Developing tobacco risk communications for young adults susceptible to dual use of cigarettes and e-cigarettes

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Abstract

Background: Dual use of combustible cigarettes and electronic cigarettes is disproportionately high among lesbian, gay, bisexual, transgender, and queer (LGBTQ+) young adults (YA). Mass-reach health communications may be effective at curbing dual use behavior. Current research is exploring whether comparative risk messaging, which poses e-cigarettes as less harmful than cigarettes, may be an effective way to stop dual use behavior.

Objective: This formative evaluation focused on communicating the health risks of cigarette smoking and e-cigarette use to young adults susceptible to dual use of these products, including LGBTQ+ YA.

Methods: Online focus groups were conducted with YA to develop candidate messages (N=12). Interviews (N=13) qualitatively explored thematic content, and an online rating survey (N=326) quantitatively assessed perceived message effectiveness (PME) of and reactance to candidate messages applying standard and comparative risk message framing.

Results: In the online survey, most messages scored above the midpoint for PME specific to cigarette smoking while reactance scores were generally low. Qualitatively, LGBTQ+ YA found comparative messages valuable for harm minimization but were concerned about unintentionally promoting vaping among non-users. Interview and focus group participants found messages featuring novel information, including that on toxic constituents and physical health, most effective, especially those deemed “shocking” by LGBTQ+ YA. Addiction messaging was best received when paired with novel harms (e.g. social or occasional use). Participants preferred gain-framed, behavioral efficacy messages that encouraged rather than demanded behavior change. YA susceptible to dual use perceived standard and comparative messages as effective.

Conclusions: Comparative messages may encourage switching to lower-risk nicotine products when paired with efficacy statements encouraging harm minimization.

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Keywords: young adult; LGBTQ+; tobacco; nicotine; communication; dual use

INTRODUCTION

Concurrent use of combustible cigarettes and electronic cigarettes ("dual use") is a persistent and growing problem, particularly among young adults (YA) living in the United States (US).[1] Approximately 15.1% of YA report current (past 30-day) smoking and vaping[2]; however, rates of dual use are higher among minoritized populations, including lesbian, gay, bisexual, transgender, and queer (LGBTQ+) YA. Estimates from US surveys indicate that 21 to 40% of LGBTQ+ YA report past 30-day dual use,[3–5] compared to 12 to 21% of non-LGBTQ+ YA.[6,7] Dual use reinforces nicotine dependence,[8] is associated with continued tobacco use,[9–11] and can lead to exclusive combustible smoking.[12,13] Identifying population-based strategies to reduce dual use among YA, including LGBTQ+ populations, is necessary for advancing health equity.

Mass reach health communication campaigns have been effective for preventing initiation[14–16] and progression of tobacco use[16,17] and reducing smoking[18–20]; however, no national US campaigns targeting young people have specifically addressed dual use. Existing campaigns (e.g., The Real Cost, This Free Life) communicate health risks of a single product and aim to prevent initiation and progression[21,22]; however, these messages may not be effective in reducing use among YA engaged in dual use. Additionally, there have been very few mass-reach communications campaigns tailored to the LGBTQ+ YA community, such as the This Free Life campaign, despite the evidence of increased mono- and dual product use in this community.

In 2016, the US Food and Drug Administration (FDA) proposed a new nicotine-based framework for public health, in which they described products that deliver nicotine on a continuum of risk, based on toxicity and addictiveness.[23] Combustible products, including cigarettes, pose the highest risk while other products, including e-cigarettes, demonstrate lower risk.[24] Consequently, FDA Center for Tobacco Products and the US National Institutes of Health have identified research to develop effective messages about the health effects of e-cigarettes, including their harms compared to cigarettes, a priority.[30] Though not harmless, e-cigarettes pose fewer health risks than

combustible cigarettes[24,31–33] and could present a lower-risk option for dual users not willing to quit nicotine entirely.[27,28,34] Evidence suggests that exposure to comparative risk communications (e.g., "Vaping heats nicotine, resulting in lower levels of harmful chemicals than burned tobacco in cigarettes") increases relative harm perceptions of cigarettes (vs. e-cigarettes),[35] intentions to quit smoking,[35] and intentions to switch to e-cigarettes[35–39] among adults who smoke. Studies present mixed findings on comparative messages and dual use: One study[38] found that comparative messages increased dual use interest in adults who smoke while another[35] found that comparative messages did not increase dual use intentions. These studies did not assess responses to comparative messaging about e-cigarettes (vs cigarettes) among YA, nor those engaged in dual use, specifically.

A growing body of evidence suggests that comparative communications can effectively influence harm perceptions and behaviors among adults who smoke; however, additional research is needed to assess YA's understanding of and receptivity to comparative messages, especially among those engaged in dual use. The goal of this study was to develop candidate health communications that described (1) shared risks of cigarettes and e-cigarettes (standard message framing), or (2) comparative risks of cigarettes and e-cigarettes (comparative message framing) and that could be applied in campaigns to reduce dual use among YA. Given disparate rates of dual use among LGBTQ+ YA, we assessed whether there were systematic differences in responses to standard and comparative candidate messages by LGBTQ+ status.

METHODS AND RESULTS

We conducted two formative studies, including in-depth interviews and an online rating survey to develop messages that were perceived as effective for influencing smoking and vaping behaviors among YA. The objective of the interviews was to qualitatively explore perceptions of thematic content (i.e., topics, populations, tone) applied in standard (i.e., "cigarettes and some nicotine vapes contain formaldehyde, a chemical that causes cancer") and comparative (i.e.,

cigarettes contain more cancer-causing chemicals—like formaldehyde—than nicotine vapes") candidate messages. In the survey, our objective was to quantitatively examine perceptions of message effectiveness (i.e., beliefs about how strongly a candidate message will influence behavior; PME) and psychological reactance (i.e., motivational resistance felt in response to a perceived threat to their freedom of choice) to candidate standard and comparative messages. These studies were approved by the [BLINDED] University's Institutional Review Board (Protocol # BLINDED).

Developing Candidate Messages:

Step 1: Focus Groups

Before developing candidate messages used in both studies, online focus groups were conducted during which YA were shown prompts about smoking cigarettes and vaping nicotine that could be used to develop candidate messages (Supplementary Table S1). We were specifically interested in what semantic strategies (i.e., language and tone) and thematic content (i.e., message topics) YA participants found most salient. Participants (N=12) were, on average, 23.8 years old and n=7 identified as LGBTQ+. All participants reported past 30-day nicotine vaping and n=11 reported past 30-day cigarette use.

