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Visual attention to blu's parody warnings and the FDA's warning on e-cigarette advertisements

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Abstract

Objectives: In 2017, the e-cigarette brand, blu, released advertisements featuring large, boxed, positively-framed messages. These messages mimicked the format of FDA-mandated warnings that would appear on e-cigarette advertisements in the United States in 2018. We compared attention to blu's parody warnings and FDA-mandated warning appearing on blu advertisements.

Methods: N = 73 young adults who had used tobacco participated in an eye-tracking study. Participants viewed three blu e-cigarette advertisements in random order: one with a parody warning and two with the FDA-mandated warning (one with a model's face and one without). Areas of interest (AOIs) were the parody or FDA-mandated warning. We compared dwell time on AOIs between the three advertisements.

Results: Participants viewed parody warnings longer than each FDA-mandated warning on average (254 and 608 ms longer; p's < 0.02). Comparing the advertisements with FDA-mandated warnings revealed that participants spent less time looking at the warning in the advertisement with a model's face (354 fewer milliseconds; p = 0.001).

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CRediT authorship contribution statement

Brittney Keller-Hamilton: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft, Supervision, Project administration. **Makala Fioritto:** Investigation, Writing – review & editing. **Elizabeth G. Klein:** Methodology, Writing – review & editing. **Marielle C. Brinkman:** Writing – review & editing, Supervision, Project administration, Funding acquisition. **Michael L. Pennell:** Methodology, Writing – review & editing. **Paul Nini:** Writing – review & editing. **Joanne G. Patterson:** Writing – review & editing. **Amy K. Ferketich:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

7. Human Subjects Approval Statement

Study procedures were approved by The Ohio State University's Institutional Review Board, and participants provided informed consent.

Conclusions: Parody warnings attracted more visual attention than FDA-mandated warnings, and the presence of a face in the advertisement drew attention away from the FDA-mandated warning. Results underscore the need for advertisement regulations that support increased attention to health warnings.

Keywords

Warnings; Electronic cigarettes; Eye-tracking

1. Introduction

Starting in 2018, the Food and Drug Administration (FDA) required health warnings on electronic cigarette (e-cigarette) advertisements in the United States (US) (FDA, 2018). Warnings must occupy the top 20% of the advertisement; use large font, contrasting colors, and the signal word: "WARNING;" and be separated from the rest of the advertisement by a rectangular border (Food & Administration, 2018). Months before the launch of the FDA's warnings on e-cigarette advertisements, Imperial Brands released the blu "Something Better" advertising campaign. Advertisements from this campaign included parody warnings that had a similar format to the FDA's warning but included positive messages about e-cigarettes, like "IMPORTANT: Vaping blu smells good" (Wackowski & Lewis, 2017). Although we are unaware of advertisements from other brands or for other tobacco products using parody warnings, blu has a history of mocking tobacco control in its advertising (Wackowski & Lewis, 2017).

It is possible that blu's intent with this campaign was to distract from the discreet voluntary warning statements that appeared on e-cigarette advertisements at the time (Wackowski and Lewis, 2017; Shang and Chaloupka, 2017; Russell et al., 2017). Our prior work identified that adolescents who were randomly assigned to view e-cigarette advertisements with a parody warning (vs. other contemporaneous e-cigarette advertisements featuring health warnings) were less likely to say that the voluntary warning was the most memorable part of the advertisement immediately after viewing (Keller-Hamilton, Roberts, Slater, Berman, & Ferketich, 2019). Another potential motivation for this advertising campaign could have been to capitalize on the novelty of warning-like boxed messages on e-cigarette advertisements to convey positive messages about their product. Novelty (Hitchman, Driezen, Logel, Hammond, & Fong, 2014) and large, boxed formats for cigarette and smokeless tobacco warnings attract attention (Evans et al., 2018; Skurka et al., 2019), and message discrepancy, such as seeing pro-e-cigarette messaging in a format typically used for health warnings, can increase processing of the message (Clark & Wegener, 2009).

Although we do not know Imperial Brands' intentions for the "Something Better" campaign, we can measure its effects on people who viewed the campaign's advertisements. Measuring visual attention is a first step to understanding the effects of viewing tobacco advertisements that differ with respect to content, such as viewing an advertisement with a parody vs. FDA-mandated warning. Visual attention can be measured using eye tracking, a psychophysiological assessment that measures the amount of time a participant views specific areas of interest (AOIs) in an image. Following the message impact framework

(Noar et al., 2016), increased visual attention supports one's ability to recall information, including information conveyed through health warnings (Klein et al., 2015; Klein et al., 2017) Recalling information from health warnings, in turn, supports intentions and behavior change (Noar et al., 2016). Thus, assessing whether specific advertising components are associated with more or less attention to health warnings is necessary for understanding the effect that warnings might have on public health.

