



OPEN Discrete choice experiment to evaluate preferences for tailored social media messages for vaping initiation prevention among sexual and gender minority youth

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Sexual and gender minority (SGM) youth are at high risk for vaping, yet few interventions are tailored toward this population. To address this gap, we explored SGM youth's preferences for anti-vaping messages to inform the development of tailored anti-vaping campaigns. Participants were 245 SGM-identifying US youth, ages 13–18 years. Participants completed a discrete choice experiment that assessed which types of images were preferred by SGM youth for a social media anti-vaping campaign. Images varied on two attributes: SGM tailoring (none, low, high), and number of people in the image (1, 2, 3 + people). Choice-based conjoint analysis (hierarchical Bayesian estimation) was conducted utilizing Sawtooth Software. Tailoring had higher importance for image selection than number of people. Images with high SGM tailoring were most preferred, and images with no tailoring were least preferred. Most preferred images contained two people with high tailoring and 3 + people with no or low tailoring. The least preferred images included 3 + people and high tailoring. Tailoring anti-vaping messaging for SGM youth may increase the likelihood that youth will notice, engage with, and share the content with peers. These findings provide insight into components that may increase the efficacy of preventative anti-vaping social media campaigns for SGM youth.

Keywords Vaping prevention, Tailored health messaging, LGBTQ health, Adolescent health, Nicotine and tobacco, Social media intervention

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Tobacco use among youth is a significant public health issue in the US. Nicotine exposure during youth can impact brain development¹, cause significant health problems, and increase the likelihood of engaging in polytobacco use^{2–6}. In 2023, 10% of youth reported currently using a tobacco product, with rates increasing among middle school students over the past year (4.5% in 2022, 6.6% in 2023)⁷. E-cigarettes (i.e., vaping) remain the most popular tobacco product among youth for the tenth consecutive year, with nearly 8% of youth reporting they currently vape. Among youth who reported vaping, more than 1 in 4 vaped daily, and 1 in 3 vaped at least 20 of the last 30 days. Nearly 1 in 2 youth who have tried vaping reported current use;⁸ therefore, vaping prevention is particularly critical among this demographic group.

Youth identifying as sexual and/or gender minorities (SGM; individuals identifying as lesbian, gay, bisexual, transgender, gender-expansive, or queer)^{9,10} are at increased risk of ever vaping (OR = 1.55)^{11–18} compared to their cisgender and/or heterosexual peers and are at heightened risk of health consequences (e.g., nicotine addiction, lung injury, harm to brain development)^{19–21}. Prevention efforts that mitigate vaping initiation among SGM youth are imperative to address these health disparities.

Anti-vaping campaigns for SGM youth are lacking. Scoping reviews indicate that SGM-tailored intervention programs are primarily limited to smoking prevention and cessation among adult populations^{22,23}. SGM youth viewed existing anti-tobacco campaigns as ineffective and unrelatable and conveyed that SGM-specific anti-tobacco campaigns would be beneficial and relevant²⁴. SGM youth reported preferring SGM-specific tobacco interventions that are inclusive, relatable, empowering, and provide specific coping strategies²². There is a clear need to develop vaping prevention interventions tailored toward SGM youth.

Culturally tailored health communication interventions involve content directly relevant to the target population, including SGM-relevant imagery, symbols, and language to engage with the intended audience^{25,26}. Tailoring can increase the likelihood of target individuals engaging with health communication materials^{27,28}. SGM tailoring may include Pride imagery, identity-affirming language, and featuring diverse and representative individuals. Social media provides an accessible medium for delivering health promotion interventions to SGM youth,²⁹ and 96% of SGM youth use social media³⁰. Patterns of social media use have been found to differ between sexual minority youth and their heterosexual peers, as well as within subgroups of sexual minority youth³¹. SGM (vs. non-SGM) youth are more likely to seek health information and support through social media^{29,32}. Developing anti-vaping messages that are engaging and attention-grabbing for SGM youth is particularly important given the prevalence of competing content that occurs online and targets SGM youth^{33–35}.