Language: Generally, participants preferred prompts that applied person-first language (e.g., people who smoke vs. smokers) and were less enthusiastic about those referring to specific subgroups of "young people" or "young adults". Participants preferred "everyday" language to describe electronic nicotine products, including "vaping" or "vapes" (vs e-cigarettes), but noted that messages should specify "nicotine vaping / vapes" to avoid confusion with non-nicotine vape products (i.e., cannabis, caffeine, herbal).

Content: Overall, standard and comparative message prompts describing short- and long-term physical health harms and toxic constituents were perceived as effective and memorable. Those describing nicotine addiction were perceived as least effective. Participants described how harm

messages that induced fear were more attention-getting and effective. Emerging YA (aged 18-24 years old) described how prior exposure to anti-tobacco campaigns during K-12 education (e.g. DARE) attenuated the effectiveness of messages describing chronic tobacco-related diseases (e.g., cancer, lung disease). As such, emerging YA found more appeal in message prompts highlighting short-term health harms (e.g., effects of nicotine on sleep) and less well-known toxic constituents (e.g., formaldehyde).

Comparative Risk Messaging: Participants held diverse opinions about the salience of comparative risk messages for young people susceptible to dual use. Some appreciated that comparative messages might encourage YA using combustible cigarettes (either mono-product or dual use of cigarettes) to move down the tobacco harm continuum by vaping only. Others were skeptical of comparative messages and were concerned that they might encourage more frequent use among young people who only vape.

Efficacy Messaging: Participants described how health communications that solely provided information about harms were insufficient. In addition to providing quit resources for individuals interested in quitting, participants suggested that messages include information about cessation and harm reduction strategies, including encouraging statements and “how to” tips (which they described as “off-ramp” messaging). In response, we developed a series of candidate messages addressing behavioral efficacy, which we explored in qualitative interviews (see Supplementary Table S2).

Step 2: In-depth Interviews to Explore Message Content

Given the rapid growth of nicotine vaping since 2017,[40] the peer-reviewed literature on vaping health effects is consistently updating; therefore, the research team continuously reviewed the scientific literature on health harms of e-cigarettes (and cigarettes) during the message development period (2021-2022). Messages were reviewed by a mentorship team of leading tobacco and communications researchers (BLINDED INTITIALS). We also adapted regulatory warnings used by the FDA to compare outcomes for candidate messages.

Overview: Qualitative interviews were conducted to explore perceptions of the semantic and thematic content used in candidate messages. We sought to understand how LGBTQ+ and non-LGBTQ+ YA perceived the effectiveness of these messages to increase harm perceptions.

Methods: We conducted interviews with US YA (18-35 years) who reported ever using cigarettes and e-cigarettes and who used at least one of those products in the past month. Eligibility criteria were informed by our formative focus groups in which participants disagreed about the potential effects of comparative messaging on mono-product users (i.e., concern that exposure to comparative messaging might support harm reduction among people who only smoke cigarettes but promote continued vaping among those who only vape nicotine). As such, we recruited YA who reported ever using both products into our sample, including current mono-product users, so that we could further consider those concerns. Our planned *analytic sample size* was N=8, designed to maximize the information power of qualitative research[41,42] in which an initial sample of 6-8 participants is recommended for interviews. We continued recruitment until we reached thematic saturation (N=13). Recruitment occurred via social media, flyers in the [BLINDED] community, emails to student organizations, a local LGBTQ+ healthcare organization, and word-of-mouth. Participants were screened for eligibility and consented into the study via phone. Afterwards, participants were sent a Qualtrics link to a baseline questionnaire about tobacco use and demographic characteristics. Interviews were conducted via Zoom, lasted about an hour, and participants received a $30 electronic gift card.

An experienced facilitator used semi-structured questions to guide the interviews. Participants were asked about their current and historical dual use prior to viewing three groups of candidate messages (12 standard, 12 comparative,12 efficacy messages; Table S2). Text-based messages with no accompanying imagery were presented. The presentation of the three groups and the order of candidate messages within groups were randomized. Participants were asked to read and respond to messages following a talk-aloud protocol in which they were prompted to identify the

"best"/ "worst" and "most effective"/ "least effective" messages and to explain their reasoning.

All interviews were audio-recorded, transcribed, and checked by an independent transcriptionist for subsequent analysis. We applied thematic analysis to code and analyze interview data (Table 1). Transcripts were independently coded deductively and inductively by coding pairs (BLINDED INITIALS). Consensus meetings were held to review coding (initial Cohen's Kappa range; .42-.49), reach agreement, and refine codes and definitions.

Table 1: Qualitative Codebook for Interviews with Young Adults

	Code	Definition	N of all statements	N of all participants
Message Framing	short + simple	discusses short + simple is an effective health communication tactic, either by saying a message would be better short or simpler, or liking a message for that reason	17	8
	facts/statistics = effective	discusses facts and statistics as an effective health communication tactic	17	7
	facts/statistics = ineffective	discusses facts and statistics as NOT or LESS effective	9	5
	constituents = effective	discusses mentioning toxic constituents (formaldehyde, etc.) as effective	28	10
	constituents = ineffective	discusses toxic constituents as NOT or LESS effective	9	6
	fear = effective	discusses "fear" as effective. May also use words like "scary" or "afraid."	17	9
	fear = ineffective	discusses "fear" as NOT or LESS effective	2	2
	shock value = effective	discusses "shock value" as effective. Participants may discuss being "surprised" by a message, making it effective.	4	1
	shock value = ineffective	discusses "shock value" as NOT being effective	2	1
	novelty = effective	discusses "novelty" (i.e.., a new idea, or new information, "outside the box" thinking) as effective	32	7
	novelty = ineffective	discusses "novelty" (i.e.., a new idea, or new information, "outside the box" thinking) as ineffective	7	3
	known truths = effective	discusses how "knowing" that something is "true" (e.g., smoking causes cancer) makes the message more effective (vs. something novel/new/unheard of)	39	9
	known truths = ineffective	discusses how "knowing" that something is "true" (e.g., smoking causes cancer) makes the message NOT or LESS effective (vs. something	24	9

