Exploring the Influence of Pro- and Anti-Tobacco Content in Social Media on Young Adults' Tobacco Use Behaviors

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Over the last 15 months, I have come to realize how much truth there is in the old adage, “it takes a village to raise a child”. Turns out, the same thing can be said of writing a dissertation. The extreme joys and challenges of new motherhood are all-consuming; to be finding my footing as a researcher at the same time I was finding my footing as a mother would have been impossible were it not for my village – and what an amazing village they are.

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complaining. And more importantly, thank you for always believing in me and wanting what is best for me and pushing me to strive for it. You make me feel like the luckiest girl in the world. And to my daughter, Sitara - you are a constant source of laughter, inspiration, and love, and gave me much needed perspective as I worked on this dissertation. I hope you read this one day and (after you finish laughing about the antiquated list of social media sites I examined) learn a little bit about what your mother's dissertation was about, and more importantly, all the people who helped her make it a reality.

Abstract of Dissertation

The Influence of Pro- and Anti-Tobacco Content in Social Media on Young Adults: A Mixed Methods Study

Young adults' use of online social media sites is widespread, making social media a key source of exposure to pro- and anti-tobacco related content, including portrayals of smoking or messages discouraging smoking from peers. Different social media sites have different purposes, audiences, and norms, which may impact the influence social media use has on risk behaviors, including tobacco use. Additionally, peer influence through social media – given the ability of users to generate, share, and critique content – may heighten the impact tobacco-related content has on young adults' tobacco use behaviors.

This dissertation utilized survey data from a national sample of approximately 1,000 young adults age 18-24 to identify distinct patterns of social media site use and their relation to health risk behaviors, as well as to examine the relationship between exposure to tobacco-related content in social media and tobacco use behaviors. To further understand the experience of young adults consuming tobacco content in social media, in-depth interviews were conducted with eighteen smokers and nonsmokers.

Young adults' social media site use patterns fell into five distinct classes – distinguished by low use across all sites, high use across all sites, high use of a professionally focused site, high use of sites known for creative user generation of content, and high use of the most popular sites. These classes differed significantly in their use of alcohol, tobacco, and other drugs. Exposure to pro-tobacco content in social media was widespread (over 70%, either alone or in combination with anti-tobacco

content), more common among smokers, and associated with openness to smoking among nonsmokers, social smoking among smokers with close friends who smoke, and use of cigars and hookah, but not cigarettes.

The experiences of young adults shared in interviews support and further explain these quantitative findings, revealing the potential existence of distinct networks with differing tobacco use content and norms, with certain young adults (primarily low-income and minority smokers) reporting experiencing group norms that support taking pride in smoking, most young adults reporting experiencing group norms that frown upon taking pride in smoking but support social smoking (especially of cigars and hookah), and hardly any young adults reporting feeling supported in taking an anti-tobacco stance on social media. Young adults interviewed also assumed smoking posts influence their peers, potentially heightening the impact these posts have on their perceptions about the prevalence and acceptability of smoking. These differences in content and norms across networks of young adults might reinforce or even exacerbate existing disparities, as well as high rates of social smoking and use of cigars and hookah among young people.

Overall, the results of this dissertation highlight the need for innovative social media interventions that disseminate preventive health information based on social media site use patterns associated with specific risk behaviors; target social smoking and cigar and hookah use; address norms related to the acceptability of smoking posts and the presumed influence posts have on peers; and purposefully leverage network characteristics to influence tobacco use behaviors.

Keywords: Tobacco use, social media, communication, social norms, young adult

Table of Contents

Acknowledgements iv

Abstract of Dissertation viii

Table of Contents x

List of Figures xii

List of Tables xiii

Chapter 1: Introduction 1

Study Overview 1

Literature Review 2

Specific Aims 34

Chapter 2: Patterns of Social Media Use and their Relationship to Health Risks Among Young Adults (Study 1/Aim 1) 36

Abstract 36

Introduction 37

Methods 40

Results 44

Discussion 51

Acknowledgements 55

Chapter 3: Young Adults' Exposure to Pro- and Anti-Tobacco Content in Social Media and Associations with Tobacco Use Outcomes (Study 2/Aim 2) 56

Abstract 56

Introduction 57

Methods 62

Results 66

Discussion 75

Acknowledgements 81

Chapter 4: A Qualitative Exploration of How Young Adults Express and Process Pro- and Anti-Tobacco Content in Social Media (Study 3/Aim 3) 82
Abstract 82
Introduction 83
Methods 89
Results 93
Discussion 109
Acknowledgements 120
Chapter 5: Conclusions 120
Summary of Findings 120
Contribution to the Literature 124
Practice Implications 127
Limitations 130
Further Research Needs 132
References 136
Appendix A: Measures – Chapter 2 (Study 1/Aim 1) 152
Appendix B: Measures – Chapter 3 (Study 2/Aim 2) 157
Appendix C: Demographic and Social Media Use Questionnaire 162
Appendix D: Semi-Structured Interview Guide 166
Appendix E: Pilot Study 175

List of Figures

Figure 1. Examples of Pro-Tobacco Content Found In Social Media……..…….11

Figure 2. Examples of Anti-Tobacco Content Found In Social Media……...…....….17

Figure 3. Dissertation Conceptual Framework……...……..…....….22

Figure 4. Examples of Pro- and Anti-Tobacco Content in Social Media…….....….59

Figure 5. Examples of Pro- and Anti-Tobacco Content in Social Media…….....….85

Figure 6. Conceptual Framework Informing Design of Study…….....….86

Figure 7. Framework Illustrating Respondents' Self-Reported Experience Receiving and Processing Tobacco-Related Content in Social Media…….....….109

List of Tables

Table 1. Model Fit Indices for 1-8 Class Solutions of Social Media Use Patterns……45

Table 2. Average use (mean, SE) of social media site use) among the five latent Classes and in the full sample, weighted (n=1062)…….……...…….46

Table 3. Characteristics of the five latent classes and in the full sample, weighted…....48

Table 4. Adjusted logistic regressions of health-related risk behaviors and factors by latent class, weighted…….....….50

Table 5. Characteristics (survey weighted %, unweighted n) of Nonsmokers, Ever Smokers, and Full Sample…….....….67

Table 6. Association between exposure to tobacco content in social media and openness to smoking among nonsmokers…….....….68

Table 7. Association between exposure to tobacco content on social media and social smoking among ever smokers, moderated by having close friends who smoke…….....….70

Table 8. Association between exposure to tobacco content on social media and combustible tobacco use……..…….……..73

Table 9. Participant Characteristics……..…….…...……93

Table 10. Additional Quotes……..……...……105

Chapter 1: Introduction

Study Overview

Young adults' use of online social media sites is widespread, making social media a key source of exposure to pro- and anti-tobacco related content, including portrayals of smoking or messages discouraging smoking from peers. Different social media sites have different purposes, audiences, and norms, which may impact the influence social media use has on risk behaviors, including tobacco use. Additionally, peer influence through social media – given the ability of users to generate, share, and critique content – may heighten the impact tobacco-related content has on young adults' tobacco use behaviors.

Yet, there is limited scholarly literature exploring the social media use patterns (i.e. type of platforms used and frequency of use) of young adults and how they relate to risk behaviors. There is also limited research on how exposure to pro- and anti-tobacco content in social media specifically might influence tobacco use behaviors and no studies in which this question is examined among a national sample of young adults. Similarly, there have not been any efforts to understand the experience of young adults consuming tobacco-related content in social media and the role of peer influence in that process.

The objective of this dissertation is to begin filling these gaps in the current body of literature by 1) identifying distinct patterns of social media site use and their relation to health risk behaviors; 2) examining how exposure to tobacco-related content in social media is related to tobacco use behaviors; and 3) exploring the subjective experience of consuming tobacco-related content in a social media environment. These systematic investigations can help inform public health efforts to minimize the impact of pro-tobacco content and maximize the impact of anti-tobacco content in social media.

Literature Review

Tobacco Use and Young Adults

Tobacco use is the leading cause of preventable death in the United States (Centers for Disease Control and Prevention, 2011), taking 400,000 lives and resulting in over 5 million years of potential life lost annually (Centers for Disease Control and Prevention, 2008). Young adults are at a particularly vulnerable stage in terms of tobacco use, as they transition through a critical development period during which lifelong health behaviors are established (Arnett, 2000). Indeed, research has demonstrated higher rates of cigarette smoking initiation and transition to regular smoking in young adulthood (Bernat, Klein, & Forster, 2012; Foldes et al., 2010; Hammond, 2005; Lantz, 2003; Rath, Villanti, Abrams, & Vallone, 2012). In addition to having substantially higher cigarette smoking rates compared to adolescents (16.7% among 18-24 year olds in 2014 versus 9.3% among high schoolers in 2015), young adults also have high rates of dual use of cigarettes and other tobacco products (Rath et al., 2012), particularly little cigars/cigarillos (Richardson, Rath, Ganz, Xiao, & Vallone, 2013) and hookah (Barnett et al., 2013; Caroline Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; Grekin & Ayna, 2012; Jarrett, Blosnich, Tworek, & Horn, 2012). As such, the use of combustible tobacco products – products that are smoked (including cigarettes, cigars, little cigars, cigarillos, hookah, and roll your own tobacco), which account for the vast majority of the harmful health consequences of tobacco use – by young adults is a critical public health concern (U.S. Department of Health and Human Services, 2014).

A common pattern of combustible tobacco use among young adults is "social smoking," or smoking primarily in social contexts (Schane, Glantz, & Ling, 2009b), such

as while partying, socializing, or drinking alcohol with others (Berg et al., 2009, 2012; Hoek, Maubach, Stevenson, Gendall, & Edwards, 2013; Moran, Wechsler, & Rigotti, 2004; Schane, Glantz, & Ling, 2009a; Shiffman, Kirchner, Ferguson, & Scharf, 2009; Waters, Harris, Hall, Nazir, & Waigandt, 2006). Social smoking generally involves light (few cigarettes per day) and intermittent (smoking on a nondaily basis) patterns of tobacco use (Schane, Ling, & Glantz, 2010), and as such, social smokers do not view themselves as addicted to nicotine and generally categorize themselves as nonsmokers (Schane et al., 2009b). National surveys estimate the prevalence of social smoking among young adult (college and non-college) smokers to be between 51% and 80% (Jiang, Lee, & Ling, 2014; Lisha, Delucchi, Ling, & Ramo, 2015; Moran et al., 2004; Song & Ling, 2011; Villanti, Rath, & Vallone, 2012). The social environment can prompt initiation of smoking and becoming an established smoker (Choi, Pierce, Gilpin, Farkas, & Berry, 1997; McCormick, 1999; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996; Waters et al., 2006). Qualitative data also suggests that social smokers perceive smoking in social situations to be an instant conversation starter and an immediate bond with strangers (Rollins, Malmstadt Schumacher, & Ling, 2002).

Indeed, peer influence plays a key role in both social smoking specifically and tobacco use more generally. Simons-Morton and Farhat identified dozens of studies in which peer smoking predicted future youth smoking (2010). This relationship may be due to processes of selection (selecting friends with similar interests) and/or socialization (being influenced by friends). Peer socialization includes overt forms of influence, such as peer pressure, as well as subtler forms of influence, such as when an individual changes attitudes or behavior based on perceived group norms. Individuals' tobacco use

behaviors can be influenced by a best friend or close friends, broader group of peers, or crowd affiliation (as youth affiliate with specific "crowds" that have unique reputations, they embrace that crowd's behaviors due to their perceptions of that crowd's reputation, as opposed to overt pressure from crowd members) (Simons-Morton & Farhat, 2010).

Young adult tobacco use behaviors are also influenced by tobacco-related communication, both pro- and anti-tobacco marketing as well as subtler pro- and anti-tobacco imagery and messages from peers and others. A large body of research indicates that tobacco marketing (including brand advertising and promotion as well as corporate sponsorship and advertising) influences initiation of smoking and broader tobacco use behavior (National Cancer Institute, 2008). Young adults in particular are an important target for tobacco industry marketing efforts (Biener & Albers, 2004; Centers for Disease Control and Prevention (CDC), 2005; Ling & Glantz, 2002). Industry documents discuss the importance of this life stage in the progression from experimental to more regular smoking, the experience of life transitions and new activities that can enable the adoption of smoking as a regular part of one's life, and the stresses of these life transitions which can foster a desire for the drug effects of the nicotine in tobacco (Ling & Glantz, 2002). Since the 1990s, the industry has increased the use of age-specific promotions like bar promotions and sponsored activities aimed at young adults, including recent innovations such as mobile cigarette lounges at concerts and bars (Mickle & Valentino-DeVries, 2016), and industry research and marketing plans reveal an emphasis on this age group, which is the youngest legal marketing target for the tobacco industry (Ling & Glantz, 2002). Beyond industry-generated messages, reviews of tobacco products and brands also increase exposure to pro-smoking messaging and imagery (Elkin, Thomson, & Wilson,

2010). Additionally, depictions of smoking in entertainment media, including television and movies, have been shown to influence tobacco initiation and use (National Cancer Institute, 2008). As the internet enables increasing amounts of user generated content, depictions of smoking and commentary on tobacco brands and use by peers that are shared online represent another source of pro-smoking imagery and messages (Elkin et al., 2010; Kostygina, Tran, Shi, Kim, & Emery, 2016; Kostygina, Tran, Szczypka, Binns, & Emery, 2015; Szczypka, 2015).

On the other hand, tobacco control mass mediated campaigns, other tobacco control communication interventions, and anti-tobacco interpersonal communication (including via the internet) from family, peers, and others can also influence young people's tobacco-related attitudes and behaviors, potentially preventing them from initiating smoking or encouraging them to quit using tobacco (Hwang, 2012; Jeong, Tan, Brennan, Gibson, & Hornik, 2015; National Cancer Institute, 2008; Thrasher et al., 2016). Public-health-sponsored anti-tobacco mass mediated campaigns have generally focused on the health risks of smoking, exposure to secondhand smoke, questioning the tobacco industry, and the declining social acceptability of smoking (National Cancer Institute, 2008). Current national anti-tobacco mass mediated campaigns include Tips for Former Smokers (an adult smoking cessation campaign led by the Centers for Disease Control and Prevention (CDC)), The Real Cost (a youth smoking prevention campaign focused on the harmful effects of tobacco use led by the Food and Drug Administration (FDA)), and the truth® FinishIt campaign (a youth and young adult smoking prevention campaign encouraging youth to be the generation that ends smoking led by the nonprofit Truth Initiative) (AdWeek, 2014; Centers for Disease Control and Prevention, 2016;

Food and Drug Administration, 2016). There is a substantial body of literature indicating that anti-tobacco mass mediated campaigns – both alone and in conjunction with school- or community-based programming – reduce smoking in youth and adult target populations (National Cancer Institute, 2008). Other types of tobacco control communication interventions include school-based education and social skills interventions (for which evidence has been mixed, with effects limited to short-term outcomes) (Thomas, McLellan, & Perera, 2013) and graphic warning labels on tobacco packages (which have been shown to lower smoking prevalence and increase quit attempts and short-term smoking cessation) (Noar et al., 2016). Although there is limited research regarding the direct effects of interpersonal communication (whether with parents, friends, healthcare providers, or others) on tobacco use behavior (U.S. Department of Health and Human Services, 2012), interpersonal communication has been shown to exert an indirect effect on tobacco use by amplifying the positive effects of tobacco control mass mediated campaigns and graphic warning labels on reducing tobacco use and increasing smoking cessation (Hwang, 2012; Jeong et al., 2015; Thrasher et al., 2016).

One key source of both tobacco-related communication and peer influence – especially among young adults – is social media.

Social Media

Young adults are heavy users of social networking sites (also known as social media) – which include Facebook, YouTube, Twitter, Instagram, Snapchat, Pinterest, and Tumblr, and are used by billions of people globally (Kamber, 2013). Ninety percent of 18-29 year olds used these sites as of 2015 (in contrast to only 65% of adults overall)

(Perrin, 2015). In a more recent study, 97.5% of young adults ages 18-24 reported regular use of at least one social media site, with the top five sites being Tumblr (85.5%), Vine (84.7%), Snapchat (81.7%), Instagram (80.7%), and LinkedIn (78.9%). There was significant overlap (81-90%) in use of multiple sites, with respondents regularly using 7.6 sites on average (Villanti, Johnson, Ilakkuvan, et al., 2017).

Young adults also spend more time on these sites than older adults, averaging over three hours a day across their social media accounts – this includes about 50 minutes per day using Facebook and Tumblr and 20-30 minutes per day using Instagram, Pinterest, Twitter and Snapchat (Emarketer, 2014). Additionally, 67% of young adults access social media on their smartphones, which means these sites are continuously available and accessible to them throughout the day (Holson, 2014; Pew Research Center, 2013).

Social media refers to sites that enable users to create and share their own content, critique and rank others' content, and interact both with content and each other (Papasolomou & Melanthiou, 2012; Tuten, 2008). In addition to allowing users to generate, post, and share their own content (including text posts, images and videos), most social media sites include features that allow users to provide feedback on content; they can "like" the piece of content, comment on it, and/or share it with their own networks. Unlike the subjective interpretation of qualitative feedback involved in most in-person communication, these social media tools enable highly visible and quantifiable forms of social endorsement (Sherman, Payton, Hernandez, Greenfield, & Dapretto, 2016).

Different social media platforms have different purposes, features, content, audiences, and norms. For instance, Twitter users often engage with individuals they do not know or do not know well, participating in "water cooler" conversations on a national or even global scale, connecting over common interests (Goldstein, 2011). Facebook social networks, on the other hand, are generally dominated by those a user knows well – family, friends, and other acquaintances – and thus is often used as a platform to share personal experiences (vacation photos, memorable or notable life events, etc.). YouTube, with 400 hours of video uploaded every minute (Jarobe, 2015), is used by companies and others to share professionally generated content as well as by the general public to share user generated content. Indeed, many social media sites have carved out unique identities: Linked In is a professional networking site, Pinterest is used to find and share craft, home improvement, cooking, and other ideas, Tumblr is a social blogging platform where users share and discuss multimedia content, and Snapchat is a messaging application (app) to send photos and videos that disappear after they have been viewed. Platforms like Instagram, Snapchat, Pinterest, and YouTube are primarily based on visual media (images and videos), whereas as other sites include substantial amounts of written text in addition to visual content. The demographics of these sites' user base varies as well – Snapchat, Vine and Tumblr user bases are younger; Pinterest users are predominantly women; more Blacks and Hispanics use Instagram than Whites; and LinkedIn users are more highly educated with higher incomes (Duggan, 2015; Hoelzel, 2015). Given this variation across social media sites, social media use patterns (the social media platforms one uses and the frequency with which one engages with these sites) likely contributes to

the degree of exposure one has to different kinds of messaging, including the quantity and nature of exposure to tobacco-related content.

Exposure to Tobacco-Related Messages in Social Media

The quantity of exposure to pro- or anti-tobacco content makes a difference in tobacco use behaviors, due to a number of potential reasons, including increased opportunities to learn a specific message, stronger beliefs about issue importance and social expectations, and increased likelihood of stimulating social discussion (Hornik, 2002a).

In terms of pro-tobacco content, studies strongly suggest a dose-response relationship between total number of tobacco advertisement exposures and susceptibility to smoking (Dube et al., 2013), between the number of cigarette promotional items (i.e., branded apparel or other items) owned and smoking uptake (Sargent, Dalton, & Beach, 2000), and between exposure to movie smoking and smoking onset (Sargent, Gibson, & Heatherton, 2009). In terms of anti-tobacco content, Hornik has suggested that "failure and success in public health communication is better predicted by variation in exposure to messages achieved than it is by variation in quality of messages"(Hornik, 2002b), and indeed, research has demonstrated a dose-response relationship between level of tobacco education advertising exposure and calls to quitlines as well as between level of exposure to a youth tobacco prevention mass mediated campaign and youth smoking prevalence (Davis et al., 2015; Farrelly, Davis, Haviland, Messeri, & Healton, 2005; Sly, Trapido, & Ray, 2002).

