Content Characteristics Driving the Diffusion of Antismoking Messages: Implications for Cancer Prevention in the Emerging Public Communication Environment

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This study examined how content characteristics of antitobacco messages affect smokers' selective exposure to and social sharing of those messages. Results from an experiment revealed that content features predicting smokers' selection of antismoking messages are different from those predicting whether those messages are shared. Antismoking messages smokers tend to select are characterized by strong arguments (odds ratio = 2.02, $P = .02$) and positive sentiments (odds ratio = 3.08, $P = .03$). Once selected, the messages more likely to be retransmitted by smokers were those with novel arguments ($B = .83$, $P = .002$) and positive sentiments ($B = 1.65$, $P = .005$). This research adds to the literature about the content characteristics driving the social diffusion of antitobacco messages and contributes to our understanding of the role of persuasive messages about smoking cessation in the emerging public communication environment.

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Cigarette smoking remains the leading preventable cause of mortality in the United States and is a significant cancer risk factor. More than 90% of lung cancer is attributable to smoking tobacco, and tobacco use significantly increases the risk of developing all of the most commonly diagnosed forms of cancer (1). Thus, tobacco control efforts are critically important for cancer prevention. Tobacco control programs have historically relied heavily on traditional mass media to spread antitobacco messages (2–4). But Web 2.0 and the social media have resulted in rapid, profound changes in the media landscape (5–7). Implications for cancer prevention and tobacco control are just beginning to be understood.

Rapid diffusion of new information technologies has created unprecedented opportunities for exposure to and sharing of antitobacco-related messages (ie, messages designed to prevent or curtail tobacco use). As of 2012, 81% of adults in the United States use the Internet, and 59% said they looked online for health-related topics (5). Of online adults, 67% reported using social networking sites such as Facebook or Twitter (8). According to a recent survey (9), 53% of US adults get news forwarded to them via e-mail or social networking sites; 36% share news with their social networks via those platforms. In sum, the production and dissemination of health information in general, and of antismoking information in particular, is no longer in the hands of a few experts or major corporations; individuals now actively seek out, generate, and share information across their social networks (7,10).

For more than 2 decades, tobacco control researchers have examined how exposure to televised antitobacco advertising affects individuals' cigarette smoking attitudes and behaviors (2,11–14). Although television advertising remains a critical component of tobacco control campaigns, it is becoming increasingly important to measure and understand the impact of antitobacco-related

information across digital media platforms and the interactions across these platforms. To inform public health campaigns, we must identify message characteristics that make tobacco control information most likely to be consumed and shared with others across media platforms, thereby facilitating diffusion of such information (15–21). Examining message-level drivers of the selection–retransmission combination is also important because messages forwarded from close ties (eg, friends, family) are more likely to be perceived as persuasive and thereafter be disseminated by recipients (22,23).

This study examines how content characteristics affect smokers' decisions to select and/or share antismoking messages in a Web-based or in-person setting. We focus on 2 message features of information that previous research has suggested enhance the selection and retransmission of the information: *emotional valence* and *novelty*. We also explore how *persuasiveness* of antitobacco messages relates to selection and retransmission decisions.

Selection

Negativity Bias. Scholars have suggested that individuals are hardwired for negative information (24–27). Research has provided strong evidence that negatively valenced information (eg, news stories with a “conflict” frame) is more likely to be selectively viewed (28–32).

Novelty. Novelty dictates news value (33–35). Novel content attracts audience attention because it tends to make people “stop and think” or perceive it as a potential threat, by interrupting routine information processing or by deviating from existing schemata (34,36). Individuals are more likely to select information containing deviant content and pay attention to surprising news events (37–39).

Retransmission

Positivity bias. The decision to share information involves considerations such as interests of potential recipients, their feelings, peer recognition, peer reputation, and tie strength (40–43). This suggests that positively valenced materials will be shared more widely because they help build or maintain positive images of the sender. Berger and Milkman (44) found that positive news articles are more frequently retransmitted via e-mail than those with negative emotional valence. Studies of viral advertising also revealed that individuals are more likely to forward video advertisements with positive emotional tone than those with negative tones (45,46).