Given the complexity in designing effective social media content for SGM youth, we needed a rigorous method to systematically evaluate different approaches for SGM representation and tailoring. We utilized a discrete choice experiment (DCE) because it allows us to understand how youth process images, similar to social media content in real life³⁶. DCEs allow for direct comparisons between multiple alternatives and indicate which combinations of attributes are most favorable when compared to other similar options. Inferences are made about participants' preferences based on which options are selected under different conditions. This approach is particularly relevant in the context of social media, given the high volume of competing posts that are presented in close succession. While SGM youth may find a certain image appealing when presented on its own, their preferences may change when that image is presented among other images with different levels of tailoring. The DCE methodology captures this nuance and provides more ecologically valid indications of participant preferences, compared to traditional survey methods.

DCEs are commonly used in marketing research, health economics, and social sciences to understand how individuals choose various alternatives³⁶. DCEs inform public health campaigns by identifying preferences within target populations, such as informing the tailoring of HPV vaccination campaigns for youth³⁷. DCEs have been used to reduce the appeal of cigarette packaging for adolescents,³⁸ explore youth preferences for ENDS devices,³⁹ and identify compelling anti-smoking message features to help adult smokers quit⁴⁰. While several applications of DCEs have been utilized to inform intervention and message tailoring to specific populations (e.g., youth, people who smoke), none have explored tailoring anti-vaping messages for SGM youth. The current study fills this gap by providing a novel application of the DCE approach, both in its focus on content—examining anti-vaping messages—and in its target population of SGM youth. The DCE will provide valuable insight regarding which levels of tailoring and the number of people in the image are preferred by SGM youth when directly compared to alternative attribute level combinations.

Study objectives

This study evaluates tailored images developed for a social media anti-vaping campaign for SGM youth, which is a critical step for intervention development. The proposed campaign was designed for Instagram, a social media platform with image-centered posts. Within the context of an anti-vaping campaign, we evaluated which combinations of two image attributes were preferred by SGM youth: (1) level of SGM tailoring and (2) number of people in the image. Identifying the appropriate levels of tailoring is important to ensure that youth perceive images favorably. Hinds and colleagues⁴¹ assessed the reactions of transgender and/or nonbinary (TNB) youth to targeted tobacco control messaging. Messages with a positive tone and explicit depictions of gender non-conformity and TNB inclusion were well-received. In contrast, overreliance on stereotypes was not perceived favorably in anti-tobacco campaigns. These findings emphasize the importance of appropriate tailoring for anti-tobacco campaigns to be well-received by youth. In addition to SGM-tailoring, varying the number of people in the image is important for identifying how to engage youth with the campaign the best. Media reflecting relationships that are valued by the target audience can facilitate greater engagement and acceptance of the messages being presented⁴². Adolescence is characterized by a heightened focus on building peer and romantic relationships alongside exploring and forming one's identity^{43,44}. Peer relationships are central during this developmental period, particularly in youth exploring their beliefs and values. Thus, portraying relationships in the context of anti-vaping messages may be important for facilitating engagement with posts. We included

images of individuals, pairs of individuals that may resemble couples, and groups of peers to accommodate individual differences in romantic relationships and friendships, ensure inclusiveness across gender and sexuality, and maximize resonance with the posts. Aligning the portrayal of peer relationships related to vaping with SGM youth’s views is crucial to enhancing campaign engagement.

Method

Participants and procedures

An online experiment was conducted from 11/2022 to 6/2023. Participants were recruited through paid social media advertisements on Instagram. Eligible participants were US youth ages 13–18 years who identified as SGM, had never vaped, and had not used tobacco products in 90 days. Parental consent was waived for 13–17-year-olds to reduce participation barriers (i.e., hesitation disclosing SGM identity, vaping status), which is a common practice for online youth research⁴⁵ Assent (13–17-year-olds) or consent (18-year-olds) forms were electronically completed. Informed consent was obtained from all subjects before they were able to proceed with study participation. Participants were compensated with a \$25 gift card.