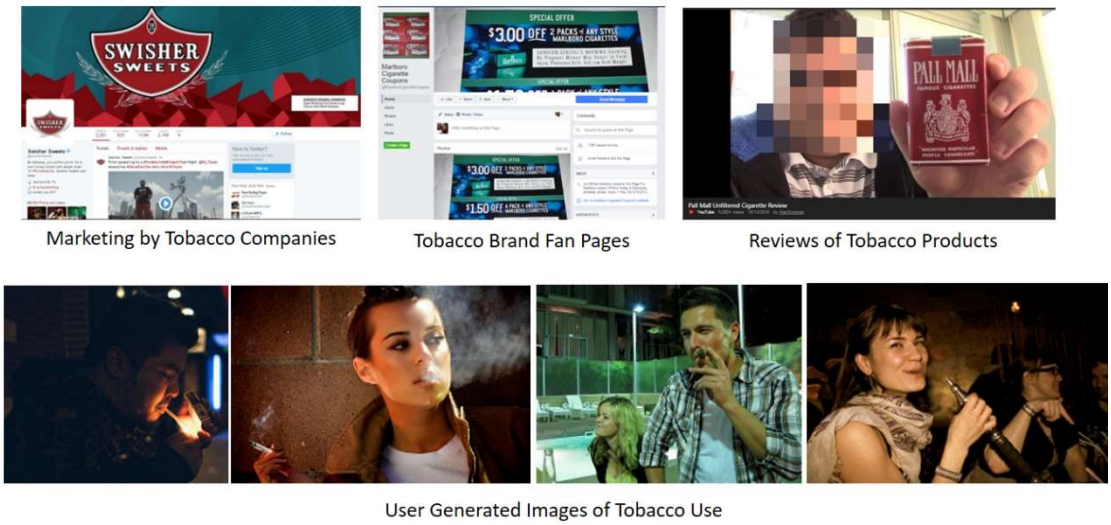
In addition to the quantity of exposure (i.e., dosage), the nature of one's exposure to tobacco-related content influences attitudes and behaviors. This includes the actual

content of a message, as well as the source, two key aspects of any communication that play an important role in whether and how much the message influences the receiver (Shannon & Weaver, 1949). Social media use patterns, particularly the social media platforms one uses, likely influences the nature of tobacco-related content one experiences. A range of both pro- and anti-tobacco content from a variety of sources can be found in social media.

Pro-Tobacco Content in a Social Media Environment

Pro-tobacco content found in social media (see Figure 1) includes marketing by tobacco companies, tobacco brand fan pages, reviews of tobacco products (often posted by tobacco users), and messages that mention tobacco use or images depicting tobacco use posted by tobacco users (Burton, Soboleva, & Khan, 2015; Freeman & Chapman, 2010; Guidry, Jin, Haddad, Zhang, & Smith, 2016; Link, Cawkwell, Shelley, & Sherman, 2015; Richardson, Ganz, & Vallone, 2014; Richardson & Vallone, 2014; Step, Bracken, Trapl, & Flocke, 2016; Szczypka, 2015).

Figure 1. Examples of Pro-Tobacco Content Found in Social Media



Photos under "User Generated Images" are CC images courtesy of the following users on Flickr (from left to right): Guian Bolisay (https://www.flickr.com/photos/instantvantage/7153745523/), Mark Sebastian (https://www.flickr.com/photos/markjsebastian/2752162749/), rockandbacon (https://www.flickr.com/photos/rockandbacon/4617489355/),Chelsea Marie Hicks (https://www.flickr.com/photos/seafaringwoman/5772041470/)

With increasing restrictions on their ability to market and promote products through more traditional media channels (National Association of Attorneys General, 1998; US Government Printing Office, 1970, 2009), tobacco companies have turned to the internet – a space that is both less regulated and more difficult to regulate (Freeman & Chapman, 2008) – to engage consumers. Although most social network sites have policies forbidding direct advertising of tobacco products – including Facebook, which stipulates that advertisements and commercial content cannot promote or facilitate the sale or consumption of tobacco products – these restrictions are difficult to enforce and often apply only to paid advertising or explicitly commercial content (Dunlop, Freeman, & Perez, 2016; Facebook, 2016a, 2016b; Google, 2016).

Although many top tobacco brands do not have an official presence on social media, some do, such as Swisher Sweets, a leading cigar brand which has a verified

Twitter account (https://twitter.com/SwisherSweets/). Researchers have also identified a social media campaign launched by Imperial Tobacco to promote its "Smoke Spots" website in the UK (a website for smokers to help them find tobacco retail outlets and bars, restaurants, and clubs with smoking facilities). The campaign around "Smoke Spots" includes a YouTube channel, Facebook page, and Twitter account, with social media posts promoting smoking and smoking locations (Burton et al., 2015). An early study in 2010 also documents how British American Tobacco (BAT) employees were promoting the company and its brands on Facebook by joining and administrating groups and joining pages as fans to share photographs of BAT events, products and promotional items (Freeman & Chapman, 2010). More recently, Snoop Dogg (an American rapper, record producer and actor) uploaded photographs to Instagram – where he has over 1.6 million followers – endorsing Executive Branch cigars. Notably, he serves as an official "Ambassador" and is said to have "hand chosen" the tobacco to "ensure the highest quality"(Richardson et al., 2014).

In addition to social media content directly from top tobacco brands and companies, a number of tobacco vendors and other users have created accounts, fan pages and other content on social media specific to cigarette brands. Liang and colleagues conducted searches on Facebook, Wikipedia, and YouTube using the top 70 popular cigarette brands as keywords, and found over 200 Facebook cigarette brand fan pages (featuring 43 different brands), 46 cigarette brand pages on Wikipedia, and over 120,000 pro-tobacco videos on YouTube (associated with 61 different cigarette brands). The pro-tobacco content found on these three sites varied, with Wikipedia pages focusing on history and culture (67%, 32/48) and major product features (56%, 27/48), Facebook

pages covering history and culture (37%, 16/43) and major products (35%, 15/43), and YouTube focusing on features of major tobacco products (79%, 48/61) and information about Web-based tobacco shops (49%, 30/61). Sales promotions (such as price discounts, coupons, free shipping, no tax, and embedded URLs of tobacco shops) were prevalent, particularly on YouTube (64%, 39/61) and Facebook (35%, 15/43) (Liang et al., 2015b). In another study of tweets related to little cigar and cigarillo use, researchers found a small group (<1%) of highly active accounts posting commercial tweets (links to websites that sell/promote little cigars and cigarillos, information on price discounts and coupons, and branded promotional messages) (Kostygina et al., 2016, 2015).

In addition to this commercial material featuring explicit brand and product promotions and other professionally created materials such as music videos (which are a common source of smoking imagery in social media (Cranwell et al., 2015; DuRant et al., 1997)), social media enables the general public to share user-generated content featuring messages and images about smoking, greatly increasing the volume of the pro-tobacco content individuals are exposed to in social media. While friends posting status updates referencing their tobacco use or images and videos that include someone smoking may not be an explicit promotion of a tobacco product, these more subtle pro-smoking messages may be equally if not more influential, particularly in a social media context, as detailed in the following section on peer influence.

Researchers have documented an extensive array of such user-generated pro-tobacco content on social media pertaining to all major types of combustible tobacco (cigarettes, cigars and little cigars, and hookah), the vast majority of which portrays smoking in a positive light. In a study assessing the amount and type of smoking imagery

and cigarette brand content on Instagram (an online photo sharing site and one of the fastest growing social networks), three common types of images were identified: images of tobacco products, tobacco selfies, and smoke clouds (Szczypka, 2015). In a study of user interaction on tobacco-related Facebook fan pages, researchers found that nearly half (43%) of the top 35 influential fan pages were promoting tobacco (Liang et al., 2015b). In a 2009 analysis of 163 of the top tobacco brand-related videos on YouTube, most (71.2%) had pro-tobacco content while only a few (3.7%) had anti-tobacco content. Most of these videos included tobacco brand content (70.6%), the tobacco brand name in the title (71.2%) or smoking imagery content (50.9%), and the most prevalent themes were celebrity/movies, sports and music (Elkin et al., 2010). In another 2009 analysis of the 124 top YouTube videos that result from a YouTube search for "cigarettes" and "smoking cigarettes", researchers found only 20 videos that portrayed smoking in a negative light, compared to 101 portraying smoking in a positive light. Among these smoking-positive videos, the most common content included music (27 videos) and smoking fetish (eroticized smoking portrayal) (26 videos) (Forsyth & Malone, 2010). In a content analysis of 200 smoking fetish YouTube videos, 96.9% explicitly portrayed smoking, 97.9% featured images of models holding their tobacco products, and 29.9% showed the models lighting up. Almost all of these videos (98.5%) featured a tobacco product, and 91% featured cigarettes (Kim, Paek, & Lynn, 2010).

YouTube has also been found to be a common source for videos featuring little cigars and cigarillos. In one study, researchers examined the top YouTube search results related to little cigars and cigarillos (LCCs) and found that the majority of the 56 unique videos examined were pro LCCs, 11 were neutral, and only two were anti LCCs. Most of

the videos were user-generated (i.e., not professionally made) and common themes included where to purchase LCCs, their candy flavors, and that they are cheap or cheaper than cigarettes, and "smooth" (Richardson & Vallone, 2014). In another study, the vast majority (99%) of accounts posing about LCCs on Twitter were found to be non-commercial, and their tweets were found to frequently contain references to marijuana (83%) and memes (29%), as well as flavors, rap/hip-hop, and urban subculture (Kostygina et al., 2016, 2015). Messages about LCCs are also common on other social media sites including Twitter and Instagram. A thematic analysis of nearly 300 public tweets and profile photos sampled from a search of two top LCC brands revealed prevalent content themes to include expressing affiliation for the LCC product and reporting smoking activity (Step et al., 2016). In a content analysis of 2000 images of different LCC brands on Instagram, researchers found that images frequently featured LCC packages, partially smoked cigarillos, and blunts (cigars rolled with marijuana) which are often posed for the photograph (Mosley, Tomc, Tracy, Walker, & Bracken, 2014).

References to hookah in social media have also been examined in a number of studies, with results suggesting that hookah smoking is portrayed in a more positive light than cigarette smoking. In a comparison of cigarette-related and hookah-related videos on YouTube, cigarette-related videos were less likely than hookah-related videos to portray tobacco use in a positive light (24% vs 92%, $p<0.001$) and more likely to mention short-term consequences (50% vs 18%, $p<0.001$) and long-term consequences (44% vs 2%, $p<0.001$), contain explicit anti-smoking images (39% vs 0%, $p<0.001$), and provide specific information on how to quit (21% vs. 0%, $p<0.001$) (Carroll, Shensa, & Primack,

2013). In an analysis of over 7000 tobacco-related tweets, researchers found tweets about hookah corresponded to positive sentiment while those about traditional tobacco products and more general references corresponded to negative sentiment (Myslín, Zhu, Chapman, & Conway, 2013a). In a content analysis of 800 Pinterest posts featuring hookah smoking, most pins appealed to positive emotions such as a sense of pleasure and relaxation (47.5%, n=380) and a sense of beauty and aesthetic (45.9%, n=367), and less than 1% of pins appealed to a negative emotion (0.9%, n=7). Nearly all pins (98.9%, n=791) did not address hookah smoking-related health risks (Guidry et al., 2016). In a study including 20 hookah smokers, 70% had references to hookah on their social media profiles and most were exposed to hookah-related content posted by friends in their social media network (Link et al., 2015).

Anti-Tobacco Content in a Social Media Environment

Anti-tobacco content found in social media (see Figure 2) includes anti-tobacco public health communication and marketing efforts, smoking cessation content – including content that is part of cessation interventions, content related to tobacco control advocacy, and user-generated anti-tobacco messages (which may include sharing any of the aforementioned anti-tobacco content from public health campaigns, smoking cessation efforts, or tobacco control advocacy initiatives) (Baskerville, Azagba, Norman, McKeown, & Brown, 2016; Duke, Hansen, Kim, Curry, & Allen, 2014; Emery, Szczypka, Abril, Kim, & Vera, 2014a; Freeman, 2012; Haines-Saah, Kelly, Oliffe, & Bottorff, 2015; Hefler, Freeman, & Chapman, 2012; Ilakkuvan, Cantrell, Hair, & Vallone, 2015; Jacobs, Cha, Villanti, & Graham, 2016; Pechmann, Delucchi, Lakon, &

Prochaska, 2016; Prochaska, Pechmann, Kim, & Leonhardt, 2012; Ramo, Thrul, Chavez, Delucchi, & Prochaska, 2015; Szczypka et al., 2015).

Figure 2: Examples of Anti-Tobacco Content Found in Social Media

For example, national mass mediated anti-smoking campaigns, such as the CDC Tips for Former Smokers campaign, the FDA Real Cost campaign, and the truth® campaign, have a social media presence. This includes social media profiles, posts, and advertising directly from the campaigns themselves, sharing advertisements, key campaign messages, and related information. All three national anti-smoking campaigns have YouTube channels (CDC's Tips from Former Smokers "playlist", The Real Cost, and truthorange) in addition to other social media profiles, such as @CDCTobaccoFree on Facebook and Twitter, @TheRealCost on Instagram and KnowTheRealCost on Facebook and Tumblr, and @truthorange on Facebook, Twitter, and Instagram. In a 2015 analysis of the truth® campaign's social media presence, and in particular social media audience growth and engagement on Facebook, Twitter, and YouTube, researchers found

that patterns in audience growth and engagement were highly reflective of the campaign's social media paid promotion strategies, with 12,000 Twitter engagements (mentions, replies, retweets, and favorites), 14,000 Facebook engagements (likes, comments, and shares), and over 1.5 million YouTube views during a week in which two new advertisements premiered at the MTV Video Music Awards, in coordination with high levels of paid social media promotion (Ilakkuvan et al., 2015). This suggests that the direct presence of anti-smoking campaigns on social media can propel high levels of reach and engagement.

In addition to such direct presence, anti-smoking campaigns – particularly those with national reach and visibility – can elicit conversation on social media from other organizations, the news media, celebrities, and the general public. Online news and policy blog coverage of the Tips from Former Smokers (from March through June 2012) generated social media conversation, including over 1000 Facebook shares and over 400 Tweets (Kornfield, Smith, Szczypka, Vera, & Emery, 2015), and the overall Twitter conversation about Tips from Former Smokers (from March through June 2012) included nearly 200,000 tweets about the campaigns (of which 87% were classified as message acceptance, meaning they were in line with the key messages of the Tips campaign about the dangers of smoking) (Emery, Szczypka, Abril, Kim, & Vera, 2014b). In addition, there were over 60,000 tweets related to the truth® campaign between August and October 2014, of which over half were retweets and 63% classified as organic (tweets by the general public) and 30% as earned (tweets by media outlets and other organizations), along with 0.05% from celebrities (Szczypka et al., 2015).

Local anti-smoking campaigns and public health communication around tobacco use add to anti-tobacco social media presence. In a study of user interaction on tobacco-related Facebook fan pages, researchers found that social media is utilized by regional public health and advocacy organizations (such as TobaccoFreeFlorida) to engage in anti-tobacco communication and campaigns and that there are over 600 tobacco control and over 700 tobacco cessation fan pages, but that the vast majority have a very limited number of followers and user interaction compared to pro-tobacco fan pages (Liang et al., 2015a). Public health departments and state tobacco control programs use social media to spread messages discouraging smoking and encouraging smoking cessation (Duke et al., 2014; Thackeray, Neiger, Smith, & Van Wagenen, 2012). According to a study of the use of social media by state tobacco control programs to promote smoking cessation, 60% of these 50 programs were using social media (60% had a Facebook page, 36% had a Twitter page, and 40% had a YouTube channel), with varying reach across sites and states. However, most programs had very limited social media reach – 73% of those with a Facebook page has fewer than 100 likes per 100,000 adults in the state, 61% of those with a Twitter page had less than 10 followers per 100,000 adults, and only seven states updated their social media sites daily (Duke et al., 2014).

In addition to media campaigns and communication, smoking cessation interventions have also used social media to reach their audience. In an analysis of quit smoking accounts on Twitter, 153 accounts were identified, of which 81 were active, with a median of 155 followers and 82 total tweets per account. Study authors also found that posted content was largely inconsistent with clinical guidelines and that 48% linked to commercial sites for quitting smoking and 43% had tweets about e-cigarettes

(Prochaska et al., 2012). According to one study examining the effect of a web and social media based smoking cessation effort in Canada, called Break it Off, the intervention reached over 35,000 young adults and those participating in the intervention were more likely (OR=2.95, $p<0.001$) than participants of a traditional cessation helpline service to have quit smoking for 30 days and more likely (OR=2.69, $p=0.04$) to have made a quit attempt (Baskerville et al., 2016). A Facebook-based smoking cessation intervention for young adults, which was based on clinical guidelines, was tested among 79 participants; retention was 72% at 12 months, with a significant increase in the proportion prepared to quit (from 13% to 46%) (Ramo et al., 2015). A novel Twitter intervention, Tweet2Quit, which sends daily, automated communications to small, private, self-help groups to encourage high-quality, peer-to-peer online conversation about smoking cessation was tested in a randomized controlled trial of 160 smokers, and results demonstrated that the intervention doubled sustained abstinence by 60 day follow up (40% vs. 20% in the control group) (Pechmann et al., 2016). Another novel intervention used an online photo group on Facebook to engage young adult smokers and recently quit former smokers to provide peer support and motivate critical reflection about tobacco use and cessation (Haines-Saah et al., 2015). Social media has also been used to recruit smokers to smoking cessation interventions (administered outside of social media) (Bold, Hanrahan, O'Malley, & Fucito, 2016; Frandsen, Walters, & Ferguson, 2014; Ramo, Rodriguez, Chavez, Sommer, & Prochaska, 2014), and to get smokers to recruit other smokers to such interventions through peer marketing (Sadasivam et al., 2016), which can increase social media users exposure to messages encouraging quitting smoking.

While anti-smoking and quit smoking messaging are the most prevalent types of anti-tobacco content on social media, there is some social media content around tobacco control advocacy, such as advocacy against tobacco sponsorship of youth-targeted events, posting protests against the tobacco industry, sharing and garnering signatories to online petitions in favor of tobacco control policies and other strategies, and generating and sharing news coverage in support of tobacco control events, policies, and other efforts (Freeman, 2012; Hefler et al., 2012).

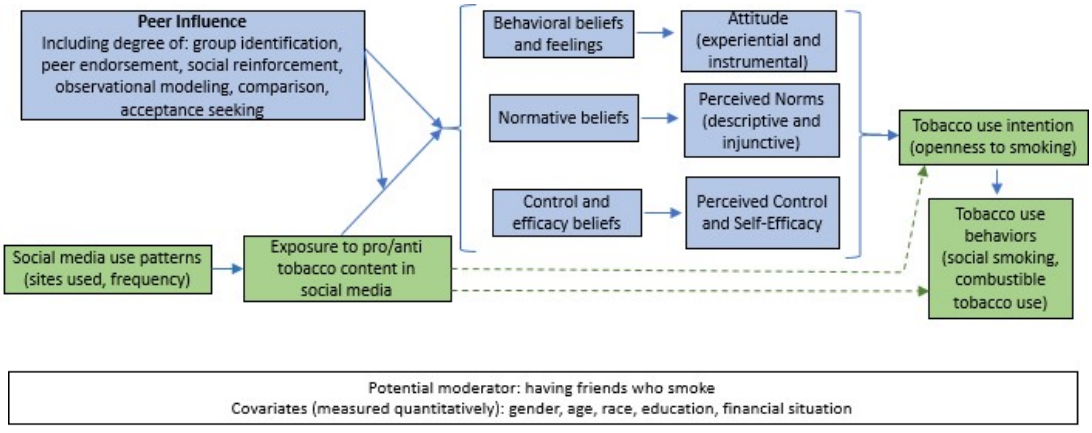
Peer Influence and its Role in Social Media Message Processing

Exposure to pro- and anti-tobacco content on social media may be particularly influential on young adults' tobacco-related attitudes and behaviors due to the role of peers. The global reach of social media, combined with aforementioned unique features of social media in terms of providing a space for user generated content and interpersonal interaction, makes social media a critical channel for peer influence.

The conceptual framework upon which this dissertation is based (see Figure 3) is rooted in the Integrated Behavior Model (which combines constructs from the Theory of Planned Behavior, Social Cognitive Theory, and the Health Belief Model) (Chen & Chaiken, 1999; Institute of Medicine, 2002; Montano & Kasprzyk, 2008; Patel et al., 2013), and incorporates additional constructs from social influence/peer influence theories (Asch, 1956; Bandura, 1978, 1986; Chatzisarantis, Hagger, Wang, & Thøgersen-Ntoumani, 2009; S. Choi, 2015; Deutsch & Gerard, 1955; Festinger, 1954; Griggs, 2012; Latane, 1981; Litt, Lewis, Stahlbrandt, Firth, & Neighbors, 2012; Mahler, Kulik, Gerrard, & Gibbons, 2010; Mead, Rimal, Ferrence, & Cohen, 2014; Eugene R. Oetting, Deffenbacher, & Donnermeyer, 1998; Petraitis, Flay, & Miller, 1995; RN Rimal & Real,

2005; Thorson & Wells, 2012). The framework posits that exposure to tobacco-related content in social media – from both peer and other sources – has an influence on behaviors through the following pathway: this content influences 1) behavioral beliefs and feelings, which influence attitudes; 2) normative beliefs, which influence perceived norms; and 3) control and efficacy beliefs, which influence perceived control and self-efficacy. In turn, attitudes, norms, and perceived control and self-efficacy influence tobacco use intention, and ultimately behavior. Critically, this framework posits that peer influence plays a key role in this process – directly influencing beliefs and related attitudes, norms, and perceived control and self-efficacy, as well as influencing the way in which exposure to tobacco-related content in social media influences beliefs and related attitudes, norms, and perceived control and self-efficacy. The theoretical grounding behind the key pieces of this pathway are detailed in the sections below.