The primary goal of this study was to compare young adults' visual attention to blu's parody warnings and the FDA-mandated that appeared later on in e-cigarette advertisements. We hypothesized that the parody warning would attract greater visual attention than the FDA-mandated warning. Due to the recency of mandated health warnings appearing on e-cigarette advertisements, a secondary goal of this study was to compare attention to the FDA-mandated warning on two similar blu advertisements that differed by featuring a model's face, as faces attract visual attention (Russell et al., 2017; Palcu et al., 2017; Sajjacholapunt and Ball, 2014). We hypothesized that inclusion of a face in the advertisement would be associated with reduced visual attention to the FDA-mandated warning. Finally, because attention to specific advertisement components might differ according to tobacco use history, we also evaluated if e-cigarette use or cigarette smoking affected attention. We hypothesized that the effects of the parody warning or face on attention to the AOI would be more extreme among participants who used e-cigarettes or cigarettes.

2. Methods

2.1. Setting and participants

Participants (N = 74; 18–29 years old) were recruited using flyers and social media posts in Columbus, Ohio, in 2019, as part of a larger study evaluating placement of a health warning on waterpipes (Klein et al., 2021; Moumen et al., 2020). Thus, all participants had smoked tobacco in a waterpipe at least once. Potential participants were excluded if they had an eye condition that would prevent accurate eye-tracking (e.g., glaucoma or cataracts) or if their eyes were unable to be calibrated for tracking due to other physiological differences resulting in poor ability to capture corneal reflection. One participant's eyes were not able to be calibrated, so they were excluded from all analyses (analytic N = 73).

3. Procedures

The study procedures were approved by our university's IRB. First, participants completed a self-administered survey assessing tobacco use history and demographics. The study was conducted in a private research area without windows and the ceiling light was turned off, leaving the monitor as the only source of illumination. Participants sat with their chin on a chinrest 24 in. from a computer monitor that sequentially displayed 96 high-quality images of waterpipes (for the parent study) and advertisements for various tobacco products in random order, for a fixed interval of 5 s each, given the simplicity of the static imagery shown as stimuli and the evidence that the brain can recognize and process information in under 0.05 s (Childress et al., 2008). The computer monitor display (1280 × 1024 pixels) was equipped with a near-infrared camera, and eye movements were captured with eye tracking equipment (SensoMotoric Instruments, 120 Hz REDm System), which has a 120

Hz sampling rate. This equipment has a minimum precision capture of dwell time and fixations of 80 ms and a reported accuracy of 93% (Titz, Scholz, & Sedlmeier, 2018).

Stimuli for the current study were three blu e-cigarette advertisements: one with a parody warning and two with the FDA-mandated warning; all warnings appeared at the top of the advertisement. The blu advertisement with a parody warning featured a young white woman holding a blu e-cigarette in her hand and exhaling vapor, and the parody warning said "IMPORTANT: Vaping blu smells good." This advertisement had a purple background and minimal other text, including the blu logo and "SOMETHING BETTER," which were both approximately half as large as the parody warning, and "BETTER TASTING – MORE SATISFYING" written in small font. A voluntary warning statement was included in white text at the bottom of the advertisement; however, the font size was small and not easily legible. One blu advertisement with the FDA-mandated warning (hereafter referred to as "FDA warning + no face") showed a young white woman's hand holding an e-cigarette beside her thigh, with large words mid-page stating "TRUE FLAVOR. TRUE FEEL." that were emphasized with a blue triangle. This advertisement had a beige background and a "my blu" logo at the bottom of the page. The second blu advertisement with the FDA-mandated warning (hereafter referred to as "FDA warning + face") featured a close-up of a young Black man holding an e-cigarette in his mouth and the message "TRUE FLAVOR. TRUE FEEL." in the same location and with the same blue triangle as in the FDA warning + no face advertisement. The FDA warning + face advertisement also had a beige background and a "my blu" logo at the bottom of the page. The FDA-mandated warning on the FDA warning + no face and FDA warning + face advertisements stated: "WARNING: This product contains nicotine. Nicotine is an addictive chemical."

4. Measures

Dependent variables.