Our final sample included 245 SGM youth, with similar distributions across gender identity and age. See Table 1. The University of Pennsylvania’s ethics review board approved the study protocol (IRB #849052). All methods were performed in accordance with the relevant guidelines and regulations.

Image tailoring

Images varied on two attributes: (1) level of SGM tailoring, and (2) number of people in the image. Each attribute had three levels - tailoring: (1) none, (2) low, (3) high, and the number of people: (1) 1 person, (2) 2 people, (3) 3 or more people. Attributes and levels were identified through a comprehensive literature review and expert consultation. Images were sourced from Canva and other image libraries and were presented in a format resembling Instagram-style posts. All images were of adolescents and young adults of varying races and ethnicities. All images contained one level of each attribute, resulting in 9 combinations (full factorial design), with four variations of each combination, for 36 unique images. We added the text: “Proud to be vape-free” to all images with uniform formatting. Images with no tailoring contained no SGM-related cues. Images with low tailoring contained depictions of SGM individuals, and images with high tailoring included SGM individuals and imagery associated with SGM identity (e.g., Pride flag). A youth advisory committee reviewed tailored images to ensure tailoring was perceived as intended by the target demographic group (i.e., SGM individuals in the images were perceived as SGM). See Supplementary Fig. 1 for examples of images in each combination of attributes and levels.

Measures

Discrete choice experiment

A DCE assessed tailoring preferences for anti-vaping social media messages among SGM youth. Choice sets consisted of images with varying attribute levels within each image and were coded with conditional relationships in Sawtooth® Software (version 9.14.2; Provo, UT). Images were randomly selected from this pool of 36 unique images for the DCE (see Fig. 1).

The DCE was disseminated online via Sawtooth Software. Participants completed 10 choice sets, each including three randomly selected images from the pool. Youths’ preferences within each choice set were assessed using four prompts: (1) “Which of these images do you like the most?” (2) “Which of these images like the least?” (3) “Which of these images are the most likely to catch your attention?” (4) “Which of these images will you be most likely to repost or share?” Participants were asked to complete all four prompts for each of the 10 choice sets presented and were instructed to view the images in the context of an anti-vaping campaign.

Analysis

The purpose of this analysis was to examine SGM youth’s preferences for level of tailoring and number of people in the image in the context of an anti-vaping campaign. Specifically, we aimed to assess SGM youth’s preferences within each attribute independently (main effects), and across all attribute level combinations (moderation). We utilized an exploratory approach. Main effect analyses explored: (1) whether SGM youth preferred high, low, or no tailoring (regardless of number of people in the image), and (2) whether SGM youth preferred one, two, or three or more people in the image (regardless of SGM tailoring level). Moderation analyses explored SGM youth’s preferences across every combination of tailoring and number of people.

Choice-based conjoint analysis (hierarchical Bayesian estimation via Sawtooth) assessed importance and utility scores for each attribute level. Hierarchical Bayesian (HB) estimation was selected because it can estimate individual-level choice behavior rather than relying on fixed coefficients, providing a more granular

	Gender		
	Cisgender	Transgender/gender-expansive	Total
Age			
13–15	46	55	101
16–18	62	82	144
Total	108	137	245

Table 1. Age and gender identity distribution among participants: USA, 2022–2023 (N = 245).