Figure 3. Dissertation Conceptual Framework



- Green boxes indicate variables that will be measured quantitatively and examined qualitatively
- Blue boxes indicate constructs that will be examined through qualitative data only
- Green arrows indicate causal relationships that will be tested quantitatively [as associations]
- Blue arrows indicate causal relationships that will not be measured/tested quantitatively

Message Effects

The way tobacco-related content in social media is processed by young adults impacts their tobacco-related knowledge, attitudes, beliefs and importantly, their tobacco-related social norms, as described by the Integrated Behavior Model (Montano & Kasprzyk, 2008).

The Integrated Behavior Model proposes that knowledge, attitudes, beliefs; descriptive norms (individuals' perceptions about the prevalence of a behavior) and injunctive norms (individuals' perceptions about peer approval and disapproval of a behavior, and their experience with the pressure to conform); and self-efficacy (individuals' perception of their ability to engage in a particular behavior) and perceived control (individuals' perception of the degree to which it is within their control to engage in a particular behavior) all influence behavioral intention and subsequently, actual behaviors (Montano & Kasprzyk, 2008; Tavousi et al., 2009). In the context of this study, tobacco-related content on social media is expected to most directly influence knowledge, attitudes, beliefs, and norms, with more limited influence on perceived control and self-efficacy. All of these constructs, in turn, are expected to influence tobacco use intention and subsequently, tobacco use behaviors.

Norms are codes of conduct that allow or disallow behaviors among a group of individuals, and are understood through social interaction as opposed to explicitly codified. There are two key types of social norms, descriptive and injunctive. Descriptive norms are individuals' perceptions about the prevalence of a behavior, while injunctive norms are individuals' perceptions about peer approval and disapproval of a behavior, and their experience with the pressure to conform (Cialdini, Reno, & Kallgren, 1990;

Rajiv N. Rimal & Real, 2003). The role of norms is of particular importance in the context of peer influence, because social norm formation is theorized to occur via "social exposure", the combination of avenues through which individuals experience or otherwise come into contact with certain behaviors in their environment (Mead et al., 2014). Social exposure encompasses both actual behavior prevalence and acceptability as well as cues about behavior prevalence and acceptability in an individual's social, physical, and symbolic environments (Mead et al., 2014), such as social media.

The presence of tobacco-related content in social media is likely a key component of tobacco-related social exposure for young adults, making it influential in shaping tobacco-related social norms. Both descriptive and injunctive norms can be influenced by the tobacco-related messages and images young adults see in social media (Mead et al., 2014; National Cancer Institute, 2008). Seeing anti-tobacco marketing, a picture of a friend smoking at a party, or friends' positive comments in response to a picture of a cigarette smoke cloud on social media can all influence individuals' perception of both how prevalent tobacco use is among their peers and also how acceptable tobacco use is among their peers. Given that individuals are exposed to messages and depictions from their friends, celebrities, and companies they have chosen to follow on social media, the social media context may be particularly powerful in the formation of social norms, which is a key piece of how individuals interpret and make meaning of the content they see.

Social Influence/Peer Influence

There is a large body of research exploring social influence – the nature and extent to which individual and group attitudes and behavior are influenced by others and

their opinions, judgments, and behaviors (Berkman, 2000; Klucharev, Hytönen, Rijpkema, Smidts, & Fernández, 2009; Knoll, Magis-Weinberg, Speekenbrink, & Blakemore, 2015; Simons-Morton & Farhat, 2010; Walker & Andrade, 1996; Zaki, Schirmer, & Mitchell, 2011). One theory of social influence, primary socialization theory, posits that norms for social behaviors, including drug use, are largely learned in the context of interactions with primary socialization sources. These interactions transmit norms by placing certain behavioral expectations on individuals, monitoring and reinforcing these expectations, providing feedback and reward when expectations are met, and imposing sanctions when expectations are not met. Primary socialization sources change across the lifespan, and include family, teachers, colleagues, peers, and other direct sources of social contact. According to primary socialization theory, secondary socialization sources – including media and community characteristics – also influence behavior, but do so through their influence on primary socialization sources or the process of socialization (Oetting & Donnermeyer, 1998; Oetting et al., 1998).

Peers are a particularly importance primary socialization source, especially in adolescence and young adulthood, and are usually the major source of deviant norms, including those supportive of substance use (although peers can also transmit prosocial norms) (Oetting & Donnermeyer, 1998; Oetting et al., 1998). Adolescence and young adulthood are times when new identifies, friendships and peer group affiliations are established and parental influences gradually diminish (Huang, Unger, et al., 2014; Kobus, 2003; Simons-Morton & Farhat, 2010). During such times of transition, individuals are particularly sensitive to peer feedback as a source of understanding their own identity (Institute of Medicine and National Research Council Committee on the

Science of Adolescence, 2011; Prinstein, 2009). Adolescence and young adulthood are also often life stages when individuals spend increasing amount of time with their peers (Cillessen, Schwartz, & Mayeux, 2011; Reitz, Zimmermann, Hutteman, Specht, & Neyer, 2014), with peers modeling, reinforcing and influencing attitudes and often providing access, encouragement, and an appropriate social setting for engaging in certain behaviors (Glaser, Shelton, & van den Bree, 2010; Tomé, Matos, Simões, Diniz, & Camacho, 2012). There is also evidence that youth and young adults are more concerned with obtaining social acceptance in peer groups than older adults (Cillessen et al., 2011; Reitz et al., 2014).

During young adulthood, when peer influence is particularly powerful, social media enables constant and real-time information and feedback from peers. Social media users can receive messages directly from their peers, who use social media channels to share their attitudes, beliefs, and behaviors in the form of videos, photographs, status updates, and other content. Content directly from a peer source has a strong influence on beliefs in part because, as outlined in Bandura's Social Cognitive Theory, the opinions and behaviors of peer role models influence individuals' expectations about the consequences of the behavior and their belief in their ability to engage in/avoid the behavior (i.e., self-efficacy and refusal self-efficacy) (Bandura, 1978, 1986; Petraitis et al., 1995). Notably, beliefs produce attitudes, norms, and perceived control and self-efficacy in the Integrated Behavioral Model (Chen & Chaiken, 1999; Institute of Medicine, 2002; Montano & Kasprzyk, 2008; Patel et al., 2013).

In addition to content directly from a peer source, social media users also see – through "likes", comments, shares, and other tools for critiquing and ranking on social

media – how their peers are responding to and reacting to social media content. In line with the two-step flow of communication model first introduced by Lazarsfeld, individuals are not only influenced by messages directly from their source; these messages flow through "opinion leaders" - who are similar to those they influence, and oftentimes are friends and peers – and these leaders' interpretation of the original message impacts individuals' perception of and reaction to the original message (Choi, 2015; Katz & Lazarsfeld, 1955; Lazarsfeld, Berelson, & Gaudet, 1948). This theory has been extended to contemporary information flows (include those online and on social media) by Thorson and Wells, who suggested a comprehensive framework of curated flows that includes the socially curated flow – the information flow curated by one's social network – and posit that the two-step flow-of communication is relevant to socially curated flows, where "socially-located opinion leaders" spread information and opinions to others in their network (Choi, 2015; Thorson & Wells, 2012).

In both cases – whether peers are the direct source of messages or providing feedback on messages from other sources – peer influence theories shed light on a number of specific mechanisms and processes through which peer influence manifests. These include:

- Observational Modeling: individuals observe and imitate behaviors they see their peers engaging in (a construct from Bandura's Social Cognitive Theory) (Mead et al., 2014)
- Social Reinforcement: individuals engage in behaviors they perceive their peers approve of (a construct from Bandura's Social Cognitive Theory) (Mead et al., 2014)

- Acceptance Seeking: individuals conform to certain attitudes and behaviors in order to be liked and accepted by the group, a tendency that arises from the fundamental human need to belong to social groups (a psychological construct called normative social influence) (Asch, 1956; Deutsch & Gerard, 1955; Griggs, 2012)
- Group Identification: when individuals identify strongly with a particular group and/or aspire to be like them, the individuals' attitudes, intentions and behaviors are more influenced by those of the group (a construct from the Theory of Normative Social Behavior) (Chatzisarantis et al., 2009; RN Rimal & Real, 2005)
- Comparison: individuals compare their personal attributes to those of others in order to better evaluate and define themselves, which can lead to changes in attitudes and behaviors (a construct from Social Comparison Theory) (Festinger, 1954; Litt et al., 2012; Mahler et al., 2010)

These mechanisms and the influence they have on young adults may be heightened in a social media context given the immediacy, frequency, and scale of information flow. Social Impact Theory posits that the impact of social influence on an individual is a multiplicative function of the strength (importance of a given source to the target), immediacy (closeness in space or time) and number of other people (Latane, 1981). In a social media context, young adults are often connected to a large number of peers, including those of importance to them (close friends, those of high social status one wishes to associate with or impress, and so on), constantly and in real-time. Thus, social influence would be expected to be heightened in this context. Additionally, the advent of social media brought together the power of interpersonal persuasion with the

reach of mass media for the first time, a phenomenon that B.J. Fogg has dubbed "mass interpersonal persuasion". Fogg calls this "the most significant advance in persuasion since radio was invented in the 1890s", noting that online social networks enable individuals to change others' attitudes and behaviors – that is, exert social influence – on a mass scale (Fogg, 2008).

Evidence of Peer Influence on Health Behaviors via Social Media

Given the role of social media in the formation of social norms, which play a key role in driving behaviors, researchers have explored the impact of social media use on a range of negative and positive health behaviors and associated social norms, as well as the degree to which peer influence in a social media context may play a role in this process (Huang, Unger, et al., 2014; Laranjo et al., 2014; Moreno & Whitehill, 2014).

In a 2014 systematic review of studies evaluating the use and effectiveness of interventions using social media to change health behaviors, Laranjo et al. examined 12 relevant studies (involving a total of over 7000 participants) focused on a range of a health behaviors (weight loss, physical activity, risky sexual activity, smoking abstinence, etc.), and concluded based on a meta-analysis of the 8 randomized controlled trials included in these studies that social media interventions had a positive effect on health behavior outcomes (Hedges' g (effect size) 0.24; 95% CI 0.04 to 0.43) but that there was considerable heterogeneity, in part because of most studies evaluated multi-component interventions, making it difficult to isolate the specific effects of social media (Laranjo et al., 2014).

While a few prior studies suggest there are relationships between high overall social media use and negative health behaviors and outcomes such as sexual behaviors

(Gebremeskel, Sessoms, Krehnbrink, Haney, & Coyne-Beasley, 2014), as well as anxiety and depression (Lin et al., 2016; Primack et al., 2017), these analyses rarely explore how differential use of specific sites may be associated with these behaviors.

Delving deeper than overall social media use, some researchers have examined the influence of exposure to peers' social media posts on risk behaviors. Moreno and Whitehill noted that young people are exposed to and display pro-alcohol messages and images through online portrayals of drinking on personal social media pages, and that such online displays of alcohol behaviors have been correlated with offline alcohol behavior and risky drinking. They theorized potential pathways by which social media might influence alcohol use and other health behaviors in adolescents and young adults, including by 1) providing and enhancing peer communication, networking and connection; 2) allowing comparison with peers using tangible information, such as photos and stated behaviors, as well as peer comments regarding this information; 3) allowing profile owners to develop an online identity and reflect and revise that identity via feedback from peers; and 4) providing an immersive experience (Moreno & Whitehill, 2014). In a study of over 1,500 tenth grade students across five Southern California high schools, friends' online pictures of partying or drinking was associated with one's own smoking (β=0.11, $p<0.001$) and alcohol use (β=0.06, $p<0.05$) six months later and adolescents without drinking friends were more likely to be affected by higher exposure to risky online pictures (β=-0.10, $p<0.05$) (Huang, Unger, et al., 2014).

In terms of tobacco use behaviors specifically, it has been established that the marketing of tobacco products and brands, designed to increase sales, influence social norms about using tobacco, and garner support for tobacco companies, is effective,

especially among young people (Lovato, Linn, Stead, & Best, 2003; National Cancer Institute, 2008; U.S. Department of Health and Human Services, 1998; Warner, 1985). Thus, the use of social media to market and promote tobacco products poses serious public health concerns. The influence of social media on tobacco use behavior specifically is only beginning to be explored in the published literature, and there is very limited examination of the role of peer influence in this process.

Depictions of smoking on social media may influence smoking behavior, and in one study of 200 young adults in Connecticut which followed individuals longitudinally, viewing tobacco use depictions in social media predicted future smoking, even after controlling for exposure to depictions of smoking in television and movies ($B=0.47$, $p<0.05$) (Depue, Southwell, Betzner, & Walsh, 2015). Additionally, in a study using 2011 National Youth Tobacco Survey data, researchers found that racial/ethnic minority status and younger age were associated with receiving tobacco promotions via social media, suggesting that pro-tobacco communication in social media also poses health equity concerns. Specifically, Blacks had 1.8 times the odds and Hispanics had 1.4 times the odds as Whites of receiving tobacco promotions via social media; and 11-13 year olds had almost twice the odds and 14-15 year olds had about 1.5 times the odds compared to 16-17 year olds of receiving tobacco promotions via social media (Cavazos-Rehg, Krauss, Spitznagel, Grucza, & Bierut, 2014). According to an analysis of a statewide survey of sixth, eighth, and tenth graders in Texas, exposure to and engagement with tobacco-related social media were higher among those who were susceptible to or used e-cigarettes and/or combustible tobacco (Hébert et al., 2017). In another study that included 20 hookah smokers, researchers found that those who posted on social media about

hookah had lower perceived vulnerability to the health risks associated with tobacco products (Link et al., 2015).

The only study to examine both pro-smoking and anti-smoking messages in social media is a survey of 366 college students from three Midwestern universities in 2012 that examined the effects of expression and reception of smoking-related messages in social media on smoking using path analysis. Results indicated that the expression (i.e., posting comments, questions, pictures, videos or other information) of pro-smoking messages was positively related to smoking intentions (β=0.14, $p<0.0001$) and the reception (i.e., seeing or hearing comments, questions, pictures, videos or other information) of pro-smoking messages was positively related to smoking attitudes (β=0.11, $p<0.05$). However, the expression and reception of anti-smoking messages were not significantly related to smoking intentions and attitudes. While there was no relationship between perceived peer expression of anti-smoking messages and perceived peer smoking norms, perceived peer reception of anti-smoking messages was *positively* related to perceived peer smoking norms (β=0.13, $p<0.05$), resulting in more favorable attitudes toward smoking and higher smoking intentions. Perceived peer expression of pro-smoking messages was positively associated with perceived peer smoking norms (β=0.21, $p<0.001$), while perceived peer reception of pro-smoking content had no significant association with perceived peer smoking norms. Perceived peer smoking norms, in turn, were positively related to smoking attitudes (β=0.20, $p<0.001$) and intentions (β=0.39, $p<0.001$). These results suggest that pro-smoking messages in social media are more influential than anti-smoking messages in social media in predicting college students' smoking behaviors (Yoo, Yang, & Cho, 2016).

Most of the existing research examining the influence of social media on tobacco use behavior focuses on pro-tobacco content in social media, with limited research on the effectiveness of anti-tobacco content via social media. This limited research suggests that – similar to the results of the aforementioned study of Midwestern college students – anti-smoking messages in social media may have limited influence. Specifically, studies suggest that anti-tobacco communication efforts in social media lack reach; do not follow evidence-based approaches; and fail to capitalize on the interactive potential of social media, instead serving as information portals (Duke et al., 2014; Hye-Jin Paek, Jun Bae, Hove, & Yu, 2011; Prochaska et al., 2012; Thackeray et al., 2012).

According to a review of the 50 state tobacco control programs, 30 had adopted at least one form of social media, but only 7 disseminated social media messages daily in 2013 and most had few followers (73% - 22 out of 30 states on Facebook – had less than 100 likes per 100,000 adults in the state; and 61% - 11 out of the 18 states on Twitter – had less than 10 followers per 100,000 adults in the state). Moreover, study authors found that very few states took advantage of the social media features that generate the most audience engagement (namely sharing photos and videos) or the opportunity to link to related content, such as national anti-smoking and cessation campaigns, and that overall, state tobacco control programs failed to generate a substantial amount of audience engagement (Duke et al., 2014). Similarly, in a review of the social media presence of state health departments, researchers found low numbers of followers, page likes, and subscriptions relative to the overall state population and concluded that most departments use a one-way social media communication pattern, primarily to share public information, and do not communicate in ways that reflect audience preferences, stimulate

response or discussion, or are tailored to the specific social media application (Thackeray et al., 2012). According to a 2010 review of Twitter quit smoking accounts, nearly half the accounts created over the past three years were no longer active and tweet content was largely inconsistent with clinical guidelines (Prochaska et al., 2012). And in a review of YouTube anti-smoking videos, most had low levels of message sensation value (average value = 2.92 (possible range 0-9) across 934 sample video clips), which was associated with fewer viewers, lower viewer ratings, and a lower number of comments (Paek, Kim, & Hove, 2010). Based on these findings, it is possible that anti-tobacco content in social media may not be eliciting the kind of peer response and feedback that pro-tobacco content does, diminishing the influence of anti-tobacco social media content on tobacco-related attitudes and behaviors.

While it is clear from the aforementioned literature that pro- and anti-tobacco content can be found on social media and that social media use is pervasive among young adults, there is limited literature exploring the precise social media use patterns (i.e. type of platforms used and frequency of use) of young adults and how they relate to risk-taking behaviors including tobacco use, as well as limited research addressing the relationship between pro- and anti-tobacco content in social media and tobacco use, particularly given the heightened role of peer interaction in a social media context. This dissertation aims to begin filling these gaps in the current body of literature.

Specific Aims

The overall objective of this dissertation, pursued through three distinct studies, is to better understand how young adults' social media use patterns might be related to health risks, particularly tobacco use, and how their exposure to and experience with

tobacco-related content in social media specifically might influence tobacco use outcomes. Specific aims are as follows:

Study 1/Aim 1: To quantitatively identify distinct classes of young adults based on social media use (sites used and frequency of use) and assess similarities and differences in demographic characteristics and health-related risk factors and behaviors across these classes.

Study 2/Aim 2a: To quantitatively explore the relationship between exposure to tobacco-related content in social media and tobacco use outcomes (openness to smoking among nonsmokers, social smoking among smokers, and combustible tobacco use among the full sample), adjusting for demographic factors.

Study 2/Aim 2b: To assess the degree to which each of the aforementioned associations is moderated by having close friends who smoke.

Study 3/Aim 3: To qualitatively explore young adults' (smokers and non-smokers) experiences consuming pro- and anti-tobacco content in social media, including the impact this content has on their beliefs, attitudes, norms, and behaviors – with a particular focus on exploring how peer influence in social media plays a role in these processes.

Chapter 2: Patterns of Social Media Use and their Relationship to Health Risks Among Young Adults (Study 1/Aim 1)

This chapter is a pre-copy-editing, author-produced version of an article submitted for publication to the *Journal of Adolescent Health*.

Abstract

Background: Social media use is pervasive among young adults, and different sites have different purposes, features, and audiences. This study identified classes of young adults based on what combination of sites they use and how frequently, and compared their demographics and health risks.

Methods: Latent profile models were developed based on frequency of using ten sites from a national sample of young adults aged 18-24 (n=1,062). Bivariate analyses and multivariable regressions examined the relationship between class membership and demographics, alcohol, tobacco and other drug (ATOD) use, and depression and anxiety.

