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Testing a Brief Web-based Intervention to Increase Recognition of Tobacco Constituents

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Objective: We examined website formats to increase smokers' recognition of harmful and potentially harmful constituents (HPHCs) in cigarettes. **Methods:** Adult, daily smokers (N = 279) were randomized to view a brief, single-page study website showing HPHC names and uses. The intervention site was tailored + interactive, labeled by cigarette brand/subbrand showing color imagery and pop-up boxes; the generic + static website (control) was unbranded in greyscale. Eye tracking equipment measured attention (dwell time) to precise website features. Linear regression analyses compared attention to HPHC descriptions and the correct recognition of 15 HPHC chemicals. A randomly selected sub-sample (N = 30) of participants qualitatively rated website usability. **Results:** Despite spending less dwell time on the HPHC text and entire website, adult smokers who viewed the generic + static website had greater improvement in HPHC recognition compared to the tailored + interactive website (4.6 vs 3.6; p = .02); this finding contrasts with current literature on tailoring and interactivity. Both websites were rated highly on ease-of-use and readability. **Conclusions:** Basic formats and narrative HPHC Web-based content attracted less visual attention, yet increased recognition of these chemicals in cigarettes, compared to brand-tailored, interactive web-based content.

Key words: constituents; communication; cigarettes; HPHCs; ingredients
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In the United States (US), details about the chemical ingredients in cigarettes have never been publicly disclosed by the tobacco industry, which may explain why US adults have poor recognition of the harmful and potentially harmful constituents (HPHCs) in cigarettes. Most adults (70%-90% studied)[1-3] recognized a few constituents (ammonia, arsenic, benzene cadmium, carbon monoxide, formaldehyde and nicotine) but few other HPHCs. Recognition of the harmful ingredients in cigarettes provides information which may be used by an individual to move toward a more active stage of preparation for a behavior change like smoking cessation.[4] Literature is emerging on the most effective manner for presenting HPHC information to consumers to increase awareness of their potential harms to health.[5-7]

In 2009, the Family Smoking Prevention and Tobacco Control Act (referred to as the Tobacco Control Act) gave the Food and Drug Administration

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(FDA) the authority to require tobacco companies to report to the FDA the presence and quantities of HPHCs in each brand and subbrand of regulated tobacco products.[8,9] The Tobacco Control Act requires that the FDA share the ingredients of tobacco products in a "public display" that is "understandable and not misleading" to consumers as a part of its regulatory and education activities. The Internet is a likely medium for "public display" of HPHC information, as Web-based information delivery is a flexible location for learning to take place, can efficiently reach the national audience of consumers, is consistent with the digital government strategy to deliver better service to the US audience,[10] and has the potential to personalize information to individual consumers.[11] US adult smokers reported that content online was the most likely source of information on constituents after cigarette packs (28.8% and 57.2%, respectively).[12] Further, the Web-based delivery of content has succeeded in promoting health-related knowledge and behavior change,[13,14] and showed promise for tobacco-related interventions.[15-17]

Studies of online delivery of health-related content (including interventions and educational information) have advised the use of tailoring, or providing individual-level information, as well as encouraging active involvement by users as 2 key elements to promote learning or knowledge acquisition.[18] Health behavior theories support this use of tailoring to avoid a "one size fits all" approach,[19] and interactivity to promote cognitive experiential processes to promote learning.[20] Health communication experts have posited that interactivity positively impacts comprehension of online health content,[21-23] and content should focus on design of "easy to use, engaging, and accessible electronic health (eHealth) applications that communicate the right information needed to guide healthcare and health promotion for diverse audiences."[24] For a tool to be acceptable and understandable for a wide range of consumers, ease of use and usability should be considered in website design, especially for consumers with less experience with technology[25-27] or who have lower health literacy.[28-30] The cognitive burden of website use can be minimized through format, wording, and presentation style in order to "free up" cognitive resources to focus on learning the central messages being conveyed.[31,32]

Such design considerations inform optimal content, but to reach consumers, an optimally designed website must first attract their attention. Greenwald et al describe a process of how consumers pay attention to advertising content in several stages of information processing.[33] Pre-attention (0.5 - 3 seconds) establishes familiarity and significance of content, followed by focused attention, comprehension, and cognitive elaboration; each stage requires a greater capacity for information processing.[33] This framework underscores the importance of getting the right information to the audience, as well as attracting and maintaining visual attention for consumers to recognize, recall, comprehend, and use health information to make health-related decisions.[34,35] Eye tracking software is uniquely positioned to directly measure attention, and produce less biased estimates to determine which elements of visual information are most effective.[36] Studies using eye tracking technology have produced objective insights into tobacco-related communications, yielding information on the pre-attention and focused attention stages while viewing health warning labels, point-of-sale advertising, and other tobacco-related communications.[36] Despite this growing area of research, tobacco control research studies using eye tracking have not yet focused on Web-based information delivery or HPHC information.

