

Fall 12-2018

## CHARACTERIZING YOUNG ADULT EXPOSURE AND ENGAGEMENT WITH SOCIAL MEDIA TOBACCO AND NICOTINE PRODUCT MARKETING AND MESSAGING

Stephanie L. Clendennen  
*UTHealth School of Public Health*

Follow this and additional works at: [https://digitalcommons.library.tmc.edu/uthsph\\_dissertsopen](https://digitalcommons.library.tmc.edu/uthsph_dissertsopen)



Part of the [Community Psychology Commons](#), [Health Psychology Commons](#), and the [Public Health Commons](#)

---

### Recommended Citation

Clendennen, Stephanie L., "CHARACTERIZING YOUNG ADULT EXPOSURE AND ENGAGEMENT WITH SOCIAL MEDIA TOBACCO AND NICOTINE PRODUCT MARKETING AND MESSAGING" (2018). *UT School of Public Health Dissertations (Open Access)*. 12.  
[https://digitalcommons.library.tmc.edu/uthsph\\_dissertsopen/12](https://digitalcommons.library.tmc.edu/uthsph_dissertsopen/12)

This is brought to you for free and open access by the School of Public Health at DigitalCommons@TMC. It has been accepted for inclusion in UT School of Public Health Dissertations (Open Access) by an authorized administrator of DigitalCommons@TMC. For more information, please contact [digitalcommons@library.tmc.edu](mailto:digitalcommons@library.tmc.edu).

CHARACTERIZING YOUNG ADULT EXPOSURE AND ENGAGEMENT WITH  
SOCIAL MEDIA TOBACCO AND NICOTINE PRODUCT MARKETING AND  
MESSAGING

by

STEPHANIE L CLENDENNEN, BS, MPH

APPROVED:

---

ANNA V WILKINSON, PHD

---

ALEXANDRA LOUKAS, PHD

---

CHERYL L PERRY, PHD

---

ELIZABETH A VANDEWATER, PHD

---

DEAN, THE UNIVERSITY OF TEXAS  
SCHOOL OF PUBLIC HEALTH

Copyright  
by  
Stephanie L. Clendennen, BS, MPH, DrPH  
2018

## DEDICATION

To Shorty and Edna Clendennen

CHARACTERIZING YOUNG ADULT EXPOSURE AND ENGAGEMENT WITH  
SOCIAL MEDIA TOBACCO AND NICOTINE PRODUCT MARKETING AND  
MESSAGING

by

STEPHANIE L CLENDENNEN  
BS, Tarleton State University, 2011  
MPH, Baylor University, 2014

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS  
SCHOOL OF PUBLIC HEALTH  
Houston, Texas  
December, 2018

## ACKNOWLEDGEMENTS

Thank you so very much to my dissertation committee members. I feel so blessed to have worked with each one of you. I could not have asked for a more attentive and encouraging group of professionals to mentor me in this process. To my advisor and chair, Anna Wilkinson – Thank you for the countless hours you have spent helping me through this process, talking me through the difficult times and celebrating my accomplishments. I am so grateful that you were willing to become my advisor. To Elizabeth Vandewater – Thank you for teaching me what it means to be a great scientist. I am a better researcher because I met you. I am so grateful that you have stuck with me, from my very first day of this doctoral program to the end. To Alexandra Loukas – Thank you for allowing me to work with Project M-PACT. It has been a privilege and an invaluable learning opportunity. I have appreciated your thoughtful feedback and encouragement, which has helped me to become a better writer. To Cheryl Perry – Thank you for investing in me and allowing me to be a part of TCORS. You have been a terrific leader and an inspiration. I am forever grateful for the time you have spent mentoring me.

Thank you to Project M-PACT team members - Sherman Chow, Shelly Li, and Tres Hinds. You met with me, emailed with me, answered my many questions, and encouraged me throughout this process. I consider you all friends, and I am very grateful to each of you for your support. Also, to the entire TCORS team – What an intelligent and warm group of people! I am so grateful to have found this niche. You all have been wonderful colleagues and friends, and I thank you for your collaboration and encouragement. I look forward to seeing all the wonderful things you all will accomplish in the future!

Finally, I could not have come this far without the love and encouragement of my wonderful family. First, to my husband, Jeff Douglas – I love you with all of my heart, my friend since 6<sup>th</sup> grade, my high school and college sweetheart. Thank you for always believing in me, for pushing me, for taking on more than your share to get me to this point. In all our years, you've never complained even once about the demands of my educational pursuits. I am so excited to begin a new chapter with you!

And to my parents, David and Myra Clendennen – Where do I even begin? Everything that I am is because of you. Thank you for supporting me in every way possible. You are a constant source of comfort and love. To my mom – Thank you especially for encouraging reading and instilling in me a desire to go to college. To my dad – Thank you for nurturing my self-esteem in a way only a father's loving words and actions can do.

To my grandparents, Fred and Cathy Felan – Thank you for praying for me, for always telling me how proud you are of me, and for allowing me to retreat to your home throughout my graduate studies. I experienced a piece of my childhood again, visiting with you, eating Granny's cooking, watching reruns, and sleeping over when Jeff was out of town.

Also to my sisters, Laura Wilcoxon, Andrea Durnell, and Aimee Barnard – You three are my best friends! Thank you for being there for me every day even though we've lived in different cities. Thank you for listening to me and making me laugh. You are the true loves of my life.

To my uncle and aunt, Trey and Joy Felan, as well as to my brothers-in-law, my in-laws, and my friends – You have each had a part in seeing me through this program. Thank you for the great times and for the love and encouragement. You are my village!

CHARACTERIZING YOUNG ADULT EXPOSURE AND ENGAGEMENT WITH  
SOCIAL MEDIA TOBACCO AND NICOTINE PRODUCT MARKETING AND  
MESSAGING

Stephanie L. Clendennen, BS, MPH, DrPH  
The University of Texas  
School of Public Health, 2018

Dissertation Chair: Anna V. Wilkinson, PhD

Tobacco use remains a critical public health issue in the United States. Young adults are disproportionately affected by high rates of tobacco use and heavily targeted by tobacco marketing. Social media has become an important source of exposure to tobacco and nicotine product marketing and messaging for young adults. This dissertation examined the prevalence and socio-environmental characteristics associated with young adults' exposure to and engagement with tobacco-related social media (paper 1); the prospective associations between young adults' exposure and engagement and tobacco and nicotine product use (paper 2); and young adults' experiences with tobacco and nicotine product messaging on social media, as well as perceptions of existing e-cigarette social media advertisements (paper 3). Participants were two- and four-year college students from the Marketing and Promotions across Colleges in Texas Study (n=4,384; mean age=20.4, standard deviation=2.32; 64.6% female; 35.5% non-Hispanic white, 30.8% Hispanic, 18.2% Asian, 7.9% African American/black, and 7.6% another race/ethnicity or multi-racial). In paper 1, 30% of students reported past 30-day exposure to cigarette, e-cigarette, hookah, cigar, and/or



smokeless tobacco advertising on Facebook, YouTube, Instagram, Twitter, Snapchat, Reddit, and/or Pinterest, and 23% of students reported engagement. Anti-engagement activities such as posting links to anti-tobacco messaging were more prevalent than pro-engagement. Racial/ethnic minorities, dual- and poly-users, higher social media users, students with friends that use tobacco, and students with higher depressive symptoms were significantly more likely to report exposure. Racial/ethnic minorities, two-year college students, poly- and dual-users, higher social media users, and students with higher depressive symptoms were more likely to report pro-engagement. Poly-users, higher social media users, students with friends that use tobacco, and students with higher depressive symptoms were more likely to report anti-engagement. In paper 2, multiple logistic regression analyses revealed exposure to and engagement with tobacco-related social media significantly predicted past 30-day use of e-cigarettes, cigars, and hookah at one-year follow up. Controlling for other social media, exposure to any product advertising via Reddit predicted e-cigarette use. Pinterest exposure predicted cigar use. Snapchat exposure predicted hookah use. Pro-tobacco engagement predicted future use of all products. Anti-tobacco engagement predicted use of cigars and hookah. In paper 3, thematic content analysis of qualitative interviews with a subsample of 30 revealed all participants recalled seeing tobacco or nicotine product messaging on social media, primarily for alternative products like e-cigarettes and hookah. Perceptions of researcher-selected advertisements were generally positive, with students preferring advertisements that did not look like traditional advertisements and conveyed fun and social themes. Findings support a critical need for social media-based federal regulation, counter-marketing and health communication campaigns, and intervention focused on tobacco.

## TABLE OF CONTENTS

List of Tables .....	xi
List of Figures .....	xii
List of Appendices .....	xiii
Background .....	1
Literature Review.....	1
Young Adults as a Priority Population .....	2
Factors That Influence Young Adult Tobacco Use .....	4
Tobacco and Nicotine Product Marketing and Messaging .....	6
Current Research Gaps .....	9
Research Gaps Addressed.....	11
Public Health Significance.....	16
Overarching Aims and Research Questions .....	17
Methods.....	20
Preliminary Work.....	20
Journal Article.....	26
College Students' Exposure and Engagement with Tobacco and Nicotine Product Marketing and Messaging on Social Media .....	26
Journal of Health Communication .....	26
Journal Article.....	62
Exposure and Engagement with Social Media Tobacco Messaging Predict Subsequent Tobacco Use among Young Adults.....	62
Nicotine and Tobacco Research.....	62
Journal Article.....	88
Exploring Young Adults' Experiences and Perceptions Related to Tobacco and Nicotine Product Marketing on Social Media: A Qualitative Approach.....	88
Journal of Medical Internet Research .....	88
Introduction.....	89
Conclusion .....	125

Appendices.....	132
References.....	140

## LIST OF TABLES

Table 1: U.S. Tobacco and Nicotine Product Use Prevalence by Age Group, 2013/2014 .....	2
Table 2: Summary of Published Studies Examining an Association Between Tobacco/Nicotine Marketing in Social Media and Use .....	12
Table 3: FDA Tobacco Research Priorities Addressed .....	17
Table 4: Tobacco-Related Social Media Engagement and Exposure Assessment Measures .....	21

## LIST OF FIGURES

Figure 1: Conceptual Model of Social Cognitive Theory Applied to Understand Tobacco Use.....	5
--	---

## LIST OF APPENDICES

Appendix A: Measurement Resource Table, M-PACT Survey Items.....	132
--	-----

## **BACKGROUND**

### **Literature Review**

Tobacco is unique from other legally sold products in the United States (U.S.) in that it is deadly when used as intended by the manufacturer, with diminutive benefit to the user. According to the U.S. Surgeon General, tobacco use causes fifteen types of cancer, chiefly lung and cancers of the respiratory tract; heart disease and stroke; lung disease; reproductive effects (e.g., ectopic pregnancy, birth defects); blindness; and other health effects.<sup>1</sup> The harmful effects of secondhand smoke exposure are heart disease, lung cancer, and stroke in adults, and respiratory and ear infections, increased severity of asthma, and sudden infant death syndrome (SIDS) in children and infants.<sup>2</sup> There are approximately 480,000 tobacco-related deaths each year in the U.S., and more than 16 million Americans living with a tobacco-related disease. The yearly cost associated with tobacco-related death and disease in the U.S. is more than \$300 billion.<sup>1</sup>

Tobacco use is considered the largest preventable cause of death and disease in the U.S.<sup>1,3</sup> The incredible decline in U.S. smoking prevalence, occurring since the landmark 1964 Surgeon General's report on smoking and health,<sup>4</sup> is considered one of the greatest public health achievements of all time. Yet, progress has stalled in recent years as the popularity of non-cigarette products has increased.<sup>1</sup> As cigarette use declined by 40% between 2000 and 2015, cigar product use increased by 100%.<sup>5</sup> Smokeless tobacco use prevalence has remained around 3% of U.S. adults since 1985 but has been slowly increasing among males since 2000.<sup>1</sup> New and alternative tobacco and nicotine product use, including the use of electronic nicotine delivery system (ENDS) devices (i.e., electronic cigarettes (e-

cigarettes), vape pens) and hookah/waterpipe, has increased notably over the past decade, with the largest uptake among young adults.<sup>6</sup> The rapidly changing landscape of tobacco and nicotine product use presents new challenges in addressing this critical public health crisis.

### ***Young Adults as a Priority Population***

Young adults, ages 18-24, are a priority population since they report the highest prevalence of tobacco and nicotine product use as shown in Table 1. Furthermore, recent studies have shown that dual- and poly-use (concurrent use of multiple products) is more prevalent than single product use among young adults, compared to other age groups.<sup>7,8</sup> High rates of dual- and poly-use are concerning since the association between tobacco use and adverse health effects is dose-dependent,<sup>1</sup> and although the health effects of new and emerging products are not completely understood, the 2016 Surgeon General’s report on e-cigarette use among youth and young adults reported that e-cigarettes contain potentially harmful chemicals (e.g., nicotine, carbonyl compounds).<sup>9</sup>

Table 1: U.S. Tobacco and Nicotine Product Use Prevalence by Age Group, 2013/2014

Age Group	Any product	Cigarettes <sup>a</sup>	Cigars	Pipes	Hookah	E-cigarettes	Smokeless tobacco
<u>Adolescents</u>							
Middle school	7.7%	2.5%	1.9%	0.6%	2.5%	3.9%	1.6%
High school	24.6%	9.2%	8.2%	1.5%	9.4%	13.4%	5.5%
<u>Adults</u>							
18-24	37.4%	33.0%	8.9%	1.6%	20.2%	13.6%	6.4%
25-44	30.9%	26.8%	6.9%	0.7%	5.0%	9.0%	4.7%
45-64	23.7%	20.7%	4.6%	0.8%	0.4%	4.7%	2.6%
≥ 65	11.5%	9.9%	2.1%	0.7%	--	1.5%	1.3%
<i>Note.</i> Adolescent data are from the National Youth Tobacco Survey, United States, 2014. <sup>10</sup> Adult data are from the National Adult Tobacco Survey, United States, 2013-2014. <sup>6</sup> For adolescents, past 30-day product use is presented. For adults, use “every day,” “some days” or “rarely” is presented. <sup>a</sup> For adults, cigarettes are not presented because the questionnaire only assessed “every day” or “some days” and there was no “rarely” response option. Instead, prevalence of any combustible tobacco product is presented. -- Estimate not presented because relative standard error ≥ 30%.							



Compared to older adults, young adults are more likely to use flavored and menthol products.<sup>11,12</sup> A recent study among Texas youth (n=2,483) and young adults (n=4,326) found that over 80% of youth and young adult tobacco users report using flavors, and 75% of tobacco users would not use tobacco products if they were not flavored.<sup>13</sup> Studies have shown that the use of flavored tobacco and nicotine products promote the transition from experimentation to regular use.<sup>14</sup> Young adults also have overall positive perceptions of tobacco and nicotine products, especially flavored products and newer products like e-cigarettes and hookah.<sup>15,16</sup> Studies have consistently shown young people perceive ENDS and hookah to be less harmful than more traditional tobacco products (i.e., cigarettes, cigars, smokeless tobacco).<sup>17,18</sup> Yet, research has shown hookah smoke contains hazardous toxins also found in cigarette smoke, and a typical one-hour long hookah smoking session delivers about 200 puffs of smoke to the lungs, compared to the 20 puffs inhaled while smoking a cigarette.<sup>19</sup>

Although the transition from experimental to regular tobacco use often occurs during young adulthood,<sup>20,21</sup> regulation and prevention efforts have previously focused on reducing tobacco initiation among children and adolescents,<sup>22</sup> while young adults remain vulnerable targets of the tobacco industry.<sup>23</sup> In addition, a recent study showed young adults have significantly higher incidence rates than youth to initiate use of cigarettes, e-cigarettes, hookah and cigars, a striking departure from decades of previous research showing initiation occurs in youth.<sup>24</sup> Tobacco industry documents reveal tobacco companies focus their marketing efforts on young adults since young adults are their “youngest legal targets.”<sup>23</sup> Young adults may be especially vulnerable to marketing tactics and other pressures since

young adulthood is an important period of transition. Young adults lack parental oversight and experience peer pressure, stress, and important life changes.<sup>25</sup> However, young adults are also more likely to make successful quit attempts compared to older adults.<sup>26,27</sup> For these reasons, young adults are an important priority population for research, prevention, and regulatory efforts.

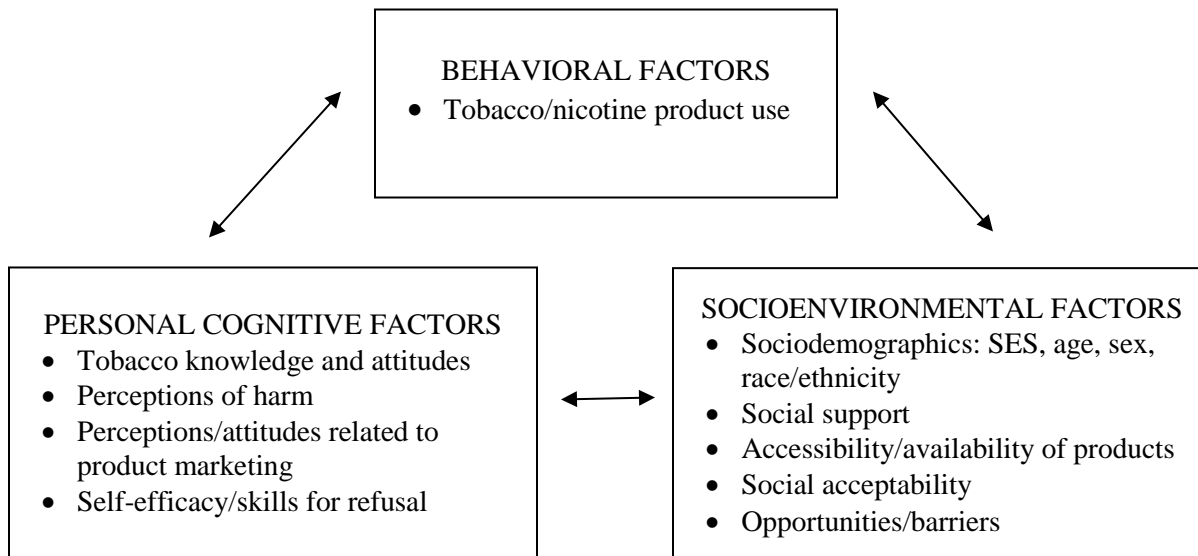
### ***Factors That Influence Young Adult Tobacco Use***

Important cognitive, social, and environmental factors influence young adult tobacco and nicotine product use behaviors.<sup>25</sup> Understanding the relationships between these factors and tobacco use is critical in informing prevention and regulatory efforts focused on this priority population. Social Cognitive Theory (SCT) is a useful framework for examining and understanding key factors that influence tobacco and nicotine product use, and the theory has been widely applied in this sense.<sup>25,28</sup> SCT posits that health behavior is a result of the reciprocal and dynamic relationship between: (1) personal cognitive factors, (2) socioenvironmental factors, and (3) behavioral factors.<sup>28</sup>

Personal cognitive factors include confidence to perform a behavior (self-efficacy), ability to anticipate the outcomes of a behavior (outcome expectations), and level of understanding about a behavior (knowledge). Socioenvironmental factors are aspects of the physical and social environment that influence behavior and include role models (observational learning), perceptions of the prevalence and social acceptability of a behavior (normative beliefs), perceptions of emotional, esteem, informational, or instrumental support (social support), and facilitators or hindrances of behavior (opportunities and barriers). Behavioral factors include capabilities (behavioral skills), goals (intentions), and rewards or

punishments related to a behavior (reinforcement).<sup>28</sup> Figure 1 illustrates key cognitive, socioenvironmental, and behavioral factors that influence tobacco product use.

Figure 1: Conceptual Model of Social Cognitive Theory Applied to Understand Tobacco Use



A strong body of literature documents significant relationships between key cognitive, social, and environmental factors and tobacco use behaviors.<sup>25</sup> The majority of studies on the etiology of tobacco use have examined factors related to cigarette smoking, while fewer studies have examined correlates of cigar, smokeless tobacco, and other product use. Sociodemographic factors that influence tobacco use are socioeconomic (SES) status, age, biological sex, and race/ethnicity. The 1994 Surgeon General's report on preventing tobacco use among young people concluded that relatively low SES, being an adolescent or young adult, being male, and belonging to a minority or immigrant population promote tobacco use initiation.<sup>29</sup> Other key factors associated with tobacco use include elements of the environment including social support (e.g., parental and peer encouragement or discouragement), the accessibility and availability of tobacco products, the social or cultural

acceptability of tobacco use, and other opportunities or barriers related to tobacco use.<sup>25</sup>

Several studies have demonstrated that having close family members and friends who use tobacco is an important influencer of tobacco use,<sup>30,31</sup> and young adults are more likely to use tobacco in social settings than when they are alone.<sup>32</sup> Key personal cognitive factors are self-efficacy for refusing or abstaining from using tobacco products and knowledge, attitudes, and perceptions about the health consequences of using tobacco, as well as tobacco product marketing.<sup>25,29</sup>

### ***Tobacco and Nicotine Product Marketing and Messaging***

Previous research, embedded in health behavior theories including SCT, the Theory of Triadic Influence (TTI), the Theory of Reasoned Action (TRA), and the Theory of Planned Behavior (TPB), has made the relationship between marketing and tobacco use clear.<sup>25</sup> Each of these theories provides a framework for the assessment of the influence of tobacco marketing, together with other cognitive, social, and environmental factors, on tobacco-related behaviors. Taken together, numerous studies provide consistent and strong evidence showing tobacco industry marketing activities *cause* tobacco use. Ultimately, the theory-based mechanism by which this causal relationship occurs is as follows. Tobacco industry marketing activities including advertisements, pricing strategies, and design and packaging shape cognitive factors (e.g., harm perceptions, knowledge, and attitudes) to influence intentions to use tobacco, and tobacco use is a direct result of intentions.<sup>25</sup> A number of other cognitive (e.g., self-image), social (e.g., peer influence), and environmental (e.g., cultural norms) factors may play a role in the dynamic and complex relationship between tobacco marketing and use, and marketing activities may also act as a moderator.<sup>33</sup>

The focus of this dissertation is tobacco and nicotine product marketing, since marketing is one of the most influential factors leading to sustained tobacco use.<sup>25,34,35</sup> Since the 19<sup>th</sup> century, cigarettes and other tobacco products have been heavily and effectively marketed in the U.S.<sup>36</sup> Despite the 1998 Master Settlement Agreement (MSA), in which cigarette marketing on billboards and other venues was restricted and the major cigarette companies agreed to refrain from targeting young people, the tobacco industry continues to spend billions of dollars on advertising that appeals to young people.<sup>37</sup> Tobacco companies spend a majority of their marketing dollars on price discounts, prime product placement, and advertisements at point-of-sale.<sup>38,39</sup> Tobacco product advertising in print, especially magazines, has increased since the 1998 MSA, and popular magazines advertising tobacco products such as *People* and *Sports Illustrated* have high youth and young adult readerships.<sup>40</sup> To date, the vast majority of research on tobacco marketing has focused on these traditional marketing channels, and a causal, dose-dependent relationship between tobacco advertising and smoking has been established.<sup>25</sup>

### *Social Media*

In the new age of media, tobacco companies are flooding non-traditional marketing channels like social media, which is inexpensive, lacks stringent marketing regulations and is highly popular among young people.<sup>41</sup> Social media is a broad term used to describe websites and applications that enable users to interact with other people and groups by viewing, creating, and sharing information over the internet. The most widely used social media site is Facebook with over 2 billion monthly active users,<sup>42</sup> followed by Instagram (800 million monthly active users),<sup>43</sup> and Twitter (328 million).<sup>44</sup> In recent years, social

media use has become ubiquitous, serving as a popular mode of entertainment as well as a primary source of communication and information, especially for young adults.<sup>41,45</sup> Tobacco companies know full well that 90% of young adults use social media sites like Facebook, Instagram, and Twitter, and companies use social media to inexpensively and effectively market their products to young people.<sup>45,46</sup> Recent studies have shown social media is a popular venue for promoting tobacco and nicotine products, especially newer products such as e-cigarettes and hookah, which are promoted by tobacco companies' representatives as well as product users and advocates.<sup>45</sup>

Tobacco marketing via social media may be more effective than marketing via traditional channels since social media allow users to engage and interact with tobacco product content.<sup>47</sup> Importantly, social media is dramatically different from any other marketing platform in that every individual is exposed to a unique, virtual environment when engaging with social media. This personal ecological environment is ever-changing, based on personal likes, dislikes, frequently visited websites, and demographic information pulled from one's social media profile. Furthermore, an individual's exposure to tobacco and nicotine product promotion is not limited to traditional industry-sponsored advertisements. Pro-tobacco imagery and promotion on social media include vape trick videos, invitations to events that are seemingly unrelated to tobacco, and personal photos and posts from friends and celebrities depicting tobacco use.<sup>48,49</sup>

For the purposes of this dissertation, and in line with published studies referenced in this dissertation, the term "marketing" is a broad term that refers to the promotion and selling of tobacco and nicotine products by tobacco companies. Marketing may include a wide array

of activities by tobacco companies to sell their products. The term “advertising” refers to a subset of marketing, and is the placement of advertisements in newspapers, magazines, at the point-of-sale, in social media, and other mediums. Since social media is quite unique from more traditional mediums, the term “messaging” is used to refer to social media content that may promote or discourage tobacco and nicotine product use. Tobacco and nicotine product messaging may include tobacco industry-sponsored advertising, social media posts, photos, and videos that are posted by laypersons, or the source of the message may be unknown.

### ***Current Research Gaps***

A growing body of literature examines how tobacco companies promote themselves on social media, and further, how product users and advocates promote tobacco use on social media. Liang et al. (2015) found that, together, the 70 most popular cigarette brands had created 238 Facebook pages and posted 120,000 pro-tobacco YouTube videos, demonstrating sales promotion of tobacco products is extensive in social media.<sup>51</sup> Huang et al. (2014) demonstrated widespread e-cigarette promotion on Twitter, reporting more than 73,000 tweets related e-cigarettes were posted on Twitter during a two-month period.<sup>52</sup> Studies show tweets related to e-cigarettes and other tobacco and nicotine products are primarily commercial advertisements, commonly mention flavors, and offer coupons and price discounts.<sup>52,53</sup> One study reported that the total number of Instagram posts using the hashtag “#vape” increased by over 4 million during a four-month period between 2014-2015.<sup>54</sup>

Research on the extent to which people are exposed to and engage with tobacco-related content on social media, and how their exposure/engagement is related to use behaviors, is limited. Table 2 is a summary of published studies that have examined the

association between exposure and/or engagement with some form of tobacco and nicotine product social media messaging and outcomes including product use behaviors and harm perceptions, among U.S. populations. Only studies conducted with U.S. populations are included in Table 2 since a primary goal of the proposed dissertation was to inform regulation in the U.S., and these U.S.-based studies are larger, more seminal studies.

