

The Age-related Positivity Effect and Tobacco Warning Labels

Megan E. Roberts, PhD

Ellen Peters, PhD

Amy K. Ferketich, PhD, MA

Elizabeth G. Klein, PhD, MPH

Objectives: This study tested whether age is a factor in viewing time for tobacco warning labels. The approach drew from previous work demonstrating an age-related positivity effect, whereby older adults show preferences toward positive and away from negative stimuli. **Methods:** Participants were 295 daily smokers from Appalachian Ohio (age range: 21-68). All participants took part in an eye-tracking paradigm that captured the attention paid to elements of health warning labels in the context of magazine advertisements. Participants also reported on their past cessation attempts and their beliefs about the dangers of smoking. **Results:** Consistent with theory on age-related positivity, older age predicted weaker beliefs about smoking risks, but only among those with no past-year quit attempts. In support of our primary hypothesis, older age was also related to a lower percentage of time spent viewing tobacco warning labels, both overall (text + image) and for the graphic image alone. These associations remained after controlling for cigarettes smoked per day. **Conclusions:** Overall, findings suggest that age is an important consideration for the design of future graphic warning labels and other tobacco risk communications. For older adults, warning labels may need to be tailored to overcome the age-related positivity effect.

Key words: graphic warning labels; age; eye-tracking; health communication

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For decades, public health campaigns have used cigarette warning labels to inform consumers about the negative health consequences of smoking. Within the U.S., these warnings may soon include colored graphic images, with the intention of eliciting emotional and cognitive responses that may aid in learning and retaining information about smoking's risks.¹⁻³ Specifically, the Family Smoking Prevention and Tobacco Control Act mandates the FDA to develop and require graphic warning labels; although the FDA has not promulgated a final rule on graphic warning labels, it is currently in development of new graphic images. Numerous studies suggest such warning labels will have a positive influence on deterring initiation among adolescents and young adults.⁴⁻⁷ However, research examining

how graphic warning labels could influence adult cessation is mixed for U.S. samples, with some studies finding that exposure reduces craving⁸ and increases intentions to quit⁹ and others finding that exposure has no effect on behavior¹⁰ or produces more positive cognitions about smoking.¹¹

Throughout this research on cigarette warning labels, most studies have focused on effects at the population level without much consideration for individual differences in their effects. This lack of attention to individual characteristics is pragmatic given the extensive and heterogeneous population that warning labels attempt to reach. Nevertheless, an understanding of how the perception of warning labels varies across individuals may inform future studies of warning labels and their designs.

Megan E. Roberts, Postdoctoral Researcher, College of Public Health, The Ohio State University, Columbus, OH. Ellen Peters, Professor, Department of Psychology, The Ohio State University, Columbus, OH. Amy K. Ferketich, Professor, College of Public Health, The Ohio State University, Columbus, OH. Elizabeth G. Klein, Associate Professor, College of Public Health, The Ohio State University, Columbus, OH.
Correspondence Dr Roberts; roberts.1558@osu.edu

Age Effects in Emotion Regulation

One individual-difference factor that appears important to consider when investigating the effects of tobacco warning labels is age. The age-related positivity effect refers to a relative preference for older adults (compared to younger adults) to favor positive over negative stimuli in cognitive processing.¹² Several recent studies suggest an age-related positivity effect whereby older adults, when compared to younger adults, perform worse at recalling negative health-related information¹³ and tend to (mis)remember negative health-related information to be more positive (the smoking status of these participants was not reported).¹⁴ This age-related positivity effect does not appear to be an artifact of cognitive aging, but, rather, it emerges from a present-oriented motivation to feel good.^{12,15,16} Drawing on socioemotional selectivity theory,¹⁷ researchers argue that as people approach the end of life and perceive the future as more constrained, motivations shift so that goals related to emotional well-being become more salient (and, simultaneously, goals related to gaining knowledge for the future become less salient).

Furthermore, it appears that one of the avenues by which this age-related positivity effect occurs is via age-related differences in the visual processing of emotional information. Specifically, laboratory research with eye-tracking equipment indicates that in Western cultures, older adults—but not younger adults—exhibit gaze preferences toward positive and away from negative emotional stimuli.¹⁵ Older and younger adults do not seem to differ on where in an image they first fixate; rather, the bias appears in measures of total fixation time.¹⁸ Directing gaze in this way seems to serve a mood-regulatory goal.^{19,20} As one example, Isaacowitz and Choi²¹ found that, when shown videos containing information about skin cancer, older adults, compared to young adults, tended to look less at the negative video content and learned fewer facts about skin cancer by the end of the study. Importantly, older adults reported more positive moods at the end of the video than did the younger adults.²¹ Such findings suggest that, when exposed to graphic warning labels, older adults (compared to younger adults) will engage in emotion regulation and look at the warning images and text for less time.

