



Feasibility and reliability of a mobile tool to evaluate exposure to tobacco product marketing and messages using ecological momentary assessment



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ABSTRACT

Introduction: Existing measures of tobacco marketing and messaging exposure are limited, relying on recall, recognition, or proxy measures. This study aimed to determine the feasibility and reliability of a mobile application for the measurement of tobacco and e-cigarette marketing and message exposure using ecological momentary assessment (EMA).

Methods: Young adults from Austin, TX (n = 181, ages 18–29) were instructed to use a mobile application to record all sightings of marketing or social media related to tobacco (including e-cigarettes) in real-time for 28 days (Event EMAs). Tobacco product use and recall of message encounters were assessed daily using an app-initiated EMA (Daily EMAs).

Results: The mobile app was a feasible and acceptable method to measure exposure to tobacco messages. The majority of messages (45.0%) were seen on the Internet, and many were user-generated. Thirty-day recall of messages at baseline was poorly correlated with messages reported via Event EMA during the study period; however, the correlation between post-study 30-day recall and Event EMA was much stronger (r = 0.603 for industry-sponsored messages, r = 0.599 for user-generated messages). Correlations between Daily EMAs and 30-day recall of message exposure (baseline and post-study) were small (baseline: r = 0.329–0.389) to large (post-study: r = 0.656–0.766).

Conclusions: These findings suggest that EMA is a feasible and reliable method for measuring tobacco message exposure, especially given the prevalence of messages encountered online and on social media. Recall measures are limited in their ability to accurately represent marketing exposure, but might be improved by a period of priming or clearer response categories.

1. Introduction

A large body of evidence links awareness and receptivity to pro-tobacco marketing and media to initiation, experimentation, and use of cigarettes among youth and young adults (Agaku & Ayo-Yusuf, 2013; Lovato, Watts, & Stead, 2011; Mantey, Cooper, Clendennen, Pasch, & Perry, 2016; Wellman, Sugarman, DiFranza, & Winickoff, 2006). Many have concluded that this evidence is sufficient to support a causal, dose-response relationship between exposure to tobacco marketing and adolescent smoking behaviors (Lovato et al., 2011; National Cancer Institute, 2008; U.S. Department of Health and Human Services, 2012). However, the validity of common marketing exposure measures has yet to be established. Increasing validity of these

measures would strengthen causal inferences that have been made from this research to date (Martino, Scharf, Setodji, & Shadel, 2012; Nelson, 2010; U.S. Department of Health and Human Services, 2012).

There is currently no “gold standard” for measuring exposure to pro-tobacco messages. The majority of marketing exposure measures rely on participant recall; for example, asking how frequently during the past 30 days participants saw tobacco ads in various locations (i.e., print media, billboards, point of sale, and the Internet) (National Institutes of Health, U.S. Food and Drug Administration, 2014; Office on Smoking and Health, 2015). Yet, recall measures have several limitations. Studies have demonstrated that when participants are asked to summarize experiences over an interval of time, recent experiences are more influential than distant experiences (Stone,

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Shiffman, & DeVries, 1999; Tversky & Kahneman, 1973). In addition, ecological factors have been shown to bias recall, such as mood at the time of the survey (Shiffman, Stone, & Hufford, 2008), and how much the viewer likes the marketing (Unger, Cruz, Schuster, Flora, & Johnson, 2001). Other methods of measuring advertising exposure are less ideal. They include evaluating recognition of tobacco brands, ownership of tobacco promotional items, or proxy measures such as gross impressions calculated from participants' favorite magazines (Heckman, Flyer, & Loughlin, 2008; Pucci & Siegel, 1999; Unger et al., 2001). At best, such methods are an indirect measure of marketing exposure, and at worst, a measure of a completely different construct (Nelson, 2010).

These weaknesses have become more problematic given the changing landscape of tobacco marketing. Numerous studies have demonstrated that tobacco products (including e-cigarettes) have an increasingly strong online presence (Jo, Kornfield, Kim, Emery, & Ribisl, 2015; Richardson, Ganz, & Vallone, 2014a; Richardson, Ganz, Pearson, et al., 2014). While some social networking sites such as Facebook and Twitter have policies preventing paid advertisement for tobacco products (Facebook, 2014; Twitter Inc, 2014), the proliferation of user-generated pro-tobacco content remains unfettered. User-generated pro-tobacco content, especially about hookah, cigars and e-cigarettes (Emery, Vera, Huang, & Szczyepka, 2014; Link, Cawkwell, Shelley, & Sherman, 2015), has been observed on a multitude of social networking sites such as YouTube (Bromberg, Augustson, & Backinger, 2012), Instagram (Richardson, Ganz, & Vallone, 2014b), and Facebook (Freeman & Chapman, 2010). The new wave of social media messaging is particularly effective at targeting adolescents and young adults, as it utilizes peer acceptance, social interaction, and identity development (Montgomery, 2009).

