Perceived effectiveness of objective features of pictorial warning messages

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ABSTRACT

Background Previous research shows that pictorial warning messages (PWMs) for tobacco cigarettes increase quit attempts and smoking-related knowledge. However, few studies have investigated what specific features within PWMs are most effective. The current study sought to examine the specific features of PWMs associated with effectiveness using four outcome measures as indicators.

Method A sample of n=319 PWMs was collected and underwent systematic content analysis on 48 different content features. A sample of n=1392 current smokers each rated a subset of the labels on perceived effectiveness, negative emotional engagement, intentions to enact avoidance behaviours and intentions to forego a cigarette. Multilevel random-effects models were fitted with all coded content features and each of the outcome measures.

Results Analysis across all four outcome measures shows that PWMs depicting diseased and damaged body parts and employing a testimonial format were most effective. Additional mediation analysis showed that image-level negative emotionality partially mediated the relationship between PWM features and perceived effectiveness.

Conclusion The effectiveness of graphic imagery, testimonials and images that elicit negative emotions provides guidance for researchers as well as for future implementation of more effective PWMs.

BACKGROUND

Pictorial warning messages (PWMs) for tobacco cigarettes have proven to be an effective method for decreasing smoking prevalence. Population-level surveys, small-scale experimental studies and randomised control trials show that the implementation of PWMs on cigarette packs is associated with greater quit attempts and smoking-related knowledge compared with text-only warning messages.[i] [1–4] However, little research has been conducted on the objective visual and thematic features within PWMs that contribute to or undermine their effects on smoking-related outcomes. The current study moves beyond the demonstrated superiority of PWMs over textual messages and aims to systematically examine specific features and provide evidence-based design principles for PWMs.

The individual small sets of PWMs implemented in campaigns and on cigarette packs use a variety of appeals, arguments and visual representations. Large population-level analyses and experimental comparisons to text-only messages are not able to provide information about the effects of specific features within the message. Systematic investigation of the content features of a large set of PWMs is necessary to determine what types of images are most effective. Through content analysis of a relatively large set of PWMs, this study first investigates the presence and prevalence of a wide variety of features. Then, the persuasiveness of these features is evaluated using four outcome measures with a sample of current adult smokers. Previous research has examined the effects of PWMs on many outcome measures of interest throughout the route of persuasion from attention and recall to message engagement and acceptance.[1] Overall, these studies tend to find an increase in persuasive effect with the presence of PWMs.

Prior research provides a starting point for the categories of features that may be predictive of the overall persuasive effects of PWMs. The first set of objective features focuses on the design and aesthetic elements of PWMs. The location and presentation of text and the use of bright colours has been associated with attention and awareness.[5 6] Furthermore, different colours on cigarette packs have been associated with inferences about health risk, taste and enjoyment.[7]

A variety of concrete objective features may also increase persuasive effects. Previous research finds that the presence of graphic depictions of disease and other negative imagery such as dead bodies often increases emotional engagement and intentions to quit.[8–10] One study found that messages with more graphic depictions of the oral health consequences of smoking increased evoked fear and intentions to quit smoking.[9] Another study using the nine PWMs for cigarette packs proposed by the US Food and Drug Administration (FDA) found that portrayals of diseased body parts were the most likely to discourage smoking compared with depictions of suffering or children and babies.[11]

In addition to the negative emotional responses elicited by the features mentioned, other features and combinations of features within a message may contribute to strong negative emotional responses. Furthermore, the elicitation of these emotions increases smoking-related knowledge and cessation attempts.[12 13] While emotional responses are often considered an effect of a message, properties

[i]While a large number of studies find that the presence of PWMs positively effects smoking related attitudes and behaviours. Some studies have failed to find a significant relationship between labels and outcomes of interest. [34] Nevertheless, the large body of research relying on both experimental and longitudinal designs provides a high level of confidence in the importance of PWMs.