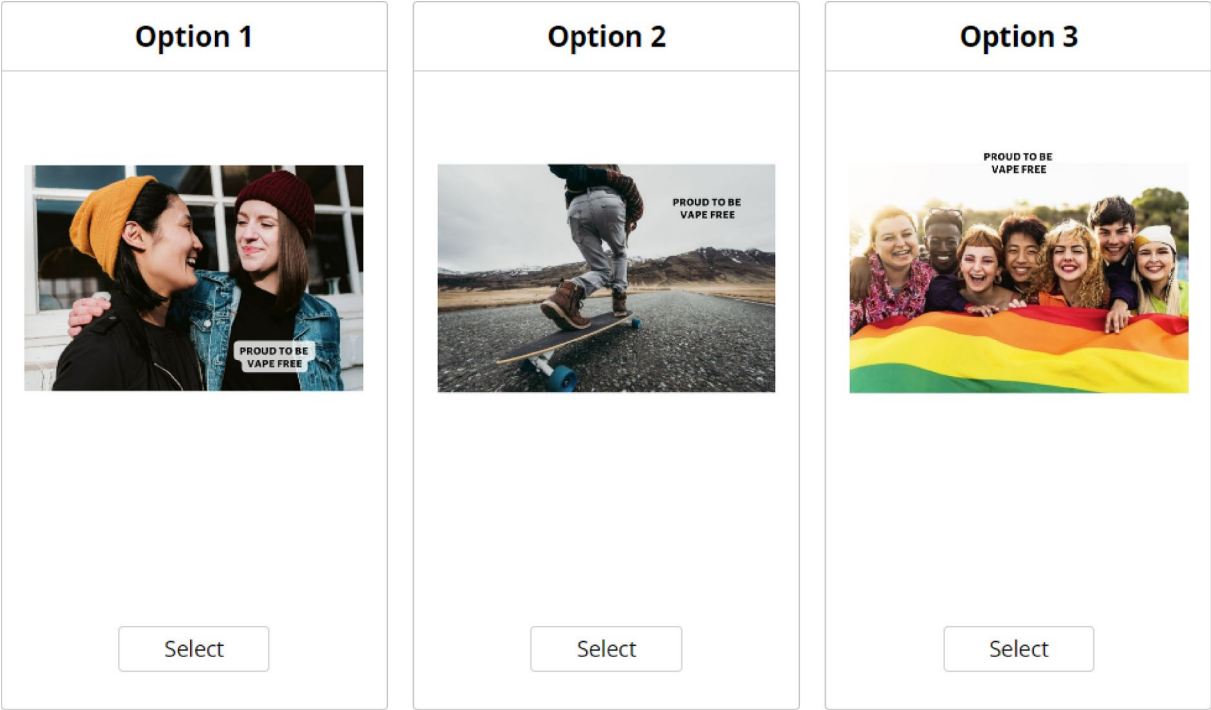


Fig. 1. Sample DCE choice set. Note: Option 1: Low tailoring, 2 people; Option 2: No tailoring, 1 person; Option 3: High tailoring, 3 + people. Note: Images were sourced from publicly available databases. The text “Proud to be vape free” was added to each of the images by the study team.

	Like the most		Like the least		Catch attention		Most likely to share	
	Importance	SD	Importance	SD	Importance	SD	Importance	SD
Tailoring	61.38	17.17	63.42	16.83	66.97	16.38	63.39	16.11
# of People	38.62	17.17	36.58	16.83	33.03	16.38	36.61	16.11

Table 2. DCE importance scores and standard deviations across all four prompts: USA, 2022–2023 (N=245). Importance scores are percentages that represent the proportional contribution of each attribute to the decision-making process. i.e., the percentage of variability accounted for by the attribute in participants’ choices.

understanding of personalized decision-making. HB estimation also uses random slopes for interactions, which allows the influence of moderators to vary across individuals rather than being constrained to a fixed effect. A power analysis^{46,47} was conducted, and indicated a minimum of 150 participants required for detecting effects. Our sample of 245 had sufficient power.

Importance scores represent the proportion of decision-making accounted for by each attribute, and higher importance scores indicate more influence relative to other attributes. Utility scores indicate the likelihood that images with an attribute level would be selected. Utility scores are zero-centered, with greater positive numbers representing greater likelihood of selecting an image with those characteristics, lower negative numbers representing greater likelihood of an image with those characteristics not being selected, and zero representing no preference for or against selection. We evaluated the main effects of each attribute on utility scores and moderation effects across attributes on utility scores.

Results
Importance scores

Importance scores were assessed for each prompt at the attribute level^{48–50} Findings were consistent across the four prompts and ranged from 61.38 to 66.97% for tailoring and 33.03 to 38.62% for number of people across prompts. See Table 2.