The age-related positive gaze presents several

potential implications for how older adults learn health-risk information. One suggestion is that older adults simply have a more “efficient” viewing strategy,²¹ whereby they can quickly extract basic information from a persuasive message without disrupting their positive moods. This possibility is in line with dual-process models of decision making:²²⁻²⁴ Rather than engaging in processing that is deliberative and slow, these older adults, relative to younger adults, may engage in more affective and gist-based processing that is faster, but less precise. Consequently, when presented with health-risk information, older adults may learn less detailed information than younger adults (although what they do learn may, at times, be sufficient to elicit positive health change²¹). We may, therefore, expect to find older smokers (compared to younger smokers) minimizing the negative health risks of smoking. As cessation-related behavior can lead individuals to alter their risk perceptions (eg, consistent with cognitive dissonance theory, perceptions of risk decline following relapse),²⁵ we may expect that quit history will have a moderating effect.

The Current Study

Research on emotion regulation would suggest that age-related positive gaze patterns may be an important consideration in the design of tobacco warning labels; however, to our knowledge, the effect has not heretofore been tested. Therefore, the purpose of the present study was to test whether age was a factor in the viewing time for, and beliefs associated with, tobacco warning labels. We employed secondary data analysis of the Ohio Health Warning Label (OHWL) study, which used eye-tracking software to capture, with accuracy and precision, the attention paid to elements of health warning labels in the context of magazine advertisements. At the time of this publication, cigarette advertisements in American magazines include only a small, text-based health warning; however, the FDA is considering the incorporation of graphic warning labels on advertising. Participants were 295 daily smokers from Appalachia Ohio, who ranged from 21 to 68 years of age. Appalachia is a rural, underserved region of the U.S. that is characterized by higher rates of cigarette and smokeless tobacco use compared to the rest of the country;²⁶ therefore, it is a critical population for tobacco-use research to target.

We first conducted a preliminary test of the age-related positivity effect's implications by examining how age relates to beliefs about the dangers of smoking. We further expected to find an Age \times Quit History interaction, such that older age would predict weaker beliefs about this negative information, particularly among individuals who had not made a quit attempt within the last year.

Our second, and primary, step was to test whether the age-related positive gaze extends to the domain of tobacco warning labels. Our outcome of interest was *percentage viewing time*—the amount of time spent looking at the warning label, relative to overall time spent looking at the advertisement. Our primary hypothesis was that among individuals viewing tobacco advertisements, older age would be related to a lower percentage of viewing time for tobacco warning labels (as well as for the graphic image alone).

METHODS

Participants

Data came from the OHWL study, a project aimed at examining responses to various types of health warning labels among tobacco users within Ohio Appalachia. Participants were recruited via flyers, newspaper ads, and brochures to take part in a study on “perceptions of advertising for consumer products.” Interested individuals completed a phone-based screener with trained field staff to determine eligibility (the screener included filler items to mask the study's tobacco focus). To be eligible, participants needed to be aged 21 or older and living in one of the 32 counties designated as a part of Ohio Appalachia; participants also needed to be current daily smokers and report smoking at least 100 cigarettes in their lifetime. Participants were excluded if they reported intending to quit within the next 30 days because OHWL researchers wished to minimize potential bias due to increased interest in the warnings. Participants were also excluded if they reported current use of other tobacco products, or if they had a history of certain eye conditions (eg, macular degeneration, glaucoma).

Three hundred Appalachian adults participated in the study. The data from 2 participants were excluded due to problems with the eye tracking equipment, and data were also excluded from participants who did not look at the cigarette advertise-

ment ($N = 2$) or did not report age ($N = 1$); these exclusions yielded a sample of 295 for analysis.

Procedures

Overview. Research sessions took place in private offices where trained interviewers explained the study and obtained signed informed consent. Next, participants were placed in front of the computer monitor with integrated eye tracking equipment to complete the eye-tracking portion of the study. Finally, participants completed several survey assessments on the computer. The entire study took approximately 45 minutes to complete.

