNCs are less harmful than regular cigarettes compared to equally/more harmful (Table 4).

Table 1. Participant Characteristics Overall and by Framing Condition

Variable	Total sample (n = 1185), W%	Framing: what would you most likely do if:				
		Nicotine levels were reduced by 95% in all cigarettes for sale? (n = 241), W%	The government reduced nicotine levels by 95% in all cigarettes for sale? (n = 241), W%	All cigarettes for sale were changed so that they were no longer addictive? (n = 241), W%	All cigarettes for sale were changed so that they no longer relieved your cravings? (n = 232), W%	All cigarettes for sale were changed so that you would be able to quit more easily? (n = 230), W%
Sex						
Male	50.2	54.1	51.1	47.7	50.7	47.9
Female	49.8	45.9	48.9	52.3	49.3	52.1
Age						
18–29 years	19.7	21.8	20.6	18.1	21.3	16.9
30–59 years	70.5	67.6	68.8	74.3	68.1	73.3
60+ years	9.8	10.6	10.5	7.6	10.6	9.7
Education						
Less than high school	56.2	49.9	53.2	57.8	57.2	62.2
High school	30.3	36.3	29.1	29.0	29.3	28.5
Some college or higher	13.5	13.8	17.7	13.2	13.5	9.3
Race						
Non-Hispanic White	60.6	65.5	59.4	59.9	63.3	55.7
Non-Hispanic Black	16.0	10.6	14.8	17.8	14.5	21.7
Other	23.4	23.9	25.8	22.4	22.3	22.6
Cigarette smoking						
Some days	29.8	30.0	31.7	31.5	30.5	25.4
Every day	70.2	70.0	68.3	68.5	69.5	74.6
Intention to quit cigarette smoking						
Quit in the next 6 months	33.6	27.6	34.4	36.7	36.2	32.3
Quit in the next year	22.0	24.4	28.5	15.4	20.2	22.2
Quit someday but not in the next year	34.1	40.4	28.4	35.6	32.9	34.0
Never plan to quit	10.2	7.6	8.7	12.3	10.7	11.5
E-cigarette use						
Never user	41.0	38.8	38.6	38.6	42.1	46.8
Former user	31.4	28.3	34.4	28.8	34.0	31.3
Current user	27.6	32.9	27.0	32.6	23.9	22.0

No significant differences were found between conditions on participant characteristics.

Table 2. Tobacco Product Use Intentions by Framing Condition Among US Adult Current Smokers

	Quit using all tobacco products^ W% (95% CI)	Smoke VLNC only W% (95% CI)	Use combusted tobacco products				Any combusted tobacco product use*^ W% (95% CI)	Switch to non-combusted tobacco^ W% (95% CI)	Do something else# W% (95% CI)
			VLNC + other NPs W% (95% CI)	Find ways to get the current brand W% (95% CI)	Modify the VLNC W% (95% CI)	Switch to combusted tobacco W% (95% CI)			
Framing: What would you most likely do if:									
Nicotine levels were reduced by 95% in all cigarettes for sale? (n = 241)	20.1 (13.9 to 26.3)	34.6 (27.2 to 42)	14.2 (7.6 to 20.8)	11.9 (6.6 to 17.3)	6.6 (2.3 to 11.0)	3.0 (0.3 to 5.8)	70.4 (62.9 to 77.8)	8.2 (3.0 to 13.4)	1.3 (0.0 to 2.8)
The government reduced nicotine levels by 95% in all cigarettes for sale? (n = 241)	30.7 (23.1 to 38.3)	35.3 (27.7 to 42.8)	7.3 (2.9 to 11.8)	11.6 (6.6 to 16.5)	5.1 (1.0 to 9.3)	2.5 (0.0 to 5.1)	61.8 (53.8 to 69.7)	5.1 (1.3 to 9.0)	2.3 (0.6 to 4.1)
All cigarettes for sale were changed so that they were no longer addictive? (n = 241)	27.2 (20.3 to 34.1)	46.0 (37.8 to 54.3)	4.4 (1.2 to 7.6)	9.3 (4.4 to 14.2)	4.0 (1.2 to 6.9)	3.0 (0.0 to 6.5)	66.8 (59.3 to 74.2)	3.8 (0.8 to 6.9)	2.2 (0.0 to 5.0)
All cigarettes for sale were changed so that they no longer relieved your cravings? (n = 232)	43.9 (35.6 to 52.2)	9.8 (6.0 to 13.7)	9.0 (3.8 to 14.3)	12.2 (6.9 to 17.5)	7.7 (3.2 to 12.3)	6.6 (2.4 to 10.8)	45.3 (37.1 to 53.6)	5.2 (1.4 to 8.9)	5.6 (1.3 to 10.0)
All cigarettes for sale were changed so that you would be able to quit more easily? (n = 230)	29.8 (22.4 to 37.3)	37.8 (29.8 to 45.7)	8.0 (4.1 to 12.0)	9.2 (4.4 to 14.0)	4.2 (1.4 to 6.9)	2.5 (0.0 to 5.2)	61.6 (53.8 to 69.5)	6.8 (2.7 to 11.0)	1.7 (0.2 to 3.2)
Total	30.5 (27.2 to 33.9)	32.8 (29.4 to 36.2)	8.4 (6.3 to 10.6)	10.8 (8.5 to 13.1)	5.5 (3.8 to 7.2)	3.5 (2.0 to 5.0)	61.0 (57.4 to 64.6)	5.8 (4.0 to 7.6)	2.7 (1.5 to 3.9)