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of a message may make it more likely to engage the audience emotionally on average. This conceptualisation of the emotional depictions has been used in the study of fear appeals.[14] The current study will analyse the mediating role of negative emotionality of a message in the relationship between objective features and measures of effectiveness by creating an aggregate PWM emotionality rating from individual message evaluations.[15] This mediation analysis may provide insight into the set of features that compose negative emotional messages.

Other concrete features may also impact outcomes of interest. Previous research on antitobacco messaging has found that the presence of smoking cues may, under some conditions, distract current and former smokers undermining perceived message effectiveness.[16–18] These cues include the depictions of cigarettes, smoking behaviour or smoke. Additionally, the presence of human characters (and their demographic features) may increase identification and emotional engagement.[19 20]

A third group of features is the type of argument used. Previous research has found that testimonial messages that tell the personal stories of individuals increase negative emotional reactions and intentions to forego smoking a cigarette.[19] Such messages allow for identification with an individual and transportation into a brief narrative decreasing the chances of counter arguing.[20 21] However, another study by Thrasher and colleagues found that more didactic statements (eg, 'smoking causes lung cancer') were perceived as more effective than testimonials.[22] Each of these studies used five or fewer images per condition. The discrepant findings may be rectified with the use of a larger stimulus set. At a minimum, the underlying principles for PWMs that effect smoking-related outcomes will be based on a wider set of cases.

Another type of argument often used in risk messages is metaphors. Some researchers describe metaphors as a 'linguistic puzzle'[23] that provides a unique way for individuals to understand and organise information. For example, a PWM portraying a plume of cigarette smoke as a gun metaphorically conveys the deadly consequences of smoking. This type of argument requires more message-consistent thinking about the message's core claims which may increase perceived message effectiveness.

Just as it is necessary to examine a variety features across a large set of PWMs, it will also be useful to employ multiple outcome measures so that the pattern of results can be used as an indicator of actual effects on attitude and behaviour change (while being careful not to capitalise on chance). Previous literature has found that emotional engagement, perceived effectiveness and avoidance behaviours are all predictive of later quit attempts.[8 24 25] While each measure may not individually be a sufficiently strong predictor, they may jointly provide greater confidence in the significance of certain features.

METHOD

Stimuli

All PWMs implemented on cigarette packs in Australia, Canada, New Zealand and the UK as of May 2016 were collected (n=103). The set of nine PWMs proposed for cigarette packs in the USA by the FDA were also included. In order to understand the full range of print-form antitobacco messages that have similar goals as cigarette pack labels, and to increase variance in the stimulus set,[26] an extensive search of online databases such as Trinkets and Trash (http://trinketsandtrash.org) and Tobacco Free CA (http://tobaccofreeca.com) was performed to collect pictorial ads from local and national campaigns in English that were not specifically targeting youth (n=187). A set of antismoking messages produced by tobacco companies was also included (n=15). Finally, the sample includes five testimonial PWMs used in an experimental study by Brennan and colleagues.[19]

Content analysis

Each PWM underwent systematic content analysis on 48 objective features within three categories: (1) design and aesthetic elements, (2) concrete features (3) and argument type based on a review of literature on antismoking-related messages and persuasion. The full codebook with coder instructions and all features is available as a supplementary file online. Coding of the objective features was conducted by three independent coders who reached sufficient levels of reliability, average Krippendorff's α=0.85. Table 1 provides a summary of the features by category and source.

Participants

After approval from the authors' institutional review board, a sample of n=1392 current smokers were recruited through Survey Sampling International (SSI). Participants must have smoked at least 100 cigarettes in their lifetime, currently smoke every day or some days[27] and been >18 years. Additionally, participants could not have participated in more than two online surveys about cigarette smoking or other tobacco products in the last three months. Any participant who took longer than 120 min to take the survey (> 2 SD from the mean duration) was removed from the data set, resulting in a final sample of n=1378.