Results: The optimal model identified five classes: Low Users (7.9%), High Users (63.1%), Professional Users – high use of LinkedIn (10.1%), Creative Users – high use of Vine and Tumblr (11.5%), and Mainstream Users – high use of Facebook and YouTube (7.4%). Classes differed significantly on education, ATOD use, and depression. Compared to High Users, Creative Users had higher odds of using most substances and lower odds of depression, Mainstream Users had higher odds of substances used socially (alcohol and hookah), Professional Users had higher odds of using alcohol, cigarettes, and cigars, and Low Users had higher odds of using other drugs (e.g., cocaine, heroin).

Conclusions: A young adult's complete social media site use profile is associated with ATOD use and depression. Use and co-use of certain sites may influence the volume and

nature of ATOD-related content and norms young adults experience in social media. Targeting interventions to sites selected based on use patterns associated with each health risk may be effective.

Introduction

Young adults are heavy users of social media (i.e., social networking sites, including Facebook, Twitter, YouTube, Twitter, Instagram, Snapchat, and Tumblr) (Kamber, 2013). Ninety percent of 18-29 year olds used social media as of 2015 (compared to only 65% of adults overall) (Perrin, 2015), and young adults spend more time (averaging over three hours daily) on social media than older adults (Emarketer, 2014).

Research indicates that use of social media is related to risk behaviors and factors among young adults, including anxiety and depression (Lin et al., 2016; Primack et al., 2017), sexual behaviors (Gebremeskel et al., 2014), and use of alcohol and other substances (Depue et al., 2015; Moreno, Cox, Young, & Haaland, 2015; Steers, Moreno, & Neighbors, 2016). While many studies have not directly explored mechanisms by which social media use might increase risk behaviors and factors, it is possible peer interactions on social media (including displays or positive reinforcement of risk behavior) play a key role in this process, and there is some evidence to support this (Fournier, Hall, Ricke, & Storey, 2013; Litt & Stock, 2011; Moreno et al., 2015; Steers et al., 2016; Yoo et al., 2016).

Social media's unique characteristics compared to other media channels – enabling users to create, share, critique, and endorse content (e.g., likes, retweets,

comments) (Papasolomou & Melanthiou, 2012;Sherman et al., 2016; Tuten, 2008) – fosters a high degree of peer interactivity, which may be a particularly powerful source of influence for young adults, who are sensitive to peer feedback as a source of understanding their identity during a time of life transition in which new identities and peer group affiliations are established (Institute of Medicine and National Research Council Committee on the Science of Adolescence, 2011; Prinstein, 2009). Thus, social media likely influences social norms, and in turn, actual behaviors.

Notably, different social media platforms have different purposes, features, content, audiences, and norms. While Facebook is typically used to share personal experiences like vacation photos and life events with family and friends, Twitter facilitates "water cooler" conversations about common interests on a global scale. Many social media sites have carved out unique identities: LinkedIn is for professional networking, Pinterest is for sharing craft, cooking, and other ideas, Tumblr is a social blogging platform where users share and discuss multimedia content, and Snapchat is a messaging application to send photos and videos that disappear once viewed. The demographics of these sites' users also vary – prior research suggests Snapchat, Vine and Tumblr user bases are younger; Pinterest users are predominantly women; more Blacks and Hispanics use Instagram than Whites; and LinkedIn users are more highly educated with higher incomes (Duggan, 2015; Hoelzel, 2015). Given this variation, the social media platforms one uses and how often one engages with them likely influences the content one is exposed to and the nature of peer interactivity within these environments, which in turn can influence health-related norms and behaviors.

Much of the extant research examining social media use has focused on frequency and duration of social media use overall, and of specific social media sites (Perrin, 2015). For example, in a study utilizing data from the Truth Initiative Young Adult Cohort, 97.5% of young adults reported regular use of at least one social media site, with the top five sites being Tumblr (85.5%), Vine (84.7%), Snapchat (81.7%), Instagram (80.7%), and LinkedIn (78.9%). There was significant overlap (81-90%) in use of multiple sites, with respondents regularly using 7.6 sites on average (Villanti, Johnson, Ilakkuvan, et al., 2017).

However, to our knowledge, no studies to date have created a nuanced profile of young adults' social media use that captures use and co-use of different sites along with frequency of use. A recent assessment of the communication environment of young adults in the context of cancer risk-promoting information concluded that gaps in the available data on young adult's social media use (including lack of data on use of specific sites) may impede the ability of cancer control efforts to counter risk-promoting marketing strategies undertaken by industry interests (McCloud, Kohler, & Viswanath, 2017).

The primary aim of this study is to aid in addressing this gap in the literature by identifying classes of young adults based on their social media use patterns (i.e., what combination of sites they use and how frequently) and assessing demographic and health risk differences between classes. The specific risk behaviors and factors examined are alcohol, tobacco, and other drug use, as well as anxiety and depression.

Methods

Data Source

This study used data from the Truth Initiative Young Adult Cohort Study, designed to understand tobacco use among U.S. young adults (18-34 years old at study entry) using a longitudinal cohort. The baseline survey was fielded in 2011, with subsequent surveys fielded at approximately six month intervals. This study used data from only Wave 9 of the survey, collected in January 2016, as it was the most recent wave with social media use questions available at the time of analysis. The sample was restricted to 18-24 year olds, (n=1,062 after 71 cases dropped due to missing data on sociodemographics or variables included in the Latent Profile Analysis).

The Truth Initiative Young Adult Cohort is composed of a national sample of young adults (weighted to be nationally representative) drawn from GfK's KnowledgePanel®, which is recruited via address-based sampling to provide statistically valid representation of the U.S. population, including cell phone-only households. African American and Hispanic young adults are oversampled to ensure sufficient sample sizes for subgroup analyses.

The household recruitment rate for the Wave 9 survey was 13.2%. In 63.9% of these households, one member completed a survey providing key demographic information. Only one panel member per household was selected at random to be part of this particular study, and no members outside the panel were recruited. The Wave 9 response rate was 60.7%, for a cumulative response rate of 5.1% (household recruitment rate x household demographic survey completion x Wave 9 response rate). The Truth Initiative Young Adult Cohort Study was approved by the Chesapeake Investigational

Review Board, Inc., and consent collected from participants before survey self-administration.

Measures

See Appendix A for a full list of measures and coding of variables in analyses.

Social media use was assessed by asking respondents about frequency of use of ten popular social media sites (Twitter, Facebook, Instagram, Snapchat, Vine, Pinterest, Tumblr, Google+, LinkedIn, and YouTube), with response options being: multiple times per day, daily, weekly, monthly, less than one time per month, or never. Although Vine was shut down in January 2017, it was used widely at the time of this survey. Demographic variables included in the analysis were gender, age, education, race, and a validated measure of subjective financial status (Williams et al., 2017).

Health-related risk variables were past 30 day use of marijuana, other drugs (cocaine, heroin, ecstasy, meth, etc.), and alcohol; ever and past 30 day use of combustible tobacco products – cigarettes, cigars, and hookah; and depression and anxiety.

Past 30-day alcohol, marijuana and other drug use were each measured by two items, the first asking about frequency of use currently (for marijuana and other drug use) or in the past year (for alcohol use). Those who reported any use were then queried about frequency of use in the past 30 days, with those responding ≥1 day defined as past 30 day users.

In this wave of the survey, respondents were randomized to receive different tobacco use questions. For ever use of each product and separately for past 30 day use of each product, respondents received one or both of two items – a "select all that apply"

item asking about use of any of the following tobacco products (cigarettes, cigars, little cigars/cigarillos/bidis, and hookah/shisha/waterpipe; the item also included other non-combustible products not used in this analysis), and another item (for ever use, the second item asked if they had ever tried each tobacco product and displayed an image of the product alongside the question and for past 30 day use, the item asked on how many days of the past 30 they smoked the product). A positive response to *either* of the two items was coded as ever or past 30 day use for cigarettes, cigars (coded as having used either cigars or little cigars/cigarillos/bidis), and hookah. Anyone who used any of these products (ever or in the past 30 days) was coded as having ever used combustible tobacco or used combustible tobacco in the past 30 days respectively.

Depression and anxiety variables were created based on a score at or above the cut-off (>3 on a four point scale) on the two-item Patient Health Questionnaire (PHQ-2) (asking about frequency of depressed mood and loss of interest in activities) and the two-item Generalized Anxiety Disorder (GAD) scale (asking about frequency of uncontrollable worry and feelings of anxiety), respectively (Kroenke, Spitzer, & Williams, 2003; Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007).

Analysis

Latent profile analyses were conducted using Mplus 7.0 to identify classes of young adults based on social media use patterns (Muthén & Muthén, 2012; Oberski, 2016). For this LPA, ten continuous variables were entered into the model, representing frequency of use for each of ten social media sites (from 1 (never) to 6 (multiple times a day)).

The optimal number of classes was determined by running models with a successive number of classes from one to eight and comparing model fit indices, entropy, and interpretability. Model fit indices assessed were: the log likelihood (-2LL), the Akaike Information Criterion, the Bayesian Information Criterion (BIC), the sample size adjusted BIC, and the Lo-Mendell-Rubin and Vuong-Lo-Mendell-Rubin tests (Collins & Lanza, 2010). According to guidelines for recommended fit indices, the optimal class solution should have lowest Bayesian Information Criterion (BIC) and sample-size adjusted BIC (SSABIC) values (Nylund, Asparouhov, & Muthén, 2007); significant Lo-Mendell-Rubin and Vuong-Lo-Mendell-Rubin tests (an indicator of model fit where significant p-values indicate the current model is a significantly better fit for the data than a model with one fewer class) (Nylund et al., 2007); and entropy values close to 1.0, demonstrating high classification precision (Muthén, 2004). With continuously declining BIC/SSABIC values, the recommendation is to select the class solution with minimal differences with the values of the subsequent class solution (DiStefano & Kamphaus, 2006).

After the best-fitting LPA model was selected, class membership and the probability of class membership were exported from MPlus for each participant and merged with the full data set in Stata IC 13 (StataCorp, 2013). Post-stratification weights were used to account for complex sample design and non-response bias. Weighted bivariate analyses were conducted to estimate the average frequency of use of each social media site, sociodemographic characteristics, and health-related risk behaviors/factors among classes. Weighted chi-square tests were used to determine differences in characteristics across latent class assignment, and weighted multivariable regressions

were conducted to determine the association between latent class assignment and each of the health-related risk behaviors/factors, adjusting for sociodemographics.

Additionally, sensitivity analyses were conducted to see if and how the number and composition of classes differed when 1) variables capturing access to digital devices with internet access (see Appendix A for survey items) were included in the LPA model, and separately, when 2) Vine was excluded from the model (since Vine does not exist currently).

Results

Selection of the Latent Class Model

Model fit indices for all latent class models are presented in Table 1. All models exhibited entropy values close to 1.0, demonstrating high classification precision (Bengt Muthén, 2004). Moving to models with more classes, BIC/SSABIC values declined continuously. Thus, the optimal model – the 5-class solution – was selected based on the class solution with minimal differences with BIC/SSABIC values from the subsequent class solution; with a significant Vuong-Lo-Mendell-Rubin test; and optimal interpretability (the extent to which an additional class provided unique information).

Table 1. Model Fit Indices for 1-8 Class Solutions of Social Media Use Patterns

Model	BIC	Adj BIC	LMR	VLMR	Entropy
1-class solution	39692.713	39629.19	-	-	-
2-class solution	37512.236	37413.775	p<0.0001	p<0.0001	0.987
3-class solution*	36435.971	36302.571	p<0.0001	p<0.0001	1.000
4-class solution	35913.139	35744.802	0.0021	0.002	0.988
5-class solution	**35460.521**	**35257.246**	**0.0005**	**0.0005**	**0.996**
6-class solution*	34991.087	34752.874	0.225	0.2248	0.998
7-class solution*	34399.578	34126.427	0.394	0.3909	0.937
8-class solution*	34220.832	33912.744	0.0001	0.0001	0.959

*Model had error indicating model nonidentification and (for the 6 and 8 class solutions only) lack of replication of log likelihood

Identification of Latent Classes

Table 2 provides the weighted average (on a scale from 1 (never) to 6 (multiple times per day)) of social media site use for each of the ten sites included in the model by latent class, the unweighted probability of class membership, and class size. The latent profile model revealed five distinct, mutually exclusive classes of social media site use, and names were selected for each class to capture their pattern of site use (although the terms low and high are used, these are not ordinal groups): 1) Low Users –lower use of all social media sites compared to the full sample (Class 1, 7.91%); 2) High Users – higher use of all sites compared to the full sample (Class 2, 63.09%); 3) Professional Users –very high use of LinkedIn[1], a site primarily used for professional reasons, and extremely low use of Vine (Class 3, 10.08%) ; 4) Creative Users –very high use of Vine and comparatively high use of Tumblr, sites that typically involve user generation of multimedia content, and extremely low use of LinkedIn (Class 4, 11.49%); and 5)

[1] This group also exhibited comparatively high use of Google+, but it is likely that the high prevalence of Google+ reflects use of Google's search engine given the failure of the Google+ social networking site (Fiegerman, 2015; Villanti et al., 2017).

Mainstream Users –high use of Facebook and comparatively high use of YouTube, sites that are popular among a broad audience, and average use of other sites (Class 5, 7.44%).

Table 2. Average use (mean, SE) of social media site use (on a scale from never (1) to multiple times per day (6)) among the five latent classes and in the full sample, weighted (n=1062)

	Class 1 Low Users	**Class 2 High Users**	**Class 3 Professional Users**	**Class 4 Creative Users**	**Class 5 Mainstream Users**	**Full Sample**
Twitter	3.361†	5.160*	4.138†	4.690	4.410†	4.844
	(0.175)	(0.066)	(0.201)	(0.194)	(0.196)	(0.058)
Facebook	3.930†	4.364	4.238	4.044	4.637*	4.308
	(0.134)	(0.065)	(0.138)	(0.140)	(0.094)	(0.050)
Instagram	3.405†	5.002	3.869†	4.620	4.548	4.717
	(0.150)	(0.062)	(0.175)	(0.170)	(0.130)	(0.053)
Snapchat	3.259†	5.161*	3.872†	4.524	4.457†	4.800
	(0.174)	(0.056)	(0.182)	(0.171)	(0.154)	(0.054)
Vine	2.032†	5.940*	1.797†	5.948*	5.676*	5.249
	(0.125)	(0.014)	(0.090)	(0.027)	(0.097)	(0.056)
Pinterest	2.812†	5.212*	3.614†	4.152†	4.557	4.750
	(0.234)	(0.059)	(0.235)	(0.213)	(0.201)	(0.060)
Tumblr	3.140†	5.613*	4.592†	5.463	5.042	5.291
	(0.257)	(0.048)	(0.213)	(0.138)	(0.174)	(0.051)
Google+	2.573†	5.293*	4.977	4.644†	4.82	4.961
	(0.212)	(0.064)	(0.182)	(0.225)	(0.221)	(0.062)
LinkedIn	1.752†	5.984*	5.936*	1.470†	3.333†	5.101
	(0.094)	(0.005)	(0.029)	(0.053)	(0.064)	(0.058)
YouTube	3.062†	3.895	3.705	3.045†	3.743	3.731
	(0.155)	(0.063)	(0.136)	(0.128)	(0.109)	(0.049)
Pr(Class membership), unweighted (%)	7.91%	63.09%	10.08%	11.49%	7.44%	
Class size, unweighted (n)	84	670	107	122	79	1062

*0.3 or more *above* full sample average
†0.3 or more *below* full sample average

Adding variables capturing access to digital devices with internet access to the LPA in sensitivity analyses did not alter classes, and excluding Vine from the model changed size and composition (but not number) of classes only slightly. While there were

still classes of Low Users, High Users (9 percentage points smaller compared to the LPA with Vine), and Creative Users (6 percentage points larger compared to the LPA with Vine), there were two classes of professional users, a Professional Creative Users class with high use of both LinkedIn and Tumblr and a Professional Mainstream Users class with high use of LinkedIn along with Facebook and YouTube (and very low use of Tumblr).

Correlates of Latent Class

Bivariate analyses of sociodemographic characteristics and health-related risk behaviors/factors by latent class are presented in Table 3. There were significant differences in education as well as use of alcohol, other drugs, hookah (ever and past 30 day use), cigars (past 30 day use), and combustible tobacco (past 30 day use). More High Users had lower education levels, while more Creative and Mainstream Users had higher education levels.

Creative Users had comparatively high use of other drugs (4.04%, in contrast to only 0.69% among High Users), alcohol (65.85%), ever and past 30 day use of hookah (35.68% and 28.68% respectively), past 30 day use of cigars (28.65% - over three times that of Low Users), and past 30 day use of combustible tobacco (45.86%); Mainstream Users had comparatively high use of alcohol (61.01%) and ever and past 30 day use of hookah (31.80% and 24.79% respectively – over twice that of Low users); Professional Users had comparatively high past 30 day cigar (26.97% - over three times that of Low Users) and past 30 day combustible tobacco use (46.16%) ; and Low Users had comparatively high drug use (5.25%, in contrast to only 0.69% among High Users).

Table 3. Characteristics of the five latent classes and in the full sample, weighted

	Class 1 Low Users	Class 2 High Users	Class 3 Profess-ional Users	Class 4 Creative Users	Class 5 Main-stream Users	Full Sample	Chi2 Test p-value
Female	57.30%	49.76%	55.49%	55.05%	50.53%	51.38%	0.6635
Young (18-20 vs. 21-24)	30.95%	30.00%	36.67%	19.06%	29.28%	29.66%	0.194
Race							
White Non-Hispanic	48.01%	49.89%	61.13%	62.29%	64.07%	52.88%	0.0536
Black Non-Hispanic	12.03%	15.13%	12.34%	8.08%	8.92%	13.61%	
Other Non-Hispanic	11.49%	7.45%	8.00%	16.75%	9.17%	8.75%	
Hispanic	28.46%	27.53%	18.52%	12.88%	17.84%	24.76%	
Education							**p<0.0001**
Less than high school	10.36%	14.54%	8.86%	1.68%	3.50%	11.82%	
High school	23.36%	33.66%	29.88%	11.86%	24.72%	30.00%	
Some college/AA degree	44.20%	43.01%	50.57%	57.42%	41.13%	45.03%	
Bachelor's Degree or Higher	22.08%	8.80%	10.69%	29.04%	30.65%	13.15%	
Financial Situation							0.191
Don't meet basic expenses	4.00%	7.21%	4.68%	3.17%	2.69%	6.09%	
Just meet basic expenses	40.41%	30.68%	21.49%	23.34%	34.94%	30.07%	
Meet needs with little left	31.02%	37.32%	44.92%	45.37%	31.57%	38.00%	
Live comfortably	24.58%	24.78%	28.92%	28.11%	30.81%	25.85%	
Drug and Alcohol Use							
Past 30 Day Marijuana Use	14.10%	11.33%	13.25%	15.58%	14.56%	12.31%	0.7797
Past 30 Day Other Drug Use (cocaine, heroin, ecstasy, meth, etc.)	5.25%	0.69%	0.72%	4.04%	2.83%	1.46%	**0.0458**
Past 30 Day Alcohol Use	55.10%	42.21%	56.48%	65.85%	61.01%	47.85%	**p<0.0001**
Tobacco Use							
Ever Combustible Tobacco Use	44.80%	42.35%	55.57%	52.64%	50.47%	45.26%	0.0872
Past 30 Day Combustible Tobacco Use	22.97%	32.69%	46.16%	45.86%	39.05%	34.93%	**0.0034**
Ever Cigarette Use	36.65%	35.34%	42.47%	38.61%	32.79%	36.26%	0.7209

Past 30 Day Cigarette Use	19.65%	25.49%	30.25%	30.41%	25.65%	26.00%	0.5437
Ever Cigar Use	24.14%	23.18%	32.23%	33.57%	24.49%	25.16%	0.1768
Past 30 Day Cigar Use	7.97%	16.17%	26.97%	28.65%	18.58%	17.94%	**0.0011**
Ever Hookah Use	28.16%	19.34%	27.14%	35.68%	31.80%	23.00%	**0.0033**
Past 30 Day Hookah Use	11.17%	12.90%	19.12%	28.68%	24.79%	15.58%	**0.0001**
Depression/Anxiety							
Depression (MDD)	6.30%	6.98%	5.63%	1.48%	2.18%	6.00%	0.143
Anxiety (GAD)	12.70%	7.34%	10.32%	3.81%	2.18%	7.35%	0.0669

*Statistically significant ($p<0.5$) p-values in bold

Multivariable Analysis of Health-Related Risk Behaviors/Factors by Latent Class

To better understand the association between latent class and health-related risk behaviors/factors, multivariable regression analyses were conducted, adjusting for sociodemographics. Results are shown in Table 4, with High Users (the largest class) set as the reference group. Creative Users had approximately ten times the odds of using other drugs and about twice the odds of using alcohol, cigars (ever and past 30 day), and hookah (ever and past 30 day) compared to High Users. Creative Users also had approximately 70 to 80% higher odds of using combustible tobacco (ever and past 30 day), and approximately 75% lower odds of depression, than High Users. Mainstream Users had approximately twice the adjusted odds as High Users of using alcohol and hookah (ever and past 30 day). Professional Users also had twice the adjusted odds as High Users of using alcohol, cigars or combustible tobacco in the past 30 days, and 60 to 75% higher odds of ever using cigarettes or cigars. Low Users had nearly ten times the odds of High Users of other drug use.