VLNC, very low nicotine cigarettes; NPs, nicotine products; W%, weighted percentage.

*The sum of columns from "Smoke VLNC only" to "Switch to combusted tobacco."

^Used as the categories of the dependent variable in the weighted multinomial logistic regression models.

#Treated as missing data in the weighted multinomial logistic regression models.

Table 3. Multinomial Logistic Regressions of Tobacco Product Use Intentions on Framing Condition

Framing: What would you most likely do if:	Quit using all tobacco/nicotine products vs. use combusted tobacco, aOR (95% CI)	Switch to non-combusted tobacco vs. use combusted tobacco, aOR (95% CI)
Nicotine levels were reduced by 95% in all cigarettes for sale?	Referent	Referent
The government reduced nicotine levels by 95% in all cigarettes for sale?	1.6 (0.7 to 3.3)	0.7 (0.2 to 2.6)
All cigarettes for sale were changed so that they were no longer addictive?	1.4 (0.7 to 2.8)	0.5 (0.1 to 2)
All cigarettes for sale were changed so that they no longer relieved your cravings?	3.6 (1.7 to 7.4)***	1.1 (0.3 to 4.1)
All cigarettes for sale were changed so that you would be able to quit more easily?	1.5 (0.7 to 3.1)	0.9 (0.2 to 3.3)
The government reduced nicotine levels by 95% in all cigarettes for sale?	Referent	Referent
All cigarettes for sale were changed so that they were no longer addictive?	0.9 (0.4 to 1.7)	0.7 (0.2 to 3.0)
All cigarettes for sale were changed so that they no longer relieved your cravings?	2.3 (1.1 to 4.6)**	1.7 (0.4 to 7.1)
All cigarettes for sale were changed so that you would be able to quit more easily?	0.9 (0.5 to 1.9)	1.3 (0.3 to 5.3)
All cigarettes for sale were changed so that they were no longer addictive?	Referent	Referent
All cigarettes for sale were changed so that they no longer relieved your cravings?	2.6 (1.3 to 5.0)***	2.4 (0.6 to 10.4)
All cigarettes for sale were changed so that you would be able to quit more easily?	1.1 (0.6 to 2.1)	1.9 (0.4 to 8.2)
All cigarettes for sale were changed so that they no longer relieved your cravings?	Referent	Referent
All cigarettes for sale were changed so that you would be able to quit more easily?	0.4 (0.2 to 0.9)**	0.8 (0.2 to 3.0)

aOR, adjusted odds ratios; CI, confidence interval. *$p < .05$; **$p < .01$; ***$p < .001$. The outcome variable for the multinomial logistic regression comprised three categories created from the responses to the reduced nicotine cigarette framing: (1) intention to use any combusted tobacco (the referent category), (2) intention to quit using all tobacco/nicotine products, and (3) intention to switch to non-combusted tobacco. All participants who indicated intention to "Do something else" (2.7%, $n = 38$) were excluded from the multinomial logistic regression analysis. Age, sex, race, education, intention to quit smoking, e-cigarette use, and cigarette dependence were controlled for. Familywise error rate inflation for all pairwise comparisons of the framing variable was corrected for using the Bonferroni correction.

Table 4. Multinomial Logistic Regressions of Perceived Risk of VLNCs on Framing Condition