		novel/new/unheard of)		
	secondary effects=effective	discusses how referencing health harms or other impacts of smoking/vaping (e.g., financial) on family/friends/bystanders is effective	2	1
Contextual Factors	real-life context	discusses how real-life context or current events (e.g., opioid epidemic, COVID) influences their perceptions of the message	4	4
	personal experience	discusses how personal experience (either their own smoking or a peer/loved one) influences their perceptions of the message	53	11
	prior quit attempts	discusses how a history of prior quit attempts influences their perceptions of the message	3	2
	audience	discusses how audience (i.e., whether target audience is smokers/vapers; established/not established users; adolescents, young or older adults) influences how effective or acceptable the message is	74	13
Product and Product Use Factors	comparative risk vapes vs. cigarettes	discusses the comparative risk of vaping versus smoking combustible cigarettes (or the messaging around comparative risk)	7	5
	equivalent risk	discusses how smoking/vaping has similar risks; or how referencing smoking/vaping in same statement makes the risk seem equivalent	13	7
	modified risk	discusses nicotine/vaping as a modified risk (healthier or lower harm) product than traditional combustible tobacco	32	10
	general health	Discusses general health when viewing the message; generally discusses how the message evoked a thought about addiction, whether positive or negative.	46	13
	general addictiveness	Discusses general addictiveness when viewing the message; generally discusses how the message evoked a thought about addiction, whether positive or negative.	35	12
	harm reduction	discusses using nicotine/tobacco as a harm reduction strategy (i.e., Instead of other drug use, to manage mental health/stress)	4	3
	switching	discusses using "switch" language to describe vaping in lieu of smoking. May use terms including, but not limited to: "turn to," "change over," "substitute," "alternative," or "use instead".	9	7
	rate reduction	discusses using information on how to decrease smoking on the path to quitting	14	5
	offramp	generally discussed building an "off ramp" (i.e., steps to quitting smoking, potentially including what to do once you know smoking is bad for you) is important content to include	17	4

Language	permissive	discusses how messaging/content is permissive (i.e., makes it seem fine to use) either vaping or cigarette smoking, or both.	36	9
	tone	discusses the tone of the message (e.g., "preachy" "friendly" etc.)	27	8
	lay language	discusses how using "lay" or "everyday" language is effective (e.g., heart disease vs. CVD).	1	1
	scientific language	discusses how using "scientific" or "professional" language is effective (e.g., cardiovascular disease vs. heart disease)	6	4
	specific language = effective	discusses how using more specific language is effective (e.g., lung injury vs. wheezing)	22	10
	broad language = effective	discusses how using broader language is effective (e.g., lung injury vs. wheezing)	7	3
	person-forward language	discusses using person-forward language (e.g., people who smoke or "using cigarettes" [Implied person]) vs product-forward language (e.g., smoker)	2	1
	general audience	discusses using language to appeal to a general audience	1	1

Results: Thirteen participants completed interviews, n=7 identified as cisgender male, n=5 were white, and n=9 identified as LGBTQ+. Their average age was 24.7 years old. Of participants, n=12 used cigarettes and n=11 vaped nicotine during the month of their interview (Table 2).

Table 2. Demographic Characteristics of Interview Participants

	N
Gender	
Cisgender female	4
Cisgender male	7
Other	2
Sexual Orientation	
Heterosexual	4
Lesbian/Gay	5
Pansexual	2
Other	2
Race	
White	5
Black or African American	5
Other People of Color	3
Age (Mean, SD)	24.7 (3.7)
Use in the Last Month	
Cigarettes	12
E-cigarettes / Nicotine vapes	11
Cigars	5
Little Cigars	4

Hookah	1

Theme 1: Messages describing novel content were perceived effective, while "known truths" had mixed response. Participants, including a greater proportion of non-LGBTQ+ YA, felt that novelty was important in candidate messages. When asked what information we should highlight, one participant responded, "Lesser-known information that I've never even heard before. I think that would actually get a lot of attention" (18-24, non-LGBTQ+, current dual use). Participants considered messages describing toxic constituents and DNA damage novel and explained that because the public is less aware of these health effects it increases "shock value": "It's a consequence you don't hear about as much about…the metals part of it. And then also, like, arsenic and lead sound just really dangerous" (18-24, non-LGBTQ+, current dual use). Some participants felt messages required novel information to engage their attention; otherwise, messages would be redundant with prior K-12 anti-tobacco education.

> "I feel like since I had DARE [Drug Abuse Resistance Education], it hasn't come out that there's like these new harms of smoking nicotine cigarettes that's like "Oh, no one knew this". We get it. It's horrible for you in every way so, while it's nice that the other messages like say specific things, I think I already know what the harm is. (25-35, non-LGBTQ+, current cigarette use)

In contrast, LGBTQ+ participants responded positively to messages describing scientifically established health harms (e.g., cancer). Said one participant, "Heart disease is so common… highlighting physical health risks as the danger [is effective], rather than, 'Oh, it's just bad for you'" (18-24, LGBTQ+, current e-cigarette use). LGBTQ+ participants also described how known physical harms messages that induced fear were more attention-getting: "Cancer is one of those statement shocker words of 'Oh, I could get this?' I just think the word 'cancer,' to see it in any kind of ad…you stop for a second and you look." (25-35, LGBTQ+, current dual use).

Responses to messages on nicotine addiction were mixed. Messages stating that "nicotine is

addictive" were generally considered ineffective: "There's no point, everyone knows that" (18-24, non-LGBTQ+, current dual use). However, messages presenting novel information about nicotine addiction (e.g., in the context of social or occasional use) were viewed as effective. Responding to the message, "Even occasional smoking and vaping can lead to nicotine addiction", one participant noted:

> If I had heard that earlier on, with maybe some more force, I would have probably been a lot more abstinent. Because my whole thinking was like, 'Well, I'm not like everyone else, I won't get addicted. I'm too good for that'. So, it's finding a way to like, broaden it and make it feel like […] you're not special. You'll get addicted. Everyone gets affected by nicotine the same way. (18-24, non-LGBTQ+, current dual use)

Theme 2: Tensions exist when communicating the harm minimization potential of vaping

Comparative candidate messages were appealing for their potential for harm minimization. Several participants, including a greater proportion of LGBTQ+ YA, remarked that comparative messages were effective because they might move dual users down the tobacco harm continuum, or encourage them to quit smoking. However, some participants interpreted comparative messages to mean that vaping is an effective strategy for quitting smoking.