Advertisements and warning labels. Participants viewed 6 advertisements over the course of this study. Five advertisements were for non-tobacco consumer products (eg, orange juice) and were viewed by all participants. The experimental advertisement was a cigarette advertisement that included one of the 9 warning labels previously proposed by the U.S. Food and Drug Administration, or FDA.²⁷ This cigarette advertisement was the same for all participants (we selected a brand that was not popular in the region and that featured simple graphics and text), but random assignment determined which of the 9 warning labels was paired with it for a participant. The order of advertisement presentation was randomized across participants, with the cigarette advertisement fixed in the fourth position. The size/content of the warning label also varied across 3 experimental conditions: In Conditions 1 and 2, a graphic warning label comprised 20% and 33%, respectively, of the cigarette ad. The value of 20% was selected because it was specified by the Family Smoking Prevention and Tobacco Control Act, which was passed by the U.S. Congress in 2009 (although this specification of the Act is not currently enforced). The value of 33% was selected to examine the effect of larger warnings. In Condition 3 (the control condition), participants viewed text-only versions of the warning label. The effects of these experimental conditions are the focus of another paper,²⁸ but throughout the present paper, we control for experimental condition.

Eye tracking. Interviewers told participants that they would be viewing a series of advertisements and that they should view them at their own pace, as if they were flipping through a magazine. Interviewers explained that participants would have to

view the advertisement for at least 5 seconds but could view it for up to 30 seconds. To standardize the location of visual attention between advertisements, participants were prompted to answer an on-screen survey question after each advertisement.

Participants were seated in a chair within a typical viewing distance (24 to 32 inches) from a 22 inch monitor equipped with the eye-tracking system. A wireless infrared camera operated to allow the participant free head movement while capturing information for very fine detail of spatial resolution (0.03°) from the on-screen display.

BeGaze software (SensoMotoric Instruments, 60 Hz RED System) was used to display the advertisements and capture the eye tracking data. Interviewers administered equipment calibration procedures 3 times per participant to ensure data quality before the start of the experiment. Once calibrated, the eye tracking equipment was able to capture visual fixations, fixation duration, and sequence of objects viewed for every advertisement shown during the study exposure.

Survey questions. At the end of the experiment, an interviewer-conducted survey assessed participants' smoking-related cognitions and behaviors and collected general demographic information.

Measures

In discussing the following measures, the term "Warning Label" refers to the entire tobacco warning (Text + Graphic Image for Conditions 1 and 2, and Text only for Condition 3). We will specify when referring exclusively to either the text or the graphic image. At times, we also refer to the "entire cigarette advertisement," of which the graphic warning label is a component. All areas of interest (text area, white space, etc.) were defined a priori for each advertisement.

Gaze behavior. We isolated viewing time for the entire cigarette advertisement (in milliseconds), for the warning label, and for the graphic-only portion of the warning label. Next, to reduce noise in the data that was due to differences in time spent viewing the cigarette advertisement overall, we also calculated the percentage of viewing time for the warning label and the percentage of viewing time for graphic-only portion of the warning label (for both variable calculations, the denominator is the time spent viewing the cigarette advertisement overall).

Smoking behavior. Participants reported the number of cigarettes they smoke per day (CPD) and how soon they smoke their first cigarette upon waking up.²⁹ They also reported the number of years they had been smoking.

Quit history. Participants were asked "In the past 12 months, how many times have you quit smoking for at least 24 hours in a serious attempt to quit?" Those who reported having made at least one serious quit attempt in the past year were coded as having made a past-year quit attempt.

Beliefs about smoking risks. To assess participants' cognitive reactions to the tobacco advertisement and the accompanying warning labels, participants were asked to think about the cigarette advertisement they had just viewed. Interviewers then asked: "How much do you agree or disagree with each of the following statements?" Items included commonly-known risks,³⁰ specifically: *cigarettes cause fatal lung disease... cancer... strokes and heart disease* (from 1 = *not at all* to 5 = *completely*). These 3 items were aggregated to create a single beliefs scale ($\alpha = .92$).

Demographic variables. Items included demographic factors of gender, race/ethnicity, education, annual household income, and marital status. Participants also provided their birthdays, which were used to calculate age.