Novelty. Novel content also enjoys a retransmission advantage. People tend to talk about unusual or surprising events to make sense of them (47,48). Previous research has found that surprising or counterintuitive news articles are more frequently shared (44,49) and that folktales and jokes are spread more widely if they have a contrasting event that creates surprise (50).

Persuasiveness

In addition to selection and retransmission as components of the diffusion process, the role of persuasiveness of the materials selected and shared is crucial. If valuable information about health is selected and shared but the information has low probability of affecting healthy behavioral intentions, the diffusion processes are ineffective at best and deleterious at worst. Argument strength is a crucial factor in the persuasive effectiveness of antismoking messages (51–55). Thus, its role in selection and retransmission decisions is explored here.

Hypotheses

Based on the research literature, we expected 1) novel antismoking messages to be more likely to be selected and retransmitted than those of lesser novelty; 2) emotionally positive messages to be more likely to be retransmitted than those less positive; and 3) more emotionally negative messages to be selected than those less negative. Finally, 4) the persuasive strength of the messages is treated as a research question for both selection and retransmission.

Methods

Sample

US adult smokers (N = 300), aged 19–64 years (M = 43 years, SD = 13), were recruited from an online research panel hosted by Survey Sampling International. Eligible participants had smoked five or more cigarettes on a typical day in the previous 7 days and more than 100 cigarettes in their lifetime. Among the participants, 54% were women, 89.7% were white, and 59.3% were currently employed; moreover, 32.3% had completed high school or less, 36.7% some college or technical school, and 31% had a bachelor's degree or higher.

Stimuli

We used 33 antismoking messages as the stimuli (Appendix Table 1). The messages were verbal arguments extracted from 33 televised antismoking public service announcements from sources such as the Centers for Disease Control and Prevention. We derived

antismoking messages from full video versions using procedures developed in previous studies (54,55).

Design and Procedures

Our study was conducted online and had three components: 1) message evaluation, 2) message selection, and 3) message retransmission. Study participants first evaluated six antismoking messages for argument strength, novelty, and emotionality. For each participant, 6 of the 33 messages were randomly sampled, and evaluation order was also individually randomized. Each message was evaluated by 55 participants on average (range: 44–69). In the message selection session, participants were exposed to three messages presented in a single column, informed that the messages are summaries of health videos, and then asked to select one for further consumption. For each participant, the three messages were randomly sampled from the 27 messages not shown to the participant in the message evaluation session. Positions of messages were randomly assigned for each participant. Once participants chose a message, they were taken to the message retransmission session, wherein their chosen message was shown again, and participants were asked to indicate intention to retransmit the message.

Measures

Argument Strength. Argument strength and novelty of the 33 antismoking messages were evaluated by 300 participants using measures developed and validated by Zhao et al. (55). Participants indicated how much they agreed that the message they read is a reason for quitting smoking that (a) is *believable*, (b) is *convincing*, (c) is *important* to them, (d) put *thoughts* in their mind about *quitting smoking*, (e) put *thoughts* in their mind about *wanting to continue smoking*, (f) is one that they *agree* with overall, and (g) is a *strong* reason for quitting smoking. Response options ranged from “strongly disagree” (= 1) to “strongly agree” (= 5). Responses to the seven items were aggregated across participants by message. To generate a thought favorability index, we subtracted the unfavorable thoughts score (“e”) from the favorable thoughts score (“d”), divided the index by “2,” and added “3” to the resulting score ($[(d - e)/2] + 3$) so that the index was on the same five-point scale as the other items. Finally, we averaged all six items to obtain an argument strength score for each message ($\alpha = .98$, $M = 3.28$, $SD = 0.31$).

Argument Novelty. Participants rated argument novelty by indicating how much they agreed that the message they read is a reason for quitting smoking that is *new* to them, on the same response options as the argument strength items. Responses were aggregated across participants by message ($M = 2.95$, $SD = 0.21$).

Positive Emotions. Participants indicated how much they felt “proud” and “hopeful” while reading an antismoking message on a four-point scale ranging from “not at all” (= 1) to “very much” (= 4). Responses were aggregated across participants by message. We averaged the two items to form a positive-emotion score for each message ($\alpha = .81$, $M = 1.64$, $SD = 0.16$).