The average age of participants was M=43.78 (SD=12.55). Over half of the sample had a high school diploma or less (58.1%, n=783). 57.6% (n=779) of the sample was female. Less than half the sample reported annual income >$50 000 (45.07%, n=621). The sample matches US national smoking rates by age and education level.[27] Table 2 provides more information on participant characteristics.

Study design

After successfully completing the eligibility screening and answering questions on demographic factors, participants took part in an experimental survey. Participants were shown six PWMs randomly selected from the corpus of 319. Participants were not allowed to move forward until the image had been on their screen for at least 8 s. After each image, participants answered items on each of the four outcome measures in response to the image they just saw. With each participant viewing a random six PWMs, the data set included n=8268 individual ratings. The mean number of ratings per PWM was M=25.41 (SD=4.78). A rating that was incorrectly recorded was dropped from the data set. Any single rating that took >120 s (>2 SD from the mean duration) was also removed from the data set (n=161), leaving all other responses from those participants.

Measures

Perceived effectiveness

Eight items were used to measure perceived effectiveness on a five-point Likert scale (1=strongly disagree; 5=strongly agree). Participants were asked if the image (1) 'put thoughts into my mind about quitting smoking', (2) 'put thoughts into my mind about wanting to continue smoking', (3) 'is convincing', (4) 'motivated me to try to quit smoking', (5) 'made me stop and think', (6) 'told me something new', (7) 'made me feel concerned about my smoking' and (8) 'is relevant to my everyday life'.[15 19] Similar to the analysis performed by Bigsby and colleagues,[15] the two items about (1) thoughts about quitting smoking and

Table 1 Pictorial warning message sample characteristics

	Cigarette pack (n=112)	Other ads (n=187)	Brennan and colleagues[14] (n=5)	Tobacco co. ads (n=15)	Total
Design and aesthetic elements					
	M (SD)				M (SD)
Word count	21.69 (15.63)	19.59 (18.08)	69.40 (5.59)	79.00 (36.14)	23.90 (22.86)
	n (%)				n (%)
Bright colour image	26 (23%)	8 (20%)	0 (0%)	3 (20%)	67 (21%)
Bright background colour	22 (19%)	30 (16%)	0 (0%)	5 (33%)	57 (17.9%)
Bright colour text	17 (15%)	20 (11%)	0 (0%)	6 (40%)	43 (13.5%)
Text along the bottom	13 (12%)	55 (29%)	0 (0%)	3 (20%)	71 (22.3%)
Composition of images	5 (4%)	24 (13%)	0 (0%)	2 (13%)	31 (9.7%)
Photo	109 (97%)	152 (81%)	5 (100%)	15 (100%)	281 (88.1%)
Digitally edited photo	3 (3%)	42 (22%)	0 (0%)	0 (0%)	45 (14.1%)
Concrete features					
Diseased or damaged body parts	40 (36%)	5 (3%)	0 (0%)	0 (0%)	45 (14.1%)
Dead body	7 (6%)	7 (4%)	0 (0%)	0 (0%)	14 (4.4%)
Medical equipment	28 (25%)	10 (5%)	3 (60%)	0 (0%)	41 (12.3%)
Frowning face	17 (15%)	25 (13%)	5 (100%)	2 (13%)	44 (13.8%)
Smoking behaviour or cigarettes	23 (21%)	100 (53%)	1 (20%)	0 (0%)	124 (39%)
Children or babies	18 (16%)	19 (10%)	0 (0%)	10 (67%)	47 (15%)
Female character	15 (14%)	40 (21%)	3 (60%)	7 (47%)	65 (20%)
Male character	17 (15%)	55 (29%)	2 (40%)	1 (7%)	75 (24%)
White character	35 (31%)	72 (39%)	4 (80%)	8 (53%)	119 (37%)
Interacting or moving characters	11 (10%)	43 (23%)	1 (20%)	5 (33%)	60 (19%)
Animal	0 (0%)	8 (4%)	0 (0%)	0 (0%)	8 (2.5%)
Argument type					
Explicit statement	106 (95%)	51 (27%)	0 (0%)	14 (93%)	171 (54%)
Metaphor	0 (0%)	56 (30%)	0 (0%)	0 (0%)	56 (18%)
Testimonial	6 (5%)	34 (18%)	5 (100%)	1 (7%)	46 (14%)
Other argument type	0 (0%)	46 (25%)	0 (0%)	0 (0%)	46 (14%)

