Harnessing the power of a ‘neural focus group’ to predict population-level anti-smoking message effects on risky decisions among adolescents

Elissa Kranzler, M.A., M.S.Ed.
Doctoral Candidate
Annenberg School for Communication
University of Pennsylvania
elissa.kranzler@asc.upenn.edu

Faculty Advisor
Robert Hornik
Wilbur Schramm Professor of Communication and Health Policy
Annenberg School for Communication

Secondary Advisor
Emily Falk
Associate Professor of Communication
Annenberg School for Communication
Specific Aims

Despite the challenges inherent in forecasting population-level effectiveness of anti-smoking messages, previous research suggests that neuroimaging can be a powerful predictive tool. The proposed study will examine the relationship between neural response in a small sample of adolescents during exposure to anti-smoking messages and population-level measures of intention to share messages and perceived message effectiveness. Findings from this study, the first of its kind with adolescents, will contribute to knowledge about the cognitive processes underlying effective and shareworthy messages likely to affect decisions around risky behaviors at the population level, and support the development of more effective anti-smoking messages.

Background and Significance

Tobacco use is the leading cause of preventable death and disease in the US. Smoking initiation typically begins during adolescence, with 90% of smokers having initiated before age 18; consequently, adolescents are at an increased risk of initiating and progressing to regular smoking. Anti-smoking media campaigns can attenuate this risk by influencing young people’s anti-smoking beliefs, which predict campaign effects including reduced intention to smoke and decreased smoking behavior. Interpersonal communication has also been conceptualized as an important link between mass media messages and message effects. Evidence suggests that exposure to anti-smoking campaigns prompts conversations about campaign messages, which can influence targeted campaign outcomes for anti-smoking campaigns in general and those targeting adolescents.

One approach to improve our understanding of these mechanisms is to examine how anti-smoking messages are received and processed by the adolescent brain, and to link neural responses during message receipt to subsequent message effects. Neuroimaging offers a means for probing both implicit and explicit cognitive processes in real time, and has been used to identify characteristics thought to underlie effective and “shareworthy” health messages. Evidence suggests that messages that are rated as self-relevant or elicit neural activity in brain regions thought to index self-related cognitions influence smoking-relevant behaviors. Neural response in the medial prefrontal cortex (MPFC), a brain region implicated in self-related processing, during message exposure has been associated with calls to a smoking quitline, clicks in an anti-smoking email campaign, smoking reduction, and smoking cessation. In sum, findings suggest that self-related considerations during message exposure can influence smoking-relevant behaviors, and can even predict population-level behavioral response. Scant research has examined the neural correlates of message sharing. Findings in this domain suggest that activity in meta-analytically defined brain regions implicated in self-relevant thought, social cognition, and subjective valuation during message exposure predicts both individual and population-level sharing of messages. These outcomes reflect adult populations, and it is unclear whether the same processes elicit comparable behavioral responses in adolescents.

Preliminary neuroimaging research in adolescents diverges in part from adult findings. In the only known study of the neural correlates of message effectiveness and sharing in teens, neural activity in brain regions implicated in social cognition was significantly associated with perceived ad effectiveness and marginally associated with teens’ intention to share messages on social media. Conversely, neural activity in regions implicated in self-relevant thought and subjective valuation was not related to either outcome. Findings suggest that among adolescents, perceived effectiveness (PE) ratings and intention to share messages may be shaped more by social considerations than self-relevance or subjective value. These findings reflect
within-subject associations between neural response and PE and sharing outcomes, and the findings from this study have not been linked to population-level outcomes.

Proposed Study

The proposed study will assess the extent to which brain activity in a “neural focus group” of adolescents during exposure to anti-smoking messages from a completed study predicts population-level ratings of message effectiveness and sharing from a study to be undertaken with support from the requested Ackoff fellowship. Specifically, we have fMRI data from forty 14-17 year olds during their exposure to 12 ads from “The Real Cost” anti-smoking campaign. These data reflect neural responses in brain regions of interest (ROIs) implicated in self-relevant thought, social cognition, and subjective reward. I will link that ad-level data with ratings of PE and intention to share each ad on social media from a new national sample of adolescents. Given that adolescents’ neural activity in ROIs within the social cognition network was significantly associated with their subsequent PE ratings, I hypothesize that neural activation in ROIs within the social cognition network from this neuroimaging sample will be positively associated with population-level ratings of PE and intention to share ads.

Research Design and Methods

Pre-existing Data. We have the needed fMRI data in hand, comprising neural responses to the Real Cost ads (PSA study), operationalized as percent signal change in blood flow in ROIs relative to baseline. With pilot data, we have demonstrated variation in neural responses to each Real Cost ad in each ROI, suggesting it is possible to establish the hypothesized associations.

Research Design. The complementary study will consist of a 20-minute online survey, administered through Qualtrics. Participants will answer questions assessing smoking-relevant cognitions and behavior, and prior recall of stimuli. Participants will then view the 12 Real Cost ads in random order and answer questions pertaining to their intention to share and PE of each ad. A final set of questions will assess personality traits and demographic information.

Sample. A national sample of adolescents from Toluna’s opt-in panel will be recruited for the study (N = 1,000). The study sample will be limited to include adolescents aged 14-17 who are non-smokers or smoking experimenters (defined by having smoked fewer than 100 cigarettes in their lifetime) and have access to a computer with internet.

Measures. Survey items will be drawn from those used in the complementary neuroimaging study. Smoking-relevant cognitions include beliefs about and intentions to use cigarettes. Ad recall items assess aided recall of each ad in the previous 30 days. Intention to share is assessed on a 5-point scale, and PE items assess the extent to which ads are attention-grabbing, worth remembering, powerful, informative, personally meaningful, convincing, and terrible (reverse coded). Demographic and personality traits assessed include age, sex, race, parent education, and sensation seeking (using the Brief Sensation Seeking Scale21).

Analysis. Previous analyses employed multilevel modeling to predict PE and sharing outcomes using neural response in each region of interest as the predictor, accounting for clustering at the participant and ad levels.20 The proposed analysis will employ a similar approach, but population-level variables will be derived from a national-level survey rather than from participant’s idiosyncratic ratings of perceived effectiveness. PE and sharing outcomes in the national sample will be aggregated, by ad, and linked with neural responses from the PSA study. Specifically, population-level PE and intention-to-share ratings for each ad from the proposed study will be linked to ad-specific neural response in each ROI from the PSA study. Estimates will be compared using population estimates as parametric modulators with the scanning participants and from multilevel modeling with the survey sample.
Budget

Rationale for Funding. Funding will be used to recruit participants through Toluna, a survey research company. A sample of 1,000 will provide sufficient power to detect effects that may be small in size.

Detailed Budget.

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toluna participant cost per 20-minute survey</td>
<td>$4.50</td>
</tr>
<tr>
<td>Sample size</td>
<td>1,000</td>
</tr>
<tr>
<td>Estimated total cost</td>
<td>$4,500</td>
</tr>
<tr>
<td>Total amount requested</td>
<td>$4,000</td>
</tr>
</tbody>
</table>

Description of Other Funding Sources. The Annenberg School for Communication provides $1,200 for each fiscal year to support academic presentations at conferences. Annenberg School for Communication graduate students may also apply for a dissertation budget of up to $1,200.
I have read the proposal, and with Professor Falk, will supervise its execution- Robert Hornik

I have read the proposal and certify that I will supervise Elissa in executing it. –Emily Falk
References