Analyses

Analyses began with descriptive statistics to examine smoking behavior in the sample, as well as analysis of variance (ANOVA) and zero-order correlations to examine relations among variables of interest. Regressions were next conducted to examine whether age and an Age \times Quit History interaction predicted (1) beliefs about smoking risks and (2) percent viewing time (for the warning label and for the graphic image alone). Due to their potential relation to the dependent variables, the regressions controlled for condition, CPD, and gender. Step 1 of the regressions entered these covariates and Step 2 entered age and quit history. For analyses looking at moderation by quit history, a third step entered the Age \times Quit History interaction term. All continuous independent and dependent variables were standardized (*z*-scored) for the regressions. Outliers with residual statistics greater than 3 were removed from the specific regressions. We also examined

Table 1
Correlations Among Factors of Interest

Factor	1	2	3	4	5	6	7	8
1. Age								
2. Time Viewing Entire Cigarette Advertisement	.08							
3. Percent of Time Viewing Warning Label	-.14*	-.32***						
4. Percent of Time Viewing Graphic Image	-.17*	-.29***	.73***					
5. Overall Time Viewing Warning Label	-.13*	.24***	.67***	.43***				
6. Overall Time Viewing Graphic Image	-.19**	.21**	.47***	.70***	.80***			
7. Beliefs about Smoking Risks	-.16**	.04	-.04	-.08	-.02	-.01		
8. Cigarettes Smoked per Day (CPD)	.17**	-.08	.08	.00	-.01	-.10	-.04	
9. Recent Quit Attempt (0=no, 1=yes)	-.17**	-.04	-.05	.00	-.05	-.02	.14*	-.21***

* $p < .05$, ** $p < .01$, *** $p < .001$

whether experimental condition moderated any of the hypothesized relations reported below, but none of these post-hoc tests produced significant results.

RESULTS

Descriptive Statistics

This sample was 67% female, with a mean age 40.4 years (SD = 11.6, range 21-68; 24% of the sample was aged 50 or older). The vast majority of the sample (97%) was non-Hispanic White, which is representative of the Ohio Appalachian area.³¹ Twenty percent of the sample had achieved less than a high school degree and another 45% reported a high school degree or GED as their highest level of education; 65% of the sample reported an annual household income below \$25,000.

Participants reported smoking an average of 18 cigarettes per day (SD = 8.8); 96% smoked every day and 77% smoked within 30 minutes of waking. No participants reported using the brand of cigarettes used in our experimental advertisement. Mean number of years smoking was 22 (SD = 11.8). Eighty percent of the sample reported having ever made a serious quit attempt and 52% reported having made a serious quit attempt in the past 12 months. For the overall sample, participants viewed the entire cigarette advertisement for an average of 12 seconds (SD = 8.8). There was no difference in viewing time for the entire cigarette advertisement across label conditions ($p > .44$).