Only three studies to date have documented an association between social media tobacco content and use in young adult populations.<sup>55,56</sup> Depue et al. (2015) reported exposure to tobacco use in social media significantly predicted past 30-day cigarette use over a five-month period, among a sample of 200 young adults.<sup>55</sup> Sawdey et al. (2017) reported positive significant associations between past 30-day e-cigarette use and viewing peer posts and advertisements about e-cigarettes in social media, among 258 college students.<sup>56</sup> Pokhrel et al. (2018) found that higher exposure to e-cigarette advertisements and posts on social media was associated with greater likelihood of past 30-day e-cigarette use, among 470 college students.<sup>57</sup>

Two studies have examined the cross-sectional relationship between online and social media exposure/engagement and use, in adolescents.<sup>58,59</sup> Soneji et al. (2017) estimated that 2.94 million (12%) U.S. adolescents, ages 12-17, engage with online tobacco marketing, and reported significant associations between engagement with online tobacco marketing and susceptibility to use any tobacco in a nationally representative sample (N=13,651).<sup>58</sup> Hébert et al. (2017) found that 52.5% of 6<sup>th</sup>, 8<sup>th</sup>, and 10<sup>th</sup> grade students reported past 30-day exposure to tobacco-related social media, and 5.7% reported engagement (i.e., posting videos or pictures of vape tricks, writing, responding to, or reblogging about tobacco or e-



cigarettes). The odds of exposure were significantly higher for students susceptible to combustible tobacco and e-cigarette use.<sup>59</sup>

### ***Research Gaps Addressed***

The purpose of this dissertation was to add rich and compelling data on the extent to which young adults are exposed to and engage with tobacco and nicotine product marketing and messaging on social media, the nature of the relationships between various forms of exposure and engagement and tobacco use behaviors, and young adult attitudes and perceptions related to social media tobacco and nicotine marketing and messaging. This dissertation sought to fill important gaps in the literature. To date, only three studies have documented the relationship between young adults' exposure to tobacco-related content in social media and tobacco use. These studies are limited by small sample size (n's= 200, 258, and 470). In addition, recall of exposure was assessed via one to two questions, and the focus of these studies was on the relationship between exposure to any tobacco use in social media and cigarette use, and between exposure to e-cigarette social media content and e-cigarette use. This dissertation extends previous research by utilizing a large (n≈4,000), racially diverse sample of young adults, and examining associations across a wide array of social media and types of tobacco and nicotine product use. The dissertation further examined the relationship between engagement and use, which no study to date has examined in a young adult population. Finally, this study is the first to utilize a qualitative approach to characterize young adult attitudes and perceptions related to social media-based tobacco and nicotine product marketing and messaging.

Table 2: Summary of Published Studies Examining an Association Between Tobacco/Nicotine Marketing in Social Media and Use

Reference	Study Design	Population	Exposure/Engagement Measures	Outcome Measures	Statistical Analysis
1. Cavazos-Rehg et al. (2013) <sup>60</sup>	Cross-sectional  Self-administered paper and pencil survey	15,673 youth (aged 11-18 years)	<b>Exposure:</b> Participants were asked whether they received (1) coupons and (2) ads from a tobacco company via mail, e-mail, the internet, Facebook, MySpace, or text message during the past 30 days.	(1) Perceptions of social benefits (2) Beliefs about health hazards (3) Intentions to smoke among never users (4) Desire to quit smoking among current users	Logistic regression
	<b>Results</b> 11% (n=1,882) reported receiving ads from tobacco companies via Facebook or MySpace (9.1% among never tobacco users; 14.7% among ever tobacco users). Chi-square Wald: 55.0, p<.001.  4.0% (n=727) reported receiving ads from tobacco companies via text message (2.8% among never users; 6.5% among ever users). Chi-square Wald: 52.6, p<.001.  Highly susceptible youth (minorities, very young youth, never users) reported exposure to Facebook and MySpace ads. These youth were more likely to have favorable attitudes and intentions to use tobacco, among never users.				
2. Depue et al. (2015) <sup>55</sup>	Longitudinal panel, 2 waves, 5-month follow-up period  Telephone survey	200 young adults (aged 18-24 years)	<b>Exposure:</b> Participants were asked how often they had seen tobacco use on television, in movies, and in social media content (such as Facebook or MySpace).	(1) Past 30-day cigarette use	Logistic regression
	<b>Results</b> Exposure to tobacco use in social media at time 1 significantly predicted time 2 smoking after controlling for sensation seeking and friends/family tobacco use (B=.47, odds ratio=1.6, p<.05).				

3. Tan et al. (2015) <sup>61</sup>	Cross-sectional  Self-administered online survey	1,449 adults (aged 18-94 years)	<b>Exposure:</b> Past 30-day recall of e-cigarette ads via (1) convenience stores, liquor stores or gas stations, (2) television, radio or newspapers or magazines, and (3) social media such as Facebook, Twitter or YouTube.	(1) Perceived harms of secondhand vapor	Logistic regression
	<b>Results</b> Frequency of e-cigarette ad and other media exposure were not significant predictors of harm perceptions.				
4. Soneji et al. (2017) <sup>58</sup>	Cross-sectional  Audio, computer-assisted self-interviews	13,651 youth (aged 12-17 years)	<b>Engagement:</b> Level of online engagement with tobacco marketing (sum of affirmative answers to 10 items): <ul style="list-style-type: none"> <li>• Signed up for email alerts</li> <li>• Used smart phone to scan QR code for tobacco product</li> <li>• Visited a website</li> <li>• Received discount coupon</li> <li>• Liked or followed on social media</li> <li>• Played online game</li> <li>• Sent link via social media</li> <li>• Received information online</li> <li>• Scanned QR code to tobacco website</li> <li>• Registered with tobacco website</li> </ul>	(1) Susceptibility to tobacco use among never users (n=10,246)  (2) Ever tobacco use  (3) Past 30-day tobacco use  Tobacco use defined as: cigarettes, e-cigarettes, cigars, pipes, hookah, smokeless tobacco, dissolvable tobacco, bidis, and kreteks.	Multivariable weighted logistic regression
	<b>Results</b> 88.2% had not engaged with any form of online tobacco marketing; 8.9% had engaged with one form; 2.9% had engaged with two or more forms. The odds of susceptibility to tobacco use were significantly higher for participants who engaged with one form (OR: 1.48; 95%CI: 1.24-1.76) and two or more forms (OR: 2.37; 95%CI: 1.53-3.68) of tobacco marketing compared to participants who did not engage with tobacco marketing. The odds of ever use were significantly higher for engagement with one form (OR: 1.33, 95%CI: 1.11-1.60) and two forms (OR: 1.54; 95%CI: 1.16-2.03) compared to zero engagement.				

5. Hébert et al. (2017) <sup>59</sup>	Cross-sectional	3,907 (6 <sup>th</sup> , 8 <sup>th</sup> , and 10 <sup>th</sup> grade students)	<p><b>Exposure:</b> Participants were asked whether they had seen any tobacco, e-cigarette, vape pen, or e-hookah related posts on site like Tumblr, Vine, Facebook, Twitter, Instagram, or YouTube during the past 30 days.</p> <p><b>Engagement:</b> Participants were asked whether they had (1) posted videos or pictures of tricks and (2) written, responded to, or reblogged about tobacco or e-cigarettes on sites like Facebook, Twitter, Tumblr, Vine, and Instagram during the past 30 days.</p>	<p>(1) Susceptibility to cigarette, hookah, cigar, and e-cigarette use among never users of any tobacco</p> <p>(2) Ever cigarette, hookah, cigar, and e-cigarette use</p> <p>(3) Past 30-day cigarette, hookah, cigar, and e-cigarette use</p>	Weighted logistic regression
	<p><b>Results</b></p> <p>52.5% reported exposure to tobacco or e-cigarette related social media. 5.7% reported engagement. Adjusted odds of exposure were higher for students susceptible to combustible tobacco (OR: 1.72; 95% CI: 1.05-2.81), e-cigarettes (OR: 2.08; 95% CI: 1.31-3.30), and both combustible and e-cigarettes (OR: 2.30; 95% CI: 1.59-3.30). Adjusted odds of engagement via posting videos/pictures were significantly higher for ever dual users (OR: 2.10; 95% CI: 1.04-4.25) and past 30-day dual users (OR: 3.59; 95% CI: 1.95-6.60). Adjusted odds of engagement via written/responded/reblogged were significantly higher for susceptibility to dual use (OR: 3.56; 95% CI: 1.39-9.09) and past 30-day combustible use (OR: 3.07; 95% CI: 1.04-9.07). Models adjusted for gender, school level, race/ethnicity, sensation seeking, and peer use.</p>				
6. Sawdey et al. (2017) <sup>56</sup>	Cross-sectional	258 college students	<p><b>Exposure:</b> Participants were asked whether they viewed e-cigarette-related (1) peer posts and (2) advertisement on Facebook, Instagram, and Twitter.</p>	<p>(1) Ever e-cigarette use</p> <p>(2) Past 30-day e-cigarette use</p>	Logistic regression
	Clicker-response questionnaire				<p><b>Results</b></p> <p>There were positive and significant associations between ever e-cigarette use and viewing peer posts (aOR = 3.11; 95% CI = 1.25–7.76) and advertisements (aOR = 3.01; 95% CI = 1.19–7.65) on social media, adjusting for cigarette use.</p>

	Current e-cigarette use was only significantly associated with viewing peer posts via social media (aOR = 7.58; 95% CI = 1.66–34.6) after adjusting for cigarette use.				
7. Pokhrel et al. (2018) <sup>57</sup>	Cross-sectional	470 college students (aged 18-25)	<b>Exposure:</b> Participants were asked how often they had seen (1) e-cigarette related posts and (2) e-cigarette ads on 6 types of social media – Facebook, Instagram, Twitter, Tumblr, Reddit, and Pinterest.	(1) Current e-cigarette use  Mediators: (1) Positive outcome expectancies (2) Negative outcome expectancies	Structural equation modeling
	Self-administered electronic survey	<b>Results</b> A model with positive outcome expectancies as mediators showed reasonably good fit ( $\chi^2 = 69.09$ , DF = 46, p = 0.02; CFI = 0.98; TLI = 0.95; RMSEA = 0.033, 90% CI: 0.015-0.048). Social media e-cigarette exposure had a statistically significant total indirect effect on current e-cigarette use (estimate = 0.045, SE = 0.017, p = 0.008), mediated through positive smoking experience (estimate = 0.024, SE = 0.012, p = 0.05) and positive sensory experience (estimate = 0.022, SE = 0.10, p = 0.03). Social media e-cigarette exposure was not associated with any of the negative expectancy variables, but had a direct effect on current e-cigarette use such that higher exposure was associated with greater likelihood of current e-cigarette use.			
<i>Note.</i> OR=odds ratio. aOR=adjusted odds ratio. CI=confidence interval.					

## **Public Health Significance**

The Healthy People (HP) 2020 goal for tobacco use is to “reduce illness, disability, and death related to tobacco use and secondhand smoke exposure.” Objective TU-18 is “to reduce the proportion of adolescents and young adults ... who are exposed to tobacco marketing,” with sub-objective TU-18.1 focused on reducing exposure to tobacco marketing on the internet. At baseline, in 2009, 36.8% of National Youth Tobacco Survey (NYTS) participants reported exposure to tobacco advertising via the internet.<sup>62</sup> In 2015, 47.1% of participants reported exposure, demonstrating that the HP 2020 objective target of reducing the proportion of adolescents and young adults exposed to internet-based tobacco marketing by 10% between 2010 and 2020 is not being met.

The 2009 Family Smoking Prevention and Tobacco Control Act (TCA) gave the U.S. Food and Drug Administration (FDA) the authority to regulate the manufacturing, distribution, and marketing of cigarettes, smokeless tobacco, and roll-your-own tobacco. In 2016, the FDA extended its authority to regulate all tobacco products including e-cigarettes, cigars, and hookah.<sup>63</sup> However, the marketing of alternative products like e-cigarettes and hookah and any tobacco and nicotine product marketing via the internet and social media remains unrestricted. To support and inform FDA regulation of tobacco and nicotine products, the FDA has outlined priority research areas. This dissertation sought to address HP 2020 sub-objective TU-18.1 and several FDA research priorities (Table 3) by filling crucial gaps in the evidence base regarding young adult exposure to and engagement with social media tobacco and nicotine product marketing.

Table 3: FDA Tobacco Research Priorities Addressed

1. Cigar (small, large, cigarillos) initiation, use (including transitions to other tobacco products and multiple use), perceptions, dependence and toxicity.
2. Smokeless tobacco initiation, use (including transitions to other tobacco products and multiple use), perceptions, dependence and toxicity.
3. E-cigarettes initiation, use (including transitions to other tobacco products and multiple use), perceptions, dependence and toxicity.
4. Other tobacco product (e.g., hookah, pipes, dissolvables) initiation, use (including transitions to other tobacco products and multiple use), perceptions, dependence and toxicity.
5. The impact of tobacco product characteristics (e.g., ingredients; constituents; components; additives, such as flavors; labeling; marketing) on initiation, especially by youth and other vulnerable populations.
6. Consumer perceptions of tobacco products including the impact of labeling and marketing.

### **Overarching Aims and Research Questions**

The overall goal of this dissertation was to characterize young adult exposure to and engagement with social media tobacco and nicotine product marketing and messaging by utilizing survey data from the Marketing and Promotions Across Colleges in Texas study (Project M-PACT) and conducting qualitative interviews with a subsample of Project M-PACT participants. The first paper is a descriptive and cross-sectional analysis of data from the wave 6 (spring 2017) Project M-PACT survey. Specifically, paper 1 aims to: characterize young adult exposure to and engagement with tobacco and nicotine product marketing and messaging on social media. Research questions addressed are:

1. To what extent do young adults recall seeing advertisements (exposure) for cigarettes, e-cigarettes, hookah, cigar products, and smokeless tobacco on YouTube, Facebook, Snapchat, Instagram, Twitter, Pinterest, and Reddit?

2. To what extent do young adults report engagement with tobacco and nicotine product marketing and messaging on social media?
3. What are the characteristics (e.g., age, sex, race/ethnicity, sensation seeking, depressive symptoms) of young adults who report exposure and engagement with tobacco and nicotine product marketing and messaging on social media?

The second paper is a prospective analysis of data from the wave 6 (spring 2017) and wave 7 (spring 2018) Project M-PACT survey. Paper 2 aims to: estimate the longitudinal associations between exposure and engagement with tobacco and nicotine product marketing and messaging on social media and subsequent tobacco and nicotine product use among young adults. Research questions addressed are:

1. To what extent does exposure to tobacco and nicotine product marketing on social media predict product use among young adults one-year later?
2. To what extent does engagement with tobacco and nicotine product messaging on social media predict product use among young adults one-year later?

The third paper is a descriptive analysis of qualitative interview data from a subsample of Project M-PACT participants who reported exposure to tobacco or nicotine product advertising on social media at wave 6. Paper 3 aims to: investigate young adults' attitudes and perceptions related to tobacco and nicotine product marketing and messaging on social media. Research questions addressed are:

1. What are young adults' perceptions and preferences related to their social media use, including how they define social media?



2. What is the nature of young adults' personal experiences with tobacco and nicotine product marketing and messaging on social media, including common themes and message source?
3. What are young adults' attitudes and perceptions related to existing social media e-cigarette advertisements?

## **METHODS**

The Marketing and Promotions Across Colleges in Texas study (Project M-PACT) is an R01 with a focus on monitoring trajectories and transitions of tobacco and nicotine product use among two-year vocational and four-year university undergraduate students (wave 1; n=5,482; mean age=20.5 standard deviation=2.36; 63% female), from 24 colleges in Texas. A primary strength of Project M-PACT is its ability to inform FDA regulatory authority of tobacco and nicotine products by documenting patterns of use among young adults and the impact of tobacco marketing on use. Project M-PACT connects young adult tobacco use to marketing at point-of-sale within one mile of participating colleges, at bars most frequented by students, and in the magazines frequently read by M-PACT participants. This dissertation is an important addition to Project M-PACT because it adds to our understanding of participants' exposure to and engagement with social media tobacco and nicotine marketing and messaging.

### **Preliminary Work**

Prior to wave 6 of the Project M-PACT survey (spring 2017), assessment of any tobacco and nicotine marketing via any form of digital media was assessed via three survey items. I added an additional seven survey items to wave 6 (spring 2017) of the Project M-PACT survey, to further assess participants' exposure and engagement with tobacco and nicotine product marketing on social media. These 10 items are shown in Table 4. This dissertation sought to characterize exposure to and engagement with social media tobacco and nicotine messaging via these survey items.

Table 4: Tobacco-Related Social Media Engagement and Exposure Assessment Measures

Construct	Measure
Social Media Use	1. During the past 30 days, how often did you read or view content on ... Facebook, Instagram, Pinterest, Reddit, Snapchat, Twitter, YouTube? <input type="checkbox"/> Never <input type="checkbox"/> About once a month <input type="checkbox"/> Every few weeks <input type="checkbox"/> 1-2 days a week <input type="checkbox"/> 3-5 days a week <input type="checkbox"/> About once a day <input type="checkbox"/> Several times a day
Social Media Engagement	2. During the past 30 days, how often did you share, post, or comment on ... Facebook, Instagram, Pinterest, Reddit, Snapchat, Twitter, YouTube? <input type="checkbox"/> Never <input type="checkbox"/> About once a month <input type="checkbox"/> Every few weeks <input type="checkbox"/> 1-2 days a week <input type="checkbox"/> 3-5 days a week <input type="checkbox"/> About once a day <input type="checkbox"/> Several times a day
Past 30-day recall of exposure to cigarette advertisements	3. During the past 30 days, how often did you see any advertisements for <b><u>cigarettes</u></b> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? <input type="checkbox"/> Never <input type="checkbox"/> Rarely <input type="checkbox"/> Occasionally <input type="checkbox"/> Frequently <input type="checkbox"/> Very frequently
Past 30-day recall of exposure to cigar product advertisements	4. During the past 30 days, how often did you see any advertisements for <b><u>cigar products</u></b> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? <input type="checkbox"/> Never <input type="checkbox"/> Rarely <input type="checkbox"/> Occasionally <input type="checkbox"/> Frequently <input type="checkbox"/> Very frequently
Past 30-day recall of exposure to hookah advertisements	5. During the past 30 days, how often did you see any advertisements for <b><u>waterpipe/hookah</u></b> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? <input type="checkbox"/> Never <input type="checkbox"/> Rarely <input type="checkbox"/> Occasionally <input type="checkbox"/> Frequently <input type="checkbox"/> Very frequently

Past 30-day recall of exposure to smokeless tobacco advertisements	<p>6. During the past 30 days, how often did you see any advertisements for <b><u>smokeless tobacco</u></b> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit?</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Rarely</p> <p><input type="checkbox"/> Occasionally</p> <p><input type="checkbox"/> Frequently</p> <p><input type="checkbox"/> Very frequently</p>
Past 30-day recall of exposure to ENDS advertisements	<p>7. During the past 30 days, how often did you see any advertisements for <b><u>ENDS</u></b> (e-cigarettes, vape pens, etc.) on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit?</p> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Rarely</p> <p><input type="checkbox"/> Occasionally</p> <p><input type="checkbox"/> Frequently</p> <p><input type="checkbox"/> Very frequently</p>
Visit/follow/like Tobacco/ENDS	<p>8. Have you visited, followed, or liked tobacco or ENDS products on social media in the following time frames? Ever? 6 months? 30 days?</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> No</p> <p>9. What kinds of products did you visit, follow, or like on social media? Check all that apply.</p> <p><input type="checkbox"/> Cigarettes</p> <p><input type="checkbox"/> ENDS (disposable/rechargeable e-cigarettes or vape pens)</p> <p><input type="checkbox"/> Large cigars, cigarillos, little filtered cigars</p> <p><input type="checkbox"/> Hookah</p> <p><input type="checkbox"/> Chewing tobacco or moist snuff/dip or snus</p>
Post/repost tobacco/ENDS content	<p>10. How often do you use social media to ...</p> <ul style="list-style-type: none"> <li>• Post links to <b><u>pro-tobacco</u></b> or ENDS product websites, stories, or articles?</li> <li>• Post links to <b><u>anti-tobacco</u></b> or ENDS product websites, stories, or articles?</li> <li>• Post your own thoughts or comments about the <b>positive</b> aspects of tobacco or ENDS use?</li> <li>• Post your own thoughts or comments on the <b>negative</b> aspects of tobacco or ENDS use?</li> <li>• <b>Encourage</b> other people to use a tobacco or ENDS product?</li> <li>• <b>Discourage</b> other people from using a tobacco or ENDS product?</li> <li>• Post about your own tobacco or ENDS use?</li> <li>• Repost content related to tobacco or ENDS that was originally posted by someone else?</li> </ul> <p><input type="checkbox"/> Never</p> <p><input type="checkbox"/> Rarely</p> <p><input type="checkbox"/> Occasionally</p> <p><input type="checkbox"/> Frequently</p> <p><input type="checkbox"/> Very Frequently</p>

## **Eligibility Criteria**

Eligibility criteria for Project M-PACT included the following: Participants at wave 1 were (1) full- or part-time degree-seeking students or enrolled in a vocational program, (2) ages 18-29 if lifetime tobacco users or ages 18-26 if non-lifetime tobacco users. Three dichotomous items regarding lifetime cigarette, cigar, and smokeless tobacco use were assessed through an eligibility survey, and lifetime users of one or more of these products were oversampled. To be eligible to participate in qualitative interviews, participants must have (1) reported any exposure to tobacco or nicotine product advertising on social media at wave 6 of the Project M-PACT survey, and (2) been willing to complete a 30-45 minute in-person or online interview in English.

## **Data Collection Procedures**

A cohort of 5,482 students attending one of 24 colleges in Texas was established in November 2014 through February 2015 (wave 1), and surveyed electronically every six months through April-May 2017 (wave 6), and then one year later in April-May 2018 (wave 7). Upon completion of the wave 6 and 7 surveys, participants received a \$20 electronic gift card and were entered in a chance to win one of 20 \$50 gift cards at wave 6, and one of 80 \$25 gift cards at wave 7. For the qualitative interviews, eligible participants were identified from the Project M-PACT database and emailed to assess interest level in the proposed study. Interested participants completed a brief, electronic survey to confirm eligibility and to assess current tobacco use. Eligible participants, who expressed interest and agreed to participate, participated in an interview with a trained interviewer. Upon completion of the interview, participants received a \$30 electronic gift card.

## **Description of Measures**

Measures for Project M-PACT were modeled after existing surveys and reviewed by nine tobacco control experts. Final item modifications were conducted through an iterative process of cognitive interviewing<sup>64</sup> with 25 young adults who were not Project M-PACT participants.<sup>65</sup> Additional wave 6 survey items were modeled after existing surveys including Pew Research Center surveys on social media use and engagement,<sup>66-70</sup> the Population Assessment of Tobacco and Health (PATH) survey,<sup>58</sup> and the Youth Tobacco Survey (YTS).<sup>71</sup> Appendix A is a measurement resource table which contains all M-PACT survey items, and related sources, used in this dissertation. These include the social media measures listed above, and other measures (e.g., product use, demographics, other covariates).

A qualitative interview guide (Table 5) was developed based on a comprehensive literature review, with the goal of addressing important gaps in our knowledge of young adult perceptions and attitudes related to social media tobacco and nicotine product marketing. Pre-determined, open-ended questions focused on young adults' personal experiences with social media-based tobacco and nicotine product content. The interview guide was intended to elicit information for future studies, health communication, and FDA regulation.

## **Human Subjects Considerations**

Project M-PACT was reviewed and approved by the University of Texas at Austin Institutional Review Board (2013-06-0034). The University of Texas Health Science Center Institutional Review Board approved this dissertation (HSC-SPH-16-0994).

Table 5: Semi-structured Qualitative Interview Guide

Major Topics	Elicitation Questions
Social media use and preferences	<p>Do you ever use social media like Facebook, Instagram, Twitter, or others?</p> <p>If yes, which ones?</p> <p>If not mentioned by participant, ask about each of the following: Facebook, Instagram, Twitter, YouTube, Snapchat, Pinterest, and Reddit.</p> <p>How do you define social media?</p> <p>Which social media site(s) is/are your favorite? Why? Least favorite? Why?</p>
Recall of exposure to social media tobacco advertising	<p>Have you ever seen advertisements for tobacco or nicotine products on social media? Tobacco and nicotine products include cigarettes, e-cigarettes, hookah, cigars, and smokeless tobacco.</p>
Experiences with advertisements participants are able to recall	<p>If yes, can you describe the advertisements you've seen for tobacco/nicotine on social media?</p> <p>What do you remember most about them?</p> <p>Do you remember certain products, colors, people, or themes that were used in the advertisements?</p> <p>Was there anything particularly appealing or unappealing to you about them?</p>
Definition of "advertisement"	<p>How do you define the term "advertisement?"</p>
Recall of exposure to social media tobacco messaging, NOT considered advertising	<p>Have you ever seen messaging related tobacco or nicotine products on any social media, which you would NOT consider "advertising?"</p> <p>If needed, give an example of messaging: photos or posts about e-cigarettes.</p>
Experiences with messaging	<p>If yes, can you describe the messaging?</p>
Perceptions of sources of tobacco-related social media	<p>Of the advertising that you see on social media, how much of it is posted by people you know personally like family members, friends, or co-workers?</p> <p>How much of it is posted by people or groups you do not know like tobacco companies or celebrities?</p> <p>When you see an ad are you able to tell whether it originated from someone you know personally or someone you do not know personally?</p>
Perceptions of researcher-selected Blu and Juul e-cigarette Instagram advertisements	<p>Have you ever seen any of these advertisements that you can remember?</p> <p>What do you think about this group of advertisements?</p> <p>Is there anything particularly appealing or unappealing to you about these?</p> <p>Of the six group of advertisements I've shown you, which group do you like most? Which do you like least? Why?</p>

## **JOURNAL ARTICLE**

### **College Students' Exposure and Engagement with Tobacco and Nicotine Product Marketing and Messaging on Social Media**

#### **Journal of Health Communication**

This study describes the prevalence and socio-environmental characteristics associated with college students' exposure to and engagement with tobacco-related social media, among a diverse sample from the Marketing and Promotions Across Colleges in Texas Study (N=4,384). Multiple logistic regression was used to examine associations between characteristics and exposure and engagement. Overall, 30.0% of students reported past 30-day exposure to cigarette, e-cigarette, hookah, cigar, and/or smokeless tobacco advertising on Facebook, YouTube, Instagram, Twitter, Snapchat, Reddit, and/or Pinterest. Exposure was greatest for e-cigarette advertisements on Facebook. Overall, 22.7% of students reported engagement. Anti-engagement activities such as posting links to anti-tobacco messaging were more prevalent than pro-engagement. Racial/ethnic minorities, dual- and poly-users, higher social media users, students with friends that use tobacco, and students with higher depressive symptoms were significantly more likely to report exposure. Racial/ethnic minorities, two-year college students, poly- and dual-users, higher social media users, and students with higher depressive symptoms were more likely to report pro-engagement. Poly-users, higher social media users, students with friends that use tobacco, and students with higher depressive symptoms were more likely to report anti-engagement. Females were more likely to report hookah advertising exposure and anti-tobacco engagement. Regulatory and practical implications are discussed.



## **Introduction**

Tobacco use in the United States (U.S.) remains a critical public health issue since rates of decline have stalled in recent years, and the popularity of non-cigarette tobacco and nicotine products like electronic cigarettes (e-cigarettes) and hookah has increased (U.S. Department of Health and Human Services [HHS], 2014). Young adults in the U.S., ages 18-29, report the highest prevalence of tobacco and nicotine product use and experience life transitions that create opportunities for initiation and solidification of use (Hu, 2016), making them an important target of tobacco industry marketing (Ling & Glantz, 2002). Tobacco marketing appeals to young people by offering price discounts and conveying themes of social acceptability and friend use of tobacco, sensation seeking and risk taking, sexuality, and relaxation (Sowles, Krauss, Connolly, & Cavazos-Rehg, 2016; Willis, Haught, & Morris II, 2017). These marketing strategies profoundly influence young adults to initiate and progress to regular tobacco use (Davis, Gilpin, Loken, Viswanath, & Wakefield, 2008). Since federal regulation has prohibited cigarette marketing on television, billboards, and other venues, tobacco companies have turned to less traditional marketing venues like social media, which is an inexpensive, under-regulated avenue for product promotion with immense potential to reach large groups of young people (Knoll, 2015; Liang et al., 2015).

Social media use has become ubiquitous, especially among young adults who were the earliest adopters and report the highest use of social media. In 2018, 88% of young adults, ages 18-29, reported use of at least one social media site, compared to only 7% in 2005 (Pew Research Center [PRC], 2018a). YouTube is the most popular social media site with 91% of young adults reporting use, followed by Facebook (81%), Snapchat (68%),

Instagram (64%), Twitter (40%), and Pinterest (34%), and the majority of users report visiting these sites on a daily basis (Greenwood, Perrin, & Duggan, 2016; PRC, 2018a). As social media use has exploded, the use of mobile devices to access the internet and social media has increased. In 2018, 94% of young adults reported owning a smartphone (PRC, 2018b). Smartphones allow young adults access to content on social media from any place at any time. A primary use of social media is connecting with friends, family, work colleagues, public figures, businesses, and organizations (Duggan, Ellison, Lampe, Lenhart, & Madden, 2015). Social media is also a popular source of news, health information, product recommendations, activism, and entertainment (Rainie, Smith, Schlozman, Brady, & Verba, 2012).