Although many agree that online advertising is an important target for regulations and counter-marketing efforts (Freeman, 2012; Ribisl & Jo, 2012), the extent of online tobacco marketing exposure is poorly understood. Thus far, research has been limited to descriptive studies (Bromberg et al., 2012; Hua, Yip, & Talbot, 2013; Seidenberg, Rodgers, Rees, & Connolly, 2012; Wackowski, Lewis, & Delnevo, 2011), studies that examine overall trends in online marketing (Cavazos-Rehg, Krauss, Spitznagel, et al., 2014; Richardson et al., 2014a) or qualitative content analyses (Cole-Lewis, Pugatch, Sanders, et al., 2015; Emery et al., 2014; Myslín, Zhu, & Conway, 2013) rather than quantifying specific exposure.

The changing landscape of tobacco marketing has created new challenges for measurement. Measuring exposure to online advertising is notoriously difficult due to the targeted and personalized nature of online marketing (Guha, Cheng, & Francis, 2010). Targeted advertising dramatically changes the online experience of each individual, and 62% of young adults between the ages of 18 and 29 reported noticing advertisements online directly related to recently visited sites or search terms (Purcell, Brenner, & Rainie, 2012). The implication of this marketing practice is that there is no way to accurately determine the types of pro-tobacco messages seen by an individual unless computer monitoring software is installed or the individual reports ad exposure themselves. Although some studies have attempted to summarize online tobacco advertising by examining marketing expenditures and conducting broad internet searches to determine general characteristics of ads (Richardson et al., 2014a), at best, this method captures only industry-sponsored messages.

One potential solution is the use of methods such as ecological momentary assessment (EMA). EMA utilizes the repeated collection of real-time data on participants' behavior and experience in their natural environment (Shiffman et al., 2008). This method accounts for environmental characteristics of the measurement, while simultaneously avoiding the data distortion inherent in retrospective accounts (Stone et al., 1999). Several pilot studies have demonstrated the feasibility of using EMA to capture tobacco and alcohol marketing exposure (Martino et al., 2012; Scharf, Martino, Setodji, Staplefoote, & Shadel, 2013);

however, participants were required to carry a separate device (i.e., not their own smartphone), and they only reported industry-sponsored messages.

In this study, we examined the feasibility and reliability of a mobile application to evaluate exposure to tobacco product marketing and messages via EMA. We utilized an application that participants could download to their own smartphone, and gathered data on exposure to and perceptions of tobacco-related marketing and messages, including both industry-sponsored and user-generated content.

2. Methods

2.1. Participants

Participants were young adults aged 18–29 living in Austin, Texas. Participants were recruited via printed flyers and online ads placed on Craigslist and the University of Texas at Austin events calendar. Participants were enrolled after completing a brief eligibility questionnaire, requiring that they speak English and own a smartphone capable of accessing the Internet. One hundred and eighty-one participants completed a baseline survey. Of those participants, 148 completed all 28 days of the study, 10 dropped out, and 23 were dropped due to inactivity.

2.2. Procedure

The study was approved by the Institutional Review Board at The University of Texas Health Science Center at Houston. Data collection took place between March and June 2015. At baseline, participants provided informed consent and installed a free application (SurveySwipe by SurveyAnalytics) onto their personal smartphone. Participants were given study instructions via e-mail, and completed a baseline survey assessing demographic information, use of social media and the internet, use of tobacco (including e-cigarettes), and perceptions of tobacco advertising.

Participants were instructed to record all sightings of marketing, messages, or social media related to tobacco seen during the study period. Products of interest were defined as: cigarettes, cigars, little cigars, or cigarillos, chewing tobacco, snuff, snus, or dip, hookah, dissolvables (such as Camel orbs, sticks, or strips), and e-cigarettes, vape pens, or personal vaporizers. Participants were asked to report both industry-sponsored marketing (defined as printed ads, flyers, billboards, coupons or promotional-email offers, online ads, and industry-sponsored social media such as an official Facebook page), and user-generated messages (defined as Facebook posts, Instagram photos, Vines, or Tweets, and online discussion threads).

2.2.1. Daily EMA

Tobacco use and recall of message sightings were evaluated every 24 h via a push notification delivered to participants' phones each day at 12 P.M. Participants who did not complete the daily survey by 9 A.M. the following morning also received a reminder via e-mail. Participants who were inactive for 7 consecutive days were sent an e-mail reminding them of the participation requirements, contact information for the research team, and a link to unsubscribe from the study if they desired. Participants who remained inactive after 14 days were dropped from the study.

2.2.2. Event EMA

Real-time encounters with tobacco marketing and/or messages were submitted via a participant-initiated, repeatable survey in the application. Upon seeing a message, participants could start the survey and upload a photograph or screenshot of the message as a question response through the app. Because we were interested in exploring what marketing and messages participants noticed without any kind of external influence or incentive, participants were not prompted or

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