Negative Emotions. These (eg, “worried” and “angry”) were also measured, but we excluded them from analyses because of near-extreme multicollinearity. Inclusion of negative emotions, however, did not change our results. We found no significant effects of negative emotions on any dependent variable.

Message Selection. Each participant was exposed to three anti-smoking messages randomly drawn from the messages *not* rated in the message evaluation session. The three messages were introduced as “brief summaries taken from different health videos,” and participants were instructed as follows: “Based on the summaries, please click the button for the one you would be *most likely* to watch if you had to watch one.”

Message Retransmission Intention. Once participants selected a message, they were asked about their intention to share it by indicating how likely it is that, based on the summary alone, they would 1) share the summary through e-mail with others who would be interested, 2) share the summary through discussion with others, 3) check a box in a public forum saying “I like the video,” and 4) recommend the video to others. Response options ranged from “very unlikely” (= -3) to “very likely” (= +3). We created a scale of message retransmission intention by averaging the items ($\alpha = .92$, $M = .67$, $SD = 1.83$).

Covariates. In addition to demographics, we included several smoking-related cognitions and textual features of antismoking messages as covariates measured before the message selection and retransmission sessions. *Intention to quit smoking* was measured by asking participants to indicate how likely it is that they will quit smoking completely and permanently in the next 3 months on a four-point scale, ranging from “definitely will not” (= 1) to “definitely will” (= 4): $M = 2.33$, $SD = 0.81$. Participants also indicated on the same four-point scale how likely it was that they would *talk* to someone (friend, family member, or spouse) about quitting smoking in the next 3 months: *intention to talk about quitting* ($M = 2.75$, $SD = 0.98$). *Worry about health* was assessed by an item with response options ranging from “strongly disagree” (= 1) to “strongly agree” (= 5): “I seldom worry about my health.” Responses were reverse scored ($M = 2.83$, $SD = 1.05$). Using the same five-point scale, we measured *perceived harm of smoking* using the item: “My smoking will have few serious effects on my health.” Responses were reverse scored ($M = 2.94$, $SD = 0.94$).

We conducted a computerized content analysis using Linguistic Inquiry and Word Count (LIWC) software (56). The LIWC 2007 dictionary covered on average 89.2% of the words in the antismoking messages ($SD = 6.5\%$). The messages had, on average, 1.0 positive emotion word ($SD = 1.06$), 0.94 negative-emotion words ($SD = 0.86$), and 0.36 death-related words ($SD = 0.65$). Moreover, 32 out of 33 messages had one or no death-related words. Thus, we created a dichotomous variable indicating the presence of death-related words (30.3% present). Finally, we included the word count of the messages as a covariate ($M = 36.39$, $SD = 8.66$).

Statistical Analysis

We conducted a conditional logistic regression analysis (57) to examine how content features of antismoking messages (ie, summaries of health videos) relate to smokers’ selection of messages for further consumption (ie, watching the videos). The effects of individual difference variables (eg, intention to quit smoking) were examined by looking at their interaction with message characteristics (57,58).

An ordinary least-squares regression analysis was performed to test how content features affect message retransmission intention. Given our study design, participants are clustered by 33 messages, with the average number of participants per message being 9.1 (range: 4–18). Thus, we estimated robust standard errors using the Huber–White sandwich method.

Results

Message Selection

As shown in Table 1, we found that smokers are more likely to select antismoking messages with stronger arguments: odds ratio (OR) = 2.20 (95% confidence interval [CI]: 1.12 to 3.64), and those evoking more positive emotions, OR = 3.08 (95% CI: 1.12 to 8.50). The effect of novelty was not statistically significant. There were no appreciable interaction effects between individual characteristics (eg, intention to quit smoking) and the message features. The presence of death-related words was negatively associated with message selection, although the relationship was marginally significant.

Message Retransmission Intention

Our analysis revealed that both novelty and positivity are positively associated with smokers’ intention to share the messages: $B = 0.83$ (95% CI: 0.33 to 1.34) and $B = 1.65$ (95% CI: 0.54 to 2.76), respectively (Table 2). The effect of argument strength was not statistically significant.