Although many social media platforms such as Facebook prohibit explicit advertising of tobacco and nicotine products, indirect promotion via tobacco company profiles is permitted (Facebook, 2018). Social media platforms are unique from other marketing channels because they allow users to engage and interact with tobacco-related content and to share content via users' personal networks (Dunlop, Freeman, & Jones, 2016). Liang et al. (2015) found that, together, the 70 most popular cigarette brands had created 238 Facebook pages and posted 120,000 pro-tobacco YouTube videos, demonstrating that sales promotion of tobacco products is extensive on social media (Liang et al., 2015). Another study demonstrated widespread e-cigarette promotion on Twitter, reporting more than 73,000 tweets related to e-cigarettes during a two-month period (Huang, Kornfield, Szczypka, & Emery, 2014). Studies show tweets related to tobacco products are primarily commercial advertisements, commonly mention flavors, and offer coupons and price discounts (Huang et

al., 2014; Sowles et al., 2016). Another study reported that Instagram posts using the hashtag “#vape” increased by over 4 million during a four-month period between 2014 and 2015 (Laestadius, Wahl, & Cho, 2016).

While these studies describe the volume and nature of tobacco-related messaging on social media, limited research has reported on people’s exposure to and engagement with tobacco-related social media (Cavazos-Rehg, Krauss, Spitznagel, Grucza, & Bierut, 2013; Depue, Southwell, Betzner, & Walsh, 2015; Hébert et al., 2017; Phua, 2018; Pokhrel et al., 2018; Sawdey, Hancock, Messner, & Prom-Wormley, 2017). Depue et al. (2015) reported exposure to tobacco use in social media significantly predicted past 30-day cigarette use at five-month follow-up, among a U.S.-based sample of 200 young adults. Sawdey et al. (2017) found that 43% of 258 college students reported viewing e-cigarette-related Facebook, Twitter, and Instagram posts from peers during the last six months, and 48% of students reported viewing e-cigarette advertisements; exposure was positively associated with e-cigarette use. No study to date has documented the extent of young adults’ exposure to popular tobacco and nicotine products (other than e-cigarettes) across an array of popular social media platforms, or the extent to which young adults engage with (e.g., post, comment, share) tobacco-related social media. In addition, no study has examined demographic, social, and behavioral characteristics of young adults who report exposure and engagement. Among youth, characteristics including being older, female, having friends who use tobacco, and higher sensation seeking were shown to be related with reporting exposure and engagement (Hébert et al., 2017).

## ***Study Aims***

This study aims to characterize young adult exposure and engagement with tobacco and nicotine product marketing and messaging on social media, among a large sample of college students by describing (1) the extent to which college students report exposure to advertisements for cigarettes, e-cigarettes, cigars, hookah, and smokeless tobacco on social media including YouTube, Facebook, Instagram, Snapchat, Twitter, Pinterest, and Reddit, (2) the extent to which college students engage (e.g., post, comment, share) with tobacco and nicotine product messaging on social media, and (3) the demographic, social, and behavioral characteristics (i.e., age, sex, race/ethnicity, friend use, sensation seeking, depressive symptoms) of college students who report exposure and engagement.

## **Methods**

### ***Sample and Design***

The Marketing and Promotions Across Colleges in Texas Study (Project M-PACT) is a multi-wave longitudinal surveillance study that focuses on monitoring trajectories of tobacco and nicotine product use among a cohort of 5,482 two- and four-year Texas college students. Twenty-four colleges were recruited from five counties that included the four largest metropolitan areas in Texas (Austin, Dallas/Fort Worth, Houston, and San Antonio). Six colleges were selected from each of the four areas in Texas. All two-year and nine of the 12 four-year colleges were public institutions. Eligible students at participating colleges were recruited between November 2014 and February 2015 to complete the baseline online survey via email invitation. Additional information about Project M-PACT procedures are reported elsewhere (Creamer et al., 2018; Loukas et al., 2016). A total of 13,714 students were

eligible to participate and 5,482 of these (40%) provided consent and completed the baseline survey. This response rate is similar to or exceeds that of similar online studies of college students (Berg, Haardoerfer, Escoffery, Zheng, & Kegler, 2014; Velazquez et al., 2011).

The present study is a descriptive analysis of Project M-PACT data collected between April and May 2017 (N=4,384; wave 6), the first wave in which detailed questions regarding tobacco-related social media exposure and engagement were included on the survey. Upon completion of the spring 2017 survey, each student received a \$20 electronic gift card, and all students were entered into a drawing to win one of 20 \$50 gift cards. The response rate was 80%. Project M-PACT was approved by the University of Texas at Austin Institutional Review Board. This study was exempt by the University of Texas Health Science Center Institutional Review Board.

### ***Measures***

#### ***Tobacco and Nicotine Product Use***

Lifetime/ever use of cigarettes, e-cigarettes, hookah, cigars, and smokeless tobacco was assessed by asking, “Have you ever smoked/used [product], even one or two puffs?” Current/past 30-day use was assessed by asking, “On how many days of the past 30 days did you smoke/use [product]?” Students who reported use on at least one day in the past 30 days were considered current users, and those who reported use on zero days in the past 30 days were considered non-users. Students who reported current use of any one product were considered single product users. Current users of any two products were considered dual-users, and users of three or more products were considered poly-users. For e-cigarettes, hookah, and cigars, language regarding using the product “as intended” was added to make it

clear the questions were asking about use with tobacco or nicotine, and not another substance, like marijuana.

### *Social Media Use and Engagement*

To assess social media use, participants were asked, “During the past 30 days, how often did you read or view content on [social media platform]?” Engagement was assessed via, “During the past 30 days, how often did you share, post, or comment on [social media platform]?” Social media platforms included the seven most popular among young adults (Greenwood et al., 2016; PRC, 2018a): YouTube, Facebook, Instagram, Snapchat, Twitter, Pinterest, and Reddit. Response options were “Never,” “About once a month,” “Every few weeks,” “1-2 days a week,” “3-5 days a week,” “About once a day,” and “Several times a day.” To calculate the prevalence of use and engagement, each was dichotomized into never and any use. To calculate mean occurrence of use and engagement, the 7-point Likert scale was coded as: 0=“Never,” 1=“About once a month,” 2=“Every few weeks,” 6=“1-2 days a week,” 16=“3-5 days a week,” 30=“About once a day,” 60=“Several times a day.” This coding allowed for a more meaningful interpretation of mean occurrence where the units are times per month rather than arbitrary values. In addition, a count variable was created to represent number of social media platforms used with 0=no platforms used and 7=all platforms used.

### *Exposure to Tobacco and Nicotine Product Social Media Advertising*

Participants were asked, “During the past 30 days, how often did you see any advertisements for [product] on [social media platform]?” Products assessed included cigarettes, e-cigarettes, hookah, cigars, and smokeless tobacco. Social media included

YouTube, Facebook, Instagram, Snapchat, Twitter, Pinterest, and Reddit. Response options were 0=“Never,” 1=“Rarely,” 2=“Occasionally,” 3=“Frequently,” 4=“Very Frequently.”

Consistent with previous research, exposure was dichotomized into 0=never/not exposed and 1=rarely/occasionally/frequently/very frequently exposed, to calculate prevalence (Depue et al., 2015; Hébert et al., 2017; Sawdey et al., 2017).

#### *Engagement with Tobacco and Nicotine Product Social Media Content*

Nine forms of engagement were assessed. Participants were asked how often they use social media to post links to (1) pro- and (2) anti-tobacco or nicotine product websites, stories, or articles, post their own thoughts or comments about the (3) positive and (4) negative aspects of tobacco use, (5) encourage and (6) discourage other people to use/from using a tobacco product, (7) post about their own tobacco use, and (8) repost content related to tobacco that was originally posted by someone else. “Pro-tobacco” was defined as any website, social media page, advertisement, post, video, or image that encourages tobacco or nicotine product use or shows tobacco use to be a positive behavior. “Anti-tobacco” was defined as any website, social media page, advertisement, post, video, or image that discourages tobacco use and shows it to be a negative behavior. Response options were “Never,” “Rarely,” “Occasionally,” “Frequently,” “Very Frequently.” Participants also were asked if they had ever (9) visited, followed, or liked tobacco products on social media. Participants who responded “yes,” were asked to select the kinds of products (e.g., cigarettes, e-cigarettes, etc.) they visited, followed, or liked. To calculate prevalence for each form of engagement, engagement was dichotomized into 0=never or no/not exposed and 1=rarely/occasionally/frequently/very frequently or yes/exposed. All nine forms of

engagement were combined to create a dichotomous engagement variable where 0=never engage and 1=engage is one or more ways. A dichotomous pro-engagement variable was created by combining three engagement activities that clearly promoted tobacco or nicotine products (i.e., post links to pro-tobacco or nicotine product websites, stories, or articles; post your own thoughts or comments about the positive aspects of tobacco use; encourage other people to use a tobacco/nicotine product). Similarly, an anti-engagement variable was created by combining the three engagement activities that discouraged use of tobacco or nicotine products.

#### *Demographic, Social, and Behavioral Factors*

Demographic factors were assessed at baseline (wave 1) and included age (range: 18-29), sex (male or female), race/ethnicity (non-Hispanic white, Hispanic/Latino, Asian, African American/black, and multi-racial or another race/ethnicity), and two-year versus four-year college student. Behavioral factors were assessed at wave 6. Friend use was dichotomized such that 0=having zero friends that use cigarettes, e-cigarettes, cigars, hookah, or smokeless tobacco, and 1=having at least one friend that uses one or more of these products. Sensation seeking was assessed through four items from the Brief Sensation Seeking Scale (BSSS) (e.g., I would like to explore strange places.) (Stephenson, Hoyle, Palmgreen, & Slater, 2003). Response options ranged from 1=“Strongly Disagree” to 5=“Strongly Agree” on a 5-point Likert scale. A mean sensation seeking score was created by summing the responses across the four items and dividing by the number of completed items. A higher score (ranging from 1-5) indicates greater sensation seeking. Sensation seeking was dichotomized such that students with an average score below three were



considered low sensation seekers, and those with a score of three or above were considered high sensation seekers. Depressive symptoms were assessed through the 10-item Center for Epidemiologic Studies Depression Scale (CES-D) (e.g., “In the past week, I felt depressed.”) (Björgvinsson, Kertz, Bigda-Peyton, McCoy, & Aderka, 2013). Response options were 0=“Rarely (less than 1 day),” 1=“Sometimes (1-2 days),” 2=“Moderate amount of time (3-4 days),” and 3=“Most of the time (5-7 days).” Based on validated cut-offs (Björgvinsson et al., 2013) students with a score below 10 were considered to have low depressive symptoms, and students with a score of 10 or above were considered to have high depressive symptoms.

### ***Statistical Analysis***

Descriptive analyses were conducted to determine the prevalence and mean occurrence of exposure to and engagement with tobacco-related social media. Frequency distributions are reported for race/ethnicity, sex, college type, tobacco use, friend use of tobacco, sensation seeking, depressive symptoms, social media use and engagement, and exposure and engagement with tobacco-related social media. Means and standard deviations are reported for age, social media use and engagement, and exposure and engagement with tobacco-related social media.

Multiple logistic regression analyses were conducted to identify participant characteristics associated with exposure and engagement. Separate models were run for six exposure outcomes (i.e., exposure to advertising for cigarettes, e-cigarettes, hookah, cigars, smokeless tobacco, and any products), and three engagement outcomes (i.e., pro-tobacco engagement, anti-tobacco engagement, and any engagement). Covariates for all models included age, sex, race/ethnicity, college type, tobacco use (single, dual-, and poly-use),

number of social media platforms used, friend use, sensation seeking, and depressive symptoms.

Data were complete for age, race/ethnicity, and college type. Some data were missing for sex (0.07%), product use (0.64%–1.85%), social media use (1.80%–1.85%) and engagement (1.82%–1.87%), tobacco-related social media exposure (1.94%–2.69%) and engagement (1.25%–2.33%), friend use (2.28%), sensation seeking (2.58%), and depressive symptoms (2.62%). The small amount of missing data (less than 5%) was considered inconsequential (Schafer, 1999). However, prevalence estimates were calculated with missing data included in the denominator to provide conservative estimates. In regression models, missing data were handled using listwise deletion. All analyses were conducted using Stata (StataCorp., 2017).

## **Results**

### ***Sample Characteristics***

Descriptive results for sample characteristics are reported in Table 1. Participants were 18-29 years of age ( $M=20.4$ ,  $SD=2.32$ ), and 64.6% were female. The majority of participants (93.1%) were enrolled at a four-year university versus a two-year college. With regard to race/ethnicity, 35.5% were non-Hispanic white, 30.8% Hispanic, 18.2% Asian, 7.9% African-American/black, and 7.6% reported being multi-racial/ethnic or another race/ethnicity. With regard to tobacco use, 16.3% of participants were current cigarette users, 9.2% were e-cigarette users, 9.3% hookah users, 5.3% cigar users, and 2.4% smokeless tobacco users.

Table 1  
*Study Population Characteristics (M-PACT Study; spring 2017; N=4,384)*

Age, M (SD)	20.4 (2.32)
Female, % (N)	64.6 (2,831)
Race/ethnicity, % (N)	
Non-Hispanic white	35.5 (1,558)
Hispanic/Latino	30.8 (1,352)
Asian	18.2 (798)
African American/black	7.9 (345)
Other <sup>a</sup>	7.6 (331)
Four-year college student, % (N) <sup>b</sup>	93.1 (4,081)
No. of tobacco/nicotine products used, % (N)	
Single product user	17.1 (748)
Dual product user	7.1 (312)
Poly product user	3.3 (146)
Non-user	72.5 (3,178)
Ever tobacco/nicotine product, % (N)	
Cigarettes	55.0 (2,411)
E-cigarettes	58.4 (2,559)
Hookah/waterpipe	68.0 (2,979)
Cigar products	48.1 (2,107)
Smokeless tobacco	27.0 (1,183)
Current tobacco/nicotine product, % (N)	
Cigarettes	16.3 (713)
E-cigarettes	9.2 (401)
Hookah/waterpipe	9.3 (409)
Cigar products	5.3 (231)
Smokeless tobacco	2.4 (103)
No. social media platforms used, M (SD) <sup>c</sup>	4.5 (1.81)
Friend use of any tobacco % (N)	75.6 (3,312)
Sensation seeking, % (N)	
Low	34.1 (1,499)
High	63.2 (2,772)
Depressive symptoms, % (N)	
Low	64.7 (2,838)
High	32.6 (1,431)

*Note.* M = mean. SD = standard deviation.

<sup>a</sup>Other = Participants reported being multi-racial/ethnic or another race/ethnicity.

<sup>b</sup>Four-year college student versus two-year university student.

<sup>c</sup>Range is 0-7 social media platforms.

### ***Social Media Use and Engagement***

The majority of participants reported using at least one social media platform (94.0%), and 90.3% reported engaging on social media by liking, sharing, posting, or commenting. Among our sample, YouTube was the most popular social media site for reading or viewing content (87.7%), followed by Facebook (85.0%), Snapchat (72.4%), Instagram (70.9%), Twitter (47.6%), Pinterest (46.8%), and Reddit (36.2%). Facebook was most popular for engaging (77.3%), followed by Snapchat (65.0%), Instagram (64.1%), YouTube (34.8%), Twitter (34.3%), Pinterest (29.2%), and Reddit (17.3%).

Participants reported the most frequent use of Facebook. Facebook users reported viewing content daily or several times a day, on average ( $M=37.0$  times per month,  $SD=25.6$ ), followed by Snapchat ( $M=29.6$ ,  $SD=25.6$ ), Instagram ( $M=28.2$ ,  $SD=26.5$ ), YouTube ( $M=23.4$ ,  $SD=23.3$ ), Twitter ( $M=13.6$ ,  $SD=22.5$ ), Reddit ( $M=9.4$ ,  $SD=20.0$ ), and Pinterest ( $M=5.5$ ,  $SD=12.8$ ). Participants reported the most frequent engagement on Facebook ( $M=22.3$ ,  $SD=24.3$ ), followed by Snapchat ( $M=19.3$ ,  $SD=23.8$ ), Instagram ( $M=17.5$ ,  $SD=23.4$ ), Twitter ( $M=8.3$ ,  $SD=18.2$ ), YouTube ( $M=5.6$ ,  $SD=14.5$ ), Pinterest ( $M=3.8$ ,  $SD=11.4$ ), and Reddit ( $M=3.5$ ,  $SD=12.0$ ).

### ***Exposure to Social Media Tobacco Advertising***

Overall, 30.0% of students reported seeing advertisements for tobacco and nicotine products on social media, during the past 30 days. Exposure across any social media was greatest for e-cigarette advertisements (20.1%), followed by advertisements for cigarettes (18.1%), hookah (14.0%), cigars (9.0%), and smokeless tobacco (8.4%). Exposure to any

product advertising was greatest on Facebook (22.5%), followed by Instagram (15.1%), YouTube (13.7%), Twitter (10.4%), Snapchat (9.3%), Reddit (8.2%), and Pinterest (6.9%). Mean occurrence of exposure ranged between 0.06 and 0.50, indicating students reported seeing tobacco advertisements on social media between “never” and “rarely,” on average (Table 2).

### ***Engagement with Social Media Tobacco Messaging***

Overall, 22.7% of students reporting engaging with tobacco and nicotine product messaging on social media. Reported engagement was greatest for discouraging other people from using tobacco (12.9%), posting links to anti-tobacco websites, stories, or articles (10.7%), and posting comments about the negative aspects of tobacco use (9.2%). Students also reported reposting tobacco content that was originally posted by someone else (5.2%), posting about their own tobacco use (4.7%), posting comments about the positive aspects of tobacco use (4.5%), posting links to pro-tobacco websites, stories, or articles (3.7%), visiting, following, or liking tobacco products on social media (3.4%), and encouraging other people to use tobacco (3.2%). Mean occurrence of engagement ranged between 0.05 and 0.68, indicating students reported engaging between “never” and “rarely,” on average (Table 3).

Table 2

*Prevalence and Mean Occurrence of Exposure to Tobacco Product Advertising on Social Media (M-PACT study; spring 2017; N=4,384)*

Exposure to:	Any product		Cigarettes		E-cigarettes		Hookah		Cigar products		Smokeless	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
Platform	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Any social media	30.0	(1,314)	18.1	(795)	20.1	(883)	14.0	(614)	9.0	(396)	8.4	(366)
	0.50	(0.88)	0.29	(0.69)	0.32	(0.73)	0.23	(0.63)	0.15	(0.56)	0.14	(0.53)
Facebook	22.5	(985)	13.5	(590)	14.5	(636)	10.0	(440)	6.9	(303)	6.3	(278)
	0.35	(0.74)	0.20	(0.55)	0.21	(0.58)	0.15	(0.50)	0.11	(0.44)	0.10	(0.41)
YouTube	13.7	(602)	9.7	(426)	9.1	(399)	5.1	(224)	5.0	(221)	4.6	(202)
	0.22	(0.63)	0.15	(0.50)	0.15	(0.50)	0.08	(0.39)	0.08	(0.39)	0.08	(0.39)
Instagram	15.1	(662)	8.3	(364)	9.4	(413)	5.1	(224)	5.3	(232)	4.6	(200)
	0.25	(0.66)	0.13	(0.47)	0.15	(0.50)	0.13	(0.47)	0.09	(0.41)	0.08	(0.39)
Twitter	10.4	(456)	7.1	(309)	6.9	(302)	5.3	(233)	4.7	(204)	4.1	(181)
	0.17	(0.57)	0.11	(0.43)	0.11	(0.44)	0.08	(0.39)	0.07	(0.37)	0.07	(0.37)
Snapchat	9.3	(408)	6.0	(264)	6.0	(262)	5.5	(242)	4.6	(204)	3.8	(166)
	0.16	(0.56)	0.10	(0.43)	0.09	(0.41)	0.09	(0.41)	0.08	(0.38)	0.06	(0.36)
Reddit	8.2	(360)	5.5	(239)	5.9	(260)	3.6	(158)	3.9	(170)	3.5	(153)
	0.14	(0.54)	0.08	(0.39)	0.09	(0.41)	0.06	(0.36)	0.07	(0.37)	0.06	(0.34)
Pinterest	6.9	(302)	4.7	(208)	4.7	(205)	3.8	(168)	3.9	(169)	3.4	(149)
	0.12	(0.50)	0.08	(0.38)	0.07	(0.36)	0.06	(0.36)	0.07	(0.37)	0.06	(0.35)

*Note.* M = mean. SD = standard deviation. Exposure assessed via, “During the past 30 days, how often did you see advertisements for [tobacco/nicotine product] on [social media platform]?” 0=“Never,” 1=“Rarely,” 2=“Occasionally,” 3=“Frequently,” and 4=“Very Frequently.” Mean occurrence of exposure ranges between 0-4 (Never – Very Frequently). Prevalence was dichotomized: Not Exposed = “Never,” Exposed = “Rarely,” “Occasionally,” “Frequently,” or “Very Frequently.” The rows and columns do not sum because participants could report exposure to one or more tobacco/nicotine products across one or more social media platforms. Missing data ranged from 1.94-2.69%. All estimates calculated with missing data included in the denominator.

Table 3

*Prevalence and Mean Occurrence of Engagement with Tobacco Messaging on Social Media (M-PACT study; spring 2017; N=4,384)*

Engagement Activity	% (n)	M (SD)
Any engagement	22.7 (997)	0.34 (0.77)
Post links to product websites, stories or articles	11.5 (503)	0.18 (0.56)
Pro-tobacco/nicotine content	3.7 (161)	0.06 (0.35)
Anti-tobacco/nicotine content	10.7 (469)	0.16 (0.51)
Post thoughts or comments about product use	9.9 (433)	0.14 (0.48)
Positive aspects of use	4.5 (198)	0.07 (0.35)
Negative aspects of use	9.2 (404)	0.13 (0.45)
Encourage other people to use a product	3.2 (142)	0.05 (0.33)
Discourage other people from using a product	12.9 (567)	0.21 (0.62)
Post about your own use	4.7 (205)	0.08 (0.39)
Repost content originally posted by someone else	5.2 (226)	0.08 (0.37)
Visited, followed or liked		
Any product	3.4 (152)	-- --
Cigarettes	1.2 (55)	-- --
E-cigarettes	2.4 (108)	-- --
Hookah	1.2 (53)	-- --
Cigar products	0.9 (43)	-- --
Smokeless tobacco	0.3 (16)	-- --
Don't know	0.1 (6)	-- --

*Note.* M = mean. SD = standard deviation. -- Not collected. Engagement assessed via, “How often do you use social media to [post links..., post your own thoughts ..., etc.].?” 0=“Never,” 1=“Rarely,” 2=“Occasionally,” 3=“Frequently,” and 4=“Very Frequently.” Engagement also assessed via, “Have you ever visited, followed, or liked tobacco/nicotine products on social media?” 0=“No,” and 1=“Yes.” Mean occurrence of exposure ranges between 0-4 (Never – Very Frequently). Prevalence was dichotomized: Not Exposed = “Never” or “No,” Exposed = “Rarely,” “Occasionally,” “Frequently,” or “Very Frequently” or “Yes.” The columns do not sum because participants could report one or more forms of engagement. Missing data ranged from 1.25-2.33%. All estimates calculated with missing data included in the denominator.

### ***Characteristics of Students who Report Exposure***

Results from the logistic regression analyses for exposure outcomes are presented in Table 4. When controlling for all other variables in the model, female students were significantly more likely than males to report exposure to hookah advertising in social media. Four-year university students were significantly less likely to report exposure to any product advertising, compared to two-year college students. Age was not significantly associated with exposure. After controlling for covariates, the odds of reporting exposure to cigarette, e-cigarette, cigar, hookah, smokeless tobacco, and any product advertising via social media were 1.43 to 2.68 times greater among Hispanic students, 1.65 to 2.89 times greater among Asian students, and 1.36 to 2.34 times greater among non-Hispanic black students, compared to non-Hispanic white students. Multi-racial students or students reporting another race/ethnicity were significantly more likely to report exposure to cigar and hookah advertising via social media, only.

Poly-tobacco users were significantly more likely than non-users to report exposure to each type of advertising exposure (cigarette, e-cigarette, cigar, hookah, smokeless tobacco), as well as any product advertising. Dual-users were more likely to report exposure to e-cigarette, cigar, and hookah advertising. There were no significant differences in exposure status between single product users and non-users. The number of social media platforms used was significantly related with exposure to each and any product advertising; for each additional social media platform used, the odds of exposure increased by 1.12 to 1.21 times the odds for those who were not exposed. Students who reported having at least one friend who uses a tobacco product were more likely to report exposure to each and any



cigarette, e-cigarette, and hookah advertising. Students with higher depressive symptoms were more likely to report exposure to all product advertising, compared to students with low depressive symptoms. Sensation seeking was not significantly associated with exposure.

### ***Characteristics of Students who Report Engagement***

Results of the logistic regression analyses for engagement outcomes are presented in Table 5. When controlling for all other variables in the model, female students were significantly more likely than males to report engaging with pro-tobacco and neutral social media messaging. Four-year university students were significantly less likely to report pro-engagement, compared to two-year college students. Age was not significantly associated with engagement. The odds of reporting pro-engagement were greater among Hispanic, Asian, Black, and multi-racial students, compared to white students. Poly-tobacco users were significantly more likely than non-users to report any type of engagement. Dual-users were more likely to report pro-engagement. Single product users were more likely than non-users to report pro-engagement and less likely to report anti-engagement. For each additional social media platform used, the odds of engaging in any type increased by 1.16 to 1.20 times relative to those who did not engage. Students who reported having at least one friend who uses a tobacco or nicotine product were more likely to report anti- and neutral engagement. Students with higher depressive symptoms were more likely to report any type of engagement, compared to students with low depressive symptoms. Sensation seeking was not significantly associated with engagement.

Table 4

*Odds Ratios for Associations between College Students' Characteristics and Exposure to Social Media Tobacco Advertising (N=4,384)*

Exposure to ...	Cigarettes (n=795)	E-cigarettes (n=883)	Cigars (n=614)	Hookah (n=396)	Smokeless (n=366)	Any Product (n=1,314)
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Characteristics						
Age	1.00 (0.96 – 1.03)	1.01 (0.97 – 1.04)	1.02 (0.97 – 1.07)	0.99 (0.95 – 1.03)	1.01 (0.96 – 1.06)	1.01 (0.98 – 1.04)
Female sex (ref: male)	1.09 (0.92 – 1.30)	0.89 (0.76 – 1.05)	0.90 (0.72 – 1.14)	1.41*** (1.15 – 1.73)	0.88 (0.69 – 1.11)	1.09 (0.95 – 1.27)
Race/ethnicity (ref: white)						
Hispanic	2.25*** (1.84 – 2.76)	1.43*** (1.18 – 1.73)	2.68*** (2.01 – 3.59)	2.21*** (1.75 – 2.78)	1.99*** (1.49 – 2.66)	1.72*** (1.46 – 2.04)
Asian	2.23*** (1.65 – 3.02)	1.65** (1.23 – 2.20)	2.89*** (1.92 – 4.33)	2.75*** (1.98 – 3.81)	2.11*** (1.38 – 3.21)	2.00*** (1.54 – 2.58)
Black	2.09*** (1.65 – 2.65)	1.36** (1.09 – 1.70)	2.34*** (1.68 – 3.27)	2.00*** (1.53 – 2.63)	2.00*** (1.43 – 2.78)	1.49*** (1.22 – 1.81)
Other	1.27 (0.90 – 1.80)	0.91 (0.66 – 1.26)	1.70* (1.06 – 2.66)	1.57* (1.08 – 2.26)	1.53 (0.97 – 2.41)	1.07 (0.81 – 1.41)
Four-year college student (ref: two-year)	0.77 (0.57 – 1.04)	0.78 (0.58 – 1.04)	1.00 (0.65 – 1.55)	0.88 (0.62 – 1.25)	0.85 (0.55 – 1.29)	0.76* (0.58 – 0.98)
Tobacco use (ref: non-user)						
Single product user	0.94 (0.75 – 1.17)	1.09 (0.88 – 1.33)	0.79 (0.57 – 1.08)	0.95 (0.74 – 1.22)	0.92 (0.67 – 1.26)	1.09 (0.91 – 1.31)
Dual-user	1.25 (0.93 – 1.68)	1.36* (1.03 – 1.80)	1.70** (1.18 – 2.44)	1.70*** (1.25 – 2.31)	1.45 (0.98 – 2.14)	1.40** (1.09 – 1.81)
Poly-user	2.57*** (1.78 – 3.70)	2.08 *** (1.45 – 3.00)	3.68*** (2.46 – 5.52)	2.81*** (1.91 – 4.14)	3.49*** (2.30 – 5.29)	2.79*** (1.96 – 3.96)
No. social media platforms used	1.12*** (1.07 – 1.18)	1.18*** (1.12 – 1.24)	1.16*** (1.08 – 1.24)	1.21*** (1.14 – 1.29)	1.18*** (1.10 – 1.27)	1.12*** (1.08 – 1.17)
Friend use	1.39** (1.12 – 1.72)	1.65*** (1.33 – 2.05)	1.29 (0.96 – 1.73)	1.99*** (1.52 – 2.60)	1.27 (0.94 – 1.73)	1.69*** (1.41 – 2.03)

High sensation seeking (ref: low)	0.91 (0.77 – 1.08)	0.92 (0.78 – 1.09)	0.86 (0.68 – 1.07)	0.90 (0.75 – 1.09)	0.77 (0.61 – 0.97)	0.92 (0.80 – 1.07)
High depressive symptoms (ref: low)	1.28** (1.09 – 1.51)	1.41*** (1.21 – 1.65)	1.54*** (1.24 – 1.92)	1.40*** (1.17 – 1.68)	1.65*** (1.32 – 2.06)	1.29*** (1.12 – 1.48)

*Note.* ref = reference category. AOR = adjusted odds ratio. CI = confidence interval. All models were adjusted for all other covariates in the model.