(2) thoughts about wanting to continue smoking were rescaled by subtracting the two from each other, dividing by two, and then adding three to fit a five-point scale. A seven-item scale was created with these items, Cronbach's α=0.92 (M=3.31; SD=1.06). The scale provides an efficient and valid measure of overall message effectiveness.[15 28]

Table 2 Participant characteristics

	M (SD)
Age	43.78 (12.55)
Quit attempts	2.04 (6.37)
	% (n)
Female	57.6% (779)
One or more children	46.1% (624)
Education	
Less than high school	6.6% (87)
High school diploma	51.5% (696)
Some college	15.8% (213)
College degree or more	26.1% (353)
Race/ethnicity	
Hispanic	8.5% (115)
White	86.8% (1171)
Black	8.2% (111)
Other	5% (68)

Negative emotional engagement

Participants were asked the extent to which the image they saw made them feel each of nine emotions: worried, guilty, disgusted, sad, regretful, anxious, uncomfortable, scared and angry on a Likert scale (1=strongly disagree; 5=strongly agree).[8] When scaled together, there was high internal reliability, Cronbach's α=0.96 (M=3.09, SD=0.36).

Avoidance behaviours and foregoing

To measure whether the PWMs affected intentions to carry out avoidance behaviours, participants were asked if they would perform four possible behaviours if the PWM they just saw appeared on a usual cigarette pack: (1) 'hold back from smoking a cigarette when I was about to smoke one', (2) 'cover it up', (3) 'keep the pack out of sight' and (4) 'transfer the cigarettes to a different container'.[24] Participants rated each item on a Likert scale (strongly disagree=1; strongly agree=5). Similar to previous studies,[8 24] the first item was used to assess cigarette foregoing, and the last three were averaged together to create an avoidance behaviours scale, Cronbach's α=0.93 (M=2.75, SD=1.24).

Analysis

Results from the content analysis were added to the participant evaluations data set so that content features were available for each exposure. To examine the effects of the image features while accounting for individual-level variation, four multilevel

random intercepts models were used (one for each outcome measure). All features from the content analysis (shown in table 1) were entered into the model as fixed effects. All features were entered as dichotomous variables representing the presence or absence of the feature except for argument type and text location which were entered as categorical variables with testimonial and multiple locations as the respective reference categories. Image and participant identification numbers were used as random-effect variables in order to adjust for multiple evaluations from the same participant and multiple evaluations of the same image. To control for ordering effects (differences in effects due merely to the order that images appeared), five dummy variables representing the exposure order were entered as fixed effects. Additionally, a categorical variable controlling for image source with cigarette pack as the reference category was used. Individual-level covariates (eg, demographics, stage of change, etc) were excluded because such covariates would not confound the relationships between image features and outcomes due to randomisation of participants to PWMs.

The ability of a PWM to engage the population emotionally (ie, negative emotionality) can be captured by aggregating individual emotional responses across the sample.[29 30] The negative emotionality variable was created by taking the average negative emotional engagement score received by each PWM (across viewers) resulting in 319 unique scores (one for each PWM). This score was used in a mediation analysis to determine the extent to which negative emotionality explained the relationship between objective features and each of the individual-level outcome measures (perceived effectiveness, avoidance behaviours and intentions to forego). SEs were adjusted for clustering around participants.