Framing: What would you most likely do if:	Less harmful (vs. equally/more harmful), aOR (95% CI)	Do not know (vs. equally/more harmful), aOR (95% CI)
Nicotine levels were reduced by 95% in all cigarettes for sale?	Referent	Referent
The government reduced nicotine levels by 95% in all cigarettes for sale?	1.6 (0.8 to 3.1)	1.6 (0.6 to 4.2)
All cigarettes for sale were changed so that they were no longer addictive?	1.5 (0.8 to 3.0)	1.5 (0.6 to 3.6)
All cigarettes for sale were changed so that they no longer relieved your cravings?	0.6 (0.3 to 1.3)	0.9 (0.4 to 2.2)
All cigarettes for sale were changed so that you would be able to quit more easily?	0.9 (0.5 to 1.9)	0.9 (0.4 to 2.4)
The government reduced nicotine levels by 95% in all cigarettes for sale?	Referent	Referent
All cigarettes for sale were changed so that they were no longer addictive?	1.0 (0.5 to 1.9)	0.9 (0.4 to 2.2)
All cigarettes for sale were changed so that they no longer relieved your cravings?	0.4 (0.2 to 0.8)**	0.5 (0.2 to 1.3)
All cigarettes for sale were changed so that you would be able to quit more easily?	0.6 (0.3 to 1.2)	0.6 (0.2 to 1.5)
All cigarettes for sale were changed so that they were no longer addictive?	Referent	Referent
All cigarettes for sale were changed so that they no longer relieved your cravings?	0.4 (0.2 to 0.8)**	0.6 (0.3 to 1.4)
All cigarettes for sale were changed so that you would be able to quit more easily?	0.6 (0.3 to 1.2)	0.6 (0.3 to 1.6)
All cigarettes for sale were changed so that they no longer relieved your cravings?	Referent	Referent
All cigarettes for sale were changed so that you would be able to quit more easily?	1.5 (0.8 to 2.9)	1.1 (0.5 to 2.5)

VLNC, very low nicotine cigarette; aOR, adjusted odds ratios; CI, confidence interval. *$p < .05$; **$p < .01$; ***$p < .001$. The outcome variable for the multinomial logistic regression comprised three categories created from the responses to the perceived risk question: (1) less harmful, (2) equally/more harmful (the referent category), and (3) do not know. Age, sex, race, education, intention to quit smoking, e-cigarette use, and cigarette dependence were controlled for. Familywise error rate inflation for all pairwise comparisons of the framing variable was corrected for using the Bonferroni correction.

Discussion

Our study examined the effects of different framings for communicating about a nicotine tobacco product standard on adult smokers' anticipated product use intentions and risk perceptions. In this nationally representative study, when presented with questions about a hypothetical reduction of nicotine in combusted cigarettes framed

in different ways, 31% of US smokers reported that they would quit. This number was highest (44%) when nicotine reduction was framed as cigarettes no longer being able to relieve cravings. Overall, few smokers (11%) indicated that they would find ways to get their current brand of cigarettes, which further demonstrates that the proportion of smokers who would seek high-nicotine cigarettes through illicit sales would likely be low.

This study evaluated the impact of different framings for communications about a nicotine reduction separate from smokers' actual experience using VLNCs. The actual proportion of smokers who attempt to quit when a nicotine tobacco product standard is used might be very different from the anticipated tobacco use intentions smokers reported in this study. On the basis of other studies that compared smokers' intentions and their actual behavior, our numbers might be an underestimation. For example, before a menthol ban in Ontario, Canada, 15% of smokers said they would quit if menthol was banned. However, 1 month after the ban, 29% of smokers have attempted to quit, indicating that actual behaviors are different from planned behaviors.[26] Reducing nicotine in cigarettes to minimally or nonaddictive levels is, arguably, a more dramatic change than banning menthol cigarettes, and it is likely to exert even greater influence on smoking cessation. Hence, our finding that nearly half of the participants indicating willingness to quit combusted cigarettes when they were presented with a nicotine tobacco product standard as "cigarettes no longer being able to relieve cravings" is a positive sign.

Few studies have examined smokers' behavioral intentions in response to a nicotine tobacco product standard. Experts' estimates of the proportion of smokers who would quit smoking after the introduction of the policy in the first year ranged from 4.5% to 55%.[9] Among US smokers, when asked whether they would be more or less likely to quit smoking if the government required tobacco companies to remove most of the nicotine from cigarettes, 23.9% reported that they would be less likely, 41.5% equally likely, and 34.6% would be more likely to quit smoking.[12] Although these questions were worded differently from ours, the proportions of participants indicating they would be likely to quit are similar to our findings.

Smokers do not fully understand what the presence or absence of nicotine in their cigarettes means to their smoking experience.[27] Thus, without messages to the contrary, smokers are likely to believe that the positive aspects of smoking will not change appreciably even if much of the nicotine is removed. Most do not understand the impact on the smoking experience of reducing nicotine by 95%. Those who regret ever starting to smoke and have tried repeatedly to stop smoking[28] are likely to have a positive view of a product that is no longer addictive or one which they will be more easily able to quit. This may encourage them to continue to smoke VLNCs until they are ready to make their next quit attempt, expecting that they are more in control and will be more successful the next time. In contrast, smokers are very aware of cravings and the need to relieve them. A product that does not provide immediate relief of cravings does not meet the physiological and psychological needs that smokers expect their cigarettes to address. The tobacco companies have been aware for years of the importance of immediate craving relief[29] in smokers' choice of product prompting them to study cigarettes with "front-end lift"[30] to relieve craving as quickly as possible. The results of this study reflect these differences in behavioral intent resulting from different message framing and support the premise that smokers are more likely to intend to smoke modified cigarettes when they are told these products will provide the advantages of

being less addictive or easier to quit in comparison to the adverse message that these products will no longer relieve their cravings. Furthermore, among different frames, the craving frame is the only frame that indicates potential negative effect of VLNCs. People are prone to place more weight on negative information in decision making (ie, negativity bias).[31] Potentially because of this negativity bias, the craving frame had a greater influence on individuals than the other frames.