The area of interest (AOI) for each advertisement was defined as the parody or FDA-mandated warning. *Dwell time* (i.e., sum of viewing time on the AOI) and *fixation count* (i.e., total number of brief visits to the AOI) were the outcome variables analyzed. Dwell time represents the depth of cognitive processing, and fixation count provides an allocation of attention to the AOI among other content in the advertisement (King, Bol, Cummins, & John, 2019).

Independent variables.

Independent variables included type of warning, e-cigarette use history, and cigarette smoking history. *Type of warning* was a three-level variable: parody warning, FDA-mandated warning on the FDA warning + no face advertisement, and FDA-mandated warning on the FDA warning + face advertisement. For *e-cigarette use history* and *cigarette smoking history*, participants were categorized into one of three groups: Never users, ever but not past 30-day users, and past 30-day users.

Covariates.

The following *demographic measures* were collected prior to the start of the experiment: age (years), self-reported gender (female vs. male), race and ethnicity (non-Hispanic white, non-Hispanic Black, and other), and economic situation during childhood (barely enough/enough to get by, solidly middle class, and plenty of extras/luxuries). Waterpipe tobacco use was categorized into two categories: ever but not past 30-day use and past 30-day use.

4.1. Statistical analysis

Our goals were to 1) compare dwell time and fixation count to the AOIs between advertisements, and 2) evaluate whether associations were modified by e-cigarette use or cigarette smoking history. First, we visually inspected the eye tracking data (using heat maps and gaze plots) as validation of the participants' dwell time and fixations on the selected stimuli. Next, we confirmed that sequence of viewing the three advertisements was counterbalanced. We then examined covariates' associations with e-cigarette use history, cigarette smoking history, and dependent variables. Covariates that were associated with tobacco use history variables and dependent variables were controlled for in analyses. Next, we modeled the main effect of warning type on dependent variables using generalized linear mixed models with a random intercept for participant and a fixed effect for warning type. For dwell time analyses, we assumed a normal distribution and identity link and checked assumptions of linear regression models, including residual normality and homoscedasticity. For fixation count analyses, we assumed a negative binomial distribution and log link. We tested the main effect of warning (parody warning vs. FDA-mandated warning on FDA warning + no face vs. FDA-mandated warning on FDA warning + face) on dwell time and fixation count. Type I error was controlled using Holm's procedure (Holm, 1979).

We also evaluated whether e-cigarette use or cigarette smoking history modified the effect of warning type on dwell time and fixation count. In separate models, we added e-cigarette use history and e-cigarette use history × warning type (or cigarette smoking history and cigarette smoking history × warning type) interactions as fixed effects and used likelihood ratio tests to evaluate effect measure modification. Our parent study's sample size was estimated to provide a 90% chance of correctly identifying the waterpipe warning label location with largest mean dwell time when the difference between the largest and second largest means is 0.5 s (Bechhofer, Santner, & Goldsman, 1995). This 0.5 s difference in dwell time across label locations was deemed scientifically important because fMRI studies have shown that short-term stimuli (shown for 0.033 s) register within brain function, indicating an individual's brain can see/recognize content unconsciously even if the dwell time is relatively short (Childress et al., 2008). An alpha of 0.05 was used to identify overall statistical significance of interaction terms. Stata/SE version 16.1 was used for analyses (StataCorp., 2019).

5. Results

5.1. Participant characteristics

A majority of participants were non-Hispanic white, the sample was well balanced according to gender and e-cigarette use history, about half of participants were never

smokers and of higher socioeconomic status, and nearly one-third were current waterpipe tobacco smokers (Table 1). The distribution of race/ethnicity was imbalanced according to e-cigarette use history and cigarette smoking history, with non-Hispanic white participants being most likely to be current users of each product ($p = 0.002$ and $p < 0.001$, respectively). Gender was also imbalanced according to cigarette smoking history, with males being more likely to be current cigarette smokers ($p = 0.03$). However, neither race/ethnicity nor gender were associated with dwell time ($p = 0.97$ and $p = 0.95$, respectively) or fixation count ($p = 0.67$ and $p = 0.55$, respectively), so they were not included in the models.

5.2. Attention to parody and FDA-mandated warnings

On average, participants viewed parody warnings for 254 and 608 ms longer than the FDA-mandated warnings ($p = 0.02$ and $p < 0.001$ for FDA warning + no face and FDA warning + face, respectively; Table 2). Comparison of dwell time between the two advertisements with FDA-mandated warnings identified that participants viewed the FDA-mandated warning on FDA warning + no face for 353.7 ms longer than FDA warning + face ($p = 0.001$). There was no evidence that e-cigarette use history or cigarette smoking history modified these associations ($p = 0.32$ and $p = 0.57$, respectively).