Utility scores
Main effects

We assessed the main effects of each attribute on each prompt. Findings were similar regarding the types of images that participants liked the most, were most likely to catch their attention, and were most likely to repost

or share. Participants preferred images with high SGM tailoring (like the most: 58.55, catch attention: 62.84, share: 57.64) and images with two people (like the most: 8.97, catch attention: 6.83, share: 8.93). Participants were least likely to select images with no tailoring (like the most: -56.17, catch attention: -63.44, share: -53.32) and one person (like the most: -13.78, catch attention: -11.01, share: -12.27). The same pattern was found for images liked the least, such that participants were most likely to select images with no tailoring (54.65) and one person (13.50) and least likely to select images with high tailoring (-53.94) and two people (-15.12). Images with low tailoring and images with three or more people had utility scores near 0, suggesting no strong preference toward or against images with these attribute levels. See Table 3; Fig. 2.

Moderation effects

We assessed moderation effects across each pair of attribute levels (Table 4). Among images liked the most, images with high SGM tailoring and two people (29.07) and images with no tailoring and three or more people (16.88) were most preferred. In comparison, images with high tailoring and three or more people (-30.97) and images with no tailoring and two people (-22.50) were least preferred.

When asked which images were liked the least, images with high tailoring and three or more people (24.88) and images with no tailoring and two people (12.66) were selected the most. In comparison, images with high tailoring and two people (-23.23) and images with no tailoring and three or more people (-15.54) were selected the least.

The images most likely to catch participants' attention were those with high tailoring and two people (21.67) and images with no tailoring and three or more people (17.39). The images least likely to catch youths' attention included high tailoring, three or more people (-23.01), and images with no tailoring and two people (-18.62).

Participants reported that they were most likely to repost or share images with high tailoring and two people (32.61), images with low tailoring and three or more people (15.81), and images with no tailoring and three or more people (14.46). Participants were least likely to select images with high tailoring and three or more people (-30.27) and images with no tailoring and two people (-20.17).

Discussion

Our analyses revealed practical insights for developing anti-vaping social media campaign messages to engage SGM youth. First, the levels of SGM tailoring and the number of people in the image affected which images participants preferred, with tailoring having higher overall importance for decision-making ($M = 63.82$) than the number of people ($M = 34.92$). These findings suggest that participants weighed tailoring twice as heavily when selecting an image relative to the number of people, regardless of prompt. SGM youth viewed images with high levels of SGM tailoring more favorably, with an increased likelihood of being liked, shared, and catching youth's attention while having a lower chance of being disliked than those with low or no SGM tailoring.

Second, including SGM imagery (e.g., rainbow branding) in only the high-tailoring images may have emphasized SGM inclusivity, making them more relatable and appealing to SGM youth. This suggests that images with more explicit SGM tailoring may be perceived as more engaging, relatable, and acceptable for SGM youth. Increased perceived relevance is associated with higher engagement;⁵¹ thus, preference for highly tailored images suggests that SGM tailoring was viewed favorably. Tailoring enhances information processing, recall, and intentions to engage in target behaviors.⁵² Including highly tailored SGM images in anti-vaping campaigns can boost engagement and efficacy⁵³ and improve vaping prevention among SGM youth.

Next, in relation to the number of people in the images, SGM youth preferred images with two people (vs. one, three, or more) across all four prompts (i.e., liked the most, likely to catch attention, likely to share with peers, and less likely to be least favored). Images with one person were the least preferred, and images with three or more people were only slightly preferred. SGM youth preferred images of pairs over individuals or groups in the context of an anti-vaping campaign. This may reflect an association between vaping and one-on-one interactions, as youth report trying vaping due to curiosity sparked by friends or family members who vape⁵⁴ Images of two people may feel more relatable, reflecting familiar social contexts.