RESULTS

Detailed results from the multilevel models are available in table 3A,B. Only results statistically significant at an alpha level of 0.05 are discussed below. The Holm-Bonferroni alpha level adjusted for multiplicity is 0.001. Results show a positive association between the presence of graphic depictions of diseased

Table 3 Results from multilevel random-effects models for outcome measures

(A)

	Perceived effectiveness			Negative emotional engagement		
	b (SE)	P values	95% CI	b (SE)	P values	95% CI
Text alongside (vs multiple locations)				−0.09 (0.04)	0.020	−0.16 to −0.01
Text along top (vs multiple locations)	−0.17 (0.05)	<0.001	−0.27 to −0.08	−0.11 (0.05)	0.042	−0.21 to −0.004
Composition of images	0.10 (0.04)	0.022	0.01 to 0.19			
Digitally edited photo						
Frowning face	0.11 (0.04)	0.010	0.03 to 0.12	0.12 (0.04)	0.007	0.03 to 0.20
Diseased and damaged body parts	0.17 (0.04)	<0.001	0.09 to 0.26	0.24 (0.04)	<0.001	0.15 to 0.32
Dead body	0.17 (0.06)	0.005	0.05 to 0.29	0.20 (0.06)	0.001	0.08 to 0.33
Medical equipment	0.12 (0.04)	0.003	0.04 to 0.21	0.14 (0.04)	0.001	0.06 to 0.23
Black/African-American character	0.10 (0.05)	0.045	0.002 to 0. 20			
Animal						
Explicit statement (vs testimonial)	−0.20 (0.05)	<0.001	−0.31 to −0.10	−0.19 (0.06)	0.001	−0.30 to −0.08
Metaphor (vs testimonial)	−0.28 (0.06)	<0.001	−0.40 to −0.16	−0.25 (0.06)	<0.001	−0.37 to −0.13
Other argument type (vs testimonial)	−0.30 (0.05)	<0.001	−0.41 to −0.20	−0.26 (0.06)	<0.001	−0.37 to −0.15
Other ad (vs cigarette pack)	−0.25 (0.04)	<0.001	−0.33 to −0.17	−0.23 (0.04)	<0.001	−0.31 to −0.14
Tobacco co. ad (vs cigarette pack)	−0.21 (0.08)	0.007	−0.36 to −0.06	−0.30 (0.08)	<0.001	−0.46 to −0.14

(B)

	Avoidance			Foregoing		
	b (SE)	P values	95% CI	b (SE)	P values	95% CI
Text alongside (vs multiple locations)	−0.08 (0.03)	0.015	−0.14 to −0.02	−0.08 (0.04)	0.025	−0.15 to −0.01
Text along top (vs multiple locations)				−0.10 (0.05)	0.042	−0.20 to −0.004
Composition of images						
Digitally edited photo	0.08 (0.04)	0.036	0.005 to 0. 15			
Frowning face						
Diseased and damaged body parts	0.18 (0.04)	<0.001	0.10 to 0.25	0.15 (0.04)	<0.001	0.07 to 0.24
Dead body						
Medical equipment				0.10 (0.04)	0.024	0.01 to 0.18
Black/African-American character						
Animal	0.15 (0.07)	0.035	0.01 to 0.29			
Explicit statement (vs testimonial)	−0.14 (0.05)	0.002	−0.23 to −0.05	−0.22 (0.05)	<0.001	−0.32 to −0.11
Metaphor (vs testimonial)	−0.17 (0.05)	0.002	−0.27 to −0.06	0.29 (0.06)	<0.001	−0.41 to −0.16
Other argument type (vs testimonial)	−0.18 (0.05)	<0.001	−0.28 to −0.09	−0.30 (0.05)	<0.001	−0.41 to −0.19
Other ad (vs cigarette pack)	−0.14 (0.04)	<0.001	−0.21 to −0.07	−0.20 (0.04)	<0.001	−0.28 to −0.12
Tobacco co. ad (vs cigarette pack)	−0.20 (0.07)	0.004	−0.34 to −0.07	−0.26 (0.08)	0.001	−0.41 to −0.10