Participants looked at the parody warning 12.8% and 30.1% more frequently than at the FDA-mandated warnings, although only the latter difference was statistically significant ($p = 0.07$ and $p < 0.001$ for FDA warning + no face and FDA warning + face, respectively; Table 2). Comparison of fixation count between the two advertisements with FDA-mandated warnings identified that participants viewed the FDA-mandated warning on FDA warning + no face 24.8% more frequently than FDA warning + face ($p = 0.006$). There was no evidence that e-cigarette use history or cigarette smoking history modified these associations ($p = 0.62$ and $p = 0.63$, respectively).

6. Discussion

Participants looked at blu's parody warnings for longer periods of time and more frequently than they looked at FDA-mandated warnings on later, separate blu advertisements. Additionally, visual attention differed between blu advertisements that had the same FDA-mandated warning but had different features otherwise. We identified no evidence that e-cigarette use history or cigarette smoking history modified these associations. In other words, participants who had never used, had previously used, or currently use e-cigarettes or cigarettes all paid more attention to the parody warnings than FDA-mandated warnings on e-cigarette advertisements.

The differences in dwell time that we observed between parody and FDA-mandated warnings (254 to 608 ms) represent scientifically important differences in dwell time; much shorter dwell times of only 33 ms register with brain function (Childress et al., 2008). Consistent with other research on warning label design (Evans et al., 2018; Skurka et al., 2019), this method of using the warning format to convey non-warning text appears to be an effective way of attracting attention to positive messages about the product. The difference between dwell times for the two advertisements with the FDA-mandated warning (353 ms) was also scientifically important, indicating that other advertisement features

can effectively draw attention away from the FDA's large, boxed warnings at the top of e-cigarette advertisements. The two advertisements that included the FDA-mandated warning had the same text in the same location. However, participants viewed the warning on the advertisement that featured the face of a person using an e-cigarette for less time than the advertisement that featured a hand holding an e-cigarette. These results align with other research describing that faces attract attention in advertisements (Russell et al., 2017; Palcu et al., 2017; Sajjacholapunt and Ball, 2014).

Differences in dwell time indicate differences in visual attention to the AOIs. Differences in visual attention are important because they reflect differences in encoding and processing of information (Thrasher, Brewer, & Niederdeppe, 2019). In other words, the finding that participants spent more time looking at the parody health warning than the FDA-mandated warnings meant that they could be more likely to recall the information communicated through the parody warning than through the FDA's warning. Likewise, our results suggest that recall of the FDA's warning could potentially be improved when the advertisement does not feature a model's face. Given our design, we were unable to directly compare message recall following the experiment; other research has identified that lower visual attention to health warnings has been associated with reduced recall of warning information on advertisements for cigarettes and smokeless tobacco (Klein et al., 2015; Klein et al., 2017). Ultimately, recall of health information is important because it is associated with behavior change (Noar et al., 2016).

Our results should be interpreted in the context of the following limitations. First, all of our participants had used waterpipe at least once, and we observed a higher prevalence of current e-cigarette use and cigarette smoking in this sample in comparison to national estimates (Creamer, Wang, & Babb, 2018). We do not know if observed associations would be the same for people who are not susceptible to tobacco use or who had presumably lower exposure to tobacco warnings. Second, our stimuli were real advertisements, meaning we did not control features to isolate the effects of parody warnings or other advertisement components on attention. In an effort to reduce participant burden, we also only included one advertisement with a parody warning. Due to the use of real advertisements and inclusion of only one advertisement with parody warning, we cannot be certain about which features contributed to differences in dwell time or fixation count between the three advertisements. Relatedly, warnings had appeared on e-cigarette advertisements in the US for nearly a year by the time our data were collected, so it is possible participants who had already been exposed to the FDA-mandated warnings were fatigued by them. Third, due to the within-subjects design and aims of the parent study, we were not able to assess other outcomes that would have been useful from a regulatory perspective, such as differences in harm or addiction perceptions associated with viewing each advertisement. Finally, participants viewed each advertisement in a laboratory setting for a fixed time of five seconds. Viewing advertisements in a more natural setting (e.g., flipping through a magazine at home) or in a different medium might lead to different findings.

In spite of these limitations, this study reached the important conclusion that the advertising tactic of using parody warnings that contain positive messages about the product attracted greater attention than the existing FDA-mandated warnings on separate e-cigarette

advertisements. We also identified that attention to the FDA's e-cigarette warnings can be modified by other advertisement features. All findings were consistent for participants who had never used, formerly used, and currently use e-cigarettes or cigarettes.