Fourth, we noted that the number of people depicted moderated the relationship between the level of tailoring and image selection. Images with two people and high tailoring (i.e., TNB representation, rainbow flag branding) were the most preferred across all prompts. Youth may have interpreted these images as showing SGM individuals in a romantic relationship due to tailoring and body language (e.g., eye contact, physical

Tailoring	Like the most			Like the least			Most Likely to catch attention			Most likely to share		
	Utility	SD	95% CI	Utility	SD	95% CI	Utility	SD	95% CI	Utility	SD	95% CI
None	-56.17	30.48	-59.99, -52.35	54.65	36.20	50.12, 59.19	-63.44	30.49	-67.26, -59.62	-53.32	36.07	-57.84, -48.81
Low	-2.38	24.83	-5.49, 0.73	-0.72	29.32	-4.39, 2.96	0.62	27.91	-2.88, 4.12	-4.31	31.18	-8.22, -0.41
High	58.55	24.26	55.52, 61.59	-53.94	35.51	-58.39, -49.49	62.82	23.10	59.93, 65.71	57.64	28.45	54.07, 61.20
# of People												
1	-13.78	31.01	-17.66, -9.90	13.50	34.43	9.19, 17.81	-11.01	31.53	-14.96, -7.06	-12.27	31.32	-16.19, -8.35
2	8.97	32.79	4.86, 13.08	-15.12	28.65	-18.71, -11.53	6.83	28.55	3.25, 10.40	8.93	30.89	5.06, 12.79
3+	4.81	39.97	-0.20, 9.81	1.62	34.64	-2.72, 5.95	4.18	31.21	0.27, 8.09	3.34	37.08	-1.30, 7.99

Table 3. Utility scores, standard deviations, and 95% confidence intervals for DCE main effects across all four prompts: USA, 2022–2023 ($N = 245$). Bold indicates statistical significance, 95% CI does not include 0.