> The reason I like [the message] is, vaping is a way of trying to quit smoking, but it does not mean it's not harmful at all. So, you have to pass across the message that it is still harmful, but it has a reduced risk from smoking. So, when you're comfortable and try and quit, vaping will help you. (18-24, LGBTQ+, current dual use)

Efficacy messages emphasizing "switching" were viewed as permissive for vaping. Participants were concerned that efficacy messages directing users to "switch" to vapes might encourage continued nicotine use instead of quitting. In describing this concern, some participants implicitly equated smoking and vaping harms: "I think [this message] is another excuse to keep doing what you've been doing, right? You just quit smoking and just go to vaping. I think that isn't

really much different... I think if you want to quit, you should quit." (25-35, LGBTQ+, current dual use). However, some participants questioned whether vaping was effective for helping smokers eventually quit all nicotine: "…is there research on—like do people that go from smoking to nicotine [vaping], do they ever end up quitting?" (18-24, LGBTQ+, current e-cigarette use).

Tone was important to YA when assessing the effectiveness of harm minimization and efficacy messages. Most participants, but especially those aged 18-24 years old, preferred when efficacy messages encouraged rather than demanded behavior change. Leading questions (e.g., "Not ready to quit completely?") and empathetic opening statements were described as effective strategies for engaging participants in behavior change: "The way [the messages are] phrased makes it seem that it's like, it's my choice to do it, rather than being told to do something." (18-24, LGBTQ+, current e-cigarette user).

Step3: Online Rating Survey to Evaluate Message Perceptions:

Methods: We conducted a survey with N=326 YA (ages 18-35 years) living in the US and who reported ever using nicotine vapes and combustible cigarettes and current use of at least one product. Participants were recruited and prescreened via Prolific[43] and were paid $3.50. Eligible participants who completed online consent were directed to a baseline survey administered via Qualtrics. Participants completed questions on tobacco use and harms perceptions before viewing five randomly sampled candidate risk messages (of N=24 messages) and three randomly sampled candidate efficacy messages (of N=12 messages). Candidate messages were presented as text, with no accompanying images. After viewing each candidate message, participants completed questions assessing PME and reactance. Supplementary Table S2 presents all messages.

Measures: PME was assessed using the three-item UNC Perceived Message Effectiveness Scale (original alpha = 0.90), which assesses effects perceptions, or beliefs about a message's potential to change behavior.[44] Meta analyses demonstrate that PME is an empirically meaningful

predictor of quit intentions and cessation behavior.[45] PME-smoking and PME-vaping measures included 3 items on a 5-point Likert scale (1 = “strongly disagree”, 5 = “strongly agree”) assessing whether message exposure discouraged use, made smoking/vaping seem unpleasant, and made participants concerned about health effects of smoking/vaping (PME-smoking alpha = .64; PME-vaping alpha=.96). Scores were summed and averaged to create two unique variables assessing candidate messages’ potential to influence smoking behavior (PME-smoking) and vaping behavior (PME-vaping).

Efficacy messages were assessed by their perceived effectiveness for motivating people to quit cigarettes and e-cigarettes a 5-point Likert scale (1 = “strongly disagree”, 5 = “strongly agree” with the question: "This message will motivate people to quit all e-cigarette and combustible cigarette products." We also assess perceived effectiveness at motiving people to switch from cigarettes to e-cigarettes using the same scale and the question: "This message will motivate people who smoke cigarettes to switch completely to vaping e-cigarettes."

Psychological reactance measures a person’s negative reactions to a message, which may preclude counterarguing to the message.[46] We measured reactance to risk and efficacy candidate messages with three-items: "This message is trying to manipulate me," "This message annoys me," and "The health effect of this message is overblown."; scored on a five-point response scale ranging from 1 = “strongly disagree” to 5= “strongly agree” (original alpha = 0.75).[46] Scores were summed and averaged ffor a total reactance score variable where higher scores equal higher psychological reactance to the message (alpha = .83).

We performed descriptive statistics to describe the sample (Table 3) and PME and reactance scores for each message. We calculated means and standard deviations on outcomes for each message before ranking messages to identify the most and least effective risk messages and most and least effective efficacy messages. Candidate risk messages rated as moderate to high perceived effectiveness to influence smoking behavior, moderate to high perceived effectiveness to influence

vaping behavior, and low psychological reactance were considered most effective. Given these parameters, messages are presented in order of least to most effective in Table 4 within each candidate message category (standard, comparative). Because we were interested in the potential for efficacy messages to influence harm reduction behaviors, candidate efficacy messages are presented in order of low to high effectiveness scores for including switching behaviors, specifically (Table 5).

Table 3. Sample demographic characteristics for an online sample of US young adults aged 18-35 years old (N=326)

	LGBTQ+	non-LGBTQ+	p-value
Age group			<.001
18-25	85 (51.20)	49 (30.63)	
26-35	81 (48.80)	111 (69.38)	
Sex assigned at birth			<.001
Female	108 (65.85)	70 (43.75)	
Male	56 (34.15)	90 (56.25)	
Hispanic or Latine/Latinx/Latino/Latina	20 (12.05)	21 (13.13)	0.77
Race			0.52
White	113 (68.07)	100 (62.50)	
Black or African American	16 (9.64)	21 (13.13)	
Asian or Pacific Islander	9 (5.42)	7 (4.38)	
American Indian or Alaska Native	2 (1.20)	0 (0.00)	
Multiracial	18 (10.84)	22 (13.75)	
Another race/ethnicity	8 (4.82)	10 (6.25)	
Education Level			0.14
<= High School Diploma/ GED	38 (22.89)	33 (20.63)	
Vocational or Associate's degree	17 (10.24)	21 (13.13)	
Some college (not graduated)	58 (34.94)	38 (23.75)	
Bachelor's degree	46 (27.71)	57 (35.63)	
Masters degree or higher	7 (4.22)	11 (6.88)	
Smoked cigarettes			0.75
Current	74 (44.58)	77 (48.13)	
Former	79 (47.59)	73 (45.63)	
Never	13 (7.83)	10 (6.25)	
Age first smoked (Mean, SD)	16.82 (15.13)	16.57 (3.20)	0.01

Vaped nicotine			
Current	101 (60.84)	89 (55.63)	
Former	62 (37.35)	56 (35.00)	
Never	3 (1.81)	15 (9.40)	
Age first vaped (Mean, SD)	19.85 (4.13)	21.40 (4.55)	
Dual use			0.40
Current	42 (26.25)	45 (27.11)	
Former	96 (60.00)	106 (63.86)	
Never	15 (9.04)	22 (13.75)	

Results:

Sample characteristics

The survey was completed by N=326 YA (Table 3). Most participants self-identified as white (65.3%), 41.1% were 18–25 years old, 34.6% were assigned female at birth (AFAB), and 50.9% identified as LGBTQ+. Of all participants, 26.7% reported current dual use, 62.0% reported former dual use, and 11.3% reported never dual use. LGBTQ+ participants were younger than non-LGBTQ+ participants ($p<0.001$, LGBTQ+: 51.2% vs. non-LGBTQ: 30.6% in the 18-24 age group). More LGBTQ+ participants were AFAB ($p<0.001$, LGBTQ+: 65.9% vs. non-LGBTQ+: 43.8%).