\*p ≤ 0.05, \*\*p ≤ 0.01, \*\*\*p ≤ 0.001

Table 5

*Odds Ratios for Associations between College Students' Characteristics and Engagement with Social Media Tobacco Messaging (N=4,384)*

	Pro-Engagement <sup>a</sup> (n=294)	Anti-Engagement <sup>b</sup> (n=806)	Any Engagement <sup>c</sup> (n=997)
Characteristics	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age	1.01 (0.96 – 1.07)	1.01 (0.98 – 1.05)	1.02 (0.99 – 1.06)
Female sex (ref: male)	1.00 (0.76 – 1.30)	1.34*** (1.13 – 1.60)	1.26** (1.08 – 1.48)
Race/ethnicity (ref: white)			
Hispanic	1.81*** (1.30 – 2.51)	1.20 (0.99 – 1.46)	1.19 (0.99 – 1.42)
Asian	2.09** (1.30 – 3.36)	1.14 (0.83 – 1.55)	1.14 (0.86 – 1.52)
Black	2.24** (1.55 – 3.24)	1.16 (0.92 – 1.46)	1.14 (0.92 – 1.41)
Other	1.70* (1.04 – 2.76)	1.24 (0.91 – 1.69)	1.29 (0.98 – 1.71)
Four-year college student (ref: two-year)	0.58* (0.38 – 0.90)	0.81 (0.60 – 1.10)	0.79 (0.60 – 1.05)
Tobacco use (ref: non-user)			
Single product user	1.74*** (1.26 – 2.41)	0.73** (0.58 – 0.91)	0.97 (0.80 – 1.18)
Dual-user	2.59*** (1.74 – 3.86)	0.83 (0.60 – 1.14)	1.31 (1.00 – 1.72)
Poly-user	7.39*** (4.86 – 11.24)	1.84*** (1.26 – 2.67)	2.34*** (1.64 – 3.34)
No. social media platforms used	1.19*** (1.10 – 1.29)	1.16*** (1.10 – 1.22)	1.15*** (1.10 – 1.21)
Friend use	1.31 (0.90 – 1.89)	1.57*** (1.27 – 1.95)	1.60*** (1.31 – 1.96)

High sensation seeking (ref: low)	0.88 (0.67 – 1.14)	0.90 (0.77 – 1.07)	0.99 (0.85 – 1.16)
High depressive symptoms (ref: low)	1.57*** (1.22 – 2.02)	1.41*** (1.20 – 1.66)	1.42*** (1.22 – 1.64)

*Note.* ref = reference category. AOR = adjusted odds ratio. CI = confidence interval. All models were adjusted for all other covariates in the model.

<sup>a</sup>Pro-engagement is post links to pro-tobacco websites, stories, or articles; post thoughts or comments about the positive aspects of tobacco use; or encourage other people to use tobacco.

<sup>b</sup>Anti-engagement is post links to anti-tobacco websites, stories, or articles; post thoughts or comments about the negative aspects of tobacco use; or discourage other people from using tobacco.

<sup>c</sup>Any engagement is post links to pro- or anti-tobacco websites, stories, or articles; post thoughts or comments about the positive or negative aspects of tobacco use, encourage or discourage others' tobacco use; post about personal tobacco use, repost tobacco-related content; or visit, follow, or like tobacco on social media.

\* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$

## **Discussion**

Our study indicates greater than 90% of college students use and engage on social media daily, reaffirming the importance of social media in young adult life. These findings are reflective of national estimates showing YouTube to be the most used platform among young adults, followed by Facebook, Snapchat, and Instagram, and reporting similar estimates to our study for Twitter, Pinterest, and Reddit (PRC, 2018a). This study additionally provides insight beyond young adults' social media use. Engagement on social media via posts, shares, and comments is an integral part of social media's appeal (Dunlop et al., 2016). Our study showed that across all platforms, social media use was higher than engagement. The largest gap between use and engagement was for YouTube; 88% of students reported using YouTube, and only 35% reported engaging (a 53% difference). This difference was 19% for Reddit, 18% for Pinterest, 14% for Twitter, 8% for Facebook, and 7% for Instagram and Snapchat. The magnitude of the difference between use and engagement may reflect the features unique to various social media. For example, YouTube allows users to view content without creating or signing into a Google account, however users cannot comment anonymously (i.e., without signing into a Google account) (YouTube, 2013), which may deter users from engaging. Future research might explore young adults' experiences and preferences related to social media use and engagement since researchers and practitioners are increasingly utilizing social media to deliver interventions and health communication messages (Korda & Itani, 2013; Shi, Poorisat, & Salmon, 2018).

This study is the first to report prevalence of young adults' exposure to popular tobacco and nicotine product advertising across an array of social media. Overall, 30% of our

sample was exposed to tobacco advertising on at least one social media platform, during the past 30 days. Exposure to e-cigarette advertising was highest with 20% of our sample reporting exposure via any social media. Our findings are comparable to those of Phua (2018) who found that among 1,016 adults, 25% were exposed to e-cigarette advertisements and brand pages, during the past 30 days. Generally, across product type, prevalence of exposure was highest on the most popular social media (i.e., Facebook, followed by Instagram or YouTube, Twitter, Snapchat, and Pinterest or Reddit). The only exception to this pattern was exposure to hookah advertising, which also was highest for Facebook, but second highest for Snapchat. Further investigation may explain why hookah advertising appears to be more prevalent on Snapchat, relative to other products. One possible explanation is that hookah retailers prefer Snapchat as a marketing platform since Snapchat offers real-time video and picture posting, and this content can be spread to users via Snapchat's Discover page, which is populated with suggested content (Snapchat, 2018b). For example, a college student may see a hookah advertisement on their Discover page because the hookah lounge that posted the advertisement is geographically near, or people with whom the student shares similar interests (sports, celebrity news, etc.) have shown interest in hookah-related content on Snapchat. Few studies have reported on social media hookah content (Grant & O'Mahoney, 2016; Krauss et al., 2015), and no studies have reported on Snapchat, which is the third most popular social media platform among young adults (PRC, 2018a). Furthermore, studies have shown hookah use has exploded among young adults, over the past decade, and although research has shown hookah smoke contains hazardous toxins also found in cigarette smoke (Centers for Disease Control and Prevention [CDC], 2016),

young adults widely perceive hookah to be trendy and less harmful than traditional cigarettes (Griffiths, Harmon, & Gilly, 2011). Hookah advertising on Snapchat and other social media may be a powerful influence shaping young adult perceptions and culture surrounding hookah and represents an important area of future research.

About 23% of our sample reported at least one form of engagement. Additional research is needed to evaluate engagement as a risk factor for young adult tobacco use since engagement has emerged as an important risk factor for youth tobacco use (Hébert et al., 2017; Soneji et al., 2017). Interestingly, among our sample, engagement with anti-tobacco content like posting links and comments, and discouraging other people from using tobacco was more prevalent than pro-engagement. To our knowledge, this is the first study to report on anti-engagement. Further study is needed to explore the nature of this engagement and to determine whether anti-engagement is a protective factor for tobacco use.

This study identified important characteristics associated with exposure and engagement with tobacco-related social media. Our findings are consistent with those of Hébert et al. (2017) and Depue et al. (2015) who found that having friends who use tobacco was significantly associated with exposure, among youth and young adults, respectively. Greater exposure among students with friends who use tobacco may occur because friends are interacting with one another on social media by sharing tobacco-related content. Both Hébert et al. (2017) and Depue et al. (2015) reported higher sensation seeking was related with exposure, while our study found no association between sensation seeking and exposure. In this study, students with higher depressive symptoms were also more likely to report exposure. More research is needed to determine whether these students are specifically



targeted by tobacco-related advertising, or whether exposure is higher because depressed students spend more time on social media, or there are other potential explanations. Research has shown that young adults who use more social media, have increased levels of depression (Primack et al., 2017).

The present study also revealed that racial/ethnic minorities (versus white students) and two-year college students (versus four-year) were more likely to be exposed to and engage with tobacco-related social media. Higher exposure among these groups may be due to the tobacco industry's long history of strategically targeting vulnerable populations (Truth Initiative, 2015). Disparities related to tobacco use and marketing may be attributed to tobacco company sponsorship of cultural events, higher prevalence of retailers in minority and low-income communities, and heavier advertising and price promotions directed towards vulnerable groups (Rising and Alexander, 2011; Truth Initiative, 2015). Interventions and counter-marketing campaigns should consider the demographic, social, and behavioral characteristics associated with exposure and engagement to reach the most at-risk audiences.

This study has some limitations. First, findings are not generalizable since the study sample was drawn from Texas colleges, and our sample does not include adults who did not attend college. However, we sampled both two- and four-year students, and our sample is racially/ethnically diverse. This is a strength of our study since vocational students are more likely to be from racial/ethnic minority subgroups and have higher rates of tobacco use, compared to other young adult populations (Biener, McCausland, Curry, & Cullen, 2011; Loukas, Murphy, & Gottlieb, 2008), and our study revealed two-year students were significantly more likely than four-year students to be exposed and engage with promotional

tobacco content on social media . Second, data were collected via self-report, which may be subject to recall bias. Finally, students may have differentially defined “advertising” when reporting exposure. It is possible that exposure reported in this study captures user-generated content such as peer posts about tobacco, as well as brand-sponsored content. Participants also may be reporting seeing anti-tobacco messaging. Although exposure to user-generated messaging about tobacco is concerning (Hébert et al., 2017), this study intentionally asked about advertising since industry-sponsored content is more likely to be subject to federal regulations in the future. Still, more research is needed to understand the nature and source of young adults’ exposure to tobacco-related content on social media.

Despite limitations, this study has important implications. Notably, paid or sponsored tobacco advertising is prohibited on all popular social media, except Reddit. Reddit permits sponsored tobacco advertising on subreddits restricted for users ages 18 and older (Reddit, 2016). For other social media, self-imposed policies prohibit sponsored advertisements promoting the sale or use of tobacco of any kind, including e-cigarettes and product accessories. However, industry-sponsored profiles connecting people based on tobacco-related interests are generally permitted (Facebook, 2018; Pinterest, 2018; Snapchat, 2018a; Twitter, 2018; YouTube, 2018). Our study findings reveal that despite these restrictions, young adults see advertisements for tobacco and nicotine products on social media, suggesting that policies prohibiting tobacco-related advertising on social media may be ineffective or under-enforced. This observation echoes recent findings from Jackler et al. (2018) who found that 108 top e-cigarette, cigar, hookah, and smokeless tobacco brands maintained brand-sponsored Facebook pages. Brand pages were found to contain web links

to purchase tobacco products, offers of coupons and discounts, and product imagery, despite Facebook's policies against these promotional activities. In addition, required age gates were absent for the majority of brand-sponsored pages (Jackler, Li, Cardiff, & Ramamurthi, 2018). Our finding that young adults see tobacco advertisements across all popular social media is important since the majority of young adults use social media and share within their peer networks on a daily basis. In addition, our findings suggest vulnerable groups including those with higher depressive symptoms, racial/ethnic minorities, and two-year college students are disproportionately exposed to and engage with tobacco-related social media, which may be exacerbating existing tobacco-related disparities. For these reasons, regulatory efforts to restrict exposure via social media should be made, and counter-messaging on social media is critical.

## References

- Berg, C. J., Haardoerfer, R., Escoffery, C., Zheng, P., & Kegler, M. (2014). Cigarette users' interest in using or switching to electronic nicotine delivery systems for smokeless tobacco for harm reduction, cessation, or novelty: a cross-sectional survey of US adults. *Nicotine & Tobacco Research, 17*(2), 245-255.
- Biener, L., McCausland, K., Curry, L., & Cullen, J. (2011). Prevalence of trial of snus products among adult smokers. *American journal of public health, 101*(10), 1874-1876.
- Björgvinsson, T., Kertz, S. J., Bigda-Peyton, J. S., McCoy, K. L., & Aderka, I. M. (2013). Psychometric properties of the CES-D-10 in a psychiatric sample. *Assessment, 20*(4), 429-436.
- Cavazos-Rehg, P. A., Krauss, M. J., Spitznagel, E. L., Grucza, R. A., & Bierut, L. J. (2013). Hazards of new media: youth's exposure to tobacco ads/promotions. *Nicotine & Tobacco Research, 16*(4), 437-444.
- Centers for Disease Control and Prevention (CDC). (2016). Hookahs. Retrieved from [https://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/tobacco\\_industry/hookahs/index.htm](https://www.cdc.gov/tobacco/data_statistics/fact_sheets/tobacco_industry/hookahs/index.htm)

- Creamer, M. R., Loukas, A., Clendennen, S., Mantey, D., Pasch, K. E., Marti, C. N., & Perry, C. L. (2018). Longitudinal predictors of cigarette use among students from 24 Texas colleges. *Journal of American College Health*, 1-8.
- Davis, R., Gilpin, E., Loken, B., Viswanath, K., & Wakefield, M. (2008). Influence of tobacco marketing on smoking behavior. *The Role of the Media in Promoting and Reducing Tobacco Use. Tobacco Control Monograph*(19), 211-291.
- Depue, J. B., Southwell, B. G., Betzner, A. E., & Walsh, B. M. (2015). Encoded exposure to tobacco use in social media predicts subsequent smoking behavior. *American Journal of Health Promotion*, 29(4), 259-261.
- Duggan, M., Ellison, N., Lampe, C., Lenhart, A., & Madden, M. (2015). Social media update 2014. Pew Research Center, 2015.
- Dunlop, S., Freeman, B., & Jones, S. C. (2016). Marketing to youth in the digital age: The promotion of unhealthy products and health promoting behaviours on social media. *Media and Communication*, 4(3).
- Facebook. (2018). Advertising Policies. Retrieved from <https://www.facebook.com/policies/ads/>
- Grant, A., & O'Mahoney, H. (2016). Portrayal of waterpipe (shisha, hookah, nargile) smoking on Twitter: a qualitative exploration. *Public Health*, 140, 128-135.

- Greenwood, S., Perrin, A., & Duggan, M. (2016). Social media update 2016: Facebook usage and engagement is on the rise, while adoption of other platforms holds steady. *Pew Research Center*.
- Griffiths, M. A., Harmon, T. R., & Gilly, M. C. (2011). Hubble bubble trouble: the need for education about and regulation of hookah smoking. *Journal of Public Policy & Marketing*, 30(1), 119-132.
- Hébert, E. T., Case, K. R., Kelder, S. H., Delk, J., Perry, C. L., & Harrell, M. B. (2017). Exposure and Engagement With Tobacco-and E-Cigarette–Related Social Media. *Journal of Adolescent Health*, 61(3), 371-377.
- Hu, S. S. (2016). Tobacco product use among adults—United States, 2013–2014. *MMWR. Morbidity and mortality weekly report*, 65.
- Huang, J., Kornfield, R., Szczypka, G., & Emery, S. L. (2014). A cross-sectional examination of marketing of electronic cigarettes on Twitter. *Tobacco control*, 23(suppl 3), iii26-iii30.
- Jackler, R. K., Li, V. Y., Cardiff, R. A., & Ramamurthi, D. (2018). Promotion of tobacco products on Facebook: policy versus practice. *Tobacco control*, tobaccocontrol-2017-054175.
- Knoll, J. (2015). Advertising in social media: a review of empirical evidence. *International Journal of Advertising*, 1-35.

Korda, H., & Itani, Z. (2013). Harnessing social media for health promotion and behavior change. *Health promotion practice, 14*(1), 15-23.

Krauss, M. J., Sowles, S. J., Moreno, M., Zewdie, K., Grucza, R. A., Bierut, L. J., & Cavazos-Rehg, P. A. (2015). Peer reviewed: Hookah-related twitter chatter: A content analysis. *Preventing chronic disease, 12*.

Laestadius, L. I., Wahl, M. M., & Cho, Y. I. (2016). # Vapelite: An Exploratory Study of Electronic Cigarette Use and Promotion on Instagram. *Substance Use & Misuse, 51*(12), 1669-1673.

Liang, Y., Zheng, X., Zeng, D. D., Zhou, X., Leischow, S. J., & Chung, W. (2015). Exploring how the tobacco industry presents and promotes itself in social media. *Journal of medical Internet research, 17*(1).

Ling, P. M., & Glantz, S. A. (2002). Why and how the tobacco industry sells cigarettes to young adults: evidence from industry documents. *American journal of public health, 92*(6), 908-916.

Loukas, A., Chow, S., Pasch, K. E., Li, X., Hinds, I., Josephine, T., . . . Perry, C. L. (2016). College students' polytobacco use, cigarette cessation, and dependence. *American journal of health behavior, 40*(4), 514-522.

Loukas, A., Murphy, J. L., & Gottlieb, N. H. (2008). Cigarette smoking and cessation among trade or technical school students in Texas. *Journal of American College Health*, 56(4), 401-407.

Pew Research Center (PRC). (2018a). Social media fact sheet. Retrieved from <http://www.pewinternet.org/fact-sheet/social-media/>

Pew Research Center (PRC). (2018b). Mobile fact sheet. Retrieved from <http://www.pewinternet.org/fact-sheet/mobile/>

Phua, J. (2018). E-Cigarette Marketing On Social Networking Sites: Effects on Attitudes, Behavioral Control, Intention to Quit, and Self-Efficacy. *Journal of Advertising Research*, JAR-2018-2018.

Pinterest. (2018). Advertising policies. Retrieved from <https://policy.pinterest.com/en/advertising-guidelines>

Pokhrel, P., Fagan, P., Herzog, T. A., Laestadius, L., Buente, W., Kawamoto, C. T., . . . Unger, J. B. (2018). Social media e-cigarette exposure and e-cigarette expectancies and use among young adults. *Addictive behaviors*, 78, 51-58.

Primack, B. A., Shensa, A., Escobar-Viera, C. G., Barrett, E. L., Sidani, J. E., Colditz, J. B., & James, A. E. (2017). Use of multiple social media platforms and symptoms of depression and anxiety: A nationally-representative study among US young adults. *Computers in human behavior*, 69, 1-9.



Rainie, L., Smith, A., Schlozman, K. L., Brady, H., & Verba, S. (2012). Social media and political engagement. *Pew Internet & American Life Project*, 19.

Reddit. (2016). Announcement: Updating our ad policy for smoking related ads. Retrieved from <https://www.reddit.com/r/selfserve/comments/49jj81/announcement Updating our ad policy for smoking/>

Sawdey, M. D., Hancock, L., Messner, M., & Prom-Wormley, E. C. (2017). Assessing the Association Between E-Cigarette Use and Exposure to Social Media in College Students: A Cross-Sectional Study. *Substance Use & Misuse*, 1-8.

Schafer, J. L. (1999). Multiple imputation: a primer. *Statistical methods in medical research*, 8(1), 3-15.

Shi, J., Poorisat, T., & Salmon, C. T. (2018). The use of social networking sites (SNSs) in health communication campaigns: Review and recommendations. *Health communication*, 33(1), 49-56.

Snapchat. (2018a). Snap advertising policies. Retrieved from <https://www.snap.com/en-US/ad-policies/#products-services>

Snapchat. (2018b). What is Snapchat? Retrieved from <https://whatis.snapchat.com/>

- Soneji, S., Pierce, J. P., Choi, K., Portnoy, D. B., Margolis, K. A., Stanton, C. A., . . . Hyland, A. (2017). Engagement With Online Tobacco Marketing and Associations With Tobacco Product Use Among US Youth. *Journal of Adolescent Health, 61*(1), 61-69.
- Sowles, S. J., Krauss, M. J., Connolly, S., & Cavazos-Rehg, P. A. (2016). Peer Reviewed: A Content Analysis of Vaping Advertisements on Twitter, November 2014. *Preventing chronic disease, 13*.
- StataCorp. (2017). Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC,.
- Stephenson, M. T., Hoyle, R. H., Palmgreen, P., & Slater, M. D. (2003). Brief measures of sensation seeking for screening and large-scale surveys. *Drug and alcohol dependence, 72*(3), 279-286.
- Twitter. (2018). Prohibited content policies: Tobacco and tobacco accessories. Retrieved from <https://business.twitter.com/en/help/ads-policies/prohibited-content-policies/tobacco-and-tobacco-accessories.html>
- U.S. Department of Health and Human Services (HHS). (2014). The health consequences of smoking—50 years of progress: a report of the Surgeon General. *Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 17*.

Velazquez, C. E., Pasch, K. E., Laska, M. N., Lust, K., Story, M., & Ehlinger, E. P. (2011).

Differential prevalence of alcohol use among 2-year and 4-year college students.

*Addictive behaviors*, 36(12), 1353-1356.

Willis, E., Haught, M. J., & Morris II, D. L. (2017). Up in vapor: Exploring the health

messages of e-cigarette advertisements. *Health communication*, 32(3), 372-380.

YouTube. (2013). We hear you: Better commenting coming to YouTube. Retrieved from

<https://youtube.googleblog.com/2013/09/youtube-new-comments.html>

YouTube. (2018). Advertising policies: Dangerous products or services. Retrieved from

<https://support.google.com/adwordspolicy/answer/6014299?hl=en>

## **JOURNAL ARTICLE**

### **Exposure and Engagement with Social Media Tobacco Messaging Predict Subsequent Tobacco Use among Young Adults**

#### **Nicotine and Tobacco Research**

Limited research examines the longitudinal relationships between young adults' exposure to and engagement with tobacco-related social media and tobacco use. We assessed whether exposure to cigarette, e-cigarette, cigar, and hookah advertising on social media predicted past 30-day use of these products one-year later and whether engagement with pro-tobacco and anti-tobacco messaging predicted tobacco and nicotine product use. Data were from two waves of the Marketing and Promotions Across Colleges in Texas study, a multi-wave study of two- and four-year Texas college students (N=3947; mean age=23.3; 64% female; 35% white, 31% Hispanic, 19% Asian, 8% African-American/black, 7% multi-racial or other). Multiple logistic regression examined longitudinal associations between exposure and engagement at baseline (wave 6, spring 2017) and tobacco and nicotine product use at follow-up (wave 7, spring 2018). Exposure to and engagement with tobacco-related social media significantly predicted past 30-day use of e-cigarettes, cigars, and hookah at one-year follow up. Controlling for other social media, exposure to any product advertising via Reddit predicted e-cigarette use (AOR=1.92 [95% CI: 1.17–3.14]). Pinterest exposure predicted cigar use (2.92 [1.24–6.85]). Snapchat exposure predicted hookah use (2.94 [1.70–5.11]). Pro-tobacco engagement predicted future use of all products (1.77 [1.29–2.42]). Anti-tobacco engagement predicted use of cigars (1.59 [1.12–2.27]) and hookah (1.69 [1.27–2.25]). Exposure to and engagement with tobacco-related social media are important risk factors for

young adult tobacco and nicotine product use. Social media should be a focus of federal regulation, counter-marketing and health communication campaigns, and intervention.

## **INTRODUCTION**

Extensive research has shown tobacco industry marketing profoundly influences tobacco use.<sup>1</sup> Since the 1998 Master Settlement Agreement in which tobacco advertising on billboards, transit media, and other outdoor venues was restricted, tobacco companies have increased advertising and promotion through less traditional venues, such as the internet and social media.<sup>2</sup> Tobacco marketing and messaging on social media in particular has exploded in recent years since social media are inexpensive, lack stringent marketing regulations,<sup>3</sup> and are highly popular among young people.<sup>4</sup> Numerous studies have shown how tobacco companies promote themselves on social media, and further, how product users and advocates promote tobacco use on social media.<sup>5-9</sup> These studies reveal common social media like Facebook, YouTube, Twitter, and Instagram are popular venues for tobacco and nicotine product brand pages, especially cigarettes and e-cigarettes, and sales promotion via these pages is widespread. Brand-generated content on social media often exploits themes of social acceptability, offers coupons and price promotions, and communicates unsubstantiated health claims.<sup>6,9</sup> User-generated tobacco-related content like peer posts about tobacco and vape trick videos is also prevalent on social media.<sup>10</sup> Since nearly 90% of young adults in the United States (U.S.) use, interact with, and seek information on social media daily,<sup>11-13</sup> social media represents an important potential source of exposure to tobacco and nicotine product messaging.

Although studies have begun to document the extent of tobacco and nicotine product marketing and messaging on social media, research on the extent to which people are exposed to (i.e., see or view) and engage with (i.e., post, share, or comment) tobacco-related content on social media, and how their exposure and engagement is related to tobacco use behaviors, is lacking. Few studies to date have documented an association between social media tobacco messaging and use in young adult populations.<sup>14-17</sup> Depue et al. (2015) reported exposure to tobacco use in social media significantly predicted past 30-day cigarette use over a 5-month period, among a sample of 200 young adults. Sawdey et al. (2017) reported positive, significant associations between past 30-day e-cigarette use and viewing peer posts and advertisements about e-cigarettes in social media, among 258 college students. Pokhrel et al. (2018) found e-cigarette exposure via Facebook, Instagram, Twitter, Reddit, and/or Pinterest was positively, concurrently associated with past 30-day e-cigarette use among 470 college students. A few studies have examined the cross-sectional relationship between online and social media exposure/engagement and use, in adolescents.<sup>10,18</sup> Soneji et al. (2017) estimated that 2.94 million (12%) U.S. adolescents, ages 12-17 years, engage with online tobacco marketing, and reported significant associations between engagement with online tobacco marketing and susceptibility to using any tobacco product in a nationally representative sample (N=13,651). Hébert et al. (2017) found that 52.5% of middle and high school students reported past 30-day exposure to tobacco-related social media, and 5.7% reported engagement, such as posting videos or pictures of vape tricks, writing, responding to, or reblogging about tobacco or e-cigarettes. The odds of exposure were significantly higher for students susceptible to use of combustible tobacco and e-cigarettes.<sup>10</sup>

No study to date has examined the relationships between exposure to or engagement with social media tobacco and nicotine product messaging and use among a large (>470), diverse sample of young adults. Furthermore, no study has examined exposure via a wide array of popular social media platforms including Snapchat, Pinterest, and Reddit. Previous studies also have been limited by examining engagement with social media tobacco-related messaging via one or two forms, and engagement among young adults has not been examined in any context. The purpose of this study is to estimate the longitudinal associations between both exposure and engagement with tobacco and nicotine product marketing and messaging across an array of social media platforms, and subsequent tobacco and nicotine product use among a large, diverse sample of young adults, one year later.