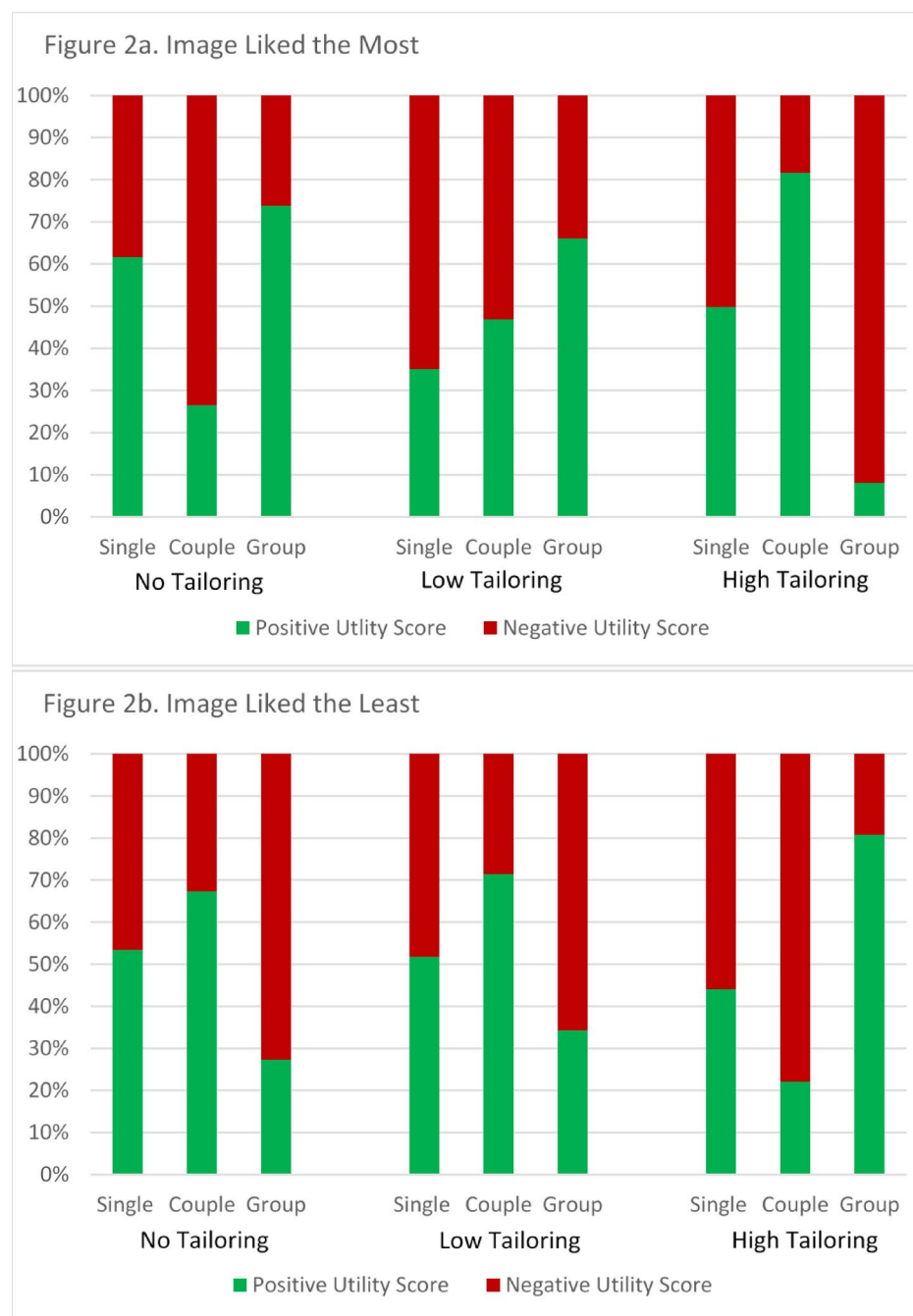


Fig. 2. Proportion of positive and negative individual-level utility scores for each DCE prompt: USA, 2022–2023 ($N=245$).

closeness). Adolescence is marked by a focus on peer and romantic relationships and identity exploration and development^{43,44}. Thus, images suggesting relationships, particularly with SGM representation, may resonate strongly with SGM youth.

Youth did not prefer images with two people and low tailoring, despite the primary difference between low and high tailoring being the absence of rainbow branding. All tailored images with two people featured same-gender pairs and body language, suggesting a close relationship. These findings indicate that youth preferred images depicting SGM couples through rainbow branding and relational body language.

Images with high tailoring and three or more people were the least preferred by youth across all prompts. Highly tailored, rainbow-themed group images may have been seen as insincere or performative allyship (i.e., rainbow-washing: utilizing LGBTQ+ symbolism and imagery without demonstrating genuine allyship or support toward the LGBTQ+ community).^{55,56} Preferences for images of groups with low or no tailoring further suggest youth avoided highly tailored group images.



Fig. 2. (continued)

Future directions

Our findings suggest that SGM youth prefer images that are tailored, and consequently relatable. More work is required to further unpack the contexts in which certain types of tailoring are preferred to maximize the effectiveness of anti-vaping interventions. SGM individuals strongly value authentic communication and representation, which is defined as messaging reflecting shared experiences^{57–60}. Future research should use qualitative methods to explore why SGM youth preferred the highly tailored images with two people but disliked those with high tailoring and groups. SGM individuals often react negatively to campaigns using LGBTQ+ stereotypes,^{41,61,62} which may explain why group images with rainbow branding were not preferred. In contrast, tailored images of two people may have felt more genuine, reflecting personal interactions tied to vaping and SGM identity. However, not all SGM youth may find depictions of romantic relationships most relatable. Preferred forms of tailoring across stratified subgroups must be examined to ensure content relevance and effectiveness within this population. Identifying tailoring and imagery that youth see as authentic, acceptable, and non-stereotypical is crucial for effective anti-vaping campaigns.