The analysis also indicated that younger smokers are more willing to retransmit antismoking messages, $B = -0.02$ (95% CI: -0.03 to -0.001), and that intentions to both quit and talk about quitting smoking are positively associated with message retransmission intention: $B = 0.62$ (95% CI: 0.38 to 0.86) and $B = 0.68$ (95% CI: 0.50 to 0.86), respectively. Finally, we found a significant negative quadratic effect of the number of negative-emotion words: $B = -0.45$ (95% CI: -0.60 to -0.30). Smokers reported a stronger intention to retransmit a message when it contained one negative-emotion word, compared with messages having none. However, further use of negative-emotion words was associated with a decrease in retransmission intention (Figure 1).

Table 1. A conditional logistic regression model of the choice of antismoking messages*

	Message selection	
	OR (95% CI)	P
Argument strength	2.02 (1.12 to 3.64)	.02
Argument novelty	0.85 (0.39 to 1.86)	.69
Positive emotion	3.08 (1.12 to 8.50)	.03
Death-related words present	0.69 (0.46 to 1.06)	.09
No. of positive-emotion words	1.05 (0.91 to 1.22)	.50
No. of negative-emotion words	0.90 (0.74 to 1.09)	.28
Word count	1.00 (0.99 to 1.02)	.65
Presentation order = 2	1.14 (0.87 to 1.51)	.35
Presentation order = 3	0.91 (0.68 to 1.22)	.52
Likelihood ratio χ^2 (4)	23.92 ($P = .004$)	
N	885 (295 participants $\times$ 3 messages)	

* Missing data were handled with listwise deletion. All variance inflation factors were <1.83. OR = odds ratio; CI = confidence interval.

Table 2. An ordinary least-squares regression model of the intention to retransmit antismoking messages*

	Intention to retransmit	
	<i>B</i> (95% CI)	<i>P</i>
Argument strength	0.17 (−0.44 to 0.77)	.58
Argument novelty	0.83 (0.33 to 1.34)	.002
Positive emotion	1.65 (0.54 to 2.76)	.005
Women	−0.18 (−0.50 to 0.14)	.26
Age	−0.02 (−0.03 to −0.001)	.04
Nonwhite	0.49 (−0.10 to 1.08)	.10
Education, some college	−0.16 (−0.65 to 0.34)	.52
Education, college graduate or more	0.05 (−0.47 to 0.57)	.84
Currently employed	−0.23 (−0.64 to 0.17)	.26
Perceived harm of smoking	0.05 (−0.15 to 0.25)	.64
Worry about health	0.12 (−0.07 to 0.31)	.20
Intention to quit smoking	0.62 (0.38 to 0.86)	<.001
Intention to talk about quitting	0.68 (0.50 to 0.86)	<.001
Death-related words present	0.10 (−0.29 to 0.50)	.59
No. of positive-emotion words	−0.01 (−0.12 to 0.10)	.87
No. of negative-emotion words	0.32 (0.10 to 0.54)	.005
(No. of negative-emotion words) ²	−0.45 (−0.60 to −0.30)	<.001
Word count	−0.002 (−0.02 to 0.01)	.74
<i>R</i> ²	0.41	<.001
<i>N</i>	298	

* *B* = unstandardized ordinary least squares regression coefficients. Standard errors were adjusted for 33 messages clusters (the Huber–White sandwich estimator). The number of negative-emotion words was mean centered before entry into the equation. Missing data were handled with listwise deletion. All variance inflation factors were <2.15. CI = confidence interval.

Discussion

Understanding how information diffuses in the emerging public communication environment requires understanding both message

selection and retransmission through word of mouth and mouse. The study described here contributes to the knowledge base by identifying message features that promote smokers' selection and retransmission of antitobacco-related messages.

The reader should consider the selection and retransmission findings together because one cannot retransmit what is not first selected. Stronger arguments are selected even though there is evidence that—among those selected—the stronger are no more likely to be shared. This latter null effect may be the result of a restricted range of argument strength among messages selected. Because those selected tend toward the persuasive, the selection–retransmission combination is primed by the selection of stronger antismoking arguments, which would be effective in helping smokers quit (54,55). There is no comparable finding in the literature to our knowledge.