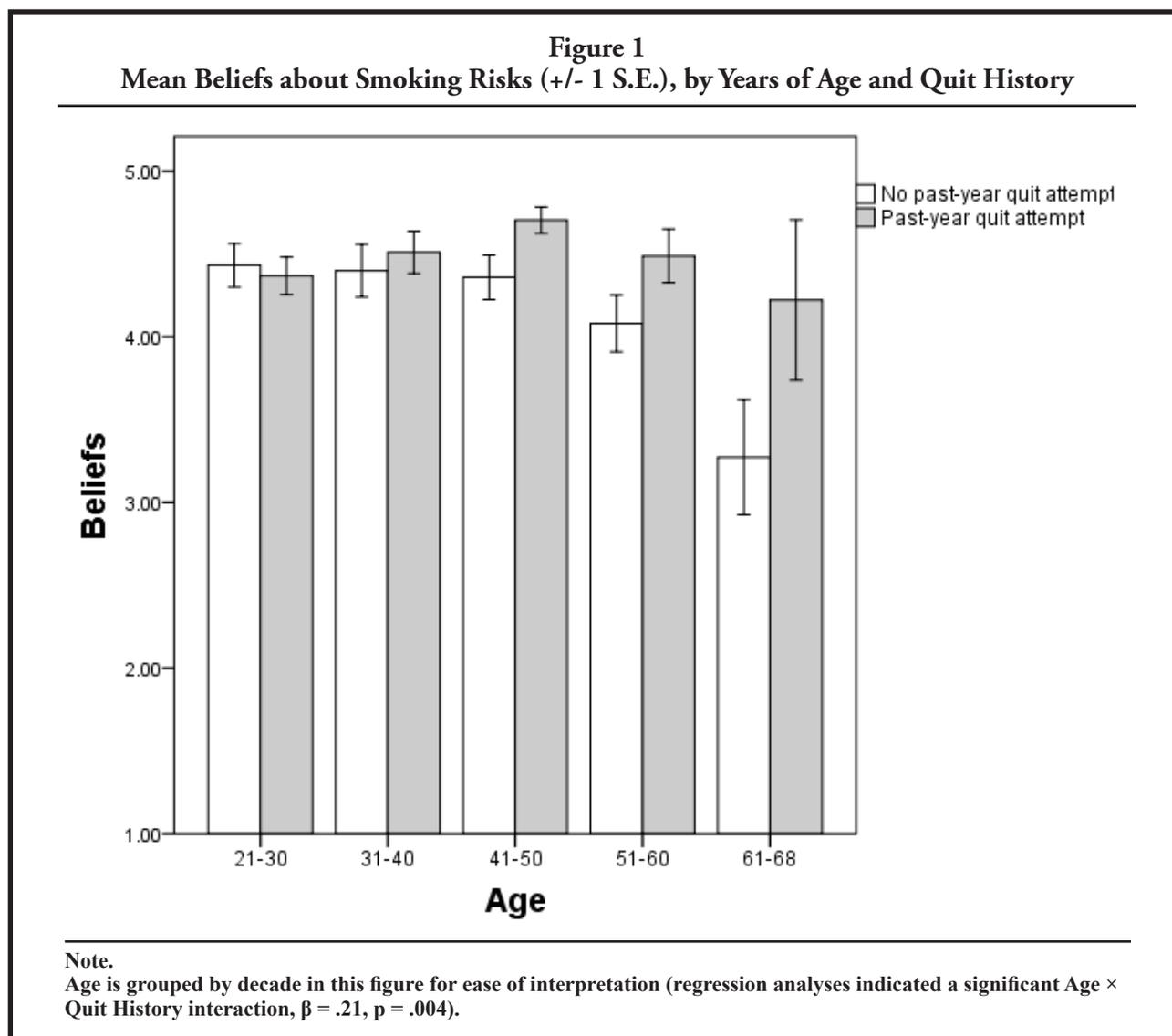
In a one-way ANOVA, total viewing time for the

warning label varied by label condition; Bonferroni post-hoc comparisons indicated that total viewing time was shorter among those in the control (text-only) group compared to the other groups ($ps < .001$); those in the 2 graphic images conditions did not differ in their viewing time of the warning label. Participants in the 2 graphic image conditions also did not differ in viewing time of the graphic image ($p > .22$; see Klein et al²⁸ for a discussion of this finding).

In zero-order correlations (see Table 1), CPD was positively related to age ($r = .17$, $p = .003$), but not to the 3 viewing-duration variables ($ps > .18$). Those who had made a past-year quit attempt were significantly younger than those who had not [$t(293) = 2.98$, $p = .003$]. Age was not correlated with viewing time for the entire cigarette advertisement ($p > .16$); however, older age was related to a lower percent of time viewing the warning label ($r = -.14$, $p = .014$) and the graphic image alone ($r = -.17$, $p = .017$).

Health-Risk Beliefs

The mean health-risk beliefs was 4.4 (SD = .9); individual item means were 4.5 (SD = .9) lung disease, 4.4 (SD = .9) cancer, 4.2 (SD = 1.0) stroke and heart disease. In the moderation model predicting smoking beliefs, a significant Age \times Quit History interaction emerged as predicted ($\beta = .21$, $p = .004$; see Figure 1). Simple slopes analyses indicated that, among smokers reporting no past-year quit attempts, older age was related to weaker be-