All predictors significant at the p<0.05 level are shown. The Holm-Bonferroni adjusted alpha level is 0.001.

or damaged body parts and perceived effectiveness (b=0.17, p<0.001, 95% CI 0.09 to 0.26), negative emotional engagement (b=0.24, p<0.001, 95% CI 0.15 to 0.32), intentions for avoidance behaviours (b=0.18, p<0.001, 95% CI 0.10 to 0.25) and foregoing (b=0.15, p<0.001, 95% CI 0.07 to 0.24). PWMs depicting frowning faces increased perceived effectiveness (b=0.11, p=0.010, 95% CI 0.03 to 0.12) and negative emotional engagement (b=0.12, p=0.007, 95% CI 0.03 to 0.20). PWMs portraying dead bodies also resulted in greater perceived effectiveness (b=0.17, p=0.005, 95% CI 0.05 to 0.29) and negative emotional engagement (b=0.20, p=0.001, 95% CI 0.08 to 0.33). The presence of medical equipment also increased perceived effectiveness (b=0.12, p=0.003, 95% CI 0.04 to 0.21), negative emotional engagement (b=0.14, p=0.001, 95% CI 0.06 to 0.23) and intentions to forego (b=0.10, p=0.024, 95% CI 0.01 to 0.18).

When comparing testimonials to the other types of arguments (explicit statements, metaphors, etc), testimonials resulted in greater effectiveness across all four outcome measures. Compared with testimonials, explicit statements were rated as lower on perceived effectiveness (b=−0.20, p<0.001, 95% CI −0.31 to −0.10). Explicit statements also decreased negative emotional engagement (b=−0.19, p<0.001, 95% CI −0.30 to −0.08), intentions for avoidance behaviours (b=−0.14, p=0.002, 95% CI −0.23 to −0.05) and foregoing (b=−0.22, p<0.001, 95% CI −0.32 to −0.11) compared with testimonials.

For features in the category of design elements, PWMs with text along the top compared with text in multiple locations decreased perceived effectiveness (b=−0.17, p<0.001, 95% CI −0.27 to −0.08), negative emotional engagement (b=−0.11, p=042, 95% CI −0.21 to −0.004) and intentions to forego (b=−0.10, p=0.042, 95% CI −0.20 to −0.004). Additionally, PWMs with text along the side were associated with decreased negative emotional engagement (b=−0.09, p=0.020, 95% CI −0.16 to −0.01), intentions for avoidance behaviours (b=−0.08, p=0.015, 95% CI −0.14 to −0.02) and foregoing (b=−0.08, p=0.025, 95% CI −0.15 to −0.01) compared with text in multiple locations. Digitally edited photos increased intentions for avoidance behaviours (b=0.08, p=0.036, 95% CI 0.005 to 0.15). This feature includes photos that have been edited in obvious ways to make depictions surreal or portray things that would exist in the real world. Finally, PWMs composed of multiple images (compared with a single image) increased perceived effectiveness (b=0.10, p=0.022, 95% CI 0.01 to 0.19). No other features in this category were statistically significant for any of the outcome measure at an alpha level of 0.05.

Additionally, PWMs with Black or African-American characters increased perceived effectiveness (b=0.10, p=0.045, 95% CI 0.002 to 0.20). The portrayal of animals resulted in higher intentions to avoid (b=0.15, p=0.035, 95% CI 0.01 to 0.29). No other features in this category were statistically significant for any of the outcome measure at an alpha level of 0.05.

Finally, the mediation analysis with the negative emotionality of the image mediating the relationship between the objective features and the individual-level outcome measures revealed a significant positive direct effect of image-level negative emotionality on avoidance (b=0.51, p<0.001, 95% CI 0.44 to 0.59), foregoing (b=0.82, p<0.001, 95% CI 0.75 to 0.88]) and perceived effectiveness (b=0.78, p<0.001, 95% CI 0.73 to 0.84). In each of the models, the presence of graphic depictions of disease, testimonial arguments and photos had a significant indirect effect through negative emotionality. Figure 1 shows the statistically significant direct and indirect paths for each of the three models.