A gap exists regarding the optimal balance of how to convey technical information to avoid misunderstanding while efficiently providing accurate HPHC information to consumers.[37] Eye tracking technology has the potential to provide detailed information on design features the FDA can use to communicate HPHC information. Given the mandate to the FDA to share HPHC information publicly, there is a need to examine how this can be done to increase consumer HPHC recognition as an important step to inform health decision making about smoking.[38] The purpose of this study was to evaluate formats to attract visual attention to Web-based content to increase recognition of HPHCs. The primary hypothesis was that tailored and interactive content attracts greater attention and increases HPHC recognition when compared to generic and static content.

METHODS

Sample

Between March and July of 2016, a convenience

sample of adult current smokers (N = 279) was recruited to participate in a randomized experimental eHealth study (blinded to the focus on HPHCs). Male and female participants were recruited through phone calls, flyers, online sources, and word of mouth. Those responding to recruitment materials were screened by phone for study eligibility criteria: adults aged 18 or older who were regular smokers (every day, some days), reporting having smoked at least 100 cigarettes in their lifetime. Participants were excluded if they had a history of certain eye conditions, such as macular degeneration, glaucoma, or cataracts, which may interfere with eye tracking equipment calibration. The total sample size required for 80% power of the hypothesized moderate effect (0.4 SD) was 120 in each arm (240 total).

Procedures

As an overview, participants were recruited (blinded to smoking status as eligibility) for an eHealth study. A trained research staff member obtained informed consent, then used a random number generator to assign participants to the study condition; participants were blinded to whether assigned to view the control (generic + static) or intervention (tailored + interactive) website condition, detailed below. Next, participants completed a brief pretest online that included current uses of technology and HPHC recognition. Participants were calibrated for the eye tracking equipment, then instructed to view and interact with each website at their own pace. First, participants viewed an online tool to assess cardiovascular health risk[39] displayed first to orient participants to the experiment. Next, participants viewed their assigned study website for at least 5 seconds. After completion of the experiment, participants completed an online posttest of HPHC recognition along with demographic survey items. A subset of participants from each condition were randomly selected for recruitment for a brief qualitative assessment of the study website they had been assigned to view. The study consisted of one single session; those who completed the experiment received a $50 gift card, and those unable to be calibrated on eye tracking equipment received a $10 gift card. Participants who completed the qualitative interview received a $20 gift card.

Experimental stimuli. The 2 study websites were professionally designed as a brief intervention; each site listed 15 chemicals selected by the research team from an abbreviated list of 20 HPHCs prepared by the FDA.[9] The study websites were developed based on formats recommended by the Framework Convention on Tobacco Control (FCTC).[40] Informed by existing research on consumer awareness of HPHCs in cigarettes and secondhand smoke,[1-3] the research team intentionally avoided well-known chemicals which may have a ceiling effect for recognition (eg, nicotine) and chose chemicals with less technical or complex names (eg, acrolein versus 2-aminobiphenyl). Although the FDA must share quantity data on HPHCs with consumers, the experiment excluded information on the quantity found in cigarettes to minimize the cognitive overload of technical information. The names and common uses for each of the 15 HPHCs was displayed on screen. For comparability, the total size, background color, text font, point size, line width and space, order of chemical names, and text box size were identical for both conditions.