The findings on positive emotion and novelty are somewhat surprising, given the previous literature. Sharing is enhanced when the message is more novel, but novelty did not predict selection. Perhaps claims about smoking are so well known that there is simply too little variation to predict initial selection. Positive emotion is associated with both message selection and retransmission.

Death-related words in the message appear to be discouraging because smokers are less likely to select such messages and too many negative-emotion words will undermine retransmission. Finally, smokers with some intention to quit are more likely to share antismoking messages than are those with little or no intention. This may help to build some social normative pressure to keep potential quitters on track because they make a more public statement by sharing smoking cessation information.

Because selection is a necessary condition for retransmission, our data suggest making strong arguments with emotionally positive tones. Among those selected initially, the more novel and positive,

Figure 1. The effect of the number of negative-emotion words on intention to retransmit antismoking messages. Values in y-axis are retransmission intention scores that are adjusted for other predictors in the ordinary least-squares regression model. The solid line represents a quadratic fit to the data, and the dashed lines indicate 95% confidence intervals.

with moderate number of negative-emotion words, will be more likely to be retransmitted by those with some intention to quit.

Our findings should be interpreted with the following limitations. The messages examined in this study are brief textual arguments extracted from televised antismoking public service announcements, and the content characteristics we tested are not exhaustive of all potential features of those public service announcements influencing the selection and retransmission behaviors, such as efficacy information (15,21,59) and psychophysiological arousing audio/visual features (44,60,61). In addition, this study was an analog study, where selection was realistic (but forced) but retransmission was hypothetical using a self-reported measure of behavioral intention. Future research should include an examination of a wider variety of message features and the conditions associated with actual selection and transmission.

Nonetheless, this study represents a step toward understanding how persuasive information to promote smoking cessation diffuses in the emerging public communication environment. The notion of passive message exposure is no longer an accurate model for how individuals interact with smoking-related or cancer prevention information. Even the act of exposure is increasingly in the hands of individuals, who actively seek out, filter, remix, and share information they find relevant to themselves and their social networks. This research has important implications for cancer prevention and control because it helps us begin to conceptualize ways to leverage online media and social networks to improve public health communication strategies for encouraging smoking cessation.

Appendix

Table 1. Examples of Antismoking Messages

Antismoking messages
Death may be the price you pay when you smoke to “keep the weight off.” Such excuses could be inscribed on gravestones in dreary graveyards—right where smoking leads you.
When you die of lung cancer from smoking, you leave behind loved ones who struggled watching you suffer. Your habit can leave them to face a future without you.
Smoking leads to wrinkles, leathery skin, yellow, tar-stained teeth, and a hairy upper lip. You would never go to the salon and ask to be made over as a smoker, so why smoke?
Smoking is stupid, and no one can think of any evidence to support a smoking habit. When you ask people to think of a reason why smoking isn’t stupid, they just look confused.
Fighting the urge to smoke after quitting is like fighting a former version of you. When you quit, you have to leave behind the smoker identity. You have the power to fight cigarette cravings.
Smokers keep a strict schedule; watching the minutes tick by until their next cigarette. Tobacco marketers spend big bucks to keep smokers on their schedule.
Tobacco executives place advertisements at children’s eye level to hook kids early. Even if the executives won’t admit it, their goal is to get children addicted for life.
The tobacco industry targets vulnerable groups, including children, to sell their products. New strategies for achieving this goal are praised. Quit smoking and undo this trend.
Tobacco companies deny that cigarettes contain 40 different poisons that cause cancer, but it’s true. Use your body to walk away from secondhand smoke.

(Table continued)

Table 1 (Continued).

Antismoking messages
For some people, quitting smoking is hard and for others, it’s easy. No matter what your experience, quitting is an accomplishment. You can join a group of proud quitters today.
If you’re trying to quit picking your nose, you might be able to occupy your hands with a hobby like baking. But unlike other bad habits, smoking is an addiction that you may need help to quit.
When you’re trying to quit smoking, temptations loom. It may be difficult to refrain from picking a lit cigarette up off the ground. We know it’s hard to quit.

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