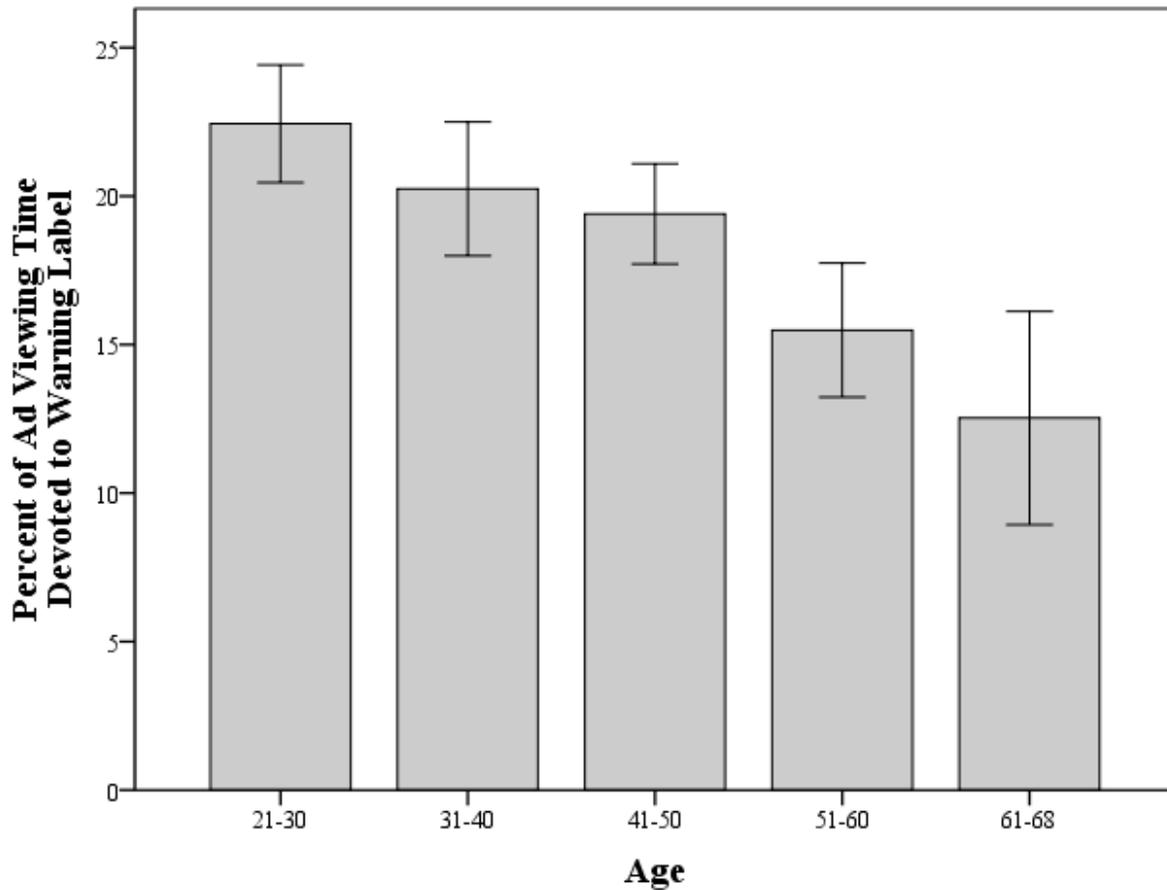
beliefs about the dangers of smoking ($\beta = -.26$, $p = .001$); among those smokers with a past-year quit attempt, the effect of age was not significant ($p > .39$). The regression was also re-run controlling for the percentage of time viewing the graphic image. Consequently, only data from participants in Conditions 1 and 2 were available for these analyses ($N = 192$). Results again paralleled the previous findings: a significant Age × Quit History interaction predicted smoking beliefs ($\beta = .21$, $p = .03$).

Viewing Time for the Warning Labels and Graphic Images

Figure 2 provides an illustration of how percent viewing time for the warning labels declined with

age. Regression analyses indicated that age was a significant predictor of the percentage of time viewing the warning label, such that older participants viewed the warning label for relatively briefer periods ($\beta = -.18$, $p = .001$). Neither quit history, CPD nor gender were associated with percentage of viewing time ($p > .1$); there was a main effect for label condition (as percent viewing time was briefer in the control condition; $\beta = .39$, $p < .001$). The above regression was also run substituting in the percentage of time viewing the warning label for the percentage of time viewing the graphic image alone ($N = 191$). Results paralleled the above findings: age predicted the percent of time viewing the graphic image ($\beta = -.17$, $p = .02$). Here, there were

Figure 2
Mean Percentage of Viewing Time (+/- 1 S.E.) Devoted to Viewing the Tobacco Warning Label, by Years of Age



Note.
 Age is grouped by decade in this figure for ease of interpretation (the correlation between age and percent viewing time of the warning label is $r = -.13$, $p = .02$).

no significant effects for CPD, gender, or label condition. In a follow-up analysis, we also looked at the relative time spent looking at negative aspects of the advertisement (the warning label) compared to time spent looking at positive/neutral aspects of the advertisement (eg, the graphics). This analysis revealed the same pattern of findings, with older age predicting a lower negative-to-positive fixation time ratio ($\beta = -.12$, $p = .03$).