The generic + static website displayed the statement: "The following ingredients are found in every cigarette" and excluded any interactive features to hover or click to open. The tailored + interactive condition included the identical HPHC information in a comparable layout, but prior to website launch, participants were required to select their brand and subbrand from a pull-down menu. Once brand information was supplied, the study website was displayed with a statement: "The following ingredients are found in [user's cigarette brand and subbrand]." Additionally, interactive features included pictorial images changed from black and white to color when the user hovered, and a brightly colored pop-up box with a repetition of HPHC ingredient information when the participant clicked on the HPHC name or image. These interactive features were designed with consideration of the requirements to meet to the Americans with Disabilities Act accessibility standards.[41]

Eye tracking protocol. In a private office lab space, participants were comfortably seated in a chair within a typical viewing distance (24 to 32 inches) from a free standing 22 inch monitor. A wireless, infrared camera eye tracking system (SensoMotoric Instruments, 60 Hz RED System) was

affixed at the bottom of the monitor where it detected fine detail of spatial resolution (0.03°) from both eyes while content was viewed on-screen. Each participant completed a 9-point equipment calibration procedure (according to manufacturer specifications) 3 times per participant to assure data quality before the initiation of the experiment. To allow participants a naturalistic experience interacting with the websites, instructions prior to launch of the study websites were: "We would like you to use the website as if you were a consumer looking for health information. When you are finished, we will ask you some questions about your evaluation of the website." For the duration of the study, participants were allowed free head movement while on-screen content was viewed.

Qualitative interview protocol. Interview slots were selected at random each week using a quota system to assure balance by study condition (N = 30, N = 15 per condition). Selected participants were invited to complete a semi-structured, qualitative interview following the experiment to gather participant perceptions of usability for both study websites. The trained research staff member asked participants 9 open-ended questions regarding perceptions of the cardiovascular and HPHC websites they viewed and typed every participant response verbatim. No visual aids were given to participants to assist in recall.