Table 4. Adjusted logistic regressions of health-related risk behaviors and factors by latent class, weighted

	Past 30 Day Marijuana Use	Past 30 Day Other Drug Use	Past 30 Day Alcohol Use	Ever Use Combustible Tobacco	Past 30 Day Use Combustible Tobacco	Depression	Anxiety
Low vs High	1.51 [0.63,3.63]	9.54* [1.58, 57.81]	1.61 [0.87, 2.99]	1.21 [0.69, 2.14]	0.61 [0.36, 1.06]	0.88 [0.31, 2.47]	1.84 [0.73, 4.64]
Professional vs High	1.31 [0.66, 2.60]	1.61 [0.18, 14.31]	1.82* [1.16, 2.87]	1.99** [1.26, 3.16]	1.90** [1.17, 3.08]	0.91 [0.31, 2.72]	1.52 [0.70, 3.29]
Creative vs High	1.70 [0.83, 3.48]	10.05** [1.82, 55.47]	2.00** [1.21, 3.30]	1.78* [1.11, 2.87]	1.68* [1.04, 2.70]	0.24* [0.07, 0.84]	0.56 [0.22, 1.43]
Mainstream vs High	1.53 [0.69, 3.37]	7.13 [0.67, 75.57]	1.86* [1.09, 3.18]	1.62 [0.93, 2.83]	1.32 [0.75, 2.31]	0.36 [0.08, 1.56]	0.31 [0.07, 1.37]

	Ever Use Cigarettes	Past 30 Day Use Cigarettes	Ever Use Cigars	Past 30 Day Use Cigars	Ever Use Hookah	Past 30 Day Use Hookah
Low vs High	1.23 [0.66,2.29]	0.77 [0.42, 1.39]	1.16 [0.56, 2.40]	0.45 [0.21, 0.95]	1.55 [0.79, 3.02]	0.71 [0.37, 1.37]
Professional vs High	1.62* [1.01, 2.61]	1.43 [0.83, 2.48]	1.75* [1.02, 3.01]	2.03* [1.13, 3.65]	1.63 [0.94, 2.83]	1.60 [0.92, 2.78]
Creative vs High	1.49 [0.91, 2.42]	1.43 [0.85, 2.40]	1.83* [1.09, 3.06]	1.92* [1.12, 3.29]	2.10** [1.28, 3.44]	2.09** [1.23, 3.54]
Mainstream vs High	1.11 [0.60, 2.06]	1.14 [0.59, 2.21]	1.14 [0.62, 2.10]	1.11 [0.60, 2.09]	1.87* [1.07, 3.27]	1.88* [1.02, 3.44]

*p<0.05, **p<0.01, ***p<0.001

Discussion

Key Findings

Overall, this analysis finds that young adults fall into distinct classes of social media use patterns, and these patterns are associated with differences in health-related risk behaviors and factors. While the formation of two of the latent classes was determined by overall

frequency of use across sites, the formation of the other three classes was driven by high and/or low frequency use of *particular* sites, providing insight into the primary reasons these groups use social media (creation and sharing of multimedia content vs. professional networking vs. use of general sites like Facebook and YouTube). These classes remained relatively stable even in sensitivity analyses adding digital device access variables to or excluding Vine from the model, suggesting these classes may be useful even as specific devices and social media sites come and go, assuming the primary reasons users turn to sites remains the same.

Educational differences between the classes may be explained by the young adult population, with those at low education levels in fact enrolled in college – this may make them more likely to be High Users as well as Professional Users, given high prevalence of social media use and job seeking among college students.

Adjusted regressions indicated that compared to High Users, Creative Users had higher odds of using most substances (but lower odds of depression), Mainstream Users had higher odds of substances used socially (alcohol and hookah), Professional Users had higher odds of using alcohol, cigarettes, and cigars, and Low Users had higher odds of using hard drugs (cocaine, heroin, ecstasy, meth, etc.). Since it is not possible to

determine directionality of these associations, it is also possible that the kinds of young adults who exhibit certain social media use profiles are those that use substances more than their peers due to uncaptured confounders (e.g., a stressful home environment may influence both low use of social media and higher use of hard drugs). Alternatively, it is possible that higher exposure to pro-tobacco/alcohol/drug content or norms on sites frequented by a particular latent class increases their use of that substance (e.g., anonymity on Tumblr may contribute to the site's high degree of disclosure and sharing around sensitive topics (OK2Talk, 2015; Parenthood, 2014; Tumblr Staff, 2012; Villanti, Johnson, Ilakkuvan, et al., 2017), so perhaps Creative Users are exposed to more content depicting substance use; Facebook is often used to share pictures of social events, which may contribute to social use of products like alcohol and hookah being more accepted). It is also possible that use of a certain substance drives use of certain social media sites (e.g., perhaps social users of alcohol and hookah turn to Facebook to share such content).

Limitations and Strengths

Key limitations of this study include the use of self-reported survey data, which may paint an incomplete picture of social media use (due to an incomplete list of sites or misinterpretation of sites listed) and is subject to recall bias (especially when use of sites blends together, as with watching a YouTube video on Facebook). Nonetheless, prior research has found self-reports of social network site use can be accurate (Scharkow, 2016), and self-report requires fewer resources and demands on participant privacy compared to tracking use on devices (Boase & Ling, 2013). Although the study sample's completion and cumulative response rates are low, they are similar to other studies that have relied on KnowledgePanel (Grande et al., 2013; Kelly et al., 2015; Kumar, Quinn,

Kim, Daniel, & Freimuth, 2012), and there is little indication of nonresponse bias on core variables in other KnowledgePanel samples or in this sample specifically (Garrett, Dennis, & Disogra, 2010; Heeren et al., 2008; Rath et al., 2012). Other limitations include that cross-sectional analyses preclude understanding causality, important confounders may have been missed, and type I error (finding a significant relationship when none exists) may be increased due to the use of multiple comparisons without applying a correction. A correction was not employed in this analysis due to the exploratory nature of this research and desire to minimize type II errors (deeming important relationships non-significant) (Perneger, 1998).

The use of a large, nationally-representative sample of young adults to form a more detailed and nuanced picture of social media use than currently exists in the literature is the primary strength and novel contribution of this study. By examining how social media use across sites forms distinct use patterns, this study goes beyond typical approaches of examining use individually by site (Perrin, 2015), without attention to patterns of co-use across sites. The use of sensitivity analyses and weighted multivariable regression analyses provide a clearer picture of the association between social media use patterns and health risk behaviors/factors.

Contribution and Implications

Although some prior studies did not find a relationship between overall social media use and risk behaviors such as alcohol and tobacco use, these studies did not explore the full range of sites used by participants (Gebremeskel et al., 2014; Hoffman, Pinkleton, Weintraub Austin, & Reyes-Velázquez, 2014). Villanti et al. (using the same dataset used in this analysis) found the number of social media sites used by young adults

was associated with alcohol use (but not marijuana use or depression or anxiety), but did not control for sociodemographics or explore what specific combinations of sites might be associated with risk behaviors (Villanti, Johnson, Ilakkuvan, et al., 2017).

The analysis presented in this paper is the first to our knowledge to explore how patterns of use of social media sites are associated with risk behaviors/factors, and suggests that patterns of use of specific sites may be more important than overall frequency of use of social media – or at least an additional factor to consider – in understanding the relationship between social media use and health risk behaviors/factors. Different social media sites have different purposes, audiences, and norms, and a young adult's complete social media site use profile may be an important factor in the volume and nature of social media content depicting risky health behaviors they are exposed to (which has been shown to influence risk behaviors (Depue et al., 2015; Hébert et al., 2017; Hoffman et al., 2014; Moreno et al., 2012; Yoo et al., 2016)), as well as the norms surrounding these behaviors they experience in their social media environment. Alternatively, young adults' risk behaviors may drive their decisions to use certain social media sites.

Future research should employ longitudinal designs to begin to unpack the causal mechanisms at play. Future research should also explore the precise nature of health risk promoting content and norms youth are exposed to on different social media sites, and how this exposure may vary based on nuanced site use patterns. More research is also needed to understand how the negative effects of health risk promoting content and norms on social media can be mitigated or countered, and whether strategies applied offline such as warning labels or notices about harmful products or sensitive content

could be effective in a social media environment. Targeting normative interventions or health campaigns through a combination of sites selected based on the use patterns associated with each of these risk behaviors may be an effective strategy to reach the young adults most likely to engage in these behavior. Further research is needed to determine whether and what preventive health information via social media would be most influential (Gebremeskel et al., 2014; Hausmann, Touloumtzis, White, Colbert, & Gooding, 2017).

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Chapter 3: Young Adults' Exposure to Pro- and Anti-Tobacco Content in Social Media and Associations with Tobacco Use Outcomes (Study 2/Aim 2)

This chapter is a pre-copy-editing, author-produced version of an article that will be submitted for publication to the *American Journal of Preventive Medicine*.

Abstract

Background: Social media use is pervasive among young adults, making social media a key source of exposure to pro- and anti-tobacco content. This study examines the relationship between exposure to pro- and anti-tobacco content in social media and young adults' tobacco use outcomes.

Methods: Using cross-sectional survey data from a national sample of young adults aged 18-24 (n=1,133), weighted, multivariable linear and logistic regression analyses were employed to examine the relationship between a categorical variable capturing exposure to tobacco-related content in social media (exposure to pro-tobacco content only, anti-tobacco content only, both or neither) and three specific tobacco use outcomes among young adults: openness to smoking among non-smokers, social smoking among smokers, and combustible tobacco use. Potential moderation of these relationships by having close friends who smoke was also assessed.

Results: Over 70% of young adults were exposed to pro-tobacco content in social media, and a higher percentage of smokers than nonsmokers saw this content (while a higher percentage of nonsmokers saw only anti-tobacco content). Seeing pro-tobacco content (whether alone or along with anti-tobacco content) was associated with higher openness to smoking among nonsmokers (0.08 points higher on a 4 point scale), greater likelihood of social smoking among smokers with close friends who smoke (5 to 7 times higher

odds), and greater likelihood of smoking cigars or hookah (1.5 to 3 times higher odds), but not cigarettes, among the full sample. Exposure to only anti-tobacco content – in comparison to not having exposure to any tobacco-related content – was associated with 40 to 50% lower odds of cigarette use.

Conclusions: That more smokers see pro-tobacco content and more nonsmokers see anti-tobacco only content is unsurprising, but these differences in tobacco content in social media have the potential to accelerate peer influence processes. While relationships between pro-tobacco content exposure and tobacco use outcomes may be reflective of peer selection and/or peer influence, the results of this study highlight the potentially heightened impact of tobacco content in social media on social smoking and use of cigars and hookah specifically. Public health campaigns and interventions delivered via social media should consider explicitly targeting social smoking and cigar and hookah use, and innovative interventions focused on changing norms around the acceptability of smoking posts and leveraging network characteristics to influence tobacco use may also be effective.

Introduction

Tobacco use is the leading cause of preventable death in the United States (Centers for Disease Control and Prevention, 2011), and young adults are at a particularly vulnerable stage in terms of tobacco use, as they transition through a critical development period during which lifelong health behaviors are established (Arnett, 2000). Indeed, research has demonstrated higher rates of cigarette smoking initiation and transition to regular smoking in young adulthood (Bernat et al., 2012; Foldes et al., 2010; Hammond, 2005; Lantz, 2003; Rath et al., 2012), as well as higher rates of dual use of cigarettes and

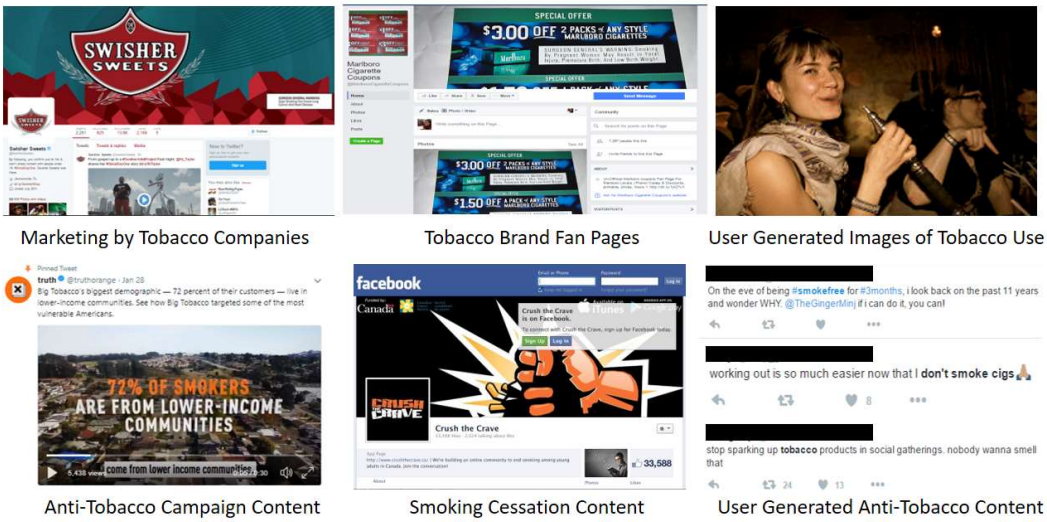
other tobacco products (Rath et al., 2012), particularly little cigars/cigarillos and hookah (Barnett et al., 2013; Cobb et al., 2010; Grekin & Ayna, 2012; Jarrett et al., 2012; Richardson et al., 2013). As such, young adults' use of combustible tobacco products – products that are smoked (including cigarettes, cigars, little cigars, cigarillos, and hookah), which account for the vast majority of the harmful health consequences of tobacco use – is a critical public health concern (U.S. Department of Health and Human Services, 2014). A common pattern of combustible tobacco use among young adults is "social smoking," or smoking primarily in social contexts (Schane et al., 2009b), such as while partying, socializing, or drinking alcohol with others (Berg et al., 2009, 2012; Hoek et al., 2013; Moran et al., 2004; Schane et al., 2009a; Shiffman et al., 2009; Waters et al., 2006). Social smoking generally involves light (few cigarettes per day) and intermittent (smoking on a nondaily basis) patterns of tobacco use (Schane et al., 2010), and as such, social smokers do not view themselves as addicted to nicotine and generally categorize themselves as nonsmokers (Schane et al., 2009b). National surveys estimate the prevalence of social smoking among young adult (college and non-college) smokers to be between 51% and 80% (Jiang et al., 2014; Lisha et al., 2015; Moran et al., 2004; Song & Ling, 2011; Villanti et al., 2012).

Both social smoking and combustible tobacco use more broadly are influenced by tobacco-related communication, and social media is a key source of exposure to both pro- and anti-tobacco related content, particularly for young adults. Ninety percent of 18-29 year olds use online social networking sites (also known as social media and including sites such as Facebook, Twitter, YouTube, Twitter, Instagram, Snapchat, and Tumblr),

and young adults average over three hours a day across their social media accounts (Emarketer, 2014; Perrin, 2015).

Young adults are exposed to pro-tobacco content on social media through messages, images, and videos depicting tobacco use by peers on their personal pages, as well as unregulated tobacco marketing and peer-to-peer promotion such as tobacco product reviews or brand fan pages (Burton et al., 2015; Freeman & Chapman, 2010; Guidry et al., 2016; Link et al., 2015; Richardson et al., 2014; Richardson & Vallone, 2014; Step et al., 2016; Szczypka, 2015), and they are exposed to anti-tobacco content from public health campaigns, smoking cessation interventions, tobacco control advocacy organizations, and peers, who may share anti-tobacco content from the aforementioned sources or post their own anti-tobacco messages (see Figure 4) (Burton et al., 2015; Freeman & Chapman, 2010; Guidry et al., 2016; Jacobs et al., 2016; Link et al., 2015; Richardson et al., 2014; Richardson & Vallone, 2014; Step et al., 2016; Szczypka, 2015).

Figure 4. Examples of Pro- and Anti-Tobacco Content in Social Media



"User Generated Images of Tobacco Use" photo is a CC image courtesy of Chelsea Marie Hicks (https://www.flickr.com/photos/seafaringwoman/5772041470/)

Given the heightened role of peer influence in social media through the ability for peers to generate and share content, critique and rank content (e.g., likes, comments), and interact with each other (Papasolomou & Melanthiou, 2012; Tuten, 2008), tobacco-related content in social media may have a unique impact on young adult's tobacco use and social smoking behaviors compared to content from traditional media channels. While a large body of research indicates that tobacco marketing and counter-marketing in traditional media channels influences tobacco use (National Cancer Institute, 2008), there is limited understanding of the influence of pro and anti-tobacco content in social media on young adult's tobacco use behavior. In a recent review of cancer risk-promoting information within the communication environment of young adults, McCloud et al. specifically highlight the need for data on the relationship between risk-promoting information exposure – including specifically in social media – and actual risk behaviors (McCloud et al., 2017).

Only a few studies have explored the influence of pro-tobacco content in social media on tobacco use among youth and young adults. In one study of 200 young adults in Connecticut, viewing tobacco use depictions in social media predicted future smoking (Depue et al., 2015), while an analysis of a statewide survey of sixth, eighth, and tenth graders in Texas indicated that exposure to and engagement with tobacco-related social media were higher among those who were susceptible to or used e-cigarettes and/or combustible tobacco (Hébert et al., 2017). In another study of 20 hookah smokers, researchers found that those who posted on social media about hookah had lower perceived vulnerability to the health risks associated with tobacco products (Link et al., 2015). Although these findings do not establish a causal relationship, they do suggest

there is a relationship between viewing tobacco imagery on social media and using combustible tobacco or e-cigarettes.

Research on the effectiveness of anti-tobacco content via social media is even more limited, and focused primarily on smoking cessation. There is some evidence that social media cessation interventions can be effective in prompting preparation to quit, as well as quit attempts and sustained abstinence (Baskerville et al., 2016; Pechmann et al., 2016; Ramo et al., 2015). However, most studies suggests that anti-tobacco communication efforts in social media lack reach; do not follow evidence-based approaches; and fail to capitalized on the interactive potential of social media, instead serving as information portals (Duke et al., 2014; Liang et al., 2015a; Hye-Jin Paek et al., 2011; Prochaska et al., 2012; Thackeray et al., 2012).

The only study to simultaneously examine the influence of both pro-smoking and anti-smoking messages in social media is based on survey data from 366 college students from three Midwestern universities conducted in 2012. The authors of this study found that the expression and reception of prosmoking messages affected smoking both directly and indirectly via perceived peer expression of prosmoking messages and perceived peer smoking norms (Yoo et al., 2016). For antismoking messages, only reception influenced smoking indirectly via perceived peer reception of antismoking messages and perceived peer smoking norms. These results suggest that pro-smoking messages in social media are more influential than anti-smoking messages in social media in predicting college students' smoking behaviors (Yoo et al., 2016).

Given the limited literature exploring the influence of exposure to pro- and anti-tobacco content in social media on tobacco use behaviors among young adults, this study

aims to examine the association between exposure to pro- and anti-tobacco content in social media on three specific tobacco use outcomes among young adults: openness to smoking among non-smokers, social smoking among smokers, and combustible tobacco use.

Methods

This study is a secondary data analysis of existing data from Wave 9 of the Truth Initiative Young Adult Cohort Study, collected in January 2016. The Truth Initiative Young Adult Cohort Study is designed to understand trajectories of tobacco use in a young adult (18-34 years old) population using a longitudinal cohort sample, and a number of published papers have utilized this dataset (Rath et al., 2012; Richardson et al., 2013; Villanti, Johnson, Ilakkuvan, et al., 2017; Villanti, Johnson, Rath, et al., 2017). The baseline survey was fielded in 2011, with subsequent surveys fielded at approximately six month intervals. This study uses data from only Wave 9 of the survey, as it was the most recent wave of the survey available at the time of analysis with questions about exposure to pro- and anti-tobacco content in social media, and restricts the sample to 18-24 year olds (n=1,133).