## **METHODS**

### **Sample**

Participants were drawn from the Marketing and Promotions Across Colleges in Texas study (Project M-PACT), a surveillance study of college students' tobacco and nicotine product use behaviors. A cohort of 5,482 students attending one of 24 colleges in Texas was established in November 2014 through February 2015 (wave 1), and surveyed every six months through April-May 2017 (wave 6), and then one year later in April-May 2018 (wave 7). Participants in the current analysis participated in data collection in April-May 2017 (wave 6) and again in April-May 2018 (wave 7), as detailed questions regarding students' exposure and engagement with social media tobacco marketing and messaging were introduced at wave 6.

## **Procedure**

Twenty-four colleges were recruited from five counties surrounding the four largest metropolitan areas in Texas (Austin, Dallas/Fort Worth, Houston, and San Antonio). Three two-year and three four-year colleges were selected from each of these four areas. Eligible students were 18-29 years of age and full- or part-time degree- or certificate-seeking undergraduate students at a participating four-year college or enrolled in a vocational or technical program at a two-year college. Eligible students who agreed to participate provided informed consent and then completed an online survey. A total of 13,714 students were eligible to participate, of whom 5,482 (40%) provided consent and completed the baseline (wave 1) survey. At wave 6, 4,384 students participated (an 80% retention rate), and of those 3,947 (90%) participated one-year later at wave 7. Participants received a \$20 electronic gift card at both waves, and all students were entered into a drawing to win one of 20 \$50 gift cards at wave 6, and one of 80 \$25 gift cards at wave 7. Further details regarding Project M-PACT procedures were published by Creamer et al.<sup>19</sup> and Loukas et al.<sup>20</sup> Hereafter, wave 6 and wave 7 are referred to as baseline and follow-up, respectively.

## **Measures**

Project M-PACT measures were modeled after existing surveys and reviewed by nine tobacco control experts. Final item modifications were conducted through an iterative process of cognitive interviewing with 25 young adults who were not Project M-PACT participants.<sup>21</sup>



### *Exposure to Social Media Tobacco Advertising*

At baseline, participants were asked, “During the past 30 days, how often did you see any advertisements for [product] on [social media platform]?” Products assessed included cigarettes, e-cigarettes, cigars, and hookah. Social media platforms assessed included the most used social media by U.S. young adults: Facebook, Instagram, YouTube, Twitter, Snapchat, Reddit, and Pinterest.<sup>13</sup> Response options ranged from “Never” to “Very Frequently” on a 5-point scale. Consistent with previous research,<sup>10,14,15</sup> exposure was dichotomized into students that reported zero exposure and students that reported any exposure. Exposure was examined by social media platform (e.g., exposure to any product advertising on Facebook, YouTube, Instagram, etc.), and by product (e.g., exposure to any product, cigarette, e-cigarette, etc. advertising on any social media).

### *Engagement with Social Media Tobacco Messaging*

In this analysis, six forms of engagement were assessed at baseline: (1) posting links to tobacco product websites, stories, or articles, (2) posting comments about tobacco use, (3) encouraging other people to use or discouraging other people from using tobacco products, (4) posting about personal tobacco use, (5) reposting tobacco-related content that was originally posted by someone else, and (6) visiting, following, or liking tobacco products on social media. Engagement was dichotomized into students that reported zero engagement and students that reported any engagement. Four engagement outcomes were assessed: any engagement, total engagement, anti-engagement, and pro-engagement. Any engagement was defined as reporting engagement via at least one of the six forms of engagement, such that 0 = never engage and 1 = engage in one or more ways. Total number of engagement activities

was examined via a count ranging from 0 = participated in zero forms of engagement to 6 = participated in six forms of engagement.

To assess pro- and anti-engagement, we asked about engagement with “pro-tobacco” and “anti-tobacco” content. Definitions of “pro-tobacco” and “anti-tobacco” were provided for participants. “Pro-tobacco” was defined as any website, social media page, advertisement, post, video, or image that encourages tobacco or nicotine product use or shows tobacco use to be a positive behavior. “Anti-tobacco” was defined as any website, social media page, advertisement, post, video, or image that discourages tobacco use and shows it to be a negative behavior. Anti-engagement was defined as reporting engaging via posting links to anti-tobacco product websites, stories, or articles; posting comments about the negative aspects of tobacco use; and/or discouraging other people from using tobacco, such that 0 = never engage in any of the three anti-engagement activities and 1 = engage in at least one of the three anti-engagement activities. Pro-engagement was defined as reporting engaging via posting links to pro-tobacco product websites, stories, or articles; posting comments about the positive aspects of tobacco use; and/or encouraging other people to use tobacco, such that 0 = never engage in any of the three pro-engagement activities and 1 = engage in at least one of the three pro-engagement activities.

#### *Current Use of Tobacco and Nicotine Products*

At baseline and one-year follow-up, current use of cigarettes, cigar products, electronic nicotine delivery system (ENDS) devices (i.e., electronic cigarettes (e-cigarettes), vape pens), and waterpipe/hookah was assessed by asking, “On how many days of the past 30 days did you smoke/use [product]?” Students who reported use on at least one day in the

past 30 days were considered current (past 30-day) users, and those that reported use on zero days in the past 30 days were considered non-current users. For cigars, hookah, and e-cigarettes, language regarding using the product “as intended” was added to make it clear the questions were asking about use of the product with tobacco or nicotine, and not another substance (e.g., marijuana).

### *Covariates*

Covariates included baseline age, biological sex (male and female), and race/ethnicity (non-Hispanic white, Hispanic\Latino, Asian, African American\black, multi-racial or another race/ethnicity). Any baseline tobacco use (items described above) was also included as a covariate and coded 0 = used no products in the past 30 days at baseline or 1 = used at least one product in the past 30 days at baseline.

### **Analysis**

Multiple logistic regression analyses were used to test whether reported exposure to and engagement with social media tobacco-related messaging at baseline predicted tobacco and nicotine product use at one-year follow-up. The longitudinal associations between (1) any exposure, (2) exposure by social media platform, and (3) exposure by tobacco product, and use of (1) any product, (2) cigarettes, (3) e-cigarettes, (4) cigars and (5) hookah were assessed. Likewise, longitudinal associations between (1) any engagement, (2) total number of engagement activities, (3) anti-engagement, and (4) pro-engagement and use of (1) any product, (2) cigarettes, (3) e-cigarettes, (4) cigars and (5) hookah were assessed. All models controlled for baseline age, sex, race/ethnicity, and baseline tobacco use. When examining the effects of exposure by social media platform, models additionally controlled for other

social media platforms (e.g., the association between baseline Facebook exposure and cigarette use was assessed controlling for baseline exposure via YouTube, Instagram, etc.). Similarly, when examining the effects of exposure by product, models additionally controlled for other product exposure. Missing data for each model ranged from 0.50% - 3.06%. Missing data were handled using listwise deletion for each model since analyses with complete cases and analyses with missing data did not yield different results.

### **Ethical Approval**

Project M-PACT was reviewed and approved by the University of Texas at Austin Institutional Review Board (2013-06-0034), and this study was reviewed and exempt by the University of Texas Health Science Center Institutional Review Board (HSC-SPH-16-0994).

## **RESULTS**

### **Sample Characteristics**

As shown in Table 1, participants were 20-32 years of age ( $M = 23.3$ ;  $SD = 2.3$ ) at baseline in spring 2017. The majority of participants were female (64.8%) and four-year university students (93.1%). Participants were 35.4% non-Hispanic white, 30.6% Hispanic, 18.7% Asian, 7.8% African American or black, and 7.5% multi-racial/ethnic or another race/ethnicity. Between baseline and one-year follow-up, lifetime (ever) use of tobacco and nicotine products increased slightly, by 1.8%, with the greatest initiation of cigar use (2.1%), followed by e-cigarettes (2.0%), and cigarettes (1.6%) and hookah (1.6%). Past 30-day (current) use increased very slightly between baseline and one-year follow-up, by 0.6%. Current cigarette, hookah, and cigar use decreased by 1.5%, 1.0%, and 0.2%, respectively. Only current e-cigarette use increased by 3.5%.

**Table 1.** Characteristics of the Study Population (M-PACT study, N = 3,947)

Variable	Baseline (Spring 2017)	One-year Follow-up (Spring 2018)
Age, M (SD)	23.3 (2.3)	24.3 (2.3)
Female, % (n)	64.8 (2,557)	64.8 (2,557)
Race/ethnicity, % (n)		
Non-Hispanic white	35.4 (1,397)	35.4 (1,397)
Hispanic	30.6 (1,209)	30.6 (1,209)
Asian	18.7 (736)	18.7 (736)
African American/black	7.8 (309)	7.8 (309)
Other	7.5 (296)	7.5 (296)
Four-year University Student, % (n)	93.1 (3,675)	93.1 (3,675)
Lifetime Tobacco Product Use, % (n)		
Any product	74.9 (2,957)	76.7 (3,027)
Cigarettes	53.9 (2,126)	55.5 (2,191)
E-cigarettes	57.4 (2,265)	59.4 (2,344)
Hookah	66.9 (2,641)	68.5 (2,703)
Cigars	47.3 (1,866)	49.4 (1,951)
Past 30-day Tobacco Product Use, % (n)		
Any product	26.2 (1,033)	26.8 (1,057)
Cigarettes	15.7 (619)	14.2 (569)
E-cigarettes	8.6 (340)	12.1 (478)
Hookah	8.9 (353)	7.9 (313)
Cigars	5.2 (204)	5.0 (199)

M = mean, SD = standard deviation.

Female, Race/ethnicity and Four-year University Student were assessed at wave 1 (November 2014 – February 2015) only.

### **Prevalence of Exposure and Engagement with Social Media Marketing and Messaging**

Overall, 29.1% of participants reported seeing advertisements for tobacco and nicotine products on social media during the past 30 days at baseline. Exposure to tobacco advertising was greatest on Facebook, then Instagram, YouTube, Twitter, Snapchat, Reddit, and Pinterest. Participants reported seeing more advertising for e-cigarettes, followed by cigarettes, hookah, and cigars. Overall, 22.9% of participants reported ever engaging with social media tobacco messaging at baseline. Prevalence of engagement with anti-tobacco related content was greater than engagement with pro-tobacco content, 18.6% and 6.7%, respectively. The mean number of engagement activities (ranging from 0-6) for the sample was 0.49 (Table 2).

**Table 2.** Prevalence of Exposure to and Engagement with Social Media Tobacco Messaging at Baseline (M-PACT study, N = 3,947)

Past 30-day Recall of Marketing Exposure, % (n)		
Any product on any social media	29.1	(1,147)
By Social Media Platform		
Facebook	22.0	(870)
Instagram	14.5	(572)
YouTube	13.1	(518)
Twitter	9.9	(392)
Snapchat	8.9	(353)
Reddit	7.8	(308)
Pinterest	6.6	(259)
By Tobacco Product		
E-cigarettes	19.9	(785)
Cigarettes	18.2	(717)
Hookah	14.0	(551)
Cigars	8.8	(349)
Lifetime Recall Engagement with Tobacco Messaging, % (n)		
Any engagement	22.9	(905)
No. engagement activities (range 0-6), M (SD)	0.49	(1.1)
Anti-engagement	18.6	(734)
Pro-engagement	6.7	(264)

M = mean, SD = standard deviation.

## **Exposure Predicting Tobacco Use**

As shown in Table 3, logistic regression analyses revealed significant relationships between exposure to tobacco-related social media advertising and current (past 30-day) tobacco use one year later. After controlling for age, sex, race/ethnicity, and baseline any current tobacco use, exposure to any product advertising on social media significantly predicted use of e-cigarettes, cigars, and hookah at one-year follow up, but not any product use or cigarette use. Controlling for age, sex, race/ethnicity, baseline tobacco use, and exposure via other platforms, the odds of e-cigarette use at follow-up were 1.92 times higher among students who were exposed to product advertising on Reddit at baseline, compared to those who were not exposed via Reddit. The odds of cigar use were 2.92 times higher among students exposed via Pinterest. The odds of hookah use were 2.94 times higher among students exposed via Snapchat. Controlling for age, sex, race/ethnicity, any baseline tobacco use, and exposure to other product advertising, the odds of e-cigarette use were 1.68 times higher among students exposed to e-cigarette advertising. The odds of cigar use were 1.97 times higher among students exposed to cigar advertising. The odds of hookah use were 1.92 and 1.60 times higher among students exposed to hookah and cigar advertising, respectively.



**Table 3.** Logistic Regressions of Social Media Tobacco Exposure Predicting Past 30-day Tobacco Use at One-year Follow-up

	Any Product Use	Cigarette Use	E-Cigarette Use	Cigar Use	Hookah Use
Type of exposure	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Any Exposure <sup>a</sup>	1.16 (0.97 – 1.40)	1.12 (0.90 – 1.39)	1.33 (1.06 – 1.66)*	1.68 (1.24 – 2.28)**	1.71 (1.33 – 2.20)***
Exposure By Platform <sup>b</sup>					
Facebook	1.01 (0.77 – 1.32)	0.86 (0.63 – 1.19)	1.09 (0.79 – 1.50)	1.23 (0.78 – 1.97)	0.99 (0.67 – 1.44)
YouTube	1.04 (0.73 – 1.47)	1.08 (0.71 – 1.63)	1.22 (0.81 – 1.84)	0.77 (0.40 – 1.48)	1.10 (0.68 – 1.76)
Instagram	1.21 (0.85 – 1.73)	1.26 (0.83 – 1.91)	0.92 (0.60 – 1.40)	0.62 (0.32 – 1.23)	1.42 (0.89 – 2.26)
Twitter	0.69 (0.45 – 1.05)	0.75 (0.45 – 1.24)	1.10 (0.67 – 1.79)	1.56 (0.78 – 3.13)	0.73 (0.42 – 1.28)
Snapchat	1.18 (0.74 – 1.88)	0.90 (0.51 – 1.61)	0.70 (0.38 – 1.28)	1.20 (0.53 – 2.75)	2.94 (1.70 – 5.11)***
Reddit	1.26 (0.81 – 1.96)	1.48 (0.90 – 2.43)	1.92 (1.17 – 3.14)**	1.38 (0.71 – 2.70)	0.85 (0.46 – 1.56)
Pinterest	1.35 (0.78 – 2.33)	1.67 (0.88 – 3.17)	0.98 (0.50 – 1.92)	2.92 (1.24 – 6.85)*	1.40 (0.71 – 2.78)
Exposure By Product <sup>c</sup>					
Cigarettes	0.92 (0.69 – 1.23)	0.87 (0.62 – 1.22)	1.05 (0.75 – 1.46)	0.91 (0.56 – 1.48)	1.10 (0.74 – 1.62)
E-cigarettes	1.18 (0.89 – 1.56)	1.17 (0.85 – 1.60)	1.68 (1.22 – 2.31)***	1.28 (0.81 – 2.01)	0.99 (0.67 – 1.46)
Hookah	1.08 (0.80 – 1.47)	1.16 (0.81 – 1.64)	0.87 (0.60 – 1.24)	1.38 (0.85 – 2.23)	1.92 (1.32 – 2.81)***
Cigar products	1.22 (0.85 – 1.77)	1.25 (0.82 – 1.92)	0.91 (0.59 – 1.40)	1.97 (1.14 – 3.42)*	1.69 (1.08 – 2.65)*

AOR = adjusted odds ratio; CI = confidence interval; N for each model ranged from 3,826 - 3,947.

Current (past 30-day) tobacco and nicotine product users are being compared to non-current users, which may include ever/lifetime users.

<sup>a</sup>Models adjusted for age, sex, race/ethnicity, and time 1 any current tobacco use.

<sup>b</sup>Models adjusted for age, sex, race/ethnicity, time 1 any current tobacco use, and other platform exposure.

<sup>c</sup>Models adjusted for age, sex, race/ethnicity, time 1 any current tobacco use, and other product exposure.

\*p < .05

\*\*p < .01

\*\*\*p < .001

## **Engagement Predicting Tobacco Use**

As shown in Table 4, logistic regression analyses revealed significant relationships between engagement with tobacco-related social media messaging and current (past 30-day) tobacco use one year later. After controlling for age, sex, race/ethnicity, and any baseline tobacco use, engagement significantly predicted use of e-cigarettes, cigars, and hookah, at one-year follow-up. For each additional engagement activity reported at baseline, the odds of any product use at follow-up increased between 1.12 and 1.30. Students who engaged with pro-tobacco content on social media at baseline were significantly more likely to report current use of any tobacco or nicotine product at one-year follow-up. Students who engaged with anti-tobacco content on social media at baseline were significantly more likely to currently use cigars and hookah at one-year follow-up.

**Table 4.** Logistic Regressions of Social Media Tobacco Engagement Predicting Past 30-day Tobacco Use at One-year Follow-up

	Any Product Use	Cigarette Use	E-cigarette Use	Cigar Use	Hookah Use
Type of engagement	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Any Engagement	1.17 (0.96 – 1.42)	1.15 (0.91 – 1.45)	1.33 (1.05 – 1.68)*	1.47 (1.06 – 2.03)*	1.69 (1.30 – 2.20)***
No. Engagement Activities	1.12 (1.04 – 1.21)**	1.12 (1.04 – 1.21)**	1.12 (1.04 – 1.21)**	1.30 (1.18 – 1.42)***	1.28 (1.18 – 1.38)***
Anti-engagement	1.07 (0.86 – 1.33)	1.16 (0.89 – 1.50)	1.16 (0.89 – 1.51)	1.59 (1.12 – 2.27)**	1.69 (1.27 – 2.25)***
Pro-engagement	1.77 (1.29 – 2.42)***	1.78 (1.28 – 2.48)***	1.45 (1.03 – 2.04)*	2.92 (1.95 – 4.37)***	2.37 (1.67 – 3.36)***

AOR = adjusted odds ratio; CI = confidence interval; N for each model ranged from 3,826 - 3,947.

Current (past 30-day) tobacco and nicotine product users are being compared to non-current users, which may include ever/lifetime users.

All models adjusted for age, sex, and race/ethnicity, and time 1 any current tobacco use.

\*p < .05

## DISCUSSION

This study is the first to examine longitudinal relationships between exposure to and engagement with an array of tobacco and nicotine products on popular social media platforms and use of these products among young adult college students. Almost a third of young adults in our sample reported exposure to tobacco and nicotine product advertising on social media in the past month, and a quarter engaged with tobacco-related messaging on social media. These exposures and engagements have implications for tobacco use. We found both exposure and engagement significantly predicated past 30-day e-cigarette, cigar, and hookah use one year later, after controlling for important demographic characteristics and any baseline tobacco use. Given that so many young adults use tobacco and nicotine products and that young adulthood is a time where there continue to be changes in tobacco use patterns,<sup>22</sup> we need to move to regulate social media and provide messages to young adults about the impact of social media on their tobacco use.

Our findings differed from those of Depue et al.<sup>14</sup> who found that self-reported exposure to tobacco use in social media predicted current cigarette use at five-month follow-up, among 200 college students, since we did not find a significant association between exposure and cigarette use. Our null finding may be due to controlling for several covariates including demographic factors and baseline tobacco use. The present study extends previous research by examining the relationships between exposure by social media platform and by product and use behaviors. After controlling for demographic characteristics, baseline tobacco use, and exposure to all other social media platforms, exposure via Reddit predicted e-cigarette use, Pinterest exposure predicted cigar use, and Snapchat exposure predicted

hookah use. These findings reveal that specific social media platforms may be more popular venues for promoting certain products, and use of these social media platforms may be an important risk factor for use of a particular product. As such, counter-marketing communications and interventions about e-cigarettes should consider utilizing Reddit; cigar and hookah prevention efforts should consider utilizing Pinterest and Snapchat, respectively.

As expected, exposure to social media e-cigarette advertising predicted e-cigarette use and cigar media exposure predicted cigar use. However, exposure to both hookah and cigar advertising each independently predicted hookah use. This is an interesting finding since hookah and cigar use often co-occur and young adults often perceive these products to be less harmful than other products.<sup>23-25</sup> Future research should investigate explanations for the relationship between social media cigar advertising and hookah use.

This study also found significant, prospective associations between several measures of engagement with tobacco-related social media and subsequent use behaviors one year later. No study to date has examined these relationships among young adults. Our findings echo those of Hébert et al. (2017)<sup>10</sup> and Soneji et al. (2017)<sup>26</sup> who both reported cross-sectional significant associations between engagement and tobacco use among youth. Our findings build upon previous studies by showing engagement with tobacco-related social media messaging is a significant risk factor for later use of tobacco and nicotine products, and higher levels of engagement were associated with increased risk of use.

This study is also the first to examine the relationship between engagement with anti-tobacco messaging on social media and tobacco use. Interestingly, those who engaged with anti-tobacco social media, compared with those who did not engage, were not more likely to

use cigarettes or e-cigarettes one year later. These null findings may be due to our inability to assess anti-engagement by product, and future research might better ascertain the individual relationships between anti-cigarette engagement and e-cigarette use and anti-e-cigarette engagement and cigarette use. However, anti-engagement did predict future cigar and hookah use. One potential explanation for these findings is that cigar and hookah users perceive these products to be less harmful than cigarettes and e-cigarettes<sup>23-25</sup> and thus engage in anti-cigarette or e-cigarette messaging. Future research should identify reasons (whether harm perceptions or others reasons) why users of one product may engage in anti-messaging for another product.

This study has some limitations. First, the study sample was limited to students attending colleges within five Texas counties; thus study findings are not generalizable to other populations. However, the study sample included students from both two- and four-year colleges and is racially and ethnically diverse. This is an important distinction of our study since two-year college students are more likely to use tobacco and be racial/ethnic minority students, compared to four year college students and other adult populations.<sup>27,28</sup> Second, data are subject to recall bias since all measures were collected via self-report. Finally, it is possible that students differentially defined exposure and engagement. Participants were asked to report about tobacco and nicotine product advertising on social media. It is possible that participants were reporting seeing anti-tobacco advertisements or user-generated content such as peer posts, as well as tobacco company advertisements. However, given the lack of regulation of social media tobacco and nicotine product advertising, it may be difficult to distinguish the exact nature of tobacco-related content,

whether user- or industry-generated. Thus, more research is needed to investigate the nature of young adults' exposure and engagement with this content, especially as newly emerging ENDS products, such as Juul are heavily utilizing social media to market their products.<sup>29</sup> We also asked about engagement with any tobacco or nicotine product, so we were not able to clearly distinguish between engagements with specific products. It may be especially important for future studies to distinguish between cigarette and e-cigarette engagement since students may be avid e-cigarette users and promoters, while heavily engaging in anti-cigarette social media content, for example. Our measures did not allow us to investigate these distinctions.

Despite limitations, this study has important strengths and implications for regulation and intervention. The present study found young adults' exposure and engagement with tobacco-related content, including industry-sponsored advertising, predict future past 30-day tobacco and nicotine product use one year later, after controlling for several other important influencing factors. In this study, we examined current (past 30-day) use versus non-current use. Non-current users may include ever users, yet we still observed significant associations between exposure and engagement and tobacco use behaviors. These findings, taken with the knowledge that social media is an integral part of young adult life, indicate that social media should be a focus of future federal regulation, counter-marketing and health communication campaigns, and intervention. Although the marketing of tobacco products through television, billboards, and other venues is prohibited, there are no federal laws prohibiting or regulating marketing via social media.<sup>30</sup> While most popular social media platforms have policies restricting sponsored tobacco and nicotine product advertising, promotion via brand pages is

permitted, and recent studies have shown these self-imposed policies are ineffective.<sup>3</sup> Future potential regulations include having tobacco and nicotine product brands register their social media accounts so that these accounts can be monitored for inappropriate content like making unsubstantiated health claims. Another potential regulation is to require brand-sponsored pages to be made private (i.e., content is visible only to followers), and to only allow verified users, ages 18 years and older, to follow brand pages. Currently, many brand social media accounts are public (e.g., Juul and Blu e-cigarette Instagram pages), so their content may be viewed and shared by anyone. Finally, brand-sponsored posts, images, and videos could be required to contain warning labels about the health effects of the products advertised. Since Juul became active on Instagram in 2016, advertisements have contained a warning about the product containing nicotine and the addictive nature of nicotine (<https://www.instagram.com/juulvapor>). In addition, this study highlights the critical need for counter-marketing campaigns that utilize social media tools for engaging young people in viewing and sharing relevant information about the addictive nature of nicotine, and the negative health effects of combustible tobacco. In a recent study that evaluated youth and young adults' preferences for online tobacco education, participants recommended social media as a way to engage them in tobacco communications.<sup>31</sup> Future research is needed to investigate the nature and source of young peoples' exposure to and engagement with tobacco-related social media to better inform regulation and prevention efforts.



## REFERENCES

1. Davis RM, Gilpin EA, Loken B, Viswanath K, Wakefield MA. The role of the media in promoting and reducing tobacco use. USA; 2008.
2. Kim AE, Arnold KY, Makarenko O. E-cigarette advertising expenditures in the US, 2011–2012. *American journal of preventive medicine*. 2014;46(4):409-412.
3. Jackler RK, Li VY, Cardiff RA, Ramamurthi D. Promotion of tobacco products on Facebook: policy versus practice. *Tobacco control*. 2018;tobaccocontrol-2017-054175.
4. Yamin CK, Bitton A, Bates DW. E-cigarettes: a rapidly growing Internet phenomenon. *Annals of internal medicine*. 2010;153(9):607-609.
5. Liang Y, Zheng X, Zeng DD, Zhou X, Leischow SJ, Chung W. Exploring how the tobacco industry presents and promotes itself in social media. *Journal of medical Internet research*. 2015;17(1).
6. Huang J, Kornfield R, Szczypka G, Emery SL. A cross-sectional examination of marketing of electronic cigarettes on Twitter. *Tobacco control*. 2014;23(suppl 3):iii26-iii30.
7. Sowles SJ, Krauss MJ, Connolly S, Cavazos-Rehg PA. Peer Reviewed: A Content Analysis of Vaping Advertisements on Twitter, November 2014. *Preventing chronic disease*. 2016;13.

8. Laestadius LI, Wahl MM, Cho YI. # Vapelite: An Exploratory Study of Electronic Cigarette Use and Promotion on Instagram. *Substance Use & Misuse*. 2016;51(12):1669-1673.
9. Vandewater EA, Clendennen SL, Hébert ET, et al. Whose Post Is It? Predicting E-cigarette Brand from Social Media Posts. *Tobacco Regulatory Science*. 2018;4(2):30-43.
10. Hébert ET, Case KR, Kelder SH, Delk J, Perry CL, Harrell MB. Exposure and Engagement With Tobacco-and E-Cigarette–Related Social Media. *Journal of Adolescent Health*. 2017;61(3):371-377.
11. Link AR, Cawkwell PB, Shelley DR, Sherman SE. An exploration of online behaviors and social media use among hookah and electronic-cigarette users. *Addictive behaviors reports*. 2015;2:37-40.
12. Emery SL, Vera L, Huang J, Szczypka G. Wanna know about vaping? Patterns of message exposure, seeking and sharing information about e-cigarettes across media platforms. *Tobacco control*. 2014;23(suppl 3):iii17-iii25.
13. Pew Research Center (PRC). Social media fact sheet. 2018; <http://www.pewinternet.org/fact-sheet/social-media/>.

14. Depue JB, Southwell BG, Betzner AE, Walsh BM. Encoded exposure to tobacco use in social media predicts subsequent smoking behavior. *American Journal of Health Promotion*. 2015;29(4):259-261.
15. Sawdey MD, Hancock L, Messner M, Prom-Wormley EC. Assessing the Association Between E-Cigarette Use and Exposure to Social Media in College Students: A Cross-Sectional Study. *Substance Use & Misuse*. 2017:1-8.
16. Pokhrel P, Fagan P, Herzog TA, et al. Social media e-cigarette exposure and e-cigarette expectancies and use among young adults. *Addictive behaviors*. 2018;78:51-58.
17. Zhu Y. Pro-smoking information scanning using social media predicts young adults' smoking behavior. *Computers in Human Behavior*. 2017;77:19-24.
18. Soneji S, Pierce JP, Choi K, et al. Engagement With Online Tobacco Marketing and Associations With Tobacco Product Use Among US Youth. *Journal of Adolescent Health*. 2017.
19. Creamer MR, Loukas A, Clendennen S, et al. Longitudinal predictors of cigarette use among students from 24 Texas colleges. *Journal of American College Health*. 2018:1-8.
20. Loukas A, Chow S, Pasch KE, et al. College students' polytobacco use, cigarette cessation, and dependence. *American journal of health behavior*. 2016;40(4):514-522.