DISCUSSION

The current study investigated a large set of features that appear in PWMs on tobacco cigarettes packs and advertising across English-speaking countries and the effects of these features on four outcome measures of interest. This study used one of the largest samples of PWMs to study objective features to date. By having multiple instances of each feature within a large stimulus set, these results allow for inferences about specific features that are more generalisable than studies using small sets of stimuli. Additionally, this design reduces the likelihood that confounding message features are correlated with the predictive feature.

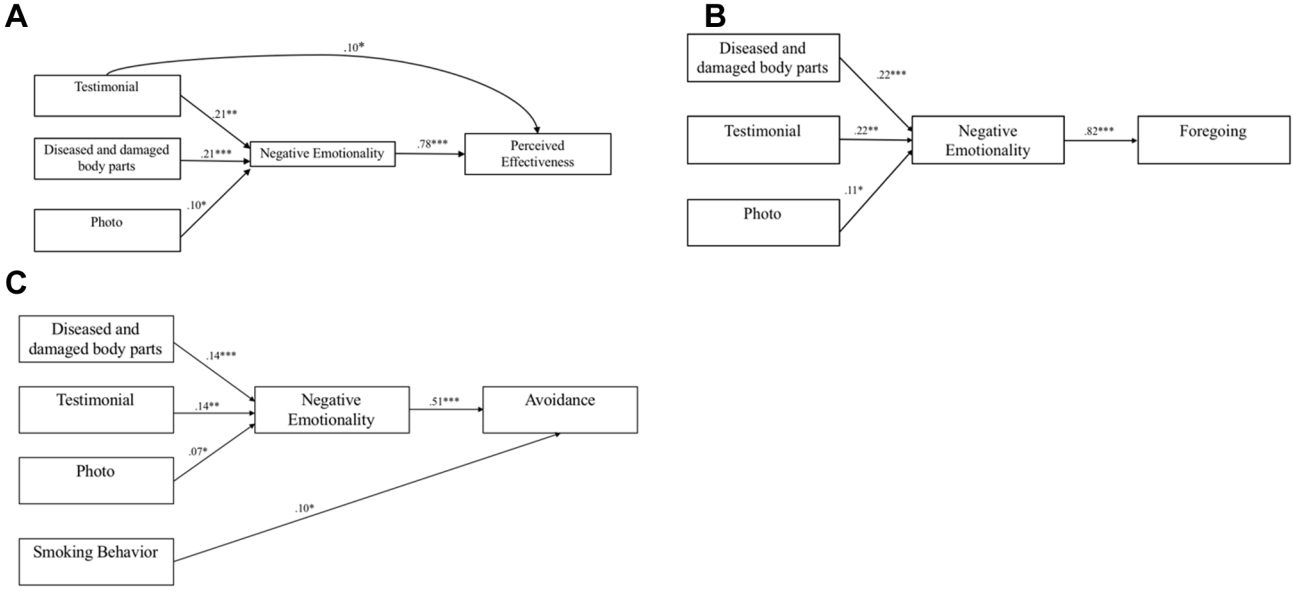

Figure 1 Path models of indirect effects of the object features on (A) perceived effectiveness, (B) foregoing and (C) avoidance through negative emotionality. All indirect paths significant at p<0.05 level are shown. *p<0.05, ** p<0.01, *** p<0.001.

Results show that the use of text in multiple locations increases message effectiveness as shown by three of the outcome measures. The use of multiple text boxes may make the PWM more visually dynamic drawing attention to different areas of the image and therefore increasing engagement. Alternatively, the effect of multiple text boxes may be a result of ambiguous imagery requiring more context and explanation. Therefore, other features of such images may be responsible for the identified relationship.