The Truth Initiative Young Adult Cohort is composed of a national sample of young adults drawn from GfK's KnowledgePanel®, which is recruited via address-based sampling to provide statistically valid representation of the U.S. population, including cell phone-only households. African American and Hispanic young adults were oversampled to ensure sufficient sample sizes for subgroup analyses, and the survey was administered online in English and Spanish.

The household recruitment rate for the Wave 9 survey was 13.2%. In 63.9% of these households, one member completed a core profile survey in which the key demographic information was collected. For the Young Adult Cohort Study, only one panel member per household was selected at random to be part of the study sample, and no members outside the panel were recruited. The study completion rate was 60.7%, and thus, the cumulative response rate was 5.1%.

The Truth Initiative Young Adult Cohort study is approved by the Chesapeake Investigational Review Board, Inc., and online consent is collected from participants before survey self-administration.

Measures

See Appendix B for a full list of measures and coding of variables in analyses.

Exposure to tobacco-related content in social media was categorized into four groups: exposure to anti-tobacco content only, exposure to pro-tobacco content only, exposure to both, or exposure to neither. Exposure to anti-tobacco content in social media was based on a question about frequency of seeing posts, images, or videos *against* using cigarettes, cigars, little cigars/cigarillos, or hookah, including posts from friends or advertisements explain the harm of using these products, discouraging their use, or encouraging quitting. Exposure to pro-tobacco content in social media was based on a questions about frequency of seeing the following while using social media, not including the anti-tobacco posts described in the prior question: text posts, images, or videos of people with cigarettes, cigars, little cigars/cigarillos, or hookah; advertisements or reviews of these products; or other posts featuring brands of these products or otherwise supporting their use.

Outcome variables used in the analysis were openness to smoking, social smoking, and combustible tobacco use. Openness to smoking among nonsmokers was determined based on an index averaging responses to three items that have been used to assess openness to smoking in prior studies (Davis, Farrelly, Messeri, & Duke, 2009; Pierce et al., 1996; J. F. Thrasher, Niederdeppe, Jackson, & Farrelly, 2006): "Will you smoke a cigarette soon?"; "Will you smoke a cigarette any time in the next year?"; and "If one of your friends or somebody close to you offered you a cigarette, would you smoke/use it?" Each item has response categories definitely yes, probably yes, probably no, and definitely no.

Social smoking was based on self-identified smoking status, as determined by asking "Do you consider yourself a social smoker?"; this social smoking measure was selected because it largely defined latent classes of social smokers in an analysis including six different social smoking measures conducted with data from prior waves of the survey used in this study (Villanti, Johnson, Rath, et al., 2017).

In the wave of the survey used in this analysis, respondents were randomized to receive different combustible tobacco use questions. For ever use of each product and separately for past 30 day use of each product, respondents received one or both of two items – a "select all that apply" item asking about use of any of the following tobacco products (cigarettes, cigars, little cigars/cigarillos/bidis, and hookah/shisha/waterpipe; the item also included other non-combustible products not used in this analysis), and another item (for ever use, the second item asked if they had ever tried each tobacco product and displayed an image of the product alongside the question and for past 30 day use, the item asked on how many days of the past 30 they smoked the product). A positive

response to *either* of the two items was coded as ever or past 30 day use for cigarettes, cigars (coded as having used either cigars or little cigars/cigarillos/bidis), and hookah. Anyone who used any of these products (ever or in the past 30 days) was coded as having ever used combustible tobacco or used combustible tobacco in the past 30 days respectively.

Having close friends who smoke was based on the question "How many of your 4 closest friends smoke cigarettes", with those responding ≥1 categorized as having close friends who smoke cigarettes. Covariates included in the analysis were gender, age, education, race, a validated measure of subjective financial status (Williams et al., 2017), and regular use of social media (defined as at least weekly use of social media sites) (Villanti, Johnson, Ilakkuvan, et al., 2017).

Analysis

All analyses were conducted using Stata IC 13 (StataCorp, 2013). Data were weighted to account for survey design and non-response, so that results are nationally representative. Survey weighted linear or logistic regression analyses, adjusted for regular use of social media and demographic covariates, were conducted to explore the relationship between the categorical variable capturing exposure to pro- and anti-tobacco content in social media and openness to smoking (a continuous variable) among nonsmokers (those who never used any combustible tobacco products), social smoking (a dichotomous variable) among smokers (those who ever used any combustible tobacco products), and combustible tobacco use (dichotomous variables representing ever and past 30 day use of various combustible tobacco products, as well as any combustible tobacco product use) among the full sample. Additional analyses including an interaction

term to assess if these relationships were moderated by having close friends who smoke were conducted, and followed by stratified analyses if a significant interaction was found. Missing data were handled with list-wise deletion per Stata's survey procedures.

Results

Overall, 20.2 % of the sample had no exposure to tobacco-related content on social media, 9.2% had exposure to only anti-tobacco content, 14.4% had exposure to only pro-tobacco content, and 56.2% had exposure to both anti- and pro-tobacco content. Unsurprisingly, a higher percentage of nonsmokers had exposure to only anti-tobacco content (12.11% vs 5.75% of ever smokers) and a higher percentage of ever smokers had exposure to pro-tobacco content, whether alone (16.3% vs 12.7% of nonsmokers) or in combination with anti-tobacco content (60.8% vs 52.4% of nonsmokers). Sample characteristics for nonsmokers, smokers, and the full sample are presented in Table 5.

Table 5. Characteristics (survey weighted %, unweighted n) of Nonsmokers, Ever Smokers, and Full Sample*

	Nonsmokers	Ever Smokers	Full Sample
Exposure to Tobacco Content on Social Media			
No Anti or Pro Exposure	22.76% (130)	17.14% (75)	20.19% (206)
Anti exposure only	12.11% (68)	5.75% (33)	9.16% (101)
Pro exposure only	12.70% (78)	16.29% (80)	14.41% (159)
Both Anti and Pro Exposure	52.43% (294)	60.83% (307)	56.24% (601)
Regular Use of Social Media			
Yes	77.50% (494)	86.98% (451)	81.37% (946)
No	22.50% (112)	13.02% (54)	18.63% (169)
Gender			
Female	52.1% (400)	48.48% (335)	50.28% (742)
Male	47.9% (213)	51.52% (172)	49.72% (391)
Age (18-20 vs. 21-24)			
18-20	32.68% (175)	24.74% (110)	29.18% (290)
21-24	67.32% (438)	75.26% (397)	70.82% (843)
Race			
White Non-Hispanic	50.70% (353)	53.78% (300)	52.6% (664)
Black Non-Hispanic	13.76% (56)	12.32% (41)	13.11% (99)
Other Non-Hispanic	10.64% (51)	6.80% (36)	8.79% (87)
Hispanic	24.91% (153)	2.71% (130)	25.49% (283)
Education			
Less than high school	9.66% (34)	14.71% (42)	11.73% (76)
High school	30.00% (148)	29.03% (112)	29.54% (263)
Some college/AA degree	47.77% (304)	42.82% (238)	45.74% (549)
Bachelor's Degree or Higher	12.56% (127)	13.44% (115)	12.99% (245)
Financial Situation			
Don't meet basic expenses	7.45% (36)	5.41% (26)	6.51% (62)
Just meet basic expenses	26.19% (149)	35.18% (166)	30.38% (317)
Meet needs with little left	35.39% (234)	40.85% (217)	37.71% (452)
Live comfortably	30.97% (191)	18.85% (98)	25.39% (291)

*Nonsmokers are those who never used any combustible tobacco products; Ever smokers are those that ever used any combustible tobacco products

Adjusting for regular use of social media and demographic characteristics, exposure to any pro tobacco content (whether alone or in combination with anti-tobacco content) is significantly associated with higher openness to smoking among nonsmokers (0.08 points higher on a 4 point scale) compared to those without any exposure to tobacco content (Table 6). Friends' cigarette use did not moderate this relationship (interaction

terms between categorical exposure variable and friends' cigarette use were insignificant, results not shown).

Table 6. Association between exposure to tobacco content on social media and openness to smoking among nonsmokers

	Openness to Smoking among Nonsmokers (n=562) *Coefficient [CI]*
Exposure to Tobacco Content on Social Media	
No Anti or Pro Exposure	*Reference*
Anti exposure only	0.02 [-0.05, 0.10]
Pro exposure only	0.08 [0.01, 0.16]*
Both Anti and Pro Exposure	0.08 [0.02, 0.15]*
Regular Use of Social Media	0.02 [-0.04, 0.07]
Female	(0.03) [-0.09, 0.03]
Young (18-20 vs. 21-24)	0.08 [0.01, 0.14]*
Race	
White Non-Hispanic	*Reference*
Black Non-Hispanic	0.03 [-0.07, 0.12]
Other Non-Hispanic	0.08 [-0.05, 0.20]
Hispanic	0.02 [-0.04, 0.08]
Education	
Less than high school	*Reference*
High school	0.03 [-0.08, 0.14]
Some college/AA degree	0.04 [-0.06, 0.15]
Bachelor's Degree or Higher	0.01 [-0.09, 0.11]
Financial Situation	
Don't meet basic expenses	*Reference*
Just meet basic expenses	(0.02) [-0.20, 0.15]
Meet needs with little left	(0.09) [-0.25, 0.08]
Live comfortably	(0.07) [-0.24, 0.10]

*p<0.05, **p<0.01, ***p<0.001

Adjusting for regular use of social media and demographic characteristics, exposure to tobacco-related content on social media was not associated with self-identified social smoking in the full sample, but the interaction terms between the categorical exposure variable and friends' cigarette use were significant for two categories of exposure (pro-tobacco only and both pro- and anti-tobacco exposure).

Stratified analyses examining the relationship between exposure and self-identified smoking among those with close friends who smoke, and separately among those without close friends who smoke, indicated exposure pro-tobacco content (whether alone or in combination with anti-tobacco content) was significantly associated with social smoking *only for those with close friends who smoke*. Specifically, among those with close friends who smoke, those with pro-tobacco only exposure had 5.6 times higher odds ($p<0.05$) - and those with both pro and anti-tobacco exposure had 6.9 times higher odds ($p<0.01$) - of self-identifying as a social smoker compared to those without any exposure to tobacco content on social media. On the other hand, among those without close friends who smoke, pro-tobacco only exposure was associated with 92% *lower* odds of self-identified social smoking and exposure to both pro- and anti-tobacco content was not associated with self-identified social smoking, compared to not having any exposure to tobacco content. See Table 7 for detailed results.

Table 7. Association between exposure to tobacco content on social media and social smoking among ever smokers, moderated by having close friends who smoke (Odds Ratio [CI])

	Social Smoking among Ever Smokers (n=488)	Social Smoking among Ever Smokers *with* close friends who smoke (n=263)	Social Smoking among Ever Smokers *without* close friends who smoke (n=214)
Exposure to Tobacco Content on Social Media			
No Anti or Pro Exposure	*Reference*	*Reference*	*Reference*
Anti exposure only	0.28 [0.03, 2.94]	4.42 [0.67, 29.14]	0.20 [0.01, 5.57]
Pro exposure only	0.08 [0.01, 0.78]*	5.59 [1.24,25.18]*	0.06 [0.00, 0.78]*
Both Anti and Pro Exposure	0.85 [0.26, 2.77]	6.88 [1.76, 26.82]**	0.78 [0.22, 2.81]
Friends' Cigarette Use	0.25 [0.05,1.29]	--	--
Exposure x Friends Cigarette Use			
No Anti or Pro Exposure x Yes	*Reference*	--	--
Anti exposure only x Yes	14.84 [0.76, 288.81]	--	--
Pro exposure only x Yes	71.97 [4.86, 1066.43]**	--	--
Both Anti and Pro x yes	7.99 [1.36, 47.05]*	--	--
Regular Use of Social Media	0.98 [0.40, 2.44]	0.82 [0.26, 2.63]	2.83 [0.39, 20.29]
Female	0.73 [0.42, 1.28]	0.60 [0.30, 1.21]	0.70 [0.25, 1.96]
Young (18-20 vs. 21-24)	0.67 [0.32, 1.37]	0.80 [0.36, 1.80]	0.80 [0.21, 3.11]
Race			
White Non-Hispanic	*Reference*	*Reference*	*Reference*
Black Non-Hispanic	1.49 [0.55, 4.06]	0.59 [0.15, 2.24]	13.13 [3.19, 54.05]***
Other Non-Hispanic	2.35 [0.75, 7.34]	0.79 [0.21, 3.08]	13.21 [2.37, 73.49]**
Hispanic	2.63 [1.43, 4.85]**	2.83 [1.32, 6.07]**	2.17 [0.74, 6.35]
Education			
Less than high school	*Reference*	0.36 [0.08, 1.55]	*predicts failure perfectly*
High school	1.48 [0.50, 4.37]	0.40 [0.13, 1.24]	1.54 [0.34, 6.95]
Some college/AA degree	1.62 [0.58, 4.55]	0.49 [0.17, 1.44]	2.49 [0.66, 9.36]
Bachelor's Degree or Higher	1.56 [0.45, 5.34]	*Reference*	*Reference*

Financial Situation			
Don't meet basic expenses	*Reference*	*Reference*	*Reference*
Just meet basic expenses	1.03 [0.34, 3.15]	1.24 [0.28, 5.54]	0.49 [0.07, 3.48]
Meet needs with little left	0.87 [0.29, 2.67]	1.09 [0.24, 4.97]	0.31 [0.06, 1.72]
Live comfortably	0.94 [0.28, 3.19]	0.81 [0.15, 4.29]	0.46 [0.06, 3.35]

*p<0.05, **p<0.01, ***p<0.001

Adjusting for regular use of social media and demographic characteristics, exposure to tobacco-related content on social media was associated with combustible tobacco use (Table 8). Any pro-tobacco content exposure (whether alone or in combination with anti-tobacco content) was significantly associated with 1.8 to 2.8 times higher odds of ever and past-30 day cigar and hookah use compared to not having any exposure to tobacco content. However, any pro-tobacco content exposure was not associated with ever or past-30 day cigarette use. Instead, those with anti-tobacco only exposure had 40 to 50% lower odds of ever and past-30 day cigarette use. Significant relationships between exposure and ever combustible use are driven by the relationship between exposure and cigar and hookah use, while the significant relationship between exposure and past 30 day use is driven by the relationship between exposure and past 30 day cigarette use. The relationship between exposure and ever and past 30 day cigarette use was not moderated by having close friends that smoked cigarettes (interaction terms not significant, results not shown), and the relationship between exposure and ever and past 30 day hookah use was not moderated by having close friends that smoked hookah (interaction terms not significant, results not shown). The survey did not include questions about close friends that smoked cigars.

Table 8. Association between exposure to tobacco content on social media and combustible tobacco use **(Odds ratio [CI])**

	Ever Combustible Use	Ever Cigarette Use	Ever Cigar Use	Ever Hookah Use	Past 30 Day Combustible Use	Past 30 Day Cigarette Use	Past 30 Day Cigar Use	Past 30 Day Hookah Use
Exposure to Tobacco Content on Social Media								
No Anti or Pro Exposure	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*
Anti exposure only	0.62 [0.32, 1.18]	0.48 [0.24, 0.94]*	1.10 [0.48, 2.55]	0.59 [0.28, 1.24]	0.50 [0.27,0.94]*	0.39 [0.19, 0.83]*	1.01 [0.45,2.28]	1.18 [0.54, 2.58]
Pro exposure only	1.62 [0.98, 2.67]*	1.22 [0.73, 2.04]	2.26 [1.20, 4.25]*	1.88 [1.06, 3.35]*	1.32 [0.79, 2.20]	1.02 [0.59, 1.77]	2.23 [1.12, 4.46]*	2.79 [1.49, 5.24]**
Both Anti and Pro Exposure	1.56 [1.05, 2.33]**	1.39 [0.92, 2.08]	2.48 [1.49, 4.15]**	1.78 [1.11, 2.87]*	1.25 [0.83, 1.89]	1.05 [0.68, 1.64]	1.99 [1.10, 3.59]*	2.52 [1.46, 4.32]**
Regular Use of Social Media	1.41 [0.89, 2.23]	1.28 [0.80, 2.07]	1.20 [0.68, 2.09]	1.38 [0.76, 2.48]	1.82 [1.12, 2.93]*	1.90 [1.10, 3.27]*	1.96 [1.03, 3.72]*	1.33 [0.70, 2.52]
Female	0.69 [0.52, 0.93]*	0.72 [0.53, 0.98]*	0.55 [0.40, 0.78]**	0.99 [0.71, 1.39]	0.82 [0.60, 1.11]	0.85 [0.61, 1.19]	0.68 [0.47, 0.98]*	1.21 [0.83, 1.75]
Young (18-20 vs. 21-24)	0.56 [0.40, 0.79]**	0.52 [0.36, 0.75]***	0.64 [0.43, 0.97]*	0.63 [0.42, 0.97]*	0.52 [0.36, 0.74]***	0.51 [0.34, 0.76]**	0.56 [0.35, 0.89]*	0.52 [0.32, 0.85]*
Race								
White Non-Hispanic	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*
Black Non-Hispanic	0.57 [0.31, 1.06]	0.66 [0.36, 1.24]	0.69 [0.34, 1.38]	0.47 [0.23, 0.96]*	0.91 [0.49, 1.71]	0.93 [0.48, 1.82]	1.01 [0.44, 2.31]	0.74 [0.31, 1.74]
Other Non-Hispanic	0.48 [0.27, 0.87]*	0.43 [0.24, 0.79]**	0.64 [0.34, 1.23]	0.80 [0.42, 1.52]	0.89 [0.49, 1.61]	0.61 [0.32, 1.16]	1.11 [0.52, 2.40]	1.35 [0.62, 2.91]
Hispanic	0.50 [0.26, 0.96]*	0.33 [0.17, 0.65]**	0.77 [0.38, 1.55]	1.18 [0.59, 2.35]	0.89 [0.46, 1.71]	0.55 [0.27, 1.11]	1.36 [0.61, 3.04]	2.22 [0.97, 5.08]

Education								
Less than high school	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*
High school	0.88 [0.50, 1.52]	0.74 [0.42, 1.30]	1.14 [0.63, 2.07]	1.13 [0.60, 2.13]	0.63 [0.36, 1.11]	0.61 [0.32, 1.18]	0.93 [0.47, 1.82]	0.55 [0.29, 1.07]
Some college/AA degree	0.60 [0.32, 1.10]	0.70 [0.37, 1.31]	0.37 [0.17, 0.78]**	0.64 [0.31, 1.32]	0.62 [0.34, 1.15]	0.78 [0.39, 1.57]	0.28 [0.14, 0.54]***	0.57 [0.27, 1.18]
Bachelor's Degree or Higher	0.96 [0.68, 1.36]	0.90 [0.63, 1.29]	0.76 [0.50, 1.14]	1.33 [0.90, 1.96]	0.82 [0.57, 1.17]	0.89 [0.60, 1.32]	0.71 [0.45, 1.13]	1.11 [0.71, 1.73]
Financial Situation								
Don't meet basic expenses	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*	*Reference*
Just meet basic expenses	1.70 [0.83, 3.48]	1.31 [0.63, 2.73]	0.84 [0.40, 1.79]	2.14 [0.98, 4.65]	1.62 [0.79, 3.34]	1.45 [0.67, 3.13]	0.83 [0.36, 1.93]	1.34 [0.59,3.07]
Meet needs with little left	1.46 [0.73, 2.96]	1.18 [0.58, 2.43]	0.66 [0.31, 1.38]	1.90 [0.88,4.13]	1.62 [0.79, 3.29]	1.33 [0.62, 2.86]	0.77 [0.34, 1.76]	1.30 [0.57, 2.99]
Live comfortably	0.72 [0.35, 1.50]	0.58 [0.28, 1.24]	0.44 [0.20,0.96]*	1.20 [0.53, 2.68]	0.88 [0.42, 1.85]	0.69 [0.31, 1.53]	0.53 [0.22, 1.26]	0.78 [0.33, 1.84]

*p<0.05, **p<0.01, ***p<0.001

Discussion

This study is the first to examine exposure to tobacco-related content in social media and the relationship between that exposure and tobacco use behaviors among a large, national sample, and lends support to the limited existing literature demonstrating that exposure to social media content featuring smoking is associated with tobacco use outcomes (Depue et al., 2015; Hébert et al., 2017; Link et al., 2015).

Exposure to pro-tobacco content in social media was widespread (over 70%, either alone or in combination with anti-tobacco content) in this young adult population. It is likely that there is far more pro-tobacco content on social media than anti-tobacco content, though comprehensive content analyses are necessary to confirm this. It is also important to note that smoking is more explicit than nonsmoking; that is, any reference to or depiction of smoking in a social media message or image can be construed as pro-smoking content, but the same cannot be said of the absence of smoking in a social media message or image.