21. Hinds III JT, Loukas A, Chow S, et al. Using cognitive interviewing to better assess young adult e-cigarette use. *Nicotine & Tobacco Research*. 2016;18(10):1998-2005.
22. Perry CL, Pérez A, Bluestein M, et al. Youth or Young Adults: Which Group Is at Highest Risk for Tobacco Use Onset? *Journal of Adolescent Health*. 2018.
23. Roberts ME, Klein EG, Berman ML, Berhane B, Ferketich AK. Young Adult Perceptions Surrounding Hookah Use. *Health behavior and policy review*. 2017;4(6):593-600.
24. Osibogun O, Taleb ZB, Bahelah R, Salloum RG, Maziak W. Correlates of poly-tobacco use among youth and young adults: Findings from the Population Assessment of Tobacco and Health study, 2013–2014. *Drug and alcohol dependence*. 2018;187:160-164.
25. Getachew B, Payne JB, Vu M, et al. Perceptions of Alternative Tobacco Products, Anti-tobacco Media, and Tobacco Regulation among Young Adults: A Qualitative Study. *American journal of health behavior*. 2018;42(4):118-130.
26. Soneji S, Pierce JP, Choi K, et al. Engagement With Online Tobacco Marketing and Associations With Tobacco Product Use Among US Youth. *Journal of Adolescent Health*. 2017;61(1):61-69.
27. Biener L, McCausland K, Curry L, Cullen J. Prevalence of trial of snus products among adult smokers. *American Journal of Public Health*. 2011;101(10):1874-1876.

28. Loukas A, Murphy JL, Gottlieb NH. Cigarette smoking and cessation among trade or technical school students in Texas. *Journal of American College Health*. 2008;56(4):401-407.
29. Huang J, Duan Z, Kwok J, et al. Vaping versus JUULing: how the extraordinary growth and marketing of JUUL transformed the US retail e-cigarette market. *Tobacco control*. 2018:tobaccocontrol-2018-054382.
30. Family Smoking Prevention and Tobacco Control Act - An Overview. US Food and Drug Administration Web site.  
<https://www.fda.gov/tobaccoproducts/guidancecomplianceregulatoryinformation/ucm246129.htm>. Updated January, 17, 2018. Accessed October 8, 2018.
31. Lazard AJ, Horrell L, Pikowski J, Cornacchione Ross J, Noar SM, Sutfin EL. Message and Delivery Preferences for Online Tobacco Education among Adolescents and Young Adults. *Journal of health communication*. 2018:1-8.

## **JOURNAL ARTICLE**

### **Exploring Young Adults' Experiences and Perceptions Related to Tobacco and Nicotine Product Marketing on Social Media: A Qualitative Approach**

#### **Journal of Medical Internet Research**

Tobacco use remains a critical public health issue in the United States. Young adults are disproportionately affected by high rates of tobacco use and heavily targeted by tobacco marketing. Social media has become an important source of exposure to tobacco and nicotine product marketing and messaging for young adults. The aim of this study was to investigate young adults' experiences with tobacco and nicotine product messaging on social media, and their perceptions of existing Blu and Juul e-cigarette Instagram advertisements. In-depth, semi-structured qualitative interviews were conducted online, individually with 30 college students, ages 20-32, from two- and four-year Texas colleges, between May-July 2018. Participants were from the Marketing and Promotions across Colleges in Texas Study and had previously reported exposure to tobacco or nicotine product advertising on social media. Thematic content analysis was used to analyze qualitative data and summarize themes. Overall, 70.0% of participants had ever used a tobacco or nicotine product, and 33.3% were current/past 30-day users of one or more products. Sixteen participants recalled seeing pro-tobacco or nicotine product advertising on social media, primarily for alternative products like e-cigarettes and hookah. Only three participants described seeing anti-tobacco advertising, all of which was for cigarettes. All 30 participants recalled seeing tobacco or nicotine-related messaging, that they would not consider traditional advertising like posts by family and friends. Perceptions of researcher-selected e-cigarette Instagram advertisements

were generally positive, with students preferring advertisements that did not look like traditional advertisements and conveyed fun and social themes. Most participants said they would engage with e-cigarettes advertisements by liking or following them on social media. Findings from these qualitative interviews extend previous research by providing detailed insight into the nature of young adults' exposure. Results may inform survey measurement items regarding what to ask and wording to use, to more accurately capture rates of exposure to tobacco-related social media, as well as federal regulations on marketing and other prevention efforts among young adult populations.

## **Introduction**

Tobacco use remains the largest cause of preventable death and disease in the United States (U.S.). As a result of smoking and secondhand smoke exposure, nearly half a million people die prematurely each year in the U.S., and more than 16 million people are living with a tobacco-related disease [1]. The incredible decline in U.S. smoking prevalence, occurring since the landmark 1964 Surgeon General's report on smoking and health, is considered one of the greatest public health achievements of all time, with 42.4% of Americans currently smoking cigarettes in 1965 compared to 15.5% in 2016 [2, 3]. Yet, progress has stalled in recent years as the popularity of non-cigarette products, such as cigars, smokeless tobacco, electronic cigarettes (e-cigarettes), and hookah, has increased [1]. As cigarette use declined by 40% between 2000 and 2015, cigar product use increased by 100% [4]. Smokeless tobacco use prevalence has remained around 3% of U.S. adults since 1985 but has been slowly increasing among males since 2000 [1]. New and alternative tobacco and nicotine product use, including the use of e-cigarettes or vape pens and hookah/waterpipe, has notably

increased over the past decade, with the largest uptake among young adults. In 2014, 37.4% of young adults, ages 18-24, reported using tobacco at least rarely, and 13.6% and 20.2% reported e-cigarette and hookah use, respectively [5]. These rates are concerning since, according to the U.S. Surgeon General, tobacco use in any form is unsafe [6].

Tobacco industry marketing is one of the most profound influences on young adult tobacco use [7], and research shows young adults are important targets of tobacco industry marketing [8]. The marketing strategies used by tobacco companies to influence young adults' to use tobacco can be understood in the context of Framing Theory which posits that people's choices are heavily influenced by the manner, or frame, in which options are presented [9]. The tobacco industry has a long history of framing their messages to appeal to young adults' interests and values, attitudes, life aspirations and role models, and social activities and groups, and then flooding young adults' physical social environments with these messages [8].

As tobacco marketing has been restricted on television and most outdoor venues, tobacco companies have begun to market their products through non-traditional marketing platforms like social media [10, 11]. The rapid uptake of social media, especially by young people, makes it an ideal venue for widely and inexpensively promoting and engaging people with unregulated tobacco and nicotine product advertising, and studies show the presence of tobacco companies on social media is extensive [12-14]. Several studies show Twitter is commonly used to advertise e-cigarettes with the majority of e-cigarette-related tweets originating from e-cigarette brands or resellers, and tweets commonly mention free samples or price promotions and flavors [15-17]. One study revealed e-cigarettes are commonly



marketed as healthier and more socially acceptable than cigarettes in YouTube e-cigarette brand advertisements [18]. Another study characterized popular e-cigarette brand marketing strategies on Facebook, Instagram, and Pinterest revealing brands were selling a fun, social lifestyle, as well as directly promoting their products [14].

Social media is unique from other marketing platforms since it allows users to create and share messages, as well as like, comment, and re-share messages posted by others. As such, user-generated content is prevalent on social media, and the source of tobacco-related messaging can be difficult to ascertain [19]. Studies show that not only is e-cigarette advertising on social media including Twitter, Reddit, and JuiceDB extensive, but user-generated messaging, like user discussions about flavors, personal experiences, and regulation debates, is common [20, 21]. One study showed about half of e-cigarette-related posts on Instagram are user-generated versus industry-sponsored. Personal posts and corporate posts did not differ in their use of themes including health and cessation claims, social identity and depictions of people, and showing e-cigarette use to be a positive behavior, however brands posted more direct promotional content [13].

Recent studies demonstrate significant positive relationships between exposure and engagement with tobacco and nicotine product marketing and messaging on social media and use behaviors, as well as perceptions and attitudes towards tobacco and nicotine products [22-26]. For example, among a sample of 200 young adults, the population with the highest rates of tobacco and social media use [2, 27], Depue et al. (2015) reported exposure to tobacco use in social media significantly predicted past 30-day cigarette use over a 5-month period [22]. Sawdey et al. (2017) reported positive significant associations between past 30-

day e-cigarette use and viewing peer posts and advertisements about e-cigarettes in social media, among 258 college students [23].

Although studies have begun to document the nature and extent of tobacco and nicotine product marketing and messaging on social media, as well as the relationships between exposure to and engagement with this content and use behaviors, important questions remain. To date, no study has examined the detailed nature of young adults' personal experiences with, and attitudes and perceptions related to tobacco and nicotine product social media marketing and messaging. Attitudes and perceptions are important predictors in theories of advertising [28] and health behaviors [29]. Well-framed, effective messages about tobacco use influence a person's attitudes and perceptions (e.g., overall evaluation of tobacco use, positive or negative feelings about tobacco use, and beliefs about the social acceptability tobacco use), which directly predict their intentions to use tobacco [29]. Understanding young adults' attitudes towards and perceptions of tobacco-related social media may reveal which types of messaging gain their attention and inform prevention efforts so that counter-messaging is more relevant. In addition, a deeper understanding of young adults' experiences via social media may inform more accurate posing of survey measurement questions that assess tobacco-related social media exposures and engagements.

This study utilized a qualitative approach to investigate (1) young adults' perceptions and preferences related to their social media use, including how they define social media; (2) the nature of young adults' personal experiences with tobacco and nicotine product marketing and messaging on social media, including themes they are able to recall and whether they are able to ascertain message source; and (3) young adults' attitudes and

perceptions related to existing Blu and Juul e-cigarette Instagram advertisements. For aim 3, Blu and Juul e-cigarette advertisements were selected since young adults in our study sample reported seeing more e-cigarette advertisements on social media, compared to other tobacco products, and Blu and Juul e-cigarette brands are among the top four e-cigarette products with the highest U.S. market share [30]. Advertisements were collected from Instagram since both Blu and Juul maintain public Instagram pages, and Instagram is an ideal platform for image-based, original content, compared to other popular social media like Twitter and Facebook which are more text-based and content is more commonly re-shared, making it difficult to determine the source of content.

## **Methods**

### ***Overview of the Study***

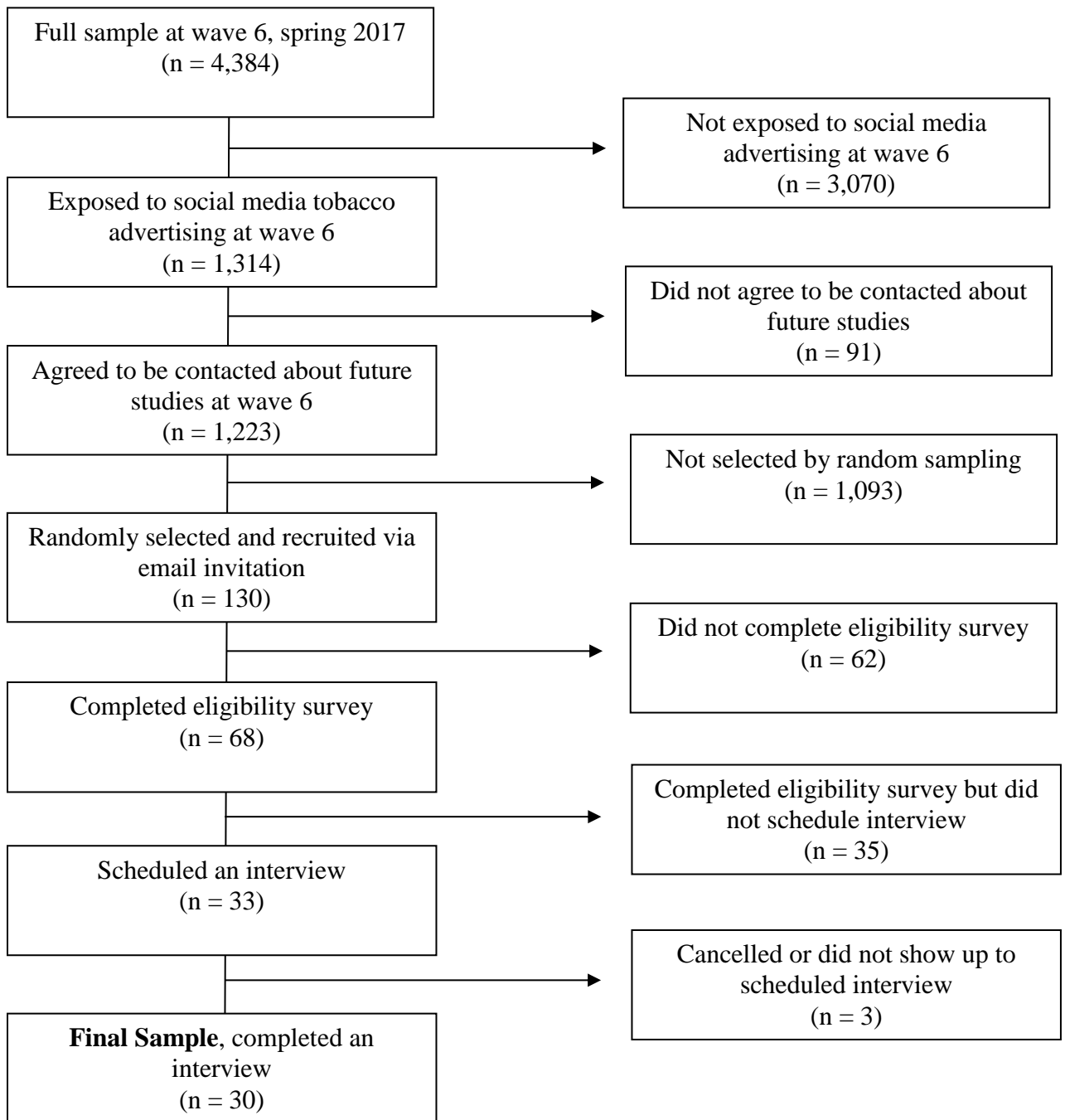
A series of 30 in-depth, semi-structured interviews were conducted with students from 24 colleges in Texas between May-July 2018. Participants were drawn from the Marketing and Promotions Across Colleges in Texas Study (Project M-PACT), an ongoing study with a focus on monitoring trajectories of tobacco and nicotine product use among two-year college and four-year university undergraduate students. A qualitative approach was selected to elicit rich and compelling data on college students' experiences with and perceptions of tobacco and nicotine product social media marketing and messaging. The University of Texas Health Science Center Institutional Review Board approved this study (HSC-SPH-16-0994).

### ***Procedure***

To be eligible to participate in interviews, individuals (1) participated in wave 6 of Project M-PACT (n=4,384; mean age (SD)=20.4 (2.32); 63% female; 35% non-Hispanic white, 31% Hispanic/Latino, 18% Asian, 8% African American/black, and 8% multi-ethnic/racial or another race/ethnicity), which was the most recent wave conducted when the present study was conceptualized, (2) reported exposure to any tobacco or nicotine product advertising via social media (assessed via wave 6 survey), (3) agreed to be contacted to participate in future studies (assessed at wave 6), and (4) were willing to complete a 30-45 minute in-person or online interview in English. A total of 1,314 M-PACT participants were identified from the project database who reported exposure to tobacco or nicotine product advertising at wave 6 (n = 1,314). Of these, 1,223 agreed to be contacted for other studies. A total of 130 M-PACT participants were randomly sampled in groups of 10 and 20, and recruited via email invitation. Of these, 68 completed the online eligibility survey. A total of 33 scheduled an interview, and 30 completed an interview. Recruitment was closed at n=30, when saturation was reached. Sample selection is depicted in Figure 1.

All 30 participants elected to conduct the interview online via Skype or WebEx. Before the interview, participants reviewed a letter of information about the study, which served as the document of consent. Upon completion of the interview, each participant received a \$30 electronic gift card as compensation for their participation.

**Figure 1.** Study sample selection.



### ***Interview Instrument***

Shown in Table 1, the interview guide was developed based on a comprehensive literature review, with the goal of addressing important gaps in our knowledge of young adult attitudes and perceptions related to social media tobacco and nicotine product marketing and messaging. Pre-determined, open-ended questions focused on young adults' personal experiences with tobacco-related social media, and their perceptions of researcher-selected Blu and Juul e-cigarette Instagram advertisements. Participants were shown six groups of four e-cigarette Instagram advertisements (Figure 2). Each group represented a unique theme, commonly conveyed in Blu and Juul Instagram advertisements, posted between October 2017 (when Juul became active on Instagram) and June 2018.

**Table 1.** Semi-structured qualitative interview guide.

Major topics	Elicitation questions
Social media use and preferences	<p>Do you ever use social media like Facebook, Instagram, Twitter, or others? If yes, which ones?</p> <p>If not mentioned by participant, ask about each of the following: Facebook, Instagram, Twitter, YouTube, Snapchat, Pinterest, and Reddit.</p> <p>How do you define social media?</p> <p>Which social media site(s) is/are your favorite? Why? Least favorite? Why?</p>
Recall of exposure to social media tobacco advertising	<p>Have you ever seen advertisements for tobacco or nicotine products on social media? Tobacco and nicotine products include cigarettes, e-cigarettes, hookah, cigars, and smokeless tobacco.</p>
Experiences with advertisements participants are able to recall	<p>If yes, can you describe the advertisements you've seen for tobacco/nicotine on social media?</p> <p>What do you remember most about them?</p> <p>Do you remember certain products, colors, people, or themes that were used in the advertisements?</p> <p>Was there anything particularly appealing or unappealing to you about them?</p>
Definition of "advertisement"	<p>How do you define the term "advertisement?"</p>
Recall of exposure to social media tobacco messaging, NOT considered advertising	<p>Have you ever seen messaging related tobacco or nicotine products on any social media, which you would NOT consider "advertising?"</p> <p>If needed, give an example of messaging: photos or posts about e-cigarettes.</p>
Experiences with messaging	<p>If yes, can you describe the messaging?</p>
Perceptions of sources of tobacco-related social media	<p>Of the advertising that you see on social media, how much of it is posted by people you know personally like family members, friends, or co-workers? How much of it is posted by people or groups you do not know like tobacco companies or celebrities?</p> <p>When you see an ad are you able to tell whether it originated from someone you know personally or someone you do not know personally?</p>
Perceptions of researcher-selected Blu and Juul e-cigarette Instagram advertisements	<p>Have you ever seen any of these advertisements that you can remember?</p> <p>What do you think about this group of advertisements?</p> <p>Is there anything particularly appealing or unappealing to you about these?</p> <p>Of the six group of advertisements I've shown you, which group do you like most and least? Why?</p>

**Figure 2.** Researcher-selected Blu and Juul e-cigarette Instagram advertisements.

Group 1: Relaxation



juulvapor Forget winter for a bit with the subtle flavor of cucumber with a hint of mint. Limited Edition Cool Cucumber. Now available at JUUL.com



juulvapor Don't go into the long holiday weekend unprepared. Today is the last day to place your #JUULpod order (before 4pm EST) and take advantage of free shipping to arrive by 11/22.

Group 2: Flavors



blucigsusa We're so excited that our Blueberry flavor tanks have crossed the pond! The UK loves them, and we hope our US #bluNation crew loves them too!



juulvapor #JUULvapor

Group 3: Direct Product Promotion



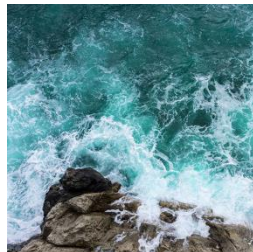
juulvapor What started as a design challenge has become a mission to impact the lives of adult smokers around the globe. Read the #JUUL story & learn more about us at <http://www.JUULlabs.com> #juulvapor



blucigsusa The convenience of a Disposable and the rechargeability of a blu PLUS+ - blu Xpress.



juulvapor Developed for smokers who want to #SwitchToJUUL: try Limited Edition Classic Tobacco for the taste of familiar robust tobacco with aromatic notes. Now available at JUUL.com and select retail locations.



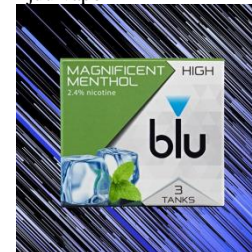
juulvapor Meet Limited Edition Classic Menthol – crafted for smokers looking to make the #SwitchToJUUL. This #JUULpod delivers a traditional menthol flavor with a brisk finish and tobacco undertones.



blucigsusa Silky smooth and always satisfying. Who's got love for Vivid Vanilla?



blucigsusa I'm your ch-ch-ch-ch-CHERRY CRUSH! #makebluasong



blucigsusa Looking for that refreshing arctic mint feeling? Look no further than our Magnificent Menthol!



juulvapor Mango has been added to the Auto-shipped lineup! Get the JUULpod flavor you love delivered right to your door & save 15%. Sing up now via link in bio.



#### Group 4: Identity



blucigsusa Kickin it with some good beats and your blu. What more could you need?



blucigsusa What does your favorite blu flavor say about you?



juulvapor Snapped mid #JUULmoment



juulvapor Having a #JUULmoment on the stoop with @\_chrisdags\_\_

#### Group 5: Social Acceptability



juulvapor Enjoy your #LaborDay weekend and start the month right. #JUULpod limits are reset so place your order today – click link in bio to shop now.



blucigsusa Your crew + blu = the perfect Saturday night.



blucigsusa #ThirstyThursday just isn't complete without your blu.

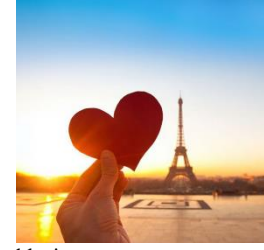


blucigsusa It's #NationalTailgatingDay! Cheers to food, booze, and blu.

#### Group 6: Adventure



blucigsusa Where do you go to find inspiration? Wherever you roam, blu will be by your side.



blucigsusa



blucigsusa To the biker, the open road is his path on a life from one moment to the next. Follow the path via the link in our bio. #justyouandblu



blucigsusa Adventure can be found out of the blu.

## ***Data Analysis***

An independent transcription service transcribed audio-recorded interviews, verbatim. Each transcript was reviewed against the audio-recording for accuracy. QRS NVivo 12 software was used to conduct thematic content analysis, to identify meaningful themes or patterns of participants' interviews. First, primary codes were developed based on the major topics presented in the semi-structured interview guide. Second, phrases and sentences were organized into primary codes, and secondary codes (i.e., common themes within major topics) were developed. Emerging and recurring themes were extracted, allowing for conclusions to be drawn. Relevant themes and representative quotes were selected. Additionally, descriptive analyses were conducted to present quantitative study sample characteristics. Finally, the Text Mining (TM) package [31] in R (v. 3.5.1) software was used to create word clouds to visually characterize participants' initial perceptions of researcher-selected Blu and Juul e-cigarette Instagram advertisements. Word clouds display common words used to describe each group of advertisements, in which the size of each word indicates the frequency (i.e., importance) of the word, with larger words having been used more frequently by participants to describe the advertisements. Common English language words like articles (e.g., "a," "an," "the") and pronouns (e.g., "this," "that," "its") were removed. Words determined to have the same meaning were truncated into a single word. For example, "electronic cigarette(s)," "e-cigarette(s)," and "e-cig(s)" became "e-cigarette."

## **Results**

### ***Sample Characteristics***

Demographic and behavioral characteristics of participants are shown in Table 2. Participants were 20-32 years of age (mean=23.3; SD=2.63), 50% female, and 96.7% were four-year college students. With regard to race/ethnicity, 36.7% of students were Hispanic, 23.3% Asian, 20.0% non-Hispanic white, 13.2% African American or black, and 6.7% multi-racial or another race/ethnicity. Overall, 70.0% of participants had ever used a tobacco or nicotine product, and 33.3% were current/past 30-day users of one or more products. Current use of cigarettes was most prevalent with 26.7% of the sample reporting use, followed by 13.3% for e-cigarettes, 10.0% hookah, 3.3% cigars, and 3.3% smokeless tobacco.

All participants reported use of at least one social media platform during the past 30 days, with YouTube being the most popular (93.3%), followed by Facebook (86.7%), Snapchat (70.0%), Instagram (63.3%), Twitter (46.7%), Pinterest (36.7%), and Reddit (33.3%). All participants reported seeing tobacco advertising on social media during the past 30 days, with exposure to Facebook e-cigarette advertisements being most prevalent (46.7%). Prevalence of exposure by tobacco product and social media platform is reported in Table 3.