Standard Risk Messages: Perceived Message Effectiveness

Most standard candidate messages scored PMEs above the midpoint score (>3). Those with the highest PMEs addressed the risk of heart disease [ID# 9] and toxic constituents, including formaldehyde [ID# 3] and heavy metals [ID# 5]. Participants also rated messages about cancer risk [ID#8] and lung damage [ID#11] as effective for influencing cigarette smoking behaviors more than vaping behaviors.

Two standard candidate messages had lower PMEs for smoking and vaping; both messages addressed the addictive potential of nicotine [ID#s 6, 7]. LGBTQ+ (vs non-LGBTQ+) young adults rated the message “Even occasional smoking and vaping can lead to nicotine addiction” as less effective for influencing smoking (LGBTQ+: M = 2.62, 95% CI: 2.17,3.06; non-LGBTQ: M = 3.68,

95% CI: 3.26, 4.10, p =.007).

Comparative Risk Messages: Perceived Message Effectiveness

Different patterns emerged in PME scores for comparative candidate messages (Table 4). Like standard candidate messages, most comparative candidate messages scored PMEs for smoking behavior > 3. The comparative candidate messages with the highest PME-smoking scores addressed how cigarette smoking increases cancer risk more than nicotine vaping [ID#s 16, 20]. With respect to PME-vaping scores, comparative candidate messages were less effective. Only two messages scored above three for PME-vaping for both LGBTQ and non-LGBTQ participants [ID#s 1, 23].

Table 4. Mean perceived message effectiveness and psychological reactance scores for standard and comparative risk candidate messages tested in an online rating survey of US young adults (N=326)

			PME-Cigarette Smoking		PME-Nicotine vaping		Psychological Reactance	
			LGBTQ+	Non-LGBTQ+	LGBTQ+	Non-LGBTQ+	LGBTQ+	Non-LGBTQ+
#	**Type**	**Message**	M (95% CI)					
7	Regulatory Standard	Cigarettes and vapes contain nicotine. Nicotine is an addictive chemical.	2.00 (0.18, 3.82)	3.11 (2.67, 3.56)	2.85 (2.39, 3.31)	3.10 (2.66, 3.54)	1.61 (1.35, 1.88)	1.79 (1.49, 2.09)
6	Candidate Standard	Even occasional smoking and vaping can lead to nicotine addiction.	2.62* (2.17, 3.06)	3.68 (3.26, 4.10)	2.59 (3.01, 3.91)	3.46 (2.11, 3.07)	2.04 (1.66, 2.42)	2.11 (1.73, 2.50)
10	Candidate Standard	Can’t sleep? Nicotine in cigarettes and vapes can lead to sleep problems, including insomnia.	3.17 (2.69, 3.64)	3.73 (3.31, 4.14)	3.04 (2.56, 3.52)	3.41 (2.99, 3.82)	2.13 (1.73, 2.53)	1.95 (1.59, 2.30)
4	Candidate Standard	Nicotine doesn’t cause cancer, but toxic chemicals in e-liquid and tobacco can.	3.42 (2.97, 3.88)	3.12 (2.60, 3.64)	3.29 (2.82, 3.76)	3.09 (2.60, 3.58)	2.08 (1.70, 2.46)	2.48 (2.07, 2.90)
2	Candidate Standard	Most people think smoking cigarettes and vaping nicotine are harmful to your	3.44 (2.98, 3.89)	3.54 (3.12, 3.96)	3.41 (2.95, 3.86)	3.33 (2.89, 3.78)	2.05 (1.70, 2.41)	1.99 (1.70, 2.28)

		health. They’re right.						
12	Candidate Standard	Can’t find your keys? Nicotine in cigarettes and vapes can harm your brain and lead to memory loss.	3.45 (3.08, 3.82)	3.53 (3.07, 4.00)	3.19 (2.79, 3.61)	3.41 (2.94, 3.87)	2.83 (2.42, 3.25)	2.74 (2.33, 3.15)
8	Candidate Standard	Smoking cigarettes and vaping nicotine damages your DNA and increases your risk for cancer.	3.76 (3.37, 4.15)	4.09 (3.75, 4.43)	3.39 (2.94, 3.84)	3.63 (3.18, 4.09)	2.41 (1.98, 2.84)	2.11 (1.69, 2.53)
5	Candidate Standard	Using cigarettes and nicotine vapes exposes you to heavy metals— like arsenic and lead.	3.85 (3.47, 4.24)	3.90 (3.52, 4.28)	3.74 (3.42, 4.06)	3.51 (3.06, 3.96)	1.77 (1.44, 2.10)	2.15 (1.81, 2.50)
11	Candidate Standard	Wheezing lately? Smoking cigarettes and vaping nicotine increases your risk for lung problems.	3.94 (3.48, 4.40)	3.86 (3.42, 4.29)	3.53 (3.01, 4.05)	3.39 (2.90, 3.89)	1.96 (1.58, 2.34)	1.82 (1.52, 2.12)
3	Candidate Standard	Cigarettes and some nicotine vapes contain formaldehyde, a chemical that causes cancer.	4.07 (3.72, 4.42)	3.90 (3.48, 4.32)	3.66 (3.23, 4.08)	3.65 (3.23, 4.06)	1.88 (1.54, 2.22)	1.87 (1.56, 2.18)
9	Candidate Standard	Smoking cigarettes and vaping nicotine increases your risk for heart disease.	4.34 (4.10, 4.59)	4.07 (3.65, 4.49)	3.59 (3.15, 4.04)	3.73 (3.26, 4.19)	1.80 (1.44, 2.16)	1.96 (1.55, 2.38)
1	Regulatory Comparative	Nicotine vapes are not a safe alternative to cigarettes.	2.86 (2.33, 3.39)	2.66 (1.45, 3.16)	3.08 (2.51, 3.65)	3.75 (3.33, 4.16)	2.33 (1.87, 2.80)	1.99 (1.61, 2.37)
24	Candidate Comparative	Can’t find your keys? Research suggests that vaping nicotine can improve attention and memory during smoking abstinence.	2.69 (2.21, 3.17)	2.60 (2.16, 3.04)	1.93 (1.54, 2.32)	2.06 (1.64, 2.47)	3.30 (2.88, 3.73)	3.41 (3.00, 3.82)
22	Candidate Comparative	Can’t sleep? People who vape and smoke report more sleep problems than those who only vape.	3.38 (2.99, 3.78)	3.01 (2.46, 3.56)	2.09 (1.69, 2.50)	2.30 (1.80, 2.80)	2.32 (1.96, 2.69)	2.60 (2.11, 3.08)
14	Candidate Comparative	Many people think vaping nicotine is just as harmful as	3.46 (3.00, 3.91)	3.71 (3.32, 4.10)	1.98 (1.54, 2.41)	2.11 (1.75, 2.47)	2.18 (1.79, 2.57)	2.47 (2.06, 2.89)