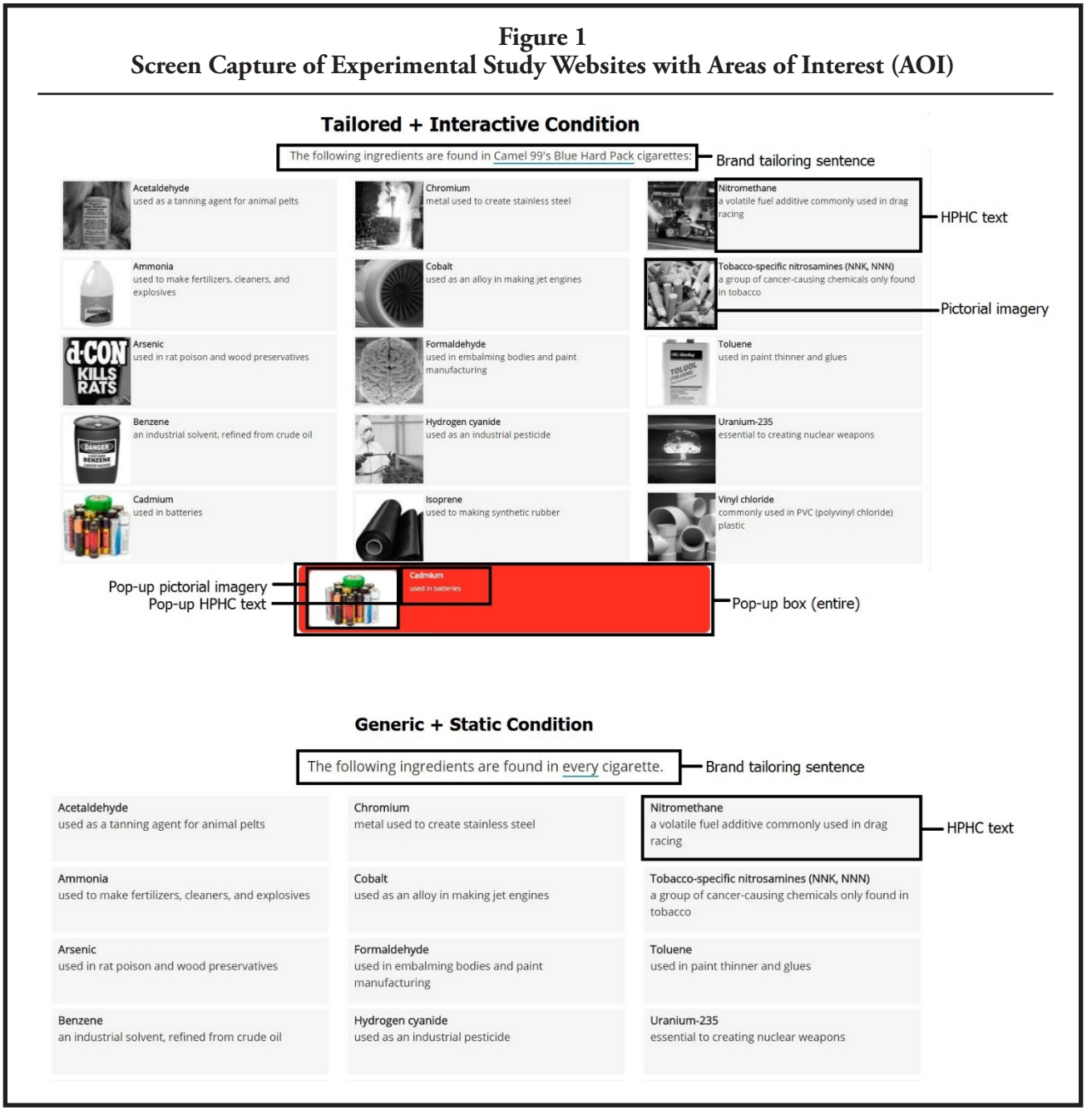
Measures

Eye tracking measures. SMI Experiment Center™ software was used to display the experimental stimuli (HPHC website) and to capture the eye tracking data. The primary measures of interest were the total and proportion of visual attention, referred to throughout as "dwell time," spent on specific website elements, called areas of interest (AOIs). A "fixation" was defined as when a participant orients their point of gaze in a particular area for at least 0.08 seconds or 80 milliseconds, the threshold of cognition to occur.[42] All AOIs were defined *a priori* (an illustration of each AOI is shown in Figure 1). Both study conditions included the following AOIs: (1) whole website (excluding screens for brand tailoring); (2) top sentence; (3) HPHC text (including pop-up boxes); and (4) white space where no defined AOIs were viewed. For the tailored + interactive condition only, AOIs included (5) HPHC imagery (including pop-up boxes).

Survey measures. In the pretest, HPHC recognition was measured using a single item: "Which of the following chemicals are found in cigarettes? Check all that apply." Responses included a list of 20 chemicals displayed in a random order: the 15 HPHCs shown in the experimental stimuli and 5 non-HPHCs not shown in the experiment. Non-HPHC chemicals were selected based on similar chemical names (eg, dextrose) and were included to assess the potential for positive response bias of endorsing all listed chemical names. Recognition was operationalized as the change in score for endorsement of true HPHCs between posttest score and pretest (each out of 15). The pretest included smoking-related behaviors: number of cigarettes per day and quit intention in the next 30 days (yes/no/don't know). In the posttest, the HPHC recognition item was repeated with responses randomized. Additional items included descriptive characteristics of the study sample included age (18-24, 25-34, 35-44, 45-54, 55+), sex (male/female), race (American Indian/Alaska Native, Asian, African-American, Native Hawaiian or other Pacific Islander, white, more than one race), Hispanic (yes/no/unknown), educational attainment (some high school, high school graduate, some college, college degree or more), and an 8-item-eHealth literacy scale to measure consumers' capability to use electronic health information, including "I have the skills I need to evaluate health resources on the Internet (strongly disagree-strongly agree);[43] this scale has alpha coefficient value of > .90.[44]

Qualitative measures. Usability was assessed with a structured, open-ended item: "I'm going to give you a set of words, and I want you to describe your experience with this website based on each of the words. Comfort, stability, readability, and operation." Next, participants were asked about website appearance: "I'm going to give you a set of words, and I want you to describe your experience with this website based on each of the words: font size, color, appeal and readability." Lastly, participants were asked for more general feedback using these items: "What did you like most/least about the website," and "Any suggestions for improvements for other people like you." A trained interview typed each participant's response verbatim to create a written transcript.

Figure 1
Screen Capture of Experimental Study Websites with Areas of Interest (AOI)



Data Analysis

Three calculations were made following the experiment to characterize visual attention to each AOI: (1) the sum total dwell time in milliseconds to the AOI; (2) the proportion of total dwell time on the AOI calculated based on the duration of dwell time on the AOI divided by total dwell time on the website, and (3) fixation count. To evaluate visual attention, total dwell time (in milliseconds) and the proportion of dwell time on specific AOIs were evaluated separately using generalized linear regression. To examine recognition of HPHCs, the score change in correct responses was calculated between pretest and posttest scores; differences were assessed via generalized linear regression with treatment condition as the only predictor. No gross violations of the equal variance assumption were found in any of the continuous variables assessed. Differences in demographic variables between the treatment conditions were examined using ANOVA or

Table 1
Demographic Characteristics of Study Participants (N = 279)