	Like the most			Like the least			Most likely to catch attention			Most likely to share		
	Utility	SD	95% CI	Utility	SD	95% CI	Utility	SD	95% CI	Utility	SD	95% CI
None x 1p	5.62	30.69	1.77, 7.24	2.88	36.27	-1.67, 7.42	1.22	41.11	-3.92, 6.37	5.70	44.10	0.18, 11.22
None x 2p	-22.50	58.11	-29.78, -15.23	12.66	34.02	8.40, 16.92	-18.62	57.20	-25.78, -11.45	-20.17	62.95	-28.05, -12.28
None x 3 + p	16.88	42.94	11.51, 22.26	-15.54	28.76	-19.14, -11.94	17.39	30.35	13.59, 21.19	14.46	37.64	9.75, 19.18
Low x 1p	-7.52	26.83	-10.88, -4.16	-1.23	19.96	-3.73, 1.27	-2.56	34.07	-6.82, 1.71	-3.36	32.03	-7.37, 0.65
Low x 2p	-6.57	40.91	-13.89, -2.82	10.57	24.18	7.54, 13.60	-3.06	35.73	-7.53, -1.41	-12.44	40.52	-17.52, -7.37
Low x 3 + p	14.09	35.08	9.69, 18.48	-9.34	22.23	-12.12, -6.56	5.62	22.27	2.83, 8.40	15.81	31.91	11.81, 19.80
High x 1p	1.90	29.25	-1.76, 5.56	-1.64	33.45	-5.83, 2.55	1.33	31.17	-2.57, 5.24	-2.34	34.63	-6.68, 2.00
High x 2p	29.07	40.64	23.98, 34.16	-23.23	36.95	-27.86, -18.61	21.67	44.21	16.14, 27.21	32.61	42.29	27.32, 37.91
High x 3 + p	-30.97	29.54	-34.67, -27.27	24.88	30.85	21.01, 28.74	-23.01	28.45	-26.57, -19.44	-30.27	29.55	-33.97, -26.57

Table 4. Utility scores, standard deviations, and 95% confidence intervals for DCE moderation effects across all four prompts: USA, 2022–2023 ($N = 245$). Bold indicates statistical significance, 95% CI does not include 0.

Limitations

Our study had limitations. Enrollment was self-selected, introducing potential selection bias.

Participants' preferences may differ from non-participants'. This sample included only SGM youth who have never vaped or used tobacco in the last 90 days, which limits generalizability. Youth with prior tobacco use may respond differently to vaping prevention campaigns.

We evaluated these images for an Instagram-based anti-vaping campaign. Other platforms, especially text- or video-focused ones, may not support these formats or resonate similarly with youth. This limits generalizability across social media.

Anti-vaping campaigns combine images and health communication text^{63–67}. This study focused on visual tailoring, using only the text "Proud to be vape free" across images. More extensive captions are warranted for the final version of the intervention, which was assessed separately (manuscript in preparation). While isolating images avoids confounding, interpretations may change with more detailed captions. Future research should examine how tailored images paired with different message types (e.g., gain vs. loss-framed, physical vs. social consequences) influence resonance with SGM youth.

Conclusion

Tailoring anti-vaping messaging for SGM youth may increase engagement and sharing with peers. This study used the DCE methodology to assess tailoring preferences for an anti-vaping social media campaign for SGM youth. SGM youth preferred highly tailored two-person images, likely seen as representative of SGM couples, while disliking highly tailored group images, possibly perceived as rainbow-washing. These findings provide insight into components that may increase the efficacy of preventative anti-vaping social media campaigns for SGM youth.

Data availability

Data will not be publicly shared to protect participant confidentiality. Participants are a vulnerable population—youth who identify as sexual and gender minorities. De-identified data may be available upon request to the corresponding author.

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Author contributions

All authors contributed to writing, reviewing, and editing the manuscript. RGS led methodology and study design. KP conducted the formal analysis and wrote the original manuscript draft. ASLT acquired funding. JP led project administration.

Declarations

Competing interests

The authors declare no competing interests.

Ethical approval

All authors have reviewed the manuscript and approved its submission, and none have potential conflicts of interest. The study was approved by the University of Florida Institutional Review Board (IRB-01) and the University of Pennsylvania Institutional Review Board.

Additional information

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