DISCUSSION

This study used participants from an underserved

region of Appalachian Ohio to examine an implication of the age-related positivity effect in the context of tobacco warning labels. These warning labels were shown printed within a tobacco advertisement, in the manner that has been proposed by the FDA.²⁷ Supporting our first hypothesis, we observed an Age \times Quit History interaction when predicting beliefs about the dangers of smoking, such that older age predicted weaker beliefs, but only among those with no past-year quit attempts. Thus, there was evidence of an age-related positivity effect among smokers for whom smoking-risk information would be the least valuable. Given

that our results are cross-sectional and our measure of beliefs focused on commonly-perceived smoking risks,³⁰ it is unclear whether exposure to warning labels in the present experiment *changed* the strength of participants' beliefs. That is, the results may have reflected a priori differences in health beliefs among those who have quit recently compared to those who have not (but only among older adults). Our variable *quit history* may also have reflected additional factors that were involved—including motivation to quit and self-efficacy to quit.

Supporting our primary hypothesis, eye tracking data indicated that older age was related to a lower percentage of viewing time for tobacco warning labels—both overall and for the graphic image alone. These associations remained even after controlling for CPD. Further, the fact that we predicted the *percentage* of warning label view time rules against the alternative explanation that our effect was due to overall differences in viewing time for the advertisement. Likewise, our use of an advertisement with simple graphics and text reduces the likelihood that our effect was driven entirely by attention to the advertisement itself.

Participants in this study were sampled from an underserved region in rural Ohio, and findings should be replicated with other populations, including populations of smokers interested in quitting. Replications should also use multiple trials of various graphic warning stimuli, and also incorporate highly positive stimuli (rather than just negative and neutral stimuli) to support a stricter demonstration of the positivity effect. In addition, future studies should extend the present findings to examine not only how the age-related positivity effect influences warning label viewing time and smoking-related beliefs, but also how it influences subsequent smoking behaviors.

Implications for Tobacco Regulation

By identifying age as an important individual difference, these findings provide a more nuanced understanding of how tobacco warning labels may impact consumers. To begin, our findings showed that older participants viewed warning labels for proportionally smaller periods relative to the overall advertisement. These results are consistent with previous research²¹ showing that older adults spent relatively less time viewing negative stimuli. Previ-

ous work has also demonstrated that older adults learn less information as a result of this shorter viewing time. Thus, it is possible that those with the greatest potential to learn new information from warning labels are younger adults (eg, those under the age of 50). Consequently, the findings also imply that research using samples with wide age ranges may be under-reporting findings with respect to younger adults, as the positive effect of a warning label on younger adults is likely obscured in a more heterogeneous sample. Furthermore, when paired with evidence that younger adults are more likely than older adults to successfully quit smoking³² and that the health benefits of quitting are greatest before the age of 35,³³ the present findings suggest that public health efforts should target their standard warning labels to younger audiences where the odds and potential impacts of success appear higher.

Yet cessation among older adults cannot be neglected. Indeed, older smokers are a population at high risk for smoking-related disease because they have been smoking for a greater number of years and tend to be heavier smokers.³⁴ There is research to indicate that the positivity effect can be moderated;^{35,36} and although the positivity effect reflects the present-oriented “default” motivations of older adults, older adults can process information in ways that are similar to younger adults when motivated to do otherwise.^{12,37} Therefore, in order to target cessation among older adults, public health efforts could be optimized to overcome the processes involved with emotion regulation. For example, warning labels tailored for older adults might use positive message framing or attempt to enhance cessation motivation as a means of getting older adult smokers to receive and respond to health-risk information in the same manner as their younger counterparts (for recent examples of such approaches in other domains, see³⁸⁻⁴⁰).

Overall, this study extends tenets of the age-related positivity effect to the literature on tobacco warning labels. More specifically, results illustrate 2 phenomena related to the age-related positivity effect: Findings demonstrate that quit history is a key moderator of whether implications of the positivity effect appear for smoking-risk beliefs and also demonstrate the age-related positive gaze in the context of tobacco warning labels. Ultimately,

age should be an important consideration for the design of future graphic warning labels and other tobacco risk communications.

Human Subjects Approval Statement

All procedures were approved by The Ohio State University Institutional Review Board.

Conflict of Interest Disclosure

The authors have no conflicts of interest to report.

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