	Tailored + Interactive (N = 137)	Generic + static (N = 142)
Age		
18-24	8%	9%
25-34	31%	27%
35-44	17%	16%
45-54	25%	29%
55+	19%	19%
Male sex	54%	47%
Black race (non Hispanic)	49%	52%
Health literacy score, out of 40 (mean, SD)	18.1 (5.8)	19.0 (6.3)
Education		
Some high school	15%	14%
High school graduate	32%	45%
Some college	34%	30%
College degree or more	18%	11%
Plan to quit in next 30 days		
Yes	24%	34%
No	42%	38%
Don't Know	33%	28%
Cigarettes smoked per day (mean, SD)	12.0 (8.5)	11.2 (8.4)

χ^2 tests. Statistical significance levels for visual attention analyses were set at $\alpha = .01$ to correct for the 3 planned comparisons for the stated AOIs; differences in recognition change score were set at $\alpha = .05$.

For the qualitative interviews, 2 trained coders reviewed all written statements to code on themes of the HPHC website functionality, appearance and strengths, and weaknesses; coders reviewed all of the responses independently and consensus meetings were held to resolve coding disagreements. The kappa coefficient for the mean interrater reliability across all qualitative items was 90%.

RESULTS

Table 1 reports participant characteristics. None of these variables was significantly different between study conditions. Few participants failed calibration for eye tracking equipment or had unusable data (N = 11); these individuals were excluded from all analyses. In the final study sample, participants were balanced between the tailored + interactive condition (N = 137) and generic + static condition (N = 142). Study participants were primarily (~60%) aged 35 or older with approximately half (~50%) male in each condition. Demographic characteristics for the qualitative study were consistent with the overall sample; 53% aged 35 or older and 53% male (data not shown). Compared to demographics of the local community, participants had lower educational attainment (14% vs 34% with a college education or greater) and were more racially diverse (50% vs 28% identifying as African-American).

Table 2
Differences in Visual Attention and Recognition of Harmful and Potentially Harmful Constituents (HPHCs) by Study Condition

	Tailored + Interactive (N = 137)	Generic + static (N = 142)
Visual attention measures		
Mean dwell time in seconds (SD)		
Total cardiovascular website (control) viewing time	83.0 (45.5)	85.5 (51.7)
Total HPHC website viewing time [a]	81.1 (60.0)	63.2 (28.0)
Brand tailoring sentence [a]	1.9 (1.6)	1.3 (1.3)
Per word (in brand/subbrand) [a]	0.55 (0.4)	1.3 (1.3)
HPHC text (including pop-up text) [a]	55.1 (44.3)	39.3 (18.7)
Pictorial images	11.0 (11.3)	--
Proportion of viewing time (including pop-up text) (%, SD)		
Brand tailoring sentence	2.7 (2.2)	2.3 (2.3)
HPHC text [a]	67.7 (13.2)	63.5 (15.6)
Pictorial images	13.5 (7.2)	--
White space/other [a]	16.7 (6.6)	20.0 (8.7)
HPHC knowledge scores (SD) [a]		
Pre-test score (out of 20)	7.0 (2.4)	6.9 (2.3)
Endorsed true HPHCs (out of 15)	2.4 (2.7)	2.3 (2.7)
Endorsed non-HPHCs (out of 5)	0.4 (0.8)	0.4 (0.8)
Post-test score (out of 20)	10.1 (3.5)	10.7 (3.7)
Endorsed true HPHCs (out of 15)	6.1 (3.8)	6.9 (4.3)
Endorsed non-HPHCs (out of 5)	0.9 (1.2)	1.2 (1.4)
Score change in true HPHCs from pre- to post-test [b]	3.6 (3.4)	4.6 (3.9)

Note.
a: indicates statistically significant differences by condition at p < .01
b: indicates statistically significant differences by condition at p < .05
*** proportions do not sum to 100% due to omitted and/or overlapping areas of interest**

Table 2 shows differences by condition for the visual attention elements and recognition scores. Participants in the tailored + interactive group spent significantly more dwell time on the total website (1 minute 21 seconds on average, compared to 1 minute 3 seconds; p = .002) compared to the generic + static group. This amount of time was similar to the time spent viewing the heart health website shown first; 83 seconds on average with no differences by condition (p = .67) At the top of the experimental website, the participants in the tailored + interactive condition viewed an average of 3.5 words for their preferred brand and subbrand, and spent half a second (538 milliseconds, p = .003) more dwell time on the sentence tailored to their brand and subbrand, compared to the generic condition that stated the HPHCs were found in "every" cigarette which used only one word; these values represent a low proportion of the total dwell time (~2.5% for each condition). The proportion of dwell time on the HPHC text description was higher in the tailored + interactive condition (68% of viewing time, compared to 64%; p = .001) compared to the generic + static condition. Pictorial images were

only shown in the tailored + interactive condition, which attracted 13.5% total dwell time. The generic + static condition participants had a significantly larger proportion of "white space" dwell time (20.0% vs 16.2%; $p < .001$) compared to the tailored + interactive condition participants.