**Table 2.** Sample characteristics (n = 30).

Age, M (SD)	23.2	(2.63)
Race, % (n)		
Non-Hispanic white	20.0	(6)
Hispanic	36.7	(11)
Asian	23.3	(7)
African American/black	13.3	(4)
Multiracial or other	6.7	(2)
Sex, % (n)		
Male	50.0	(15)
Female	50.0	(15)
College Type		
Four-year	96.7	(29)
Two-year	3.3	(1)
Ever/lifetime Tobacco Use, % (n)		
Never-users	30.0	(9)
Cigarettes	56.7	(17)
E-cigarettes	60.0	(18)
Cigars	63.3	(19)
Hookah	63.3	(19)
Smokeless	40.0	(12)
Current/past-30 day Tobacco Use, % (n)		
Non-users	66.7	(20)
Cigarettes	26.7	(8)
E-cigarettes	13.3	(4)
Cigars	3.3	(1)
Hookah	10.0	(3)
Smokeless	3.3	(1)
Current/past 30-day Social Media Use		
YouTube	93.3	(28)
Facebook	86.7	(26)
Snapchat	70.0	(21)
Instagram	63.3	(19)
Twitter	46.7	(14)
Pinterest	36.7	(11)
Reddit	33.3	(10)

**Table 3.** Prevalence of exposure to tobacco advertising on social media (n=30).

	Cigarettes		E-cigarettes		Cigars		Hookah		Smokeless	
	%	(n)	%	(n)	%	(n)	%	(n)	%	(n)
YouTube	26.7	(8)	23.3	(7)	10.0	(3)	13.3	(4)	13.3	(4)
Facebook	36.7	(11)	46.7	(14)	10.0	(3)	23.3	(7)	13.3	(4)
Snapchat	16.7	(5)	6.7	(2)	3.3	(1)	6.7	(2)	3.3	(1)
Instagram	16.7	(5)	20.0	(6)	6.7	(2)	13.3	(4)	10.0	(3)
Twitter	20.0	(6)	10.0	(3)	3.3	(1)	3.3	(1)	3.3	(1)
Pinterest	6.7	(2)	6.7	(2)	0.0	(0)	3.3	(1)	0.0	(0)
Reddit	16.7	(5)	13.3	(4)	3.3	(1)	6.7	(2)	3.3	(1)

### ***Aim 1: Perceptions and Preferences Related to Social Media***

Interviewees were first asked whether and which social media platforms they use, and all participants reported using social media to some extent. If participants did not comment on one or more common social media platforms identified by researchers (YouTube, Facebook, Snapchat, Instagram, Twitter, Pinterest, and Reddit), participants were asked about use of the respective platforms. Several participants, when prompted, responded in the affirmative, and reported they did not think of the platform in question or did not consider it to be social media. For example, one participant initially reported using Instagram, Facebook, Twitter, and Tumblr. When asked about Snapchat and YouTube, the participant said: *“I do, yes. I forgot about that one.”* and *“Yeah. I forgot that’s technically social media.”* Nearly all interviewees did not consider YouTube to be social media, rather an entertainment media. Participants resoundingly described YouTube as *“a television channel.”* Only a few participants reported using social media other than the seven most popular platforms. These were Tumblr, MySpace, and Minds. Several participants expressed uncertainty about the interviewer’s definition of social media: *“I think Pinterest counts as social media.”*

Interviewees described their reasons for classifying platforms as *“social media.”* One participant noted a difference between internet browsing and using social media saying: *“I usually look at those [YouTube and Reddit] on my computer, as opposed to my phone, so I think of that as like browsing the internet.”* Likewise, another participant did not consider himself a Reddit user although internet browsing search results sometimes lead him to Reddit. Another criteria used to define social media was the degree to which students interact on a particular platform. For example, one participant did not consider Reddit to be social

media saying: *“I really don’t use it to chat with people and build connections with them. When I think of social media, I think of connecting with people, so in that sense, YouTube and Reddit are, to me, just looking at news or watching videos, not really connecting with people.”*

## ***Aim 2: Experiences with Social Media Tobacco-Related Marketing and Messaging***

### ***Direct Tobacco and Nicotine Product Advertising***

Although study participants were selected because they had previously reported exposure to tobacco advertising on social media, only sixteen interviewees actually described their exposure as being direct, promotional tobacco or nicotine product advertising. Most students’ experiences were described as *“sponsored advertising”* of e-cigarettes and hookah, as shown in the following example: *“I’ve seen Juul pens and hookah on Instagram.*

*Definitely seen some vape products on Instagram ... and maybe on Facebook. Usually it’s a sponsored ad, just showing the product itself and then maybe listing a price or, you know, a hyperlink to the website where you can purchase or learn more information.”* When asked what they could remember about advertisements they had seen, students most often mentioned flavors, colors, hyperlinks, and brands. For example: *“It was advertising for flavors, scents, stuff like that.” “The one I remember right now advertised flavors. I don’t remember the flavors.” “A box of cigarettes with a red background” “The Blu e-cig. I see that one a lot.”*

### ***Anti-tobacco Advertising***

Three participants described seeing anti-tobacco advertisements; two of these had previously described seeing pro-tobacco advertising. Participants expressed uncertainty about

the source of these advertisements, but all interviewees believed they were “*sponsored*” or “*pushed*” advertisements. One student described their exposure: “*I feel like I see a lot of anti-smoking campaigns. Not so much pro-smoking on social media. They’re really targeted towards young people. They’re just like, ‘hey, the tobacco companies are calling you hopeless and stuff.’ And yeah, just some inspirational videos and stuff. I think mostly on Facebook and YouTube.*” Participants described all anti-tobacco advertising as anti-cigarette, and did not report seeing this type of advertising for any other product. One participant noted: “*It seems like most cigarette [advertising] I see is anti-cigarette, and the pro-advertising is for e-cigarettes.*”

#### *Defining “Advertisement”*

After describing their experiences with tobacco-related advertising on social media, participants were asked to define the term “advertisement.” All participants provided similar, traditional descriptions of advertising. For example: “*a paid content,*” “*a piece of media intended to sell you something,*” “*Targeted marketing. It shows the product. It communicates information about the product and the ability for people to buy it.*”

#### *Tobacco and Nicotine Product Messaging*

Participants were then asked to describe their experiences with tobacco-related messaging on social media, that they would not consider an advertisement. All 30 participants described being exposed to some form of tobacco-related messaging. This messaging was primarily described as images of friends, family members, and acquaintances using tobacco and nicotine products, or posts from people about tobacco and nicotine products. For example, one participant said, “*Sometimes they [my family] post when they go*



to hookah lounges.” Another student stated, “*People talk about their favorite brands or like someone said, ‘Oh, I went to a bar last night and they were giving free samples.’ I see things like that pop up on my Facebook news feed.*” Participants also mentioned seeing tobacco cessation-related social media posts: “*People are trying to quit, someone going to a hookah lounge, or someone getting a new e-cigarette.*” “*I have a couple friends that still smoke cigarettes and they’re transitioning to e-cigarettes. So, I will typically see them post a picture of their new setup. Stuff like that. Typically a Snapchat.*” Participants also described seeing vape trick and hookah smoking videos being shared in their networks. For example, one participant described having friends who are vaping enthusiasts saying, “*They do tricks and post videos, and they have people who follow them who are interested in the same kind of hobby and then they’ll converse about it. They’ll be like, ‘Oh, really cool. What do you use?’ Maybe my friend is sponsored by a vape company.*”

When asked about messaging that would not be considered an advertisement, several students alluded to content that was likely tobacco company-sponsored. For example, one participant stated, “*You have certain people, certain Instagram pages, they might post videos where they’re using the product but they’re not necessarily directly alluding to the fact that it’s an advertisement. So it’s kind of clever. They’re using it and they might tag the account where you can go purchase it in the caption. That way it doesn’t really seem like an advertisement. It’s just a casual video.*” When asked about the source of tobacco-related advertising and other messaging, participants primarily believed they were seeing content through people they know personally, and some via social media celebrity or other pages they follow. One student responded: “*I guess personally ... I’m not friends with people I*

*don't know on Facebook.*" Others stated: *"Mostly people that are in my friend feed," "Mostly friend and family [tobacco] use,"* and *"...people who I used to know in high school."*

### ***Aim 3: Perceptions Related to Researcher-Selected E-cigarette Instagram Advertisements***

Figure 3 displays word clouds created to reveal the words most commonly used by students when asked, "What do you think about this group of advertisements?" The word clouds provide a visual representation of participants' first impressions of six groups of Blu and Juul e-cigarette Instagram advertisements (see Figure 2 for advertisements). Shown in Figure 3, each word cloud contains the 35 most frequently used words by students to describe each of the six groups of advertisements. The most frequently used words appear largest in size.

#### ***Group 1: Relaxation***

For group 1, the most common words were *"picture," "beach,"* and *"relax,"* revealing students felt these advertisements conveyed themes of relaxation and serenity, and several participants likened this group to vacation pictures or advertisements. When describing group 1, participants said: *"They're very misleading." "They're clever." "...unrelated to smoking"* *"I wouldn't think that they're advertisements for tobacco or nicotine products. To me, they look more like vacation advertisements."* Overall, students found group 1 appealing.

#### ***Group 2: Flavors***

Common words used to describe group 2 were *"food"* and *"color,"* showing e-cigarette flavors were promoted by appealing to sense of taste. Participants found the artistry and use of color engaging. Participants stated: *"I think artistically, they're pretty cool."* *"They look delicious and colorful."* *"I could mistake them for album art."* *"It seems kind of*

*appealing. Makes me want to try it.” “I just did a double take because you would not think they are nicotine-related at all. I still can’t tell. If I saw these, I would just be thinking about food and get hungry.”*

#### *Group 3: Direct Product Promotion*

Group 3 advertisements were more traditional e-cigarette advertisements and students used words “*advertisement*” and “*product*” to describe this group. Students thought group 3 advertisements were more “*straight-forward*.” Some participants appreciated that this group was less deceptive, while others felt they were uninteresting. For example, one participant stated, “*They’re definitely ads. They’re product specific ads. I don’t really think anything else besides that. The first ad kind of looks cool because it looks very mechanical. The others just look like brands. It’s not very appealing.*” Another participant felt this group was “*a bit more honest and not as misleading.*”

#### *Group 4: Identify*

In group 4, participants commented most about the advertisements showing people smoking, and students commonly described this group as “*cool*.” One interviewee said, “*The first thing I would think is that they’re encouraging tobacco or nicotine use. I don’t know any of the people, but they all kind of look like they’d be fun to get to know at some point. I mean they’re all attractive. I don’t really like smoke, so I think that’s unattractive.*” Another participants stated, “*I like these best of all because there’s people in them. They all look very cool. They all look like people that are striving to just be young, hip, and posed in a cool way. All the people are attractive and that’s appealing. I don’t think there’s anything unappealing about these images.*”

#### *Group 5: Social Acceptability*

Participants felt group 5 advertisements looked more like traditional advertisements compared to other groups and found the social and fun aspects of this group appealing. However, students felt this group was advertising clothing, food, and alcohol products and not e-cigarettes, as demonstrated by the following example: *“It's hard to tell at first what they're selling. You really have to stop and look at the picture to kind of realize what they're trying to sell you. Otherwise, it kind of just feels like people are hanging out, having a good time ... the appealing part is that it feels like a family dynamic, where you're around your family. You're just having a good time together. It's easy to see yourself doing it, because you've probably done it before. It's easy to put yourself in their shoes. It's very relatable.”*

#### *Group 6: Adventure*

Words most commonly used to describe group 6 were *“people,” “photo,” “travel,” “appealing,”* and *“adventure.”* Participants described this group as *“something a friend would post”* and less like *“stock photos”* or *“advertising,”* compared to other groups. Other interviewees said, *“They don't look like they have anything to do with tobacco,”* and *“Honestly, I didn't even realize these were advertisements.”* A common sentiment expressed by participants was that their perceptions of e-cigarette advertising had changed after viewing the researcher-selected advertisements. For example, one interviewee stated, *“I think I have probably seen more [e-cigarette advertisements] than I thought, if this is what they look like. I might not have paid attention to them because I would have written them off as something else. I definitely may have seen more advertisements of e-cigarette products, but I didn't notice because of the way they were advertised.”*

**Figure 3.** Word clouds depicting the 35 most frequently used words by participants to describe e-cigarette advertisements.

### *Engagement with Researcher-Selected E-cigarette Instagram Advertisements*

All participants reported that at least one of the e-cigarette advertisements they were shown would attract their attention, and nearly all said they would engage with an advertisement in some way. Engagement activities included liking, commenting, sharing, and following the source of the advertisement. Students described ways in which they might potentially engage: *“I might go into the comments to try to see if the location is posted.”* *“Sometimes I would like a page, and if it interests me enough, I would go to the profile and see what other pictures they have. It wouldn’t be out of the question to follow the page if I enjoyed content by them.”* One participant expressed a sentiment echoed by many participants: *“If the advertisements evoke emotions or nostalgia that definitely piques my interest. It brings other levels of my life into it, which is what attracted me to group 5. Group 3 is just product-heavy, so there’s nothing there for me to connect with.”*

Students commonly reported no desire to engage if the advertisement looked like an advertisement, as shown in the following example: *“I’d probably scroll by. I’m not really interested in them. Personally, they look like ads to me. I don’t think they look like content that anyone I care about following would have posted.”* Another interviewee was uninterested stating the advertisements *“seem fake.”* Another common reason for not engaging was the knowledge that the content was an e-cigarette advertisement. For example, when asked about whether they would engage, one participant stated, *“I guess it would depend. If I found out that it is advertising tobacco products, that’s not something I like, so I would probably scroll by.”*

## **Discussion**

### ***Principal Findings***

This study utilized a qualitative approach to explore young adults' personal experiences with tobacco and nicotine product marketing and messaging on social media, as well as attitudes towards and perceptions of e-cigarette Instagram advertisements. While previous studies have shown tobacco-related marketing and messaging is prevalent on social media [14, 32] and young adults' exposure to tobacco-related social media is associated with tobacco use [22, 23], findings from these qualitative interviews extend previous research by providing detailed insight into the nature of young adults' exposure.

Findings from this study address an important gap in our understanding of the nature of young adults' exposure to tobacco-related social media, which no study to date has investigated. Overall, sixteen interviewees described exposure to direct tobacco or nicotine product advertising. Most students said they saw sponsored advertising on common social media like Facebook, despite sponsored advertising being prohibited via self-regulation on nearly all social media, except Reddit [32]. All participants described being exposed to messaging, that they would not consider tobacco advertising. Messaging including personal posts and photos by friends and family members that was most likely not industry-generated content. However, the source was less clear for vape trick videos, content posted by celebrities or people not known personally, and content populated by social media platforms (e.g., Explore page on Instagram), especially since this content may have been re-shared by friends. It was evident that participants in this study may be unable to distinguish between social media content that is tobacco-industry sponsored and content that is generated by lay-

persons. This is a key finding since greater exposure to tobacco advertising is associated with greater perceptions of peer use [33], and perceptions of peer use directly influence young adults' to use tobacco [7]. Furthermore, after viewing e-cigarette advertisements, participants' perceptions about brand-sponsored advertisements had changed with students noting they may have seen more advertising than they previously thought since brand advertising often appears unrelated to tobacco. This finding is unique compared to advertising via more traditional venues where the message source is clearer.

This study's findings add to limited research suggesting anti-tobacco campaigns may be outdated since they focus primarily on cigarettes and not newer, alternative products [34], since the three students in this study who reported seeing anti-tobacco advertisements described them as being directed to cigarette smokers. This highlights the critical need for messaging about the risks of non-cigarette products, especially as research emerges showing e-cigarettes and hookah, especially, are harmful [6]. The absence of counter-messaging about non-cigarette products may imply to young adults that these products are safe since promotional messaging for these products convey themes of health and safety [14, 18, 35] and young adults commonly perceived non-cigarette products as less harmful and less addictive than cigarettes [34].

### ***Implications and Directions for Future Research***

Historically, tobacco use was shown to begin in adolescence. However, recent studies show the developmental timing of initiating tobacco use has changed, and young adults initiate tobacco and nicotine product use at higher rates than adolescents [36]. Relatively few interventions and counter-messaging efforts have focused on young adults [37]. This study



revealed young adults have overall positive perceptions of social media e-cigarette advertisements, and social media represents an important potential source of exposure to both pro- and anti-tobacco messaging. In addition, despite the knowledge that they were being shown e-cigarette advertisements, students expressed interest in engaging with these advertisements indicating social media e-cigarette advertisements are effective in drawing-in both tobacco users and non-users. For these reasons, it is critical that future prevention efforts utilize social media. In a qualitative study of youth and young adults' preferences related to online tobacco education, participants suggested social media as a tool for engaging them [38], and a few studies have demonstrated success in engaging young adults in low-cost tobacco interventions via social media [39, 40]. Future interventions should consider the types of messages that captured the attention of young adults in our study and that could be adapted for prevention. Participants in this study were attracted to themes of relaxation, travel, and adventure. They liked the use of color and food products and appreciated honesty and realness. Interviewees were drawn to messages that they could connect with, those that were relevant to their lives or evoked emotions or nostalgia.

This study revealed young adults' perceptions of social media differed importantly, which may help to inform survey measures of social media use and tobacco-related exposure and engagement via social media. Interviewees identified connecting with people as a defining characteristic of social media. Participants in this study almost unanimously classified YouTube as a media channel, and not as a social media platform. However, their perceptions of other platforms, primarily Snapchat, Pinterest, and Reddit, were split. Considering these findings, it is important for researchers to clearly define social media.

Previous studies that have assessed exposure to and engagement with tobacco-related content on any social media [22, 41], and not by specific platforms, may be not be capturing important sources of exposure like YouTube, Snapchat, Pinterest, and Reddit.

This study also has implications for tobacco control. Currently, the FDA does not regulate brand-sponsored social media pages [42]. Rather, tobacco-related content is regulated by individual social media platforms or by the brands themselves. Recent studies have shown that policies prohibiting explicit advertising of tobacco and nicotine products on social media are ineffective [32], and exposure to social media tobacco-related content has a strong influence on users' attitudes and tobacco use behaviors [43]. Findings from this study support the need for the FDA to enact regulations of social media-based advertising, such as restricting unsubstantiated health claims, cessation claims, celebrity endorsements, and using glamorized themes to promote tobacco and nicotine products.

### ***Limitations***

The primary strength of this study is its utility in deepening our understanding of young adults' exposure and perceptions related to tobacco and nicotine product messaging on social media, through in-depth interviews with a demographically diverse sample of two- and four-year college students. This study is subject to a few limitations. First, findings from this study are not generalizable beyond the study sample due to the qualitative design. Moreover, data were self-reported and relied on participants' recollections of exposure. Future research should examine young adults' exposure to tobacco-related social media in real-time, in their natural environments to minimize recall bias and to more accurately determine message sources. Finally, while the interviews were coded by one author, which may have produced

bias in reporting and interpreting interview data, the common themes that emerged from the interviews were reviewed by two authors. Despite these limitations, study findings address important gaps in our knowledge of young adults' experiences with tobacco-related social media, and was conducted in a way that elicited comparable reactions to advertising about Blu and Juul. Specifically, results may inform survey metrics to more accurately capture rates of exposure to tobacco-related social media, as well as federal regulations on marketing and guiding the content of other prevention efforts among young adult populations.

## References

1. US Department of Health and Human Services., The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2014;17.
2. Jamal, A., et al., Current cigarette smoking among adults—United States, 2016. Morbidity and Mortality Weekly Report, 2018. 67(2): p. 53.
3. Centers for Disease Control and Prevention. Trends in Current Cigarette Smoking Among High School Students and Adults, United States, 1965-2014. [cited 2018 October 16]; Available from: [https://www.cdc.gov/tobacco/data\\_statistics/tables/trends/cig\\_smoking/index.htm](https://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm).
4. Campaign For Tobacco-Free Kids. The Rise of Cigars and Cigar-Smoking Harms 2016; Available from: Retrieved from <https://www.tobaccofreekids.org/research/factsheets/pdf/0333.pdf>.
5. Hu, S.S., Tobacco product use among adults—United States, 2013–2014. MMWR. Morbidity and Mortality Weekly Report, 2016. 65.

6. US Department of Health and Human Services., E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General. . Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2016.
7. US Department of Health and Human Services., Preventing tobacco use among youth and young adults: A report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2012;3.
8. Ling, P.M. and S.A. Glantz, Why and how the tobacco industry sells cigarettes to young adults: evidence from industry documents. American journal of public health, 2002. 92(6): p. 908-916.
9. De Martino, B., et al., Frames, biases, and rational decision-making in the human brain. Science, 2006. 313(5787): p. 684-687.
10. Richardson, A., et al., Noncombustible tobacco product advertising: how companies are selling the new face of tobacco. nicotine & tobacco research, 2013. 16(5): p. 606-614.

11. Yamin, C.K., A. Bitton, and D.W. Bates, E-cigarettes: a rapidly growing Internet phenomenon. *Annals of internal medicine*, 2010. 153(9): p. 607-609.
12. Liang, Y., et al., Exploring how the tobacco industry presents and promotes itself in social media. *Journal of medical Internet research*, 2015. 17(1).
13. Laestadius, L.I., M.M. Wahl, and Y.I. Cho, # Vapelife: An Exploratory Study of Electronic Cigarette Use and Promotion on Instagram. *Substance Use & Misuse*, 2016. 51(12): p. 1669-1673.
14. Vandewater, E.A., et al., Whose Post Is It? Predicting E-cigarette Brand from Social Media Posts. *Tobacco Regulatory Science*, 2018. 4(2): p. 30-43.
15. Kim, A.E., et al., Using Twitter data to gain insights into e-cigarette marketing and locations of use: an infoveillance study. *Journal of medical Internet research*, 2015. 17(11).
16. Clark, E.M., et al., Vaporous marketing: uncovering pervasive electronic cigarette advertisements on Twitter. *PLoS One*, 2016. 11(7): p. e0157304.
17. Sowles, S.J., et al., A Content Analysis of Vaping Advertisements on Twitter, November 2014. *Preventing chronic disease*, 2016. 13.
18. Willis, E., M.J. Haught, and D.L. Morris II, Up in vapor: exploring the health messages of e-cigarette advertisements. *Health communication*, 2017. 32(3): p. 372-380.

19. Allem, J.-P. and E. Ferrara, The importance of debiasing social media data to better understand e-cigarette-related attitudes and behaviors. *Journal of Medical Internet Research*, 2016. 18(8).
20. Zhan, Y., et al., Identifying topics for e-cigarette user-generated contents: a case study from multiple social media platforms. *Journal of medical Internet research*, 2017. 19(1).
21. Lazard, A.J., et al., E-cigarette social media messages: a text mining analysis of marketing and consumer conversations on Twitter. *JMIR public health and surveillance*, 2016. 2(2).
22. Depue, J.B., et al., Encoded exposure to tobacco use in social media predicts subsequent smoking behavior. *American Journal of Health Promotion*, 2015. 29(4): p. 259-261.
23. Sawdey, M.D., et al., Assessing the Association Between E-Cigarette Use and Exposure to Social Media in College Students: A Cross-Sectional Study. *Substance Use & Misuse*, 2017: p. 1-8.
24. Hébert, E.T., et al., Exposure and Engagement With Tobacco-and E-Cigarette–Related Social Media. *Journal of Adolescent Health*, 2017. 61(3): p. 371-377.

25. Soneji, S., et al., Association between initial use of e-cigarettes and subsequent cigarette smoking among adolescents and young adults: A systematic review and meta-analysis. *JAMA pediatrics*, 2017. 171(8): p. 788-797.
26. Soneji, S., et al., Engagement With Online Tobacco Marketing and Associations With Tobacco Product Use Among US Youth. *Journal of Adolescent Health*, 2017.
27. Pew Research Center (PRC). Social media fact sheet. 2018; Available from: <http://www.pewinternet.org/fact-sheet/social-media/>.
28. Cameron, K.A., A practitioner's guide to persuasion: An overview of 15 selected persuasion theories, models and frameworks. *Patient Education and Counseling*, 2009. 74(3): p. 309-317.
29. Montano, D.E. and D. Kasprzyk, Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. *Health behavior: Theory, research and practice*, 2015: p. 95-124.
30. Campaign For Tobacco-Free Kids. JUUL and Youth: Rising E-cigarette Popularity. 2018; Available from: <https://www.tobaccofreekids.org/assets/factsheets/0394.pdf>.
31. Feinerer, I. and K. Hornik. Text Mining Package. July 7, 2018; Available from: <https://cran.r-project.org/web/packages/tm/tm.pdf>.
32. Jackler, R.K., et al., Promotion of tobacco products on Facebook: policy versus practice. *Tobacco control*, 2018: p. tobaccocontrol-2017-054175.



33. Kreitzberg, D.S., et al., Exposure to tobacco and nicotine product advertising: Associations with perceived prevalence of use among college students. *Journal of American College Health*, 2018: p. 1-11.
34. Getachew, B., et al., Perceptions of Alternative Tobacco Products, Anti-tobacco Media, and Tobacco Regulation among Young Adults: A Qualitative Study. *American journal of health behavior*, 2018. 42(4): p. 118-130.
35. Paek, H.-J., et al., Reduced harm or another gateway to smoking? Source, message, and information characteristics of e-cigarette videos on YouTube. *Journal of health communication*, 2014. 19(5): p. 545-560.
36. Perry, C.L., et al., Youth or Young Adults: Which Group Is at Highest Risk for Tobacco Use Onset? *Journal of Adolescent Health*, 2018.
37. Ling, P.M. and S.A. Glantz, Tobacco industry research on smoking cessation. *Journal of general internal medicine*, 2004. 19(5): p. 419-426.
38. Lazard, A.J., et al., Message and Delivery Preferences for Online Tobacco Education among Adolescents and Young Adults. *Journal of health communication*, 2018: p. 1-8.
39. Haines-Saah, R.J., et al., Picture Me Smokefree: a qualitative study using social media and digital photography to engage young adults in tobacco reduction and cessation. *Journal of medical Internet research*, 2015. 17(1).

40. Jacobs, M.A., et al., Using Tumblr to reach and engage young adult smokers: a proof of concept in context. *American journal of health behavior*, 2016. 40(1): p. 48-54.
41. Tan, A.S., et al., Is exposure to e-cigarette communication associated with perceived harms of e-cigarette secondhand vapour? Results from a national survey of US adults. *BMJ open*, 2015. 5(3): p. e007134.
42. Luo, C., et al., Portrayal of electronic cigarettes on YouTube. *BMC public health*, 2014. 14(1): p. 1028.
43. Phua, J., S.V. Jin, and J.M. Hahm, Celebrity-endorsed e-cigarette brand Instagram advertisements: Effects on young adults' attitudes towards e-cigarettes and smoking intentions. *Journal of health psychology*, 2018. 23(4): p. 550-560.

## CONCLUSION

### Principal Findings

This dissertation sought to characterize exposure to and engagement with tobacco and nicotine product marketing and messaging on social media among a large, diverse sample of young adults. Findings from this work are timely as the vast, unregulated world of social media has become known as the “wild west” for tobacco and nicotine products, where the tobacco industry freely targets young people,<sup>52,63</sup> a population raised on social media.<sup>68</sup> Results contribute to the body of research addressing an important Healthy People 2020 objective, to reduce the proportion of young adults exposed to tobacco marketing on the internet,<sup>62</sup> as well as FDA research priorities including the impact of marketing on tobacco and nicotine product use and perceptions of tobacco marketing among young people.<sup>72</sup>

Paper 1 examined the extent to which young adults are exposed to and engage with tobacco and nicotine product marketing and messaging on social media, and the demographic, social, and behavioral characteristics associated with young adults who report exposure and engagement. Limited research has documented the proportion of young adults exposed to tobacco-related social media.<sup>56,73</sup> In fact, at the time of this work, only one study had reported on this among a young adult population, not including older adults. Sawdey et al. (2017) reported that 48% of 258 college students were exposed to e-cigarette advertising and 43% to e-cigarette-related peer posts on Facebook, Twitter or Instagram. Paper 1 extends previous research by reporting the proportion of young adults exposed to common tobacco and nicotine products, beyond e-cigarettes, across seven popular social media. A few studies

have examined engagement and characteristic associated with engagement among youth, however, no study has reported on these among young adults.

Paper 1 results reveal that 30.0% of young adults in the sample were exposed to advertising for a least one tobacco or nicotine product on any social media, during the past 30-days. Exposure was greatest for e-cigarettes on Facebook (22.5%). Nearly 23.0% of young adults engaged with tobacco or nicotine product-related marketing or messaging on social media. Engagement was greatest for anti-engagement activities like discouraging other people from using a tobacco or nicotine product (12.9%), compared to pro-engagement activities like encouraging other people to use a tobacco or nicotine product (3.2%). Users of more than one tobacco product (compared to non-users), higher social media users, and those with higher depressive symptoms were significantly more likely to report exposure, pro-engagement, and anti-engagement. Racial/ethnic minorities (compared to non-Hispanic whites) were significantly more likely to report exposure and pro-engagement. Young adults with friends that use at least one tobacco product were more likely to report exposure and anti-engagement. Two-year college students (compared to four-year university students) were more likely to report pro-engagement. Females were more likely to report exposure to hookah advertising, only, and anti-engagement.

Paper 2 examined the longitudinal associations between exposure and engagement and use behaviors. Previous studies show exposure to e-cigarette and other tobacco use via social media is positively associated with young adults' e-cigarette use.<sup>55-57</sup> Paper 2 builds upon previous work by examining these associations longitudinally, among a large sample of young adults, as well as being the first study to examine engagement, products beyond e-

cigarettes, and associations by product and social media type. Controlling for age, sex, race/ethnicity, and baseline tobacco use, both exposure to and engagement with tobacco-related social media at baseline significantly predicted past 30-day use of e-cigarettes, cigars, and hookah at one-year follow up. Controlling for other social media, exposure to any product advertising via Reddit predicted e-cigarette use; Pinterest exposure predicted cigar use; Snapchat exposure predicted hookah use. Pro-tobacco engagement predicted future use of all products. Anti-tobacco engagement predicted use of cigars and hookah.

Paper 3 utilized a qualitative approach to investigate young adults' experiences with tobacco and nicotine product marketing and messaging on social media, as well as their attitudes towards and perceptions of researcher-selected Blu and Juul e-cigarette Instagram advertisements. Although a growing body of research documents the presence and nature of tobacco and nicotine products marketing and messaging on social media,<sup>46,51,74</sup> no study to date explores young adults' attitudes towards and perceptions related to this content. Thus, paper 3 fills an important gap in our knowledge of young adults' exposures and engagements. In paper 3, all interviewees recalled personal experiences with tobacco or nicotine product marketing or other messaging that they would not consider tobacco advertising. Sixteen participants described seeing direct, promotional advertising, primarily for e-cigarettes and hookah. Three described anti-tobacco advertising, all of which focused on cigarettes. All 30 described messaging, other than traditional advertising, which was primarily posts or images from friends or family members about tobacco or nicotine products. Perceptions of e-cigarette Instagram advertisements were generally positive, with students preferring advertisements that did not look like traditional advertisements and

conveyed adventure, travel, fun, food and social themes. Despite the knowledge that they were being shown e-cigarette advertisements, most participants said they would engage with the advertisements by liking, commenting, or following them on social media.