		smoking cigarettes. Truth is, nicotine vapes are less harmful than cigarettes.						
19	Candidate Comparative	Nicotine vapes are addictive, but people who vape and smoke tobacco are 7 times more likely to be addicted to nicotine than those who only vape.	3.50 (3.09, 3.92)	3.51 (3.12, 3.90)	2.63 (2.25, 3.02)	2.52 (2.11, 2.93)	1.94 (1.54, 2.33)	2.40 (1.99, 2.81)
18	Candidate Comparative	Vaping heats nicotine, resulting in lower levels of harmful chemicals than burned tobacco in cigarettes.	3.52 (3.03, 4.00)	3.63 (3.24, 4.03)	2.38 (1.89, 2.87)	2.33 (1.90, 2.77)	2.28 (1.85, 2.71)	2.14 (1.78, 2.50)
13	Candidate Comparative	Vaping nicotine is harmful to your health, but it is less harmful than smoking.	3.71 (3.25, 4.17)	3.77 (3.43, 4.11)	2.39 (1.96, 2.82)	2.48 (2.08, 2.89)	2.02 (1.65, 2.39)	2.46 (2.15, 2.78)
21	Candidate Comparative	People who smoke cigarettes and vape nicotine have a higher risk of developing heart disease than those who only vape.	3.73 (3.33, 4.13)	4.07 (3.66, 4.49)	2.46 (1.93, 3.00)	3.03 (2.57, 3.48)	1.96 (1.57, 2.35)	2.07 (1.72, 2.43)
17	Candidate Comparative	Using cigarettes and nicotine vapes exposes you to more heavy metals—like arsenic and lead—than if you only vape.	3.82 (3.43, 4.21)	3.50 (2.95, 4.05)	3.06 (2.61, 3.52)	2.90 (2.34, 3.47)	2.13 (1.74, 2.53)	2.18 (1.72, 2.64)
23	Candidate Comparative	Wheezing much? People who smoke cigarettes and vape nicotine report more lung problems than those who only vape.	3.89 (3.51, 4.28)	4.35 (4.09, 4.61)	3.11 (2.64, 3.59)	3.23 (2.69, 3.77)	2.11 (1.78, 2.44)	2.13 (1.70, 2.56)
16	Candidate Comparative	Many people think nicotine in vapes and cigarettes causes cancer. Truth is, toxic chemicals in burning	3.97 (3.58, 4.36)	3.78 (3.36, 4.20)	2.63 (2.19, 3.07)	2.63 (2.10, 3.16)	1.88 (1.56, 2.20)	2.38 (1.96, 2.80)

		cigarettes are more likely to cause cancer.						
15	Candidate Comparative	Cigarettes contain more cancer-causing chemicals—like formaldehyde—than nicotine vapes.	4.01 (3.60, 4.42)	4.13 (4.42, 4.48)	2.10 (1.71, 2.50)	2.53 (2.04, 3.01)	1.95 (1.59, 2.31)	1.84 (1.49, 2.18)
20	Candidate Comparative	Smoking cigarettes can increase your risk for lung, head, and neck cancer. Using nicotine vapes only may decrease your cancer risk.	4.04 (3.69, 4.39)	3.94 (3.48, 4.39)	2.34 (1.85, 2.84)	2.34 (1.88, 2.81)	2.11 (1.63, 2.59)	2.58 (2.11, 3.04)

Risk Messages: Psychological reactance

Almost all standard and comparative candidate messages scored below the midpoint for psychological reactance, indicating that participants did not respond negatively to the messages (Table 4). Messages with highest reactance discussed effects of smoking and vaping on memory (ID#12, ID#24).

Efficacy Messages: Perceived Effectiveness for motivating quit and switch behaviors

Efficacy messages that directed viewers to quit all smoking and vaping to reduce health risks [Q1, Q3] and exposures [Q2] were rated most effective for motivating quitting behaviors, but least effective for motivating switching to vaping only (Table 5). However, both LGBTQ+ and non-LGBTQ+ young adults rated candidate efficacy messages that acknowledged viewers might not be ready to quit all nicotine and encouraged vaping only [C1, C2, C3] as most effective for motivating smokers to switch to vaping. Candidate messages describing how switching to vaping only could reduce related health risks [S1 and S2] were also rated highly for perceived effectiveness in motivating switch behaviors.

Efficacy Messages: Psychological Reactance

All efficacy messages scored below the midpoint for psychological reactance, indicating that participants did not respond negatively to the messages (Table 5). The message with highest reactance scores addressed switching to vaping to reduce serious risks to health (S1).