Additionally, the use of digitally altered photos increased intentions for avoidance indicating that depictions of situations that are not experienced in the real world may also result in more engaging PWMs. Similarly, the increased perceived effectiveness in response to compositions of multiple images highlights how the use of various images may result in more engagement as individuals seek to understand multiple parts of the image as a whole.

These results align with previous research on the positive effects of testimonial messages that include images of a person and text describing the consequences of their smoking.[19 31 32] However, the greater perceived effectiveness of testimonials over more explicit statements does not align with the results of an experimental study by Thrasher and colleagues[22] which showed greater effects for more explicit or didactic statements compared with testimonial statements. This difference may be due to the measure of perceived effectiveness used in Thrasher and colleague's study which focused more on the perceived reactions of others to the labels instead of focus on one's self. Additionally, the greater effect for didactic messages was more pronounced among those with higher levels of education.

Diseased and damaged body parts are depicted in 46% (n=51) of cigarette pack PWMs. Participants reported greater perceived effectiveness, negative emotional engagement and higher intentions to avoid PWMs with such images. Images with other types of negative imagery including medical equipment, dead bodies and frowning faces were also significant for some outcome measures. As previous research notes, these graphic images consistently elicit negative emotions such as fear.[9 13] Furthermore, the ability of messages to elicit strong negative emotions also increases smoking cessation behaviours.[12 13] The current study provides further support for this idea through the exploration of the mediational pathway from exposure to objective features to image-level negative emotionality to individual perceptions of effectiveness. Results showed a positive indirect association for graphic depictions of disease, testimonials and photos through negative emotionality. This result implies that these features contribute to the overall emotionality of a PWM which is associated with the outcome measures of interest.

Limitations and future research

This study has some limitations to be noted. First, while somewhat similar to the demographic makeup of current smokers,[27] the sample was not representative of US adult smokers. Additionally, the results from this study provide information about initial responses to images of PWMs in an online setting, responses to PWMs on actual cigarette packs or print advertising may differ.

For the content analysis, while three independent coders reached a high level of reliability, the features noted are limited to that of the codebook. While efforts were made to review the pertinent literature in order to produce a complete list of features, important features may be missing.

Additionally, the effects described in this study result from multilevel random-effects models accounting for all coded image features. As a result, the models control for many features that are likely to covary with targeted predictive features. For example, testimonials must include human characters by definition. However, when both features are included as predictors, testimonials are a significant predictor while human characters are not due to the natural covariation between the two. Consequently, some features may still be effective if designed orthogonally into message even if they were not significant in the analysis for this study.

CONCLUSIONS

The current study highlights a set of features that may increase the effectiveness of PWMs in reducing smoking prevalence. Based on results from this study, graphic depictions of diseases and testimonials not only increase the overall emotionality of PWMs but also evaluations of their perceived effectiveness. The pattern of results across measures of perceived effectiveness, negative emotional engagement, avoidance behaviours and foregoing within a large set of labels provides insight for how effective PWMs can be designed and implemented. Because this study examined the objective features of the labels that can be manipulated by label designers, the results of the study provide generalisable guidelines for the set label features may impact message effectiveness and eventually smoking-related attitude and behaviour change.

What this paper adds

- We examined the visual features that increase perceived effectiveness, negative emotional engagement, avoidance behaviours and intentions to forego within one of the largest sets of warning messages to date.
- Messages with diseased body parts compared with messages without these features increase effectiveness.
- Testimonials were more effective than explicit statements and metaphors.
- Text in multiple locations within the message increased effectiveness compared with text along the sides or top.
- Negative emotionality is a feature of the label that captures how it engages the audience emotionally on average.
- Diseased body parts, testimonials and photographs increased negative emotionality compared with the absence of these features which in turn was associated with perceived effectiveness, avoidance behaviours and intentions to forego.

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