A nicotine tobacco product standard might result in an unintended outcome of associating reduction of nicotine in cigarettes with reduced risk of combusted cigarettes. Byron et al. found that 47% of US adult smokers believed that VLNCs were less harmful than regular cigarettes.[12] The way VLNCs were introduced in that study, "imagine the government required tobacco companies to remove most of the nicotine from cigarettes" is similar to our framing "the government reduced nicotine levels by 95% in all cigarettes for sale," for which we found that 42% of smokers believed VLNCs were less harmful than regular cigarettes. Another recent study examined how different ways of describing nicotine reduction in cigarettes affect perceptions of VLNCs.[14] The description ranged from very simple to very detailed by adding numerical reduction (removal of "95% of the nicotine"), a pictograph, and the words "nearly nicotine-free" alone and in combination. The study found that descriptions including the numeric information (95%) were more effective at conveying to smokers and non-smokers that VLNCs contain less nicotine and are less addictive than current cigarettes (which are correct beliefs) but also fostered perceptions that VLNCs are less harmful to smoke (incorrect belief). In our study, the framing of the nicotine tobacco product standard as cigarettes "no longer relieve cravings" resulted in the lowest proportion of participants who believed VLNCs are less harmful than regular cigarettes (26%), which was significantly different from framings "government reduced nicotine" and "cigarettes were no longer addictive." The finding that the frame "no longer relieve cravings" was most likely to increase intentions to quit and the least likely to increase incorrect perceptions that VLNCs are less harmful than regular cigarettes further indicates the need to evaluate the framing of "cigarettes no longer able to relieve cravings" as a promising way of communicating about the nicotine tobacco product standard.

Limitations

Smokers were asked about different framings of nicotine reduction separate from smokers' actual use of VLNCs. Past randomized clinical trials have begun to examine actual behavior.[32,33] Instead, our focus was on how different ways of communicating the nicotine tobacco product standard may influence smokers' product use intentions. Smokers' experience when smoking VLNCs, which is congruent with communication messages, is likely to magnify the effects seen here. Future research should combine use of VLNCs with different communication frames to more closely approximate the actual circumstances of implementation of the nicotine tobacco product standard.

Self-reported anticipated behavioral intentions might have over- or under-estimated the actual behavior if the policy is used. We asked about nicotine reduction only in cigarettes. Although the FDA has only announced considering nicotine reduction in combusted cigarettes,[34] the agency requested public comment on whether this product standard should include other combusted tobacco products, such as cigars, cigarillos, and hookah. Future research should investigate the effects of framing nicotine reduction as only aimed at cigarettes versus all combusted tobacco products. In addition, future studies should

evaluate responses to the messages by tobacco disparity groups, including by lesbian, gay, bisexual, and transgender (LGBT) status.

The wording of the question items also differed in terms of personal language, with some items including the word "you." Future studies should evaluate the role of personal language in nicotine reduction message in addition to framing. We did not have a control group to measure smokers' anticipated behavioral intentions in the absence of nicotine tobacco product standard. Future studies should include a control group measuring the outcome variables without exposing participants to the framing questions. The measure for perceived risk did not reflect the framing condition, which might have reduced the effect of framing on risk perceptions. Nonetheless, some differences were found.

Although our study points to some promising messaging strategies, the actual messages need to be further developed and tested to ensure that they motivate quitting and that they do not provoke unintended reactions, such as smokers' anger at the FDA. Future research should also evaluate the mode of delivery of such messages, whether it should be in a media campaign, a formal FDA communication, or on the packaging of VLNCs. In addition, future research should examine what limitations should be placed on the industry for how they would be allowed to communicate with their customers about VLNCs.

Conclusion

As the FDA moves toward announcing a nicotine tobacco product standard, it needs to prepare the public by communicating the rationale behind this reduction. It is particularly important to communicate this policy to smokers in such a way that promotes maximum public benefit, including quitting and switching to noncombusted tobacco products among smokers. Our research indicates that different ways of framing nicotine reduction in cigarettes have different effects on smokers' anticipated intentions and that framing the reduction as cigarettes no longer being able to relieve cravings might be particularly effective at achieving this goal. Future studies that develop and test messages about reduced nicotine should explore adding the message that VLNCs do not reduce smokers' cravings to the informational part explaining reduced nicotine.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

Declaration of Interests

None declared.

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