There were no statistically significant differences by condition in pretest scores for HPHC recognition (total score, true, or non-HPHCs). Change in correct recognition of HPHCs from pretest to posttest score was significantly higher for participants in the generic + static condition compared to the tailored + interactive condition (F statistic = 4.7, $p = .03$).

Among the post-experiment qualitative interview participants, there were no meaningful differences in themes by study condition; all highly rated the comfort, readability, and ease of using the study website. When asked to describe the strengths of the website, participants in the generic + static condition most often referenced the clarity of information presented as "crisp and easy to read" and "short and simple." Most commented (87%; N = 18) about the content ("finding out the ingredients in cigarettes;" "information presented… got me thinking about my health;" "learning the facts") as strengths. These themes were consistent for participants in the tailored + interactive condition ("Learning about the tobacco ingredients" and "did not know this information before coming here").

Participants in the generic + static condition negatively rated the look of the study website, describing it was "boring" and "almost too simple." In the tailored + interactive condition, a few participants (13%) found the font size too small, or (17%) wanted additional information about the chemicals, including health effects. When asked for recommendations on how to improve the website overall, participants suggested including greater interactivity and more content (43%) information on health outcomes (20%), more visuals/pictures (10% - all from the generic + static condition), and resources for quitting (7%).

DISCUSSION

The goal in the present study was to evaluate formats to attract visual attention to improve HPHC recognition among adult smokers as part of FDA's obligation to publicly share information on tobacco constituents in a format that is "understanding and not misleading."[45] Recognition of the constituents in cigarettes informs consumers regarding the potential danger of the chemical ingredients in cigarettes, and accurate information about the harmfulness of cigarettes may be an important step in a complex behavioral process of smoking cessation.[46] In a convenience sample of adult smokers, we found a greater increase in correct recognition of HPHCs when smokers were presented with a website featuring simple textual information compared to those smokers who viewed a tailored and interactive version. This finding was counter to the robust health promotion literature supporting the use of tailoring and interactivity to enhance recognition, memory, and learning.[19,22,47,48]

Eye tracking data demonstrated that participants in the generic + static condition spent a lesser proportion of their dwell time (64% vs 68%) on the HPHC textual information compared to the tailored + interactive condition. Indeed, the higher engagement with pictorial imagery depicting industrial uses for the selected HPHC chemicals had small effects and did not translate into greater recognition of the HPHC names for participants in the tailored + interactive condition. The greater proportion of dwell time on white space in the generic + static condition may be explained by the absence of visual imagery or popup boxes, compared to the tailored + interactive condition (34.2% vs 16.2%, respectively). Although eye tracking studies have demonstrated that the addition of color to a greyscale images is correlated to increased visual attention,[49] these minor additions of colors and images in the present study did not translate, on the whole, to better recognition of HPHC information within the tailored + interactive website. Whereas the present study is not designed to allow for the examination of the independent impacts of color or pop-up boxes, these pictorial elements only contributed to 14% of the overall dwell time for participants in the tailored + interactive condition.

According to dual coding theory, the employment of an intervention using interactivity with both words and imagery should enhance learning.[50-52] There are several potential explanations for our findings to diverge from the published research on tailoring and interactivity.[19,53,54] First, the rel-

evance of interactivity on a website may depend on the health-related task or purpose for information seeking. As the current task is recognition, interactivity may not enhance recognition as the interactive aspects used (clicking or hovering for links or pop-up content) did not add new information other than visual depictions of the chemical uses and could act as distractors from the outcome of HPHC recognition. Interactivity was defined by image-focused content and hovering actions; interventions with more involved interactions such as entering comments, taking surveys, doing practice exercises, sharing on social media, and others may be more potent for more complex behavior change tasks.[14,20,24] Second, the tailoring to brand and subbrand attracted greater attention to the tailored information, but this may be due to greater word count. Furthermore, the "dose" of information (less than 2 seconds) may have only attracted pre-attention and not included sufficient content to produce more active information processing by participants.[33]