Notably, exposure to only anti-tobacco content was more common among nonsmokers and exposure to pro-tobacco content was more common among smokers. While homophily of risk behaviors – including specific to tobacco use – is by no means unique to social media, and has been demonstrated in offline social networks (Christakis & Fowler, 2008; Go, Tucker, Green, Pollard, & Kennedy, 2012; Kobus, 2003), such homophily in tobacco use content and norms experienced in social media has the potential to accelerate peer influence processes. Not only is social media accessible 24/7 from almost anywhere via mobile devices, it also enables the sharing of highly visible and quantifiable peer-to-peer feedback. This accelerated peer influence, occurring in the

context of differing tobacco use content and norms across networks of young adults, may in turn strengthen pro-tobacco norms among certain networks and anti-tobacco norms among others (Grace C. Huang, Unger, et al., 2014), potentially exacerbating existing disparities in tobacco use (U.S. National Cancer Institute, 2017).

This is the first study to demonstrate an association between exposure to tobacco-related content in social media and the discrete tobacco use outcomes of openness to smoking among nonsmokers (albeit a small effect), self-identified social smoking among smokers with close friends who smoke, and use of different combustible tobacco products among the full sample. The cross-sectional nature of this data precludes drawing conclusions about directionality, and these associations may be due to peer selection (nonsmokers that are open to smoking and smokers being more likely to initiate and maintain friendships with those that share pro-tobacco content) or peer influence (those that see pro-tobacco content being influenced by this content to be more open to smoking, identify as a social smoker, or use certain tobacco products).

Nonetheless, these findings provide useful insights. Although a positive association was detected between exposure to pro-tobacco content and openness to smoking among nonsmokers, the extremely small effect (a difference of 0.08 on a scale of 1-4) is unlikely to have substantive importance. Smoking among close friends moderated only the relationship between exposure to tobacco-related content in social media and self-identified social smoking among smokers. This was the only relationship assessed among smokers specifically, and also the only *social* smoking outcome. Though directionality cannot be determined, it is possible that the nature of pro-tobacco content exposure experienced by those with close friends who smoke is different (e.g., more

images of smoking in a fun, social atmosphere), and both the nature of this content and the fact that one's close friends smoke could influence a more positive response to seeing these images, prompting a greater likelihood of identifying as a social smoker. Indeed, researchers have found that social media posts featuring drinking in a sociable, affirmative light receive significantly more "likes" than other posts (Beullens & Schepers, 2013; Steers et al., 2016). On the other hand, not having close friends who smoke could prompt a negative response to pro-tobacco content, explaining the lower odds of self-identified social smoking among those without close friends who smoke who were exposed to pro-tobacco content only. It is also possible that directionality is reversed, such that self-identified social smokers who have close friends who smoke are more likely to share pro-tobacco content with each other, perhaps because they anticipate their smoker friends will provide positive feedback (in the form of likes, comments, etc.) in response to such content.

The differences in the relationship between exposure to tobacco-related content in social media and use of different combustible tobacco products are notable. Pro-tobacco content exposure was associated with cigar and hookah use, but not cigarette use. It is possible that social media posts of cigar and hookah smoking portray use of these products in a more social, positive light, driving a stronger relationship between exposure to such content and use of these particular products. Indeed, prior research suggests young adults have positive associations with smoking hookah and little cigars and cigarillos because they are used in social gatherings, can be used to perform smoke tricks, come in various flavors, and are thought to be less harmful than cigarettes and less likely to have health consequences due to their infrequency of use (Cornacchione et al., 2016).

It is also possible that cigar and hookah users see more pro-tobacco content in their networks, perhaps because they are friends with other cigar and hookah users who may be more likely to share images of using these products because of the aforementioned positive associations young adults have with smoking hookah and cigars.

On the other hand, anti-tobacco only exposure was associated with lower odds of cigarette use but not cigars or hookah. It is possible that anti-tobacco content on social media is more specific to cigarette use, or at least interpreted as relevant only by regular smokers of cigarettes and dismissed by those who use cigars and hookah, especially those who use them infrequently. Because such social smokers do not see themselves as "smokers" and do not feel vulnerable to the long-term consequences of smoking (Youjin Choi, Choi, & Rifon, 2010; Debevec & Diamond, 2012), traditional anti-tobacco messages may be ineffective with this population.

Limitations of this study include the study sample's low completion and cumulative response rates. However, these rates are similar to other studies that have relied on KnowledgePanel (Grande et al., 2013; Kelly et al., 2015; Kumar et al., 2012), and there is little indication of nonresponse bias on core variables in other KnowledgePanel samples or in this sample specifically (Garrett et al., 2010; Heeren et al., 2008; Rath et al., 2012). Although the use of self-reported survey data may be subject to recall bias, one's perceptions of exposure may have more bearing on changes in tobacco use attitudes and behaviors than objective exposure. The survey measures around exposure to tobacco content in social media also lacked specificity (asking about exposure to combustible tobacco use generally, without specifying which products or whether the context of the posts was social). The exposure variable also examined *any*

exposure to pro- or anti-tobacco content as opposed to differing levels of exposure, precluding the understanding of dose-response effects or a ratio of pro to anti-tobacco content seen. Further research is needed to understand the precise nature of the tobacco-related content young adults see on social media (including what products are featured, what the context of smoking images and videos are, whether smoking is glamorized in such posts, etc. as well as how much pro-tobacco content is seen and how that compares to quantity and frequency of anti-tobacco content seen) and how that may contribute to the differences seen in this study as far as how exposure may differentially influence use of different tobacco products, as well as social smoking. Research is also needed to glean insight into the sharing of tobacco content among different peer networks, and if increased sharing of tobacco content among those who smoke certain tobacco products or have close friends who smoke reinforces pro-smoking norms in these networks. Since the use of cross-sectional analyses precludes understanding causality, longitudinal research is needed to understand the directionality of the associations found between exposure to tobacco-related content in social media and tobacco use outcomes.

While further research is needed to elucidate the results of this analysis, this is the first study to examine exposure to pro- and anti-tobacco content in social media – and the relationship between that exposure and tobacco use outcomes, adjusting for demographic characteristics – among a large, national sample of young adults. In addition to adding to the evidence base demonstrating a link between exposure to tobacco posts on social media and tobacco use behaviors, the results of this study highlight the potentially heightened impact of tobacco content in social media on social smoking and use of cigars and hookah specifically. These are behaviors demonstrated to be more common in the

young adult population (Barnett et al., 2013; Caroline Cobb et al., 2010; Grekin & Ayna, 2012; Jarrett et al., 2012; Jiang et al., 2014; Lisha et al., 2015; Moran et al., 2004; Richardson et al., 2013; Song & Ling, 2011; Villanti et al., 2012), and deserve greater attention from the tobacco control community.

Campaigns and interventions delivered in the social media environment specifically targeting social smoking and use of cigars and hookah should be explored as a potential public health approach to countering the influence of smoking posts in social media. Though the ever-changing social media landscape and unique features of different sites (such as those where networks remain largely private, or where posts disappear after a certain time) may complicate the development of such interventions, such interventions also hold much potential for influencing tobacco use norms and behaviors among this at-risk population of young adults (Ridout & Campbell, 2014; Steers et al., 2016). Normative interventions may be particularly influential as norms are the likely mechanism by which exposure to smoking posts on social media influences tobacco use outcomes (Steers et al., 2016; Yoo et al., 2016). Given young adults' use of social media to share images and videos while out socializing, social media may also prove to be an ideal channel to deliver normative and other information about social smoking and use of cigars and hookah in real-time (Ridout & Campbell, 2014). Additionally, given the possibility that those who smoke certain products or have close friends who smoke see more pro-tobacco content in social media, network interventions (which purposefully use social networks or social network data to generate social influence and change behavior (Valente, 2012)) should also be explored.

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Chapter 4: A Qualitative Exploration of How Young Adults Express and Process Pro- and Anti-Tobacco Content in Social Media (Study 3/Aim 3)

This chapter is a pre-copy-editing, author-produced version of an article that will be condensed and submitted for publication to *Tobacco Control*.

Abstract

Background: Given pervasive use of social media among young adults, social media is a key source of exposure to pro- and anti-tobacco content. Unique features of social media, including the ability for users to generate, share, and critique content, may heighten the role of peer influence in determining the nature and impact of young adults' exposure to tobacco-related content on social media. However, little is known about young adults' experiences with pro- and anti-tobacco content in social media. This study explores young adults' subjective experience of consuming tobacco-related content in social media and peer influences on this experience.

Methods: Eighteen in-depth interviews were conducted with 18-24 year olds in the DC metro area, eight current or former smokers and ten nonsmokers. Respondents were asked about their exposure to and processing of pro- and anti-tobacco content in social media, as well as their perceptions on the influence such content had on their tobacco use attitudes, norms, and behaviors. Interviews were audio recorded and transcribed, and transcriptions coded thematically in NVivo.

Results: The experiences of young adults interviewed suggest that there may differences in tobacco content and norms experienced in social media across networks of young adults – where certain smokers (primarily low income, minority respondents) report

experiencing group norms that support smoking, most young adults report experiencing group norms that support social smoking (especially of cigars and hookah), and almost nobody reports feeling supported in taking an anti-tobacco stance. Young adults reported careful image curation to match group norms in their network, and while they did not consciously think smoking posts had an impact on them, they did believe these posts influence their peers.

Conclusions: Differing social media tobacco use content and norms across networks of young adults may reinforce or even exacerbate existing disparities, as well as high rates of social smoking and use of cigars and hookah among young people. Young adults' assumption that smoking posts on social media influence their peers heightens the impact these posts have on their perceptions of the prevalence and acceptability of smoking, especially with respect to social smoking and use of cigars and hookah. Innovative social media interventions – including those focused on norms around the acceptability of smoking posts and the presumed influence posts have on peers, as well as network interventions that purposefully leverage network characteristics to influence behavior change – could be developed to mitigate or counter this influence.

Introduction

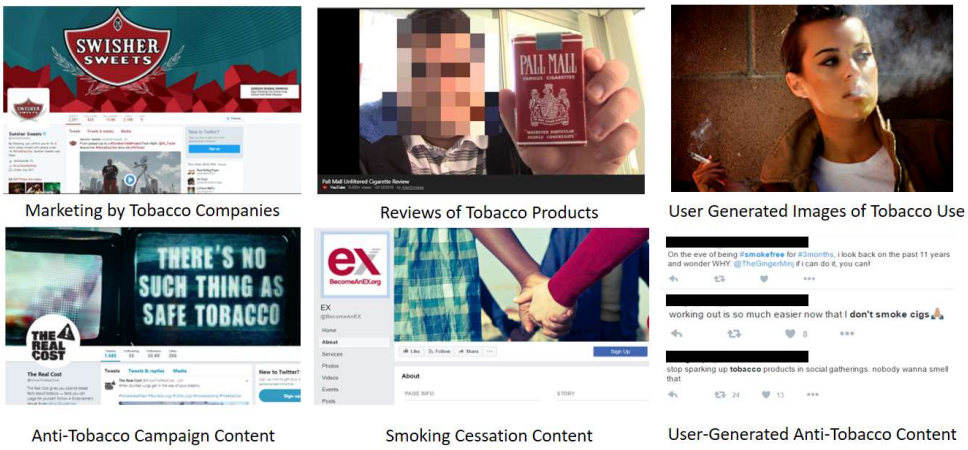
Young adults' use of social media (i.e., online social networking sites including Facebook, Twitter, YouTube, Twitter, Instagram, Snapchat, and Tumblr) is widespread, with 95% of 18-29 year olds using social media and young adults averaging over three hours a day across their social media accounts (Emarketer, 2014; Perrin, 2015). As such, social media is a key source of exposure to both pro- and anti-tobacco related content that may influence the tobacco-related attitudes and behaviors of young adults, who are at a

particularly vulnerable stage in terms of tobacco use, as they transition through a critical development period during which lifelong health behaviors are established (Arnett, 2000).

Young adults are exposed to pro-tobacco content on social media through messages, images, and videos depicting tobacco use by peers on their personal pages, as well as unregulated tobacco marketing and peer-to-peer promotion such as tobacco product reviews or brand fan pages (Burton et al., 2015; Freeman & Chapman, 2010; Guidry et al., 2016; Link et al., 2015; Richardson et al., 2014; Richardson & Vallone, 2014; Step et al., 2016; Szczypka, 2015); and they are exposed to anti-tobacco content from public health campaigns, smoking cessation interventions, tobacco control advocacy organizations, and peers, who may share anti-tobacco content from the aforementioned sources or post their own anti-tobacco messages (see Figure 5) (Burton et al., 2015; Freeman & Chapman, 2010; Guidry et al., 2016; Link et al., 2015; Richardson et al., 2014; Richardson & Vallone, 2014; Step et al., 2016; Szczypka, 2015).

And while researchers have examined the influence of pro- and anti-tobacco content in traditional media channels on changing attitudes, norms, and behaviors (National Cancer Institute, 2008), social media has unique properties – such as the ability for users to generate and share content, critique and rank content (e.g., likes, comments), and interact with each other (Papasolomou & Melanthiou, 2012; Tuten, 2008) – that may heighten the role of peer influence in determining the nature and impact of young adults' exposure to tobacco-related content on social media.

Figure 5. Examples of Pro- and Anti-Tobacco Content in Social Media

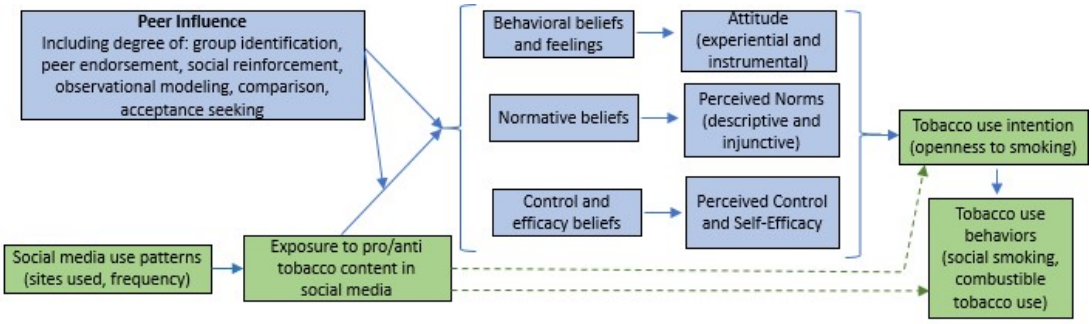


"User Generated Images of Tobacco Use" photo is a CC image courtesy of Mark Sebastian (https://www.flickr.com/photos/markjsebastian/2752162749/)

Conceptual Framework

The conceptual framework (see Figure 6; boxes in blue represent constructs that were explored qualitatively) upon which the design of this study and the creation of the interview guide were based was rooted in the Integrated Behavior Model (Chen & Chaiken, 1999; Montano & Kasprzyk, 2008; Patel et al., 2013), and incorporated additional constructs from social influence/peer influence theories (Asch, 1956; Bandura, 1978, 1986; Chatzisarantis et al., 2009; S. Choi, 2015; Deutsch & Gerard, 1955; Festinger, 1954; Griggs, 2012; Latane, 1981; Litt et al., 2012; Mahler et al., 2010; Mead et al., 2014; Eugene R. Oetting et al., 1998; Petraitis et al., 1995; RN Rimal & Real, 2005; Thorson & Wells, 2012).

Figure 6. Conceptual Framework Informing Design of Study*



*Green boxes indicate variables that will be measured quantitatively and examined qualitatively; Blue boxes indicate constructs that will be examined through qualitative data only; Green arrows indicate relationships tested quantitatively (as associations); Blue arrows indicate relationships that will be examined through qualitative data only

Theoretically, the framework predicts that peers influence perceptions of tobacco-related content through social reinforcement, observational modeling, and other such factors, and that prevalence and acceptability of smoking within one's network is a key factor in the nature of peer influence one experiences and the impact that influence has on one's attitudes, norms, and behaviors. Applying the IBM to the process by which pro- and anti-tobacco content is processed and ultimately impacts behavior, the framework posits that one's perception of tobacco-related content in social media in turn influences tobacco use behaviors through the following pathway: this content influences 1) behavioral beliefs and feelings, which influence experiential (i.e., emotional) and instrumental (i.e., cognitive, determined by beliefs about outcomes of the behavior) attitudes towards the idea of engaging in the behavior; 2) normative beliefs, which influence perceived descriptive (perceptions about the prevalence of a behavior) and injunctive (perceptions about peer approval and disapproval of a behavior, and their experience with the pressure to conform) norms; and (to a lesser degree) 3) control and efficacy beliefs, which influence perceived control (perception of degree to which it is within one's control to engage in the behavior) and self-efficacy (perception of one's

ability to engage in a particular behavior). In turn, attitudes, norms, and perceived control and self-efficacy influence tobacco use intention, and ultimately behavior (Cialdini et al., 1990; Montano & Kasprzyk, 2008; Rimal & Real, 2003; Tavousi et al., 2009).

Norms play a significant role in this model. According to primary socialization theory, socialization is the process of learning these social behaviors, and occurs as an active interaction between an individual and the primary socialization sources that place certain behavioral expectations on individuals, monitor and reinforce these expectations, provide feedback and reward when expectations are met, and impose sanctions when expectations are not met. Peers are a particularly important primary socialization source, especially in adolescence and young adulthood (Oetting et al., 1998), as individuals are particularly sensitive to peer feedback as a source of understanding their own identity (Institute of Medicine and National Research Council Committee on the Science of Adolescence, 2011; Prinstein, 2009) during a time of transition when new identities and peer group affiliations are being established (Huang, Unger, et al., 2014; Kobus, 2003; Simons-Morton & Farhat, 2010).

During young adulthood, when peer influence is particularly powerful, social media enables a constant and real-time "socially curated" flow of information and feedback from peers, who generate and share content directly as well as critique and rank content, thus serving as "socially-located opinion leaders" (S. Choi, 2015; Thorson & Wells, 2012). Peer influence in social media may manifest in a number of ways, including group identification (where identifying with a particular group makes them more influential in shaping one's attitudes, norms, and behaviors), social reinforcement (engaging in behaviors one's peers approve of), acceptance seeking (engaging in

behaviors in order to be liked and accepted by peers), and observational modeling (imitating behaviors of peers) (Asch, 1956; Chatzisarantis et al., 2009; Deutsch & Gerard, 1955; Griggs, 2012; Mead et al., 2014; RN Rimal & Real, 2005). These mechanisms and the influence they have on young adults may be heighted in a social media context given the immediacy, frequency, and scale of information flow (Latane, 1981), which enables a phenomenon B.J. Fogg dubbed "mass interpersonal persuasion", noting that online social networks enable individuals to change others' attitudes and behaviors – that is, exert social influence – on a mass scale (Fogg, 2008).

Extensive research has established the role of peer influence and the social environment in initiation and continuation of smoking, especially for young people (Simons-Morton & Farhat, 2010), and a number of studies have explored the role of peer influences in social media on health behaviors and outcomes, including alcohol use (Boyle, LaBrie, Froidevaux, & Witkovic, 2016; Moreno & Whitehill, 2014), sexual behaviors (Gebremeskel et al., 2014), and anxiety and depression (Lin et al., 2016; Primack et al., 2017). However, there has been very limited exploration of the role of peer influence in exposure to and perception of tobacco-related content in social media (Depue et al., 2015; Hébert et al., 2017; Link et al., 2015; Yoo et al., 2016), and to our knowledge, no literature to date qualitatively exploring the subjective experience of consuming tobacco-related content in social media and peer influences on this experience.

Methods

Data Collection

Eighteen in-depth, individual interviews, approximately 60 minutes long, were conducted with 18-24 year olds in the DC metro area who used social media at least once a week, 10 nonsmokers and 8 current or former smokers (defined as having ever regularly smoked cigarettes, cigars, or hookah). In-depth interviews were chosen as the data collection method because of their ability to provide insights into an individual's personal experience seeing and understanding tobacco-related messages in social media

Participants were recruited via Craigslist, fliers posted at targeted locations such university and community college campuses, and emails sent via gatekeepers at universities, community colleges, and youth and young-adult serving organizations in the DC metro area; two smokers were also recruited via snowball referrals. Only 18-24 year olds who used social media at least once a week were eligible to participate. Purposive sampling was employed to gather data from both smokers (who used cigarettes, cigars, and/or hookah) and nonsmokers, with varied demographic characteristics (gender, race, age, education, college enrollment, etc.). Participants were asked to complete a brief questionnaire prior to the interview to capture their demographics and social media use (see Appendix C) and were provided a $25 Amazon or CVS gift card upon completion of the interview.