### **Implications for Interventions and Health Communication**

Young adults are an important priority population since contemporary research shows young adults initiate tobacco use at higher rates than adolescents,<sup>24</sup> few prevention efforts have focused on young adults,<sup>75</sup> and young adults are key targets of tobacco promotion.<sup>23</sup> Young adults can be challenging to reach, especially those that do not attend college and those that have finished college. Social media is an ideal platform for tobacco interventions and health communications since greater than 90% of young adults in the sample reported using and engaging on common social media. This rate is similar to national estimates by the Pew Research Center showing 88% of young adults use social media, and young adults of all races/ethnicities and income brackets use social media.<sup>67</sup> This dissertation showed that young adults will engage with anti-tobacco messages, and this engagement was higher than pro-engagement. In addition, young adults with friends that use tobacco were significantly more likely to anti-engage, but not to pro-engage. In a recent study about young adults' preferences for tobacco education, participants suggested social media be used to engage them in online tobacco education.<sup>76</sup> Thus, future interventions and health communications should seek to involve young people with messaging so that it is shared within their peer networks. Findings from this dissertation also reveal the type of product exposure most prevalent for various social media. A particularly interesting finding was that, in paper 1, exposure to hookah advertising was especially high on Snapchat, and, in paper 2, exposure to any product

advertising on Snapchat predicted hookah use one-year later. Future prevention efforts that focus on hookah might consider Snapchat as a venue for health and safety messages about hookah. Future prevention efforts also should consider types of messages preferred by young adults. In paper 3, participants were attracted to e-cigarette advertisements that did not look like advertisements, connected with them on a personal level, and conveyed themes of adventure, relaxation, and fun.

### **Implications for Tobacco Control**

This dissertation supports a critical need to federally regulate the marketing of tobacco and nicotine products on social media since young adults in the sample were exposed to and engaged with this content, and their exposure and engagement predicted future tobacco use. Currently, tobacco-related content on many popular social media are self-regulated, but research shows these self-imposed policies are ineffective.<sup>77</sup> Although regulation is problematic due to freedom of speech laws, direct industry-sponsored advertising is the most realistic target of tobacco control laws. Potential regulations include requiring tobacco companies and other brands to register their social media accounts so that they can be monitored for inappropriate content such as making unsubstantiated health claims. Also, industry pages could be made private so that content is not visible to just anyone and only verified users over the age of 18 would be permitted to follow brand pages. Finally, brand-sponsored advertising including any posts, images, or videos could be required to contain warning labels about the health effects of the products advertised.

## **Strengths and Limitations**

The primary strength of this dissertation is that it adds greatly to our understanding of young adults' exposure and engagement with tobacco-related social media. Findings should be considered in the context of some limitations. First, the sample was drawn from colleges within five Texas counties and does not include young adults who did not attend college. Thus, findings are not generalizable to other populations. However, a strength of this dissertation was a large, racially/ethnically diverse sample that included both two- and four-year college students. This is an important distinction from previous work since two-year, vocational students are more likely to be racial/ethnic minorities and use tobacco, compared to other young adult populations.<sup>78,79</sup> In addition, in paper 1, two-year students were significantly more likely to report exposure and engagement with social media tobacco promotion. This finding suggests vulnerable groups are disproportionately exposed and engage which may exacerbate existing tobacco-related disparities. Second, data were collected via self-report which may be subject to recall bias. Although paper 3 provided important insight into the nature of young adults' exposure and engagement with tobacco-related social media, it was not possible to know the exact nature of content described, rather results are based on participants' recollections. Future research should utilize real-time assessment to capture current exposures and engagements in a natural setting. Another potential limitation is that young adults may have differentially defined exposure and engagement. For example, in papers 1 and 2, some participants may have reported anti-tobacco advertising or user-generated messaging, while others defined advertising as strictly promotional content. However, paper 3 allowed for a more detailed investigation of



participants definitions of exposure and engagement which could be used to inform survey measurement items. In paper 3, three students described seeing anti-tobacco advertising when asked about social media-based tobacco advertising indicating they would interpret the term “advertising” to include both pro- and anti-tobacco messaging. In addition, it was not possible to examine engagement by product and by social media platform since survey space was limited. Future research should make these distinctions, especially for cigarettes and e-cigarettes since young adults may anti-engage with one product (e.g., cigarettes), while promoting another (e.g., e-cigarettes). Overall, findings from this dissertation address several important gaps in our understanding of young adults’ experiences with tobacco-related social media including the extent to which young adults are exposed and engage, how their exposures and engagements are longitudinally associated with their tobacco use behaviors, and their personal experiences with and perceptions related to social media tobacco messages.

## APPENDICES

Appendix A: Measurement Resource Table, M-PACT Survey Items

Measurement Resource Table		
DEMOGRAPHICS		
Construct	Protocol	Source
Sex (1 item)	What is your sex? 01 Male 02 Female	AM004 SCR
Age (1 item)	What is your current age? _____ [RANGE 00-99] 998 Don't know 999 Refused	M-PACT
College Student Status (1 item)	Are you a full- or part-time degree/certificate-seeking student? 01 Yes, I am a first-year student. 02 Yes, I am a second-year student. 03 Yes, I am a third-year student. 04 Yes, I am a fourth-year student. 05 Yes, I am a fifth-year or more student. 06 No, I am not a full- or part-time degree/certificate seeking student.	M-PACT
Ethnicity (1 item)	Are you Hispanic or Latino/a? 01 No 02 Yes, I am Mexican, Mexican American, or Chicano/a. 03 Yes, I am some other Hispanic or Latino/a ethnicity not listed here.	Youth Tobacco Survey (YTS)
Race (1 item)	What race or races do you consider yourself to be? Check all that apply. 01 White 02 Black or African American 03 Asian	YTS, Behavioral Risk Factor Surveillance System (BRFSS)

	04 American Indian or Alaskan Native 05 Native Hawaiian or other Pacific Islander 06 Other	
TOBACCO AND NICOTINE PRODUCT USE		
Ever Cigarette Use (1 item)	How old were you the first time you smoked part or all of a cigarette? _____ [RANGE Under 10 years old - 29] 21 I don't remember how old I was 22 I have never smoked a cigarette, even 1 or 2 puffs.	AC1006 M p. 1
Ever ENDS Use (1 item)	Have you ever used an ENDS product, (i.e. e-cigarette, vape pen, or e-hookah) as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice), even one or two puffs? 01 Yes 02 No	AE1002 SCR M p. 7
Ever Cigar Use (1 item)	Have you ever tried either of these cigar products types as intended (i.e. with tobacco), ever one or two puffs? 01 Yes 02 No	YTS
Ever Hookah Use (1 item)	How old were you when you first tried smoking a hookah as intended (i.e. with tobacco), even one or two puffs? _____ [RANGE Under 10 years old - 29] 21 I don't remember how old I was 22 I have never smoked hookah, even 1 or 2 puffs.	AH1006 M p. 62
Ever Smokeless Tobacco Use (1 item)	How old were you the first time you used smokeless tobacco, even one or two times? _____ [RANGE Under 10 years old - 29] 21 I don't remember how old I was 22 I have never used smokeless tobacco, even 1 or 2 times.	AS1006 M p. 77
Current Cigarette Use (1 item)	On how many of the past 30 days did you smoke cigarettes? _____ [RANGE 00-30]	AC1022 M p. 6

	998 Don't know 999 Refused	
Current ENDS Use (1 item)	During the past 30 days, have you used any ENDS product, (i.e. e-cigarette, vape pen, or e-hookah), even one or two puffs, as intended (i.e. with nicotine cartridges and/or e-liquid/e-juice)? days 01 Yes 02 No	AE1022 M p. 26
Current Cigar Use (1 item)	During the past 30 days, how many days did you smoke a cigar product as intended (i.e. with tobacco)? _____ [RANGE 00-30] 998 Don't know	AG1022 M p. 40
Current Hookah Use (1 item)	On how many of the past 30 days have you smoked hookah as intended? _____ [RANGE 00-30] 998 Don't know	AH9001 M p. 64
Current Smokeless Tobacco Use (1 item)	During the past 30 days, on how many days did you use smokeless tobacco? _____ [RANGE 00-30] 998 Don't know	AS1022 M p. 80
SOCIAL MEDIA USE AND ENGAGEMENT		
Social Media Use (1 item)	During the past 30 days, how often did you read or view content on ... Facebook, Instagram, Pinterest, Reddit, Snapchat, Twitter, YouTube? 01 Never 02 About once a month 03 Every few weeks 04 1-2 days a week 05 3-5 days a week 06 About once a day 07 Several times a day	Population Research Center (PRC), Population Assessment of Tobacco and Health (PATH)

Social Media Engagement (1 item)	During the past 30 days, how often did you share, post, or comment on ... Facebook, Instagram, Pinterest, Reddit, Snapchat, Twitter, YouTube? 01 Never 02 About once a month 03 Every few weeks 04 1-2 days a week 05 3-5 days a week 06 About once a day 07 Several times a day	PRC
RECALL OF SOCIAL MEDIA TOBACCO/NICOTINE PRODUCT ADVERTISING		
Past 30-day recall of exposure to cigarette advertisements	During the past 30 days, how often did you see any advertisements for <u>cigarettes</u> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? 01 Never 02 Rarely 03 Occasionally 04 Frequently 05 Very frequently	YTS
Past 30-day recall of exposure to cigar product advertisements	During the past 30 days, how often did you see any advertisements for <u>cigar products</u> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? 01 Never 02 Rarely 03 Occasionally 04 Frequently 05 Very frequently	YTS
Past 30-day recall of exposure to	During the past 30 days, how often did you see any advertisements for <u>waterpipe/hookah</u> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit?	YTS

waterpipe/hookah advertisements	01 Never 02 Rarely 03 Occasionally 04 Frequently 05 Very frequently	
Past 30-day recall of exposure to smokeless tobacco advertisements	During the past 30 days, how often did you see any advertisements for <b><u>smokeless tobacco</u></b> on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? 01 Never 02 Rarely 03 Occasionally 04 Frequently 05 Very frequently	YTS
Past 30-day recall of exposure to ENDS advertisements	During the past 30 days, how often did you see any advertisements for <b><u>ENDS</u></b> (e-cigarettes, vape pens, etc.) on ... Facebook, Instagram, Twitter, Snapchat, YouTube, Pinterest, Reddit? 01 Never 02 Rarely 03 Occasionally 04 Frequently 05 Very frequently	YTS
RECALL OF ENGAGEMENT WITH SOCIAL MEDIA TOBACCO/NICOTINE PRODUCT MESSAGING		
Visit/follow/like Tobacco/ENDS (2 items)	Have you visited, followed, or liked tobacco or ENDS products on social media in the following time frames? Ever? 6 months? 30 days? 01 Yes 02 No	M-PACT, PRC

	<p>What kinds of products did you visit, follow, or like on social media? Check all that apply.</p> <p>01 Cigarettes</p> <p>02 ENDS (disposable/rechargeable e-cigarettes)</p> <p>03 ENDS (vape pens)</p> <p>04 Large cigars</p> <p>05 Cigarillos</p> <p>06 Little filtered cigars</p> <p>07 Hookah</p> <p>08 Chewing tobacco or moist snuff/dip</p> <p>09 Snus</p>	
Post/repost tobacco/ENDS content (8 items)	<p>How often do you use social media to ...</p> <p>Post links to <b>pro-tobacco</b> or ENDS product websites, stories, or articles?</p> <p>Post links to <b>anti-tobacco</b> or ENDS product websites, stories, or articles?</p> <p>Post your own thoughts or comments about the <b>positive</b> aspects of tobacco or ENDS use?</p> <p>Post your own thoughts or comments on the <b>negative</b> aspects of tobacco or ENDS use?</p> <p><b>Encourage</b> other people to use a tobacco or ENDS product?</p> <p><b>Discourage</b> other people from using a tobacco or ENDS product?</p> <p>Post about your own tobacco or ENDS use?</p> <p>Repost content related to tobacco or ENDS that was originally posted by someone else?</p> <p>01 Never</p> <p>02 Rarely</p> <p>03 Occasionally</p> <p>04 Frequently</p> <p>05 Very Frequently</p>	PRC, PATH
PERSONAL COGNITIVE FACTORS		

Sensation seeking (4 item scale)	<p>How much do you agree or disagree with the following statements?</p> <p>I would like to explore strange places.</p> <p>I like to do frightening things.</p> <p>I like new and exciting experiences, even if I have to break the rules.</p> <p>I prefer friends who are exciting and unpredictable.</p> <p>01 Strongly Disagree</p> <p>02 Disagree</p> <p>03 Agree</p>	Brief Sensation Seeking Scale (BSSS-4)
Depression (10 item scale)	<p>In the past week ...</p> <p>I was bothered by things that usually don't bother me.</p> <p>I had trouble keeping my mind on what I was doing.</p> <p>I felt depressed.</p> <p>I felt nervous and anxious.</p> <p>I felt that everything I did was an effort.</p> <p>I felt hopeful about the future.</p> <p>I felt fearful.</p> <p>My sleep was restless.</p> <p>I was happy.</p> <p>I felt lonely.</p> <p>I could not get "going".</p> <p>01 Rarely (less than 1 day)</p> <p>02 Sometimes (1-2 days)</p> <p>03 Moderate amount of time (3-4 days)</p> <p>04 Most of the time (5-7 days)</p>	Center for Epidemiologic Studies Depression 10 Scale (CES-D 10)
Social acceptability	<p>How socially acceptable is it for people your age to use ... ENDS, cigars, hookah, smokeless tobacco, cigarettes?</p> <p>01 Totally unacceptable</p> <p>02</p> <p>03</p>	AX0007 M p.159



	04 05 Totally acceptable	
--	-----------------------------	--

## REFERENCES

1. US Department of Health and Human Services. *The health consequences of smoking—50 years of progress: a report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2014;17.
2. US Department of Health and Human Services. *The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2006;709.
3. US Department of Health and Human Services. *The health consequences of smoking: a report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2004;62.
4. US Department of Health Education and Welfare Public Health Service. *Report of the Advisory Committee to the Surgeon General of the Public Health Service*. 1964.
5. Campaign For Tobacco-Free Kids. The Rise of Cigars and Cigar-Smoking Harms 2016; Retrieved from <https://www.tobaccofreekids.org/research/factsheets/pdf/0333.pdf>.

6. Hu SS. Tobacco product use among adults—United States, 2013–2014. *MMWR Morbidity and mortality weekly report*. 2016;65.
7. Loukas A, Chow S, Pasch KE, et al. College students' polytobacco use, cigarette cessation, and dependence. *Am J Health Behav*. 2016;40(4):514-522.
8. Richardson A, Williams V, Rath J, Villanti AC, Vallone D. The next generation of users: prevalence and longitudinal patterns of tobacco use among US young adults. *American journal of public health*. 2014;104(8):1429-1436.
9. US Department of Health and Human Services. *E-Cigarette Use Among Youth and Young Adults. A Report of the Surgeon General*. . Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2016.
10. Arrazola RA, Singh T, Corey CG, et al. Tobacco use among middle and high school students-United States, 2011-2014. *MMWR Morbidity and mortality weekly report*. 2015;64(14):381-385.
11. Delnevo CD, Giovenco DP, Ambrose BK, Corey CG, Conway KP. Preference for flavoured cigar brands among youth, young adults and adults in the USA. *Tobacco control*. 2014;tobaccocontrol-2013-051408.

12. Giovino GA, Villanti AC, Mowery PD, et al. Differential trends in cigarette smoking in the USA: is menthol slowing progress? *Tobacco control*. 2013;tobaccocontrol-2013-051159.
13. Harrell MB, Loukas A, Jackson CD, Marti CN, Perry CL. Flavored Tobacco Product Use among Youth and Young Adults: What if Flavors Didn't Exist? *Tobacco Regulatory Science*. 2017;3(2):168-173.
14. Huang LL, Baker HM, Meernik C, Ranney LM, Richardson A, Goldstein AO. Impact of non-menthol flavours in tobacco products on perceptions and use among youth, young adults and adults: a systematic review. *Tobacco control*. 2016;tobaccocontrol-2016-053196.
15. Berg CJ, Stratton E, Schauer GL, et al. Perceived harm, addictiveness, and social acceptability of tobacco products and marijuana among young adults: marijuana, hookah, and electronic cigarettes win. *Substance use & misuse*. 2015;50(1):79-89.
16. Lee YO, Bahreinifar S, Ling PM. Understanding tobacco-related attitudes among college and noncollege young adult hookah and cigarette users. *J Am Coll Health*. 2014;62(1):10-18.

17. Wagoner KG, Cornacchione J, Wiseman KD, Teal R, Moracco KE, Sutfin EL. E-cigarettes, hookah pens and vapes: adolescent and young adult perceptions of electronic nicotine delivery systems. *Nicotine & Tobacco Research*. 2016;18(10):2006-2012.
18. Wackowski OA, Delnevo CD. Young adults' risk perceptions of various tobacco products relative to cigarettes: results from the National Young Adult Health Survey. *Health Educ Behav*. 2016;43(3):328-336.
19. Centers for Disease Control Prevention. Dangers of Hookah Smoking. 2015; <https://www.cdc.gov/features/hookahsmoking/index.html>. Accessed October 19, 2017.
20. Rath JM, Villanti AC, Abrams DB, Vallone DM. Patterns of tobacco use and dual use in US young adults: the missing link between youth prevention and adult cessation. *J Environ Public Health*. 2012;2012.
21. Bernat DH, Klein EG, Forster JL. Smoking initiation during young adulthood: a longitudinal study of a population-based cohort. *Journal of Adolescent Health*. 2012;51(5):497-502.
22. Lantz PM, Jacobson PD, Warner KE, et al. Investing in youth tobacco control: a review of smoking prevention and control strategies. *Tobacco control*. 2000;9(1):47-63.

23. Ling PM, Glantz SA. Why and how the tobacco industry sells cigarettes to young adults: evidence from industry documents. *American journal of public health*. 2002;92(6):908-916.
24. Perry CL, Pérez A, Bluestein M, et al. Youth or Young Adults: Which Group Is at Highest Risk for Tobacco Use Onset? *Journal of Adolescent Health*. 2018;63(4):413-420.
25. US Department of Health and Human Services. *Preventing tobacco use among youth and young adults: A report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2012;3.
26. Lavinghouze SR, Malarcher A, Jama A, Neff L, Debrot K, Whalen L. Trends in quit attempts among adult cigarette smokers—United States, 2001–2013. *MMWR Morb Mortal Wkly Rep*. 2015;64(40):1129-1235.
27. Messer K, Trinidad DR, Al-Delaimy WK, Pierce JP. Smoking cessation rates in the United States: a comparison of young adult and older smokers. *American journal of public health*. 2008;98(2):317-322.
28. Kelder SH, Hoelscher D, Perry CL. How individuals, environments, and health behaviors interact. *Health behavior: Theory, research, and practice*. 2015;159.

29. US Department of Health and Human Services. *Preventing Tobacco Use Among Young People A Report of the Surgeon General*. Atlanta (GA): US Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1994.
30. Andrews JA, Tildesley E, Hops H, Li F. The influence of peers on young adult substance use. *Health Psychol*. 2002;21(4):349.
31. Brook JS, Whiteman M, Czeisler LJ, Shapiro J, Cohen P. Cigarette smoking in young adults: Childhood and adolescent personality, familial, and peer antecedents. *The Journal of genetic psychology*. 1997;158(2):172-188.
32. Moran S, Wechsler H, Rigotti NA. Social smoking among US college students. *Pediatrics*. 2004;114(4):1028-1034.
33. Muller D, Judd CM, Yzerbyt VY. When moderation is mediated and mediation is moderated. *J Pers Soc Psychol*. 2005;89(6):852.
34. Paynter J, Edwards R. The impact of tobacco promotion at the point of sale: a systematic review. *Nicotine and Tobacco Research*. 2009;11(1):25-35.
35. Davis RM, Gilpin EA, Loken B, Viswanath K, Wakefield MA. The role of the media in promoting and reducing tobacco use. USA; 2008.

36. Brandt AM. *The cigarette century: the rise, fall, and deadly persistence of the product that defined America*. Basic Books (AZ); 2007.
37. Richardson A, Ganz O, Stalgaitis C, Abrams D, Vallone D. Noncombustible tobacco product advertising: how companies are selling the new face of tobacco. *nicotine & tobacco research*. 2013;16(5):606-614.
38. Federal Trade Commission. Cigarette Report for 2013. 2016;  
<https://www.ftc.gov/reports/federal-trade-commission-cigarette-report-2013>.
39. Federal Trade Commission. Smokeless Tobacco Report for 2013. 2016;  
<https://www.ftc.gov/reports/federal-trade-commission-smokeless-tobacco-report-2013>.
40. Campaign For Tobacco-Free Kids. Trends in Tobacco Industry Marketing 2016  
<https://www.tobaccofreekids.org/assets/factsheets/0156.pdf>.
41. Yamin CK, Bitton A, Bates DW. E-cigarettes: a rapidly growing Internet phenomenon. *Ann Intern Med*. 2010;153(9):607-609.
42. Company Info. *Facebook Newsroom* 2017; <https://newsroom.fb.com/company-info/>. Accessed April 6, 2017.
43. Instagram says it now has 800 million users, up 100 million since April. 2017;  
<https://www.cnbc.com/2017/09/25/how-many-users-does-instagram-have-now-800-million.html>. Accessed October 11, 2017.



44. Twitter is now losing users in the U.S. 2017  
<http://money.cnn.com/2017/07/27/technology/business/twitter-earnings/index.html>.  
Accessed October 11, 2017.
45. Link AR, Cawkwell PB, Shelley DR, Sherman SE. An exploration of online behaviors and social media use among hookah and electronic-cigarette users. *Addictive behaviors reports*. 2015;2:37-40.
46. Vandewater EA, Clendennen SL, Hébert ET, et al. Whose Post Is It? Predicting E-cigarette Brand from Social Media Posts. *Tobacco Regulatory Science*. 2018;4(2):30-43.
47. Dunlop S, Freeman B, Jones SC. Marketing to youth in the digital age: The promotion of unhealthy products and health promoting behaviours on social media. *Media and Communication*. 2016;4(3).
48. Phua J, Jin SV, Hahm JM. Celebrity-endorsed e-cigarette brand Instagram advertisements: Effects on young adults' attitudes towards e-cigarettes and smoking intentions. *Journal of Health Psychology*. 2017:1359105317693912.
49. Luo C, Zheng X, Zeng DD, Leischow S. Portrayal of electronic cigarettes on YouTube. *BMC public health*. 2014;14(1):1028.

50. Forsyth SR, Malone RE. “I’ll be your cigarette—Light me up and get on with it”: Examining smoking imagery on YouTube. *Nicotine & Tobacco Research*. 2010;ntq101.
51. Liang Y, Zheng X, Zeng DD, Zhou X, Leischow SJ, Chung W. Exploring how the tobacco industry presents and promotes itself in social media. *Journal of medical Internet research*. 2015;17(1).
52. Huang J, Kornfield R, Szczypka G, Emery SL. A cross-sectional examination of marketing of electronic cigarettes on Twitter. *Tobacco control*. 2014;23(suppl 3):iii26-iii30.
53. Sowles SJ, Krauss MJ, Connolly S, Cavazos-Rehg PA. Peer Reviewed: A Content Analysis of Vaping Advertisements on Twitter, November 2014. *Prev Chronic Dis*. 2016;13.
54. Laestadius LI, Wahl MM, Cho YI. # Vapelite: An Exploratory Study of Electronic Cigarette Use and Promotion on Instagram. *Substance Use & Misuse*. 2016;51(12):1669-1673.
55. Depue JB, Southwell BG, Betzner AE, Walsh BM. Encoded exposure to tobacco use in social media predicts subsequent smoking behavior. *Am J Health Promot*. 2015;29(4):259-261.

56. Sawdey MD, Hancock L, Messner M, Prom-Wormley EC. Assessing the Association Between E-Cigarette Use and Exposure to Social Media in College Students: A Cross-Sectional Study. *Substance Use & Misuse*. 2017;1-8.
57. Pokhrel P, Fagan P, Herzog TA, et al. Social media e-cigarette exposure and e-cigarette expectancies and use among young adults. *Addict Behav*. 2018;78:51-58.
58. Soneji S, Pierce JP, Choi K, et al. Engagement With Online Tobacco Marketing and Associations With Tobacco Product Use Among US Youth. *Journal of Adolescent Health*. 2017.
59. Hébert ET, Case KR, Kelder SH, Delk J, Perry CL, Harrell MB. Exposure and Engagement With Tobacco-and E-Cigarette–Related Social Media. *Journal of Adolescent Health*. 2017;61(3):371-377.
60. Cavazos-Rehg PA, Krauss MJ, Spitznagel EL, Grucza RA, Bierut LJ. Hazards of new media: youth's exposure to tobacco ads/promotions. *nicotine & tobacco research*. 2013;16(4):437-444.
61. Tan AS, Bigman CA, Mello S, Sanders-Jackson A. Is exposure to e-cigarette communication associated with perceived harms of e-cigarette secondhand vapour? Results from a national survey of US adults. *BMJ open*. 2015;5(3):e007134.

62. Healthy People 2020. Tobacco Use. 2016  
<https://www.healthypeople.gov/2020/topics-objectives/topic/tobacco-use>. Accessed June 8 2017.
63. FDA's New Regulations for E-Cigarettes, Cigars, and All Other Tobacco Products 2017;  
<https://www.fda.gov/tobaccoproducts/labeling/rulesregulationsguidance/ucm394909.htm>. Accessed June 8 2017.
64. Willis GB. *Cognitive interviewing: A tool for improving questionnaire design*. Sage Publications; 2004.
65. Hinds III JT, Loukas A, Chow S, et al. Using cognitive interviewing to better assess young adult e-cigarette use. *Nicotine & Tobacco Research*. 2016;18(10):1998-2005.
66. Lenhart A. Teens, social media & technology overview 2015. *Pew Research Center*. 2015;9.
67. Perrin A. Social media usage: 2005–2015. Pew Research Center, 2015. 2016.
68. Greenwood S, Perrin A, Duggan M. Social media update 2016: Facebook usage and engagement is on the rise, while adoption of other platforms holds steady. *Pew Research Center*. 2016.
69. Duggan M, Ellison N, Lampe C, Lenhart A, Madden M. Social media update 2014. Pew Research Center, 2015. 2015.

70. Rainie L, Smith A, Schlozman KL, Brady H, Verba S. Social media and political engagement. *Pew Internet & American Life Project*. 2012;19.
71. Centers for Disease Control and Prevention. Youth Tobacco Survey (YTS) 2017; [https://www.cdc.gov/tobacco/data\\_statistics/surveys/yts/index.htm](https://www.cdc.gov/tobacco/data_statistics/surveys/yts/index.htm). Accessed December 11, 2017.
72. US Food and Drug Administration. Research Priorities 2017.
73. Phua J. E-Cigarette Marketing On Social Networking Sites: Effects on Attitudes, Behavioral Control, Intention to Quit, and Self-Efficacy. *Journal of Advertising Research*. 2018:JAR-2018-2018.
74. Kim AE, Hopper T, Simpson S, et al. Using Twitter data to gain insights into e-cigarette marketing and locations of use: an intelligence study. *Journal of medical Internet research*. 2015;17(11).
75. Ling PM, Glantz SA. Tobacco industry research on smoking cessation. *J Gen Intern Med*. 2004;19(5):419-426.
76. Lazard AJ, Horrell L, Pikowski J, Cornacchione Ross J, Noar SM, Sutfin EL. Message and Delivery Preferences for Online Tobacco Education among Adolescents and Young Adults. *Journal of health communication*. 2018:1-8.

77. Jackler RK, Li VY, Cardiff RA, Ramamurthi D. Promotion of tobacco products on Facebook: policy versus practice. *Tobacco control*. 2018;tobaccocontrol-2017-054175.
78. Biener L, McCausland K, Curry L, Cullen J. Prevalence of trial of snus products among adult smokers. *American Journal of Public Health*. 2011;101(10):1874-1876.
79. Loukas A, Murphy JL, Gottlieb NH. Cigarette smoking and cessation among trade or technical school students in Texas. *J Am Coll Health*. 2008;56(4):401-407.