The qualitative interviews revealed that the vast majority of participants positively rated the appearance and usability of the website. These factors are critically important to the creation of a website that will be sought out by consumers, as website usability directly relates to a consumer's trust, satisfaction, and source credibility.[55] The current environment where HPHC or any constituent labelling is absent,[56,57] may shed light on why nearly all qualitative participants noted content of the study website was a strength, acknowledging an appreciation for sharing "the facts" about HPHCs in cigarettes. Although recognition of information and knowledge are not likely to be sufficient to motivate cessation, these comments demonstrate the potential for involvement beyond focused attention which can lead to comprehension and/or cognitive elaboration.[34]

In these study websites, participants were not able to make comparisons between brands of tobacco products. In the qualitative interviews, none of the participants mentioned a desire for a brand comparison. Yet, the lesson learned from "light" cigarette labeling suggests that consumers may switch brands based on misperceptions of reduced harm.[58-60] Future examinations should explore how to accurately convey HPHC and risk information across brands. Data on how to convey accurate risk information may be especially important in consideration of Section 206 of the Tobacco Control Act which states that FDA may "prescribe disclosure requirements… if that disclosure would be of benefit to public health or otherwise increase consumer awareness of the health consequences of the use of tobacco products."

The present research has important limitations to note. We did not recruit participants based on cessation intentions; although quit intent had no statistical impact on recognition or visual attention (data not shown), it may impact health information seeking behavior.[61] In this study, participants were mandated to review website content, which created a brief, naturalistic experiment; our results do not yield information on how to draw consumers to such a website. With limited literature on the independent contributions of tailoring and interactivity on HPHC recognition, and no data on visual attention to HPHC information on websites, our study design combined both of these attributes in the intervention condition. Thus, our study design precludes the ability to estimate the impacts of tailoring or interactivity individually. Futures studies on HPHCs or other tobacco-related communications could investigate tailored and interactive elements independently to enhance our understanding of these factors on consumer's recognition, knowledge, and memory. Our study used limited tailoring to a user's brand name and minimal interactivity of content, which precluded our ability to investigate other web design features; future investigation into more extensive tailoring and interactivity should examine their combined and independent impacts on consumer's recognition or other behavioral outcomes. As evidence continues to emerge on the best format for informational websites on HPCHs and their potential health effects,[5-7] more complex, multicomponent interventions may be needed to examine these factors simultaneously. The identification or recognition of HPHC represents one dimension of learning but does not represent deeper comprehension or memory. The recognition memory of chemical names did not include any measure of the recall of their industrial uses. The cross-sectional design of the present experiment does not inform longer-term retention of knowledge or behavior change; longitudinal data are needed to confirm

such relationships over time. Generalizability of our findings may be limited to adult smokers with similar demographic characteristics; findings may not apply to young smokers, other tobacco users, or non-users.

Within this brief Web-based intervention, adult smokers who viewed an unbranded, simple website produced a small but greater improvement in HPHC recognition from a lower amount of visual attention compared to smokers who, on average, viewed a tailored and interactive website for a longer period of time. This finding is in contrast to current recommendations for the use of tailoring and interactivity for the promotion of health behavior change. The qualitative interviews revealed that the interactive website was preferred subjectively, and thus, might be more likely to attract use. Careful consideration should be used to develop Web-based health communications content to deliver information deemed critical for the user to recall and use. The challenge, then, remains how to combine the preferred interactivity and visual interest with relevant interactivity to promote well informed health decision making.

IMPLICATIONS FOR TOBACCO REGULATION

Basic formats and narrative content did not attract a greater proportion of visual attention from adult consumers, yet it increased recognition of HPHCs in cigarettes compared to brand-tailored, interactive Web-based content. Despite these findings in contrast to research supporting the effectiveness of tailoring and interactivity, our study contributes to emerging research focused on optimal strategies to communicate HPHC information to consumers and provide an objective for the FDA on how the use of simplistic, visual information may be considered in the FDA's effort to meet the Tobacco Control Act's standard of presenting HPHC information that is understandable and not misleading to consumers.

Human Subjects Statement

The study protocol (ID#2015B0538) received expedited approval by The Ohio State University's Institutional Review Board on 02/05/2016. The protocol was not pre-registered as an experimental trial.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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