Table 5: Mean perceived effectiveness of candidate messages to motivate to quitting and switching behaviors and psychological reactance scores for efficacy candidate messages tested in an online rating survey of US young adults (N=326)

		Effectiveness for motivating switching behaviors		Effectiveness for motivating quitting behaviors		Psychological Reactance	
		LGBTQ+	Non-LGBTQ+	LGBTQ+	Non-LGBTQ+	LGBTQ+	Non-LGBTQ+
#	**Message**	M (95% CI)					
Q2	Quit all smoking and vaping to reduce your cancer risk.	1.79* (1.46, 2.12)	2.42 (2.03, 2.81)	3.14 (2.68, 3.60)	3.50 (3.10, 3.90)	1.84 (1.46, 2.21)	1.82 (1.47, 2.16)
Q1	Quit all smoking and vaping to reduce serious risks to your health.	1.85* (1.51, 2.20)	2.41 (2.01, 2.80)	2.94 (2.51, 3.37)	2.94 (2.46, 3.41)	2.14 (1.74, 2.54)	1.98 (1.57, 2.39)
Q3	Quit smoking and vaping completely to reduce your exposure to toxic chemicals.	2.16 (1.77, 2.54)	2.33 (1.91, 2.75)	3.11 (2.71, 3.51)	3.22 (2.79, 3.65)	1.90 (1.56, 2.23)	1.86 (1.52, 2.20)
S4	Manage your smoking cravings with nicotine replacement therapy.	2.21* (1.90, 2.52)	2.70 (2.35, 3.06)	2.62 (2.26, 2.98)	2.66 (2.33, 2.99)	2.04 (1.74, 2.33)	1.97 (1.68, 2.27)
Q4	Ready to quit smoking and vaping completely? Manage your cravings with nicotine replacement therapy.	2.22 (1.86, 2.58)	2.38 (1.94, 2.82)	3.00 (2.59, 3.41)	2.76 (2.29, 3.24)	1.79 (1.42, 2.15)	1.86 (1.51, 6.65)

C4	If you're not ready to quit all nicotine, using nicotine replacement therapy can help you manage cravings and quit smoking.	2.38 (2.03, 2.72)	2.61 (2.26, 2.96)	2.90 (2.52, 3.28)	2.76 (2.35, 3.16)	1.63 (1.32, 1.95)	1.94 (1.61, 2.27)
S3	Switching from smoking to vaping only to reduce your exposure to toxic chemicals.	3.11 (2.72, 3.51)	3.04 (2.68, 3.41)	2.20 (1.79, 2.61)	2.08 (1.75, 2.42)	1.97 (1.61, 2.34)	2.08 (1.72, 2.43)
C3	Start quitting smoking by switching to nicotine vapes only.	3.17 (2.80, 3.54)	3.48 (3.12, 3.83)	1.72 (1.43, 2.02)	1.93 (1.56, 2.30)	2.17 (1.83, 2.51)	2.26 (1.89, 2.63)
S2	Switching completely from smoking to vaping nicotine can reduce your cancer risk.	3.29 (2.93, 3.65)	3.48 (3.09, 3.86)	1.83* (1.48, 2.18)	2.43 (2.03, 2.82)	2.01 (1.61, 2.41)	2.33 (1.93, 2.73)
S1	Switching completely from smoking to vaping nicotine can reduce serious risks to your health.	3.42 (3.05, 3.80)	3.37 (2.98, 3.75)	2.02 (1.69, 2.36)	2.53 (2.11, 2.94)	2.33 (1.93, 2.72)	2.44 (2.01, 2.88)
C1	Not ready quit completely? Quit smoking all tobacco, and use nicotine vapes only to reduce serious risks to your health.	3.46 (3.08, 3.84)	3.34 (2.84, 3.85)	1.52 (1.26, 1.78)	2.17 (1.76, 2.58)	1.87 (1.54, 2.21)	2.23 (1.80, 2.65)
C2	If you're not ready to quit all nicotine, switching completely to vaping may reduce your cancer risk.	3.65 (3.21, 4.08)	3.80 (3.44, 4.17)	1.88 (1.47, 2.29)	2.10 (1.72, 2.48)	2.01 (1.55, 2.46)	2.06 (1.63, 2.49)

*Indicates a statistically significant difference between LGBTQ+ and non-LGBTQ+, validated via a Wilcoxon rank-sum test

DISCUSSION

This mixed-methods formative study explored YA responses to and perceived effectiveness of candidate standard and comparative messages about nicotine vaping and cigarette smoking. We also compared how LGBTQ+ participants' responses differed from their non-LGBTQ+ peers. Messages with the highest effectiveness ratings discussed risk of exposure to toxic constituents and physical health harms, including heart disease and cancer. Qualitatively, participants explained that it was a "shock" to learn how both smoking and vaping could contribute to chronic disease risks beyond lung disease (e.g., hypertension, heart disease). Qualitatively, LGBTQ+ YA in our sample found these fear-appeals effective. This finding is important, because while fear appeals have commonly been used in anti-tobacco messaging and found to be effective,[47,48] some contemporary studies suggest that youth and YA are skeptical of these tactics.[49] Messages on nicotine addiction were perceived as least effective, a finding that aligns with contemporary studies.[50,51] However, participants were more receptive to addiction messaging when paired with a novel statement (e.g. "even *occasional/social* smoking and vaping can lead to nicotine addiction"). This provides some insight into how researchers could adjust traditional anti-smoking messages to be more appealing.

In the online survey, descriptive analyses suggest that standard and comparative candidate messages performed better than our "referent" regulatory standard and comparative messages for their perceived effectiveness in influencing smoking. Comparative candidate messages performed less well for influencing vaping behaviors. Together these findings suggest that standard and comparative messaging may be effective in reducing cigarette smoking among YA susceptible to dual use. However, experimental studies are needed to confirm these hypotheses.

Survey results also identified that efficacy messages that acknowledged participants' hesitation to quit all nicotine may be most effective for influencing tobacco harm reduction

behaviors. Qualitatively, participants express that tone was especially important when providing behavioral directives. Interview participants preferred an encouraging and non-demanding tone, which aligns with Lazard et al.'s (2018) finding that YA dislike "authoritative" tones. Accordingly, mass-reach health communications that acknowledge a range of behavioral choices (e.g., cessation and harm minimization) and encourage informed decision-making may be more palatable for young adults engaged in dual use behaviors.

Across studies, we identified mixed findings on the use of "known truths" (i.e., well-established physical health harms) in candidate messages. Quantitatively, candidate messages that addressed cancer risk and lung disease performed well for perceived effectiveness in influencing smoking behaviors. In interviews, some YA appreciated the evidence-based nature of these truths, while others found them repetitive given prior exposure to K-12 tobacco education programs. Researchers should consider that YA who smoke may not resonate with known long-term physical health harms featured in tobacco health communications, but they still want factual, evidence-based health messages. Messages that incorporated "novel truths" (e.g., risk for nicotine addiction from occasional use, hypertension and heart disease) were found to be effective across the board and could be leveraged in future campaigns.