6.1. Implications for tobacco regulation

Greater attention to warnings on tobacco advertisements is associated with improved warning recall (Meernik et al., 2016; Mays et al., 2019), which in turn is associated with changes in attitudes, intentions, and behaviors (Noar et al., 2016). Tactics that reduce attention to the FDA's warnings could weaken their impact (Berry, Burton, & Howlett, 2017). We identified that parody warning messages attract more attention than the FDA-mandated warning on separate e-cigarette advertisements, but additional research would be needed to test whether they would draw attention away from the FDA-mandated warning if they appeared on the same advertisement. This would be a concern for products like cigarettes that require relatively small warnings in the US. We also identified differences in dwell time and fixation count between the two advertisements with FDA-mandated warnings, pointing to the potential for other advertisement features (e.g., faces) to reduce attention to the warning. Additional research to identify which advertisement features attract the most attention on current e-cigarette advertisements would provide useful information for regulations that ultimately support increased attention to warnings.

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Table 1

Eye-tracking participant characteristics and descriptive study outcomes, Columbus, OH, 2019.[a]

	N = 73
Age (mean [SD])	21.8 (2.1)
Gender (n [%])	
Female	36 (49.3)
Male	37 (50.7)
Race (n [%])	
Non-Hispanic White	40 (54.8)
Non-Hispanic Black	15 (20.6)
Other	18 (24.7)
Family socioeconomic status (n [%])[b]	
Barely enough/enough to get by	16 (22.2)
Solidly middle class	23 (31.9)
Plenty of extras/luxuries	33 (45.8)
E-cigarette use history (n [%])[c]	
Never use	25 (34.3)
Ever, not past 30-day use	20 (27.4)
Past 30-day use	28 (38.4)
Cigarette smoking history[c]	
Never smoker	33 (45.2)
Ever, not past 30-day smoker	25 (34.3)
Past 30-day smoker	15 (20.6)
Waterpipe tobacco use history	
Ever, not past 30-day smoker	50 (67.6)
Past 30-day smoker	24 (32.4)
Dwell time (milliseconds; mean [SD])[d]	
Parody warning[e]	1788.9 (921.7)
FDA-mandated warning (FDA warning + no face[f])	1534.6 (987.5)
FDA-mandated warning (FDA warning + face[g])	1180.9 (834.5)
Fixation count (mean [SD])[d]	
Parody warning[e]	7.6 (4.3)
FDA-mandated warning (FDA warning + no face[f])	6.7 (4.3)
FDA-mandated warning (FDA warning + face[g])	5.4 (4.1)

Abbreviations: SD = standard deviation.

[a]Statistics calculated from this table differ slightly from what is reported in text due to rounding. Percentages might not sum to 100 due to rounding.

[b]One participant was missing data for family socioeconomic status.

[c] Three participants who were ever users of e-cigarettes and two participants who were ever cigarette smokers answered "don't know" to the item assessing past 30-day use. They were categorized into the "ever, not past 30-day" user group for the analysis.

[d] Participants viewed each advertisement for a fixed time of five seconds.

[e] https://www.trinketsandtrash.org/detail.php?artifactid=12393&page=4.

[f] https://www.trinketsandtrash.org/detail.php?artifactid=14274&page=1.

[g] https://www.trinketsandtrash.org/detail.php?artifactid=14407&page=1.

Table 2

Differences in dwell time and fixation count according to warning type, Columbus, OH, 2019.[a]

	Dwell time (milliseconds)		Fixation Count	
	Mean (95% CI)	**p-value**	**% difference (95% CI)**	**p-value**
Parody warning[b]	Ref		Ref	
FDA-mandated warning (FDA warning + no face[c])	−254.3 (−461.9, −46.7)	0.016	−12.8 (−24.8, 1.2)	0.07
FDA-mandated warning (FDA warning + face[d])	−608.0 (−815.7, −400.4)	<0.001	−30.1 (−40.2, −18.4)	<0.001

[a]Participants (N = 73) viewed each advertisement for a fixed time of 5 s. Advertisement order was randomized and counterbalanced.

[b]https://www.trinketsandtrash.org/detail.php?artifactid=12393&page=4.

[c]https://www.trinketsandtrash.org/detail.php?artifactid=14274&page=1.

[d]https://www.trinketsandtrash.org/detail.php?artifactid=14407&page=1.

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