Most standard and comparative candidate messages scored low for psychological reactance during survey testing, indicating that participants are less likely to engage in counterarguing to the message.[55,56] Yet, qualitatively, participants expressed some apprehension that comparative messages may encourage current cigarette smokers to continue to use nicotine (rather than completely quit) and that non-smokers may misperceive nicotine vapes as being "safe" rather than "lower harm than cigarettes." These concerns suggest that harm minimization messaging must be carefully balanced, and that research is needed to assess whether exposure to harm minimization messaging has unintended effects (e.g., encouraging initiation among non-users or sustained dual use among exclusive cigarette smokers).

One strength of this formative research is the systematic approach we took to develop standard and comparative candidate messages, including qualitative and quantitative studies to explore language, content, message framing and tone. Because we are interested in reducing tobacco inequities, we also explored the effectiveness of candidate messages among LGBTQ+ and non-LGBTQ+ YA, finding messaging tactics that are uniquely appealing to both groups. Our testing of behavioral efficacy messages allowed us to explore focus group participants' requests for "off-ramp" messaging, which was positively received. Messages encouraging quitting of all nicotine or switching to vaping as a step toward quitting could balance comparative messaging and attenuate perceived permissiveness.

Our research was limited by convenience sampling and, thus, may not be generalizable to the broader YA population; however, findings were triangulated across qualitative and quantitative studies with unique samples. In our survey, the reliability coefficient for PME-smoking was low (Cronbach's alpha=0.64). Our sample includes YA reporting current dual use of cigarettes and nicotine vapes, former dual use, and never dual use (i.e., mono-product use only; vapes or cigarettes). While the measure performed well among subpopulations of YA reporting mono-product use (Cronbach's alpha=0.94), current dual use (Cronbach's α =0.93), and former dual use/current smoking (Cronbach's alpha=0.93), it was less reliable among YA reporting former dual use/current vaping (Cronbach's alpha=0.32). Evidence from US samples suggests that people who switch to vaping only differ in effects perceptions from those who continue dual use,[57] which may explain their differing reliability score. Future work could benefit from focused recruitment of never users, current cigarette smokers, and "switchers" to assess the potential effects of exposure to standard and comparative messages among these groups. This work could be extended to look at the potential public health impact of exposure to standard and comparative messaging across the life course (e.g., among adolescents or older adults), or among other high-risk populations (e.g., rural YA, racially minoritized YA). Additionally, there has been some debate surrounding the validity of PME as an

instrument to measure actual message effectiveness (i.e., behaviors; AME). Some studies have called into question the correlational evidence between PME and AME,[58] and have argued that individuals' PME scores cannot adequately identify a messages' effectiveness.[59] However, several contemporary studies have found a positive relationship between individuals' PME and AME,[60,61] and results from a systematic review found that PME was predictive of small to medium effects in tobacco quit intentions and cessation behavior.[62] Considering these promising results, PME is still a useful tool for measuring candidate message effectiveness during formative development stages.

Conclusions

The goal of this mixed-methods study was to develop candidate health messages that would resonate with YA at-risk for dual use. Our findings suggest that both standard and comparative messages have the potential to influence YA's smoking behavior, especially when highlighting long-term and novel physical health harms. LGBTQ+ YA, specifically, may find alternate messaging tactics, such as comparative risk messaging, more salient. When developing comparative messages, researchers must consider that YA may perceive these messages as promoting lower-risk nicotine products (i.e., vaping); however, adding behavioral efficacy statements that encourage harm minimization as a step to complete quitting may temper this concern. Experimental studies testing the effect of exposure to comparative messages on effects perceptions and use among YA who have never used nicotine or tobacco are also needed to assess the potential population-level impact of disseminating tobacco public education comparing the health risks of nicotine vapes and combustible cigarettes on uptake among nicotine-naïve YA.

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Abbreviations:

AFAB: Assigned Female at Birth

AME: Actual Message Effectiveness

DARE: Drug Abuse Resistance Education

FDA: Food and Drug Administration

LGBTQ+: Lesbian, Gay, Bisexual, Transgender, Queer or Questioning (A ”+” sign to recognize the limitless sexual orientations and gender identities used by members of our community.)

PME: Perceived Message Effectiveness

US: United States

YA: Young Adults

	N
Gender	
Cis-female	4
Cis-male	7
other	2
Sexual Orientation	
Heterosexual	4
Lesbian/Gay	5
Pansexual	2
Other	2
Race	
White	5
Black/AA	5
Other	3
Age (Mean, SD)	24.69 (3.71)
Use in the Last Month	
Cigarettes	12
Cigars	5
Little Cigars	4
Hookah	1
EC, Nicotine Vapes, Pods	11

Table 2. Sample demographic characteristics for an online sample of US young adults aged 18-35 years old (N=326)

	LGBTQ	non-LGBTQ	p-value
Age group			<.001
18-25	85 (51.20)	49 (30.63)	
26-35	81 (48.80)	111 (69.38)	
Sex assigned at birth			<.001
Female	108 (65.85)	70 (43.75)	
Male	56 (34.15)	90 (56.25)	
Hispanic or Latine/Latinx/Latino/Latina	20 (12.05)	21 (13.13)	0.77
Race			0.52
White	113 (68.07)	100 (62.50)	
Black or African American	16 (9.64)	21 (13.13)	
Asian or Pacific Islander	9 (5.42)	7 (4.38)	
American Indian or Alaska Native	2 (1.20)	0 (0.00)	
Multiracial	18 (10.84)	22 (13.75)	
Another race/ethnicity	8 (4.82)	10 (6.25)	
Education Level			0.14
<= High School Diploma/ GED	38 (22.89)	33 (20.63)	
Vocational or Associate's degree	17 (10.24)	21 (13.13)	
Some college (not graduated)	58 (34.94)	38 (23.75)	
Bachelor's degree	46 (27.71)	57 (35.63)	
Masters degree or higher	7 (4.22)	11 (6.88)	
Smoked cigarettes			0.75
Current	74 (44.58)	77 (48.13)	
Former	79 (47.59)	73 (45.63)	
Never	13 (7.83)	10 (6.25)	
Age first smoked (Mean, SD)	16.82 (15.13)	16.57 (3.20)	
Vaped nicotine			0.01
Current	101 (60.84)	89 (55.63)	
Former	62 (37.35)	56 (35.00)	
Never	3 (1.81)	15 (9.40)	
Age first vaped (Mean, SD)	19.85 (4.13)	21.40 (4.55)	
Dual use			0.40
Current	42 (26.25)	45 (27.11)	
Former	96 (60.00)	106 (63.86)	
Never	15 (9.04)	22 (13.75)	

Supplementary Files