Interviews were guided by a semi-structured interview guide (see Appendix D). Key instrument domains followed the conceptual framework and captured exposure to, processing of, and influence of pro-tobacco and anti-tobacco content, as well as response to specific examples (where participants were shown print-outs of examples of tobacco-

related content in social media and asked to walk through their reaction to them). The questions included in the guide were formulated to shed light on the key theoretical constructs and relationships outlined in the conceptual framework, and the examples were purposively chosen to capture different types of pro-tobacco content (smoking alone vs. in a social setting, smoking cigarettes vs. hookah, etc.) and anti-tobacco content (different public health campaigns, informational content, advocacy content, etc.). Both formulation of questions and selection of images were further informed by knowledge of young adults' tobacco use patterns (including high rates of social smoking (Jiang, Lee, & Ling, 2014; Lisha, Delucchi, Ling, & Ramo, 2015; Moran et al., 2004; Song & Ling, 2011; Villanti, Rath, & Vallone, 2012) and cigar and hookah use (Barnett et al., 2013; Caroline Cobb et al., 2010; Grekin & Ayna, 2012; Jarrett et al., 2012; Rath et al., 2012; Richardson et al., 2013)), as well as by an IRB-approved pilot study conducted in the Spring of 2016 (Appendix E). During this pilot study, young adults dismissed many example images that did not meet their standards for aesthetic sophistication because they felt they were unlikely to see such low-quality images in their social media feeds. In order to better align with young adult's real-life social media experiences, in this study, care was taken to select aesthetically high-quality examples. Questions and probes were also added to better understand the role of aesthetics in how young adults reacted to pro- and anti-tobacco content in social media, as well as the role of whether or not smoking was the focus of a post, which pilot study participants highlighted as another key factor in determining their response.

Interviews were conducted from July through October of 2017 by the primary researcher either in person (thirteen interviews) or via Facetime (five interviews), and

data collection continued until after theoretical saturation was reached. This study was approved by the George Washington University IRB. The aforementioned conceptual framework and methodology (including recruitment, sampling, and semi-structured interview guide) were informed by the aforementioned pilot study (see Appendix E).

Analysis

All interviews were audio recorded, transcribed verbatim, and imported into NVivo V.11 for coding (QSR International, 2015). Full transcripts were coded thematically using a theoretically-driven, open-coding approach, whereby a list of predetermined codes based on the interview guide and conceptual framework were used to begin coding transcripts, and codes were continually changed and added as new ideas pertaining to the conceptual framework emerged from analysis of the transcripts (Braun & Clarke, 2006; Creswell, 2007; Strauss & Corbin, 1990). This theoretical thematic analysis was undertaken with a realistic approach, reporting experiences, meanings and the reality of participants (Braun & Clarke, 2006).

Once all interviews were completed and a codebook fully developed, the primary researcher trained a dual-coder to code the interviews independently using the codebook. The dual-coder independently coded a subset of 11% (2/18) of the interviews based on a qualitative analysis method where segments of the transcript coded by the primary researcher are highlighted for re-code (Campbell, Quincy, Osserman, & Pedersen, 2013). Inconsistent application of codes by the two coders were discussed and resolved, with modifications made to the codebook when needed to maximize coherence and validity, including merging codes and clarifying code names, definitions or inclusion/exclusion criteria. Once the coding scheme was finalized, the primary researcher coded all

transcripts (including re-coding the transcripts coded prior to finalizing the coding scheme).

Upon coding transcripts, themes and subthemes were identified via a comparative "cutting and sorting" process in which participant statements were sorted into various codes, which in turn were used to identify themes, including common experiences and differing views. Linkages and patterns in the data were determined by cross-referencing different codes to examine the relationship between them, with particular attention paid to the role of peer influence in consuming tobacco-related content in social media, and how the experience of consuming this content was similar or different for smokers and non-smokers. Information from the demographic questionnaire including financial situation and race/ethnicity were coded for each interview, so this cross-referencing process also helped uncover certain experiences that differed by demographic characteristics among those interviewed. When quotations are used in the Results section, participants are identified by a numerical identifier (101-118), gender (F=female/M=male), age (in years) and smoking status (S=smoker, N=non-smoker). See Table 9 for participant characteristics.

Table 9. Participant Characteristics

CHARACTERISTIC	*# of participants*	CHARACTERISTIC	*# of participants*
Smoking Status		*Education Level*	
Smoker	8*	Less than high school/GED	2
Non-smoker	10	Completed high school/GED	9
Gender		Completed associate's degree	2
Female	13	Completed bachelor's degree	5
Male	5	*Current Status*	
Age		Undergraduate student	7
18-20	6	Graduate student	2
21-24	12	Non-student working part-time	2
Race		Non-student working full-time	2
White	5	Non-student, unemployed	2
Black/African American	5	Other	2
Hispanic	3	Missing	1
Asian	4	*Financial Situation*	
Other	1	Don't meet basic expenses	2
Social Media Use		Just meet basic needs	4
Multiple times per day	15	Meet needs with little left	6
Daily	3	Live comfortably	6

*Smokers were defined as those that had ever regularly smoked one or more combustible tobacco products; 2 out of 8 smokers were former smokers

Results

Themes that emerged from the interviews fall into three key categories, corresponding to peer and related normative influences on exposure to tobacco-related content in social media and on reactions to and processing of such content, and the impact such content might have on attitudes, norms, and behaviors. All references to smokers and smoking refer to the use of combustible tobacco products (cigarettes, cigars, and/or hookah). Pro-tobacco content includes not only marketing and promotion of tobacco products, but also depictions of tobacco use by peers.

Curating an Image to Match Group Norms*: The Influence of Peers and Perceived Norms on Exposure to Tobacco-Related Content in Social Media*

Many interviewees said they saw smoking posts in their social media feeds only occasionally, which most attributed to the fact that even their friends who smoked were not posting about it on social media. The notable exception to this was a few respondents – primarily smokers – with low financial situations (not meeting or just meeting expenses) who said the vast majority of their social network used tobacco products *and* posted pictures/videos of themselves smoking, and a couple interviewees who mentioned frequently seeing pictures of models smoking on social media.

Smokers and non-smokers alike felt that smokers fell into one of two categories when it came to posting images or videos of themselves smoking on social media, with most smokers rarely or never sharing such content and a minority of smokers posting such content frequently.

Based on participants' experiences, it seems the minority of smokers who do post images of themselves smoking are curating an image in accordance with norms of a niche group that values being artsy and rebellious, or norms of a younger group that still views smoking as "cool".

> "Most of photos featuring tobacco usage [that I see] are from, I guess, alt or indie people, like a film photo of someone with a cigarette in their mouth…You don't see people in business casual posting photos of them smoking. It's really people from a certain scene." (*103,M,20,N*)

> "It becomes this weird sort of anti-cool, where it's like, I [smoke tobacco] anyway even though you don't think it's cool." (*106,F,21,N*)

> "I do think most of the people that do post, they are either younger or they're just kind of new to the activity, so I guess it makes them think that they're cool." *(114, M, 22, S)*

On the other hand, the majority of smokers that don't post about smoking also seem to be engaging in impression management, but in deference to broader societal norms that frown upon tobacco use. Nonsmokers and smokers alike suggested that sharing pictures of smoking would present a negative image to others, particularly employers and family members. Many also felt their generation thinks smoking is "trashy" and no longer cool.

> "People sometimes hide their hands [in pictures on social media even though you know they're smoking cigarettes]…It's kind of like a habit, like a rite of passage. You started hiding it because of your family, now you hide it because, well you're interested in people having a good impression of you…and even further down the road after college, it's like, you're a professional." (*108,M,22,N*)
>
> "Even when I went through that stage, I wouldn't post up any pictures of me smoking or of me drinking…I was always conservative 'cause I didn't want people talking all 'Look at her, she's smoking all the time. Look at her'". (*109,F,19,S*)
>
> "I don't post pictures of myself smoking "because it's not really something people put on social media…because it's not good, and it stinks. It literally stinks, so nobody wants to show that they inhale stink. [And] it doesn't go with my funny stuff [that I post on my social media]." (*107,F,18,S*)

Smokers also mentioned wanting to avoid conflict with others in their network.: "In general, I think we usually just keep it to ourselves. Not in a taboo kind of way, it's just…It's not something to brag about….I'd rather not post something that's in general [something] that people don't like, understandably. [Then I] have to have a virtual argument because I decided to promote… something provocative….That's mostly the reason I don't post. Just to save conflicts, and that's really about it." (*117,M,21,S*)

Young adults interviewed were adept at self-monitoring in terms of what they posted on social media about tobacco use, shifting their self-presentation to match differing group norms on different social media sites, based on factors such as:

- composition of the group (e.g., family members and employers vs. only close friends): “Instagram I guess is where I find the most smoke posts, because…you just go private and you can post whatever you want, it isn’t going to have any backlash…professional or family wise.” (*108,M,22,N*) *Also see Q1, Q2, and Q3 in Table 10*;
- degree of anonymity: a number of interviewees mentioned seeing more depictions of tobacco use on their peers’ Finstas, which are fake Instagram accounts disassociated from a person’s real name or identify, than on their regular accounts. *See Q4 in Table 10*; and
- how long they expected the post to be visible (with more ephemeral posts warranting less self-monitoring, as they were less likely to become a part of one’s lasting image online). “[I see more pictures and videos of smoking on Snapchat because] I feel like people, just, are more themselves, I guess, on Snapchat…You have it on for a certain amount of time or you can delete it whenever you want or essentially you can send it to someone else for like two seconds and then that’s that, you know, it just disappears.“ (*114,M,22,S*)).

Respondents’ willingness to ask for pictures of themselves or peers to be taken down when they were seen as counter to prevailing group norms highlights the lengths to which they will go to preserve an image that aligns with groups norms. One nonsmoker described her reasoning: “I care about your future and I want you to have a job after college, which is why I tell you to take that stuff [smoking pictures] down.“ (*104,F,20,N*). One smoker described a picture of him smoking posted by a friend:

> " I had like a kind of drunk face with a cigar in my hand, kind of laying around on the beach... I didn't feel it was nice picture so people that base me or are trying to understand me and kind of evaluate me based on a piece of paper and some pictures on social media, trying to get information of me online…it didn't create a close resemblance to how I think I am. So I thought it's not necessary…it's fine to put in the group friends chat or whatever, but if you can just take it off [social media]." (*108,M,22,N*)

Despite a strong belief that norms in society broadly and social media networks specifically frowned upon tobacco use, interviewees – even nonsmokers who held strong antismoking beliefs – were generally unwilling to speak out against tobacco use on social media, again due to concerns about image, either their own or their peers.

> "I think as uncool as it might be to post photos of you smoking, I think it's less cool to confront someone about that [and] be like, 'Oh, you're so lame,' or like, 'Don't you know the consequences?' That's not a great look, literally." (*103,M,20,N*)

> "In person, it's a lot easier to say, "Hey, you shouldn't smoke," and the person says, "Yeah, I know I shouldn't." But if you say that in the public thing, like commenting on their Facebook post, now they have to defend themselves in front of how many people, and it's not one on one…You've publicly called them out, which is far more serious than just saying it privately." (*115,M,20,N*)

Look Good, Look Social, But Don't Look Like a Smoker*: The Influence of Peers and Pre-existing Attitudes/Norms on Reaction to/Processing of Tobacco-Related Content*

Respondents' reaction to social media posts featuring smoking were driven both by attitudes and norms around tobacco use ("I don't see it as cool. I just see it as self-harm in a pretty gross way." (73101)) as well as attitudes and norms around *posting* about tobacco use ("What's the purpose of this?...Why you putting [it] on social media? Why you want everybody [to] know that you smoke a cigarette?" (81801)). Although group norms seemed to oppose posts focused solely on one's tobacco use, this was not true of posts in which tobacco use was incidental, especially if the context was artistic or social.

Individuals sharing posts focused solely on one's tobacco use or calling attention to their smoking with hashtags such as #smokingselfie were judged harshly because they

"own it and enjoy that image [of being a smoker]" (*103,M,20,N*). These individuals were seen as attention seeking, showing off, and trying too hard.

> "They want to call your attention…and I think they use the cigarette kind of like, 'Oh, I'm in this really cool place, and I'm smoking and I have a nice quote. Like me, make me feel like I'm great.'…If they know that, they don't really have to take the picture, do the pose, take like 300 pictures until the perfect one with the perfect filtering…I don't buy that 'Oh I was just posing, it was natural.' I don't think so…I wouldn't like it. And I guess like, the cigarette's just like an indicator like, oh you really put effort in that picture." (*108M,22,N*) *Also see Q5, Q6, and Q7 in Table 10.*

Smokers and nonsmokers alike viewed posting pictures focused specifically on smoking much more negatively than smoking itself, not only because it was attention seeking, but also because it glorified a harmful behavior.

> "Usually if you're taking a picture and you're smoking, you're not just going to be like standing, you're going to really fashion it, like fashionify. I don't know. Make it as cool as you can, and that's the problem with it. There's a difference between having to take a smoke break and just casually standing outside versus posing for it. You make it more okay…You're making it kind of like a way of life…You're making it seem like it's something you do all the time. You just add that appeal to it that it doesn't really deserve." (*105,F,20,N*) *Also see Q8 and Q9 in Table 10.*

Less common reasons for judging smokers who featured their smoking prominently in social media posts included concerns about secondhand smoke and belittling the idea of smoking being a show of rebellion (*See Q10 and Q11 in Table 10*).

A few respondents said they would not like posts featuring tobacco use regardless of the context ("I'm like, 'That's not really what I support, so not gonna waste my time liking something I don't necessarily support.'"(*101,F,24,N*); "I think I don't want to be as supportive of something that actually doesn't align with my values." (*104,F,20,N*). However, most interviewees were willing to overlook tobacco use and like/respond positively to a post (with many going so far as to say the presence of tobacco

was irrelevant to their response) in cases where smoking was incidental and not the focus of the post.

More specifically, based on interviewee responses, it appears that young adults' online social networks highly value artistic, visually appealing images and fun, social experiences – such that posts featuring these things are often seen positively, *even when* they include depictions of tobacco use.

With respect to an artistic context, the presence of tobacco in photos on social media was seen as "a prop [used so that] the picture looks cooler, or it looks more profound, more meaningful for whatever the reason" (*108,M,22,N*) or simply dismissed due to the aesthetically pleasing features of the post (i.e., individuals were well dressed, the background was pretty, etc.).

> "If there is some sense of art to it. If there's some intelligence behind it and it's art, then it's like, okay that's kind of cool. I can respect that if it seems like there's more being said than just, 'I like smoking.'"(*106,F,21,N*) *Also see Q12 in Table 10.*
>
> "I wouldn't share a Snapchat of me like actually smoking something, but I would share, maybe, like take a picture if I was at a hookah bar if it was nicely decorated…I think it's more about the aesthetic of the scene just for me." (*114,M,22,S*)
>
> "I used to not like anything that had smoking-related content, but I gave in just because sometimes I think the clothing or the composition of the photo's fun." (*103,M,20,N*) *Also see Q13 in Table 10.*

This attitude is also exemplified by negative reactions to smoking posts that were *not* perceived to be aesthetically pleasing: "Oh my God, this sounds superficial. I mean, I don't really think, I don't like his shirt. I don't think it's a cool setting. His hair's kind of in shambles. And then, like, the cigarette is like, or whatever that is, is prevalent." (*114,M,22,S*)

Social contexts, particularly those featuring close friends, were also viewed positively by many. As one respondent said, "I don't see why someone would post a picture of them smoking like alone in their bedroom, but if they're at a party, I just think it adds on to the cool aspect of things." (*114,M,22,S*). This attitude was exemplified in respondents' reaction to a social media post featuring a few guys hanging out at a club, one of whom has a cigarette in his hand.

> "It's a drunk off guard-ish sort of woo-hoo kind of thing, so I guess it's normal to have a cigarette. He's drinking something, and he has a cigarette…They're in an area where they do that." (*107,F,18,S*)

> "He's just having a good time and he happens to be smoking. That would be more acceptable to me [than a picture of just one person smoking in their room]. I might even like that photo, because, 'Oh, those are guys I know and I haven't seen them in a long time,' so I'll like it." (*115,M,20,N*)

Interviewees responded similarly to a social media post featuring a large group at a hookah bar, saying their first impression upon seeing the photo is not "'Oh they're smoking hookah' [but rather] 'Oh, they're going out.'" (*105,F,20,N*).

> "This picture looks like a picture that my friends and I would take... where we were at a hookah bar and there's probably hookah on the side, but the point of the picture was to capture my group of friends… We wouldn't actively try to take it out of the picture, but we wouldn't actively be like, 'Oh my god, it has to be in the picture.'" (*116,F,25,S*)

Attitudes and norms about different types of tobacco products (cigarettes versus cigars versus hookah) intersected with these ideas of art and social experiences. While cigarettes were perceived as "trashy" or "disgusting" and more harmful, posts featuring cigar use were often seen as more aesthetically pleasing, taking place in picturesque or classy settings, with well-dressed people, and hookah use was seen as primarily a social activity, such that posts featuring hookah use were perceived as being about a "weekend

night, friends, enjoyment, celebrating something, or just trying to be out" (*101,F,24,N*), as opposed to being about tobacco use.

> "I guess cigars are usually associated with high class people, like really old people, like the country club type of…gentleman, because that's kind of…the best word to encompass cigar smoking…So yeah, like oh, they're sitting on a porch, I guess in their country home, with a rifle and a cigar also, I'm gonna like that picture. Because I guess it gets cooler and it's a nice picture in general. " (*108,M,22,N*) *Also see Q14 and Q15 in Table 10.*

> "You don't feel as ashamed posting it [pictures of smoking hookah] as opposed to if you were smoking a cigarette or if it was something illegal, like weed. I would never feel comfortable putting that on a social media outlet... Hookah is not illegal. It's increasingly a socially done activity…I would [also] say cigarettes aren't as publicized [as hookah]" (*116,F,25,S*)

Several interviewees also mentioned seeing social media posts about hookah use more frequently than other tobacco products, and many were more accepting of hookah because of its cultural significance to certain populations ("Maybe it's bad for you, but if it matters in some religious context, then I'm not gonna f---ing say anything." (*106,F,21,N*)).

While even those respondents who held strong anti-smoking beliefs were willing to like a post featuring smoking if tobacco use was not the focal point of the post, many interviewees were dismissive of anti-tobacco posts (especially advertisements, which nonsmokers in particular thought were irrelevant to them) and did not want to publicly align themselves with an anti-tobacco stance through visible actions such as likes and shares. Because respondents and their peers generally do not see being against smoking as a core part of their identity, they do not wish to present that image to their online networks.

> "[I wouldn't share an anti-smoking ad on my profile because] it might feel like junk for other people, so I try to avoid [it]. Because I like to have my timeline clean, like things that I actually care about…If I send them [privately to a specific person], or tag them…I

> actually think it's more efficient to get a personal response [and be] sure they've seen it." (*108,M,22,N*)
>
> "[I don't see anti-tobacco statements from my friends on social media.] I think controversial topics do get likes and do get reactions. I just don't think tobacco is seen as a controversial topic though…I think it's been ingrained in our society long enough that…it's something that's expected….In my Facebook friend groups, smoking doesn't really, it's not a thing that stirs up emotion in people" (*113,F,23,N*)

Smoking Posts Influence My Friends, Not Me*: Influence of Exposure on Attitudes/Norms and through them, on Intention/Use*

A couple respondents thought seeing smoking posts might change their perceptions of how acceptable or prevalent smoking is among their peers (i.e., injunctive and descriptive norms), causing them to think "Oh, maybe it wouldn't be that bad to smoke a cigar" (*115,M,20,N*), or "Subconsciously, it's probably like, 'Oh, they're smoking hookah too,'…I think it's very popular these days…." (*116,F,25,S)*. One respondent elaborated further:

> "[On social media], the ability to reblog things and view content from anywhere in the world is so easy, it feels like ... Especially if you follow a lot of people in similar scenes and circles, [tobacco use] feels like it's more prevalent than it is. Even though it's, I don't know, less than 20% in America, sometimes if you are on one account and you see a bunch of photos, then you're like, 'Wow. Okay…Are they wrong about the numbers? Is it growing?'" (*103,M,20,N*)

However, the vast majority of interviewees – smokers and nonsmokers alike – firmly believed that they were immune to such influences, particularly when it came to their attitudes about using tobacco and their tobacco use intentions/behaviors. In most cases, they did *not* think this immunity extended to their peers (especially younger peers and "certain impressionable people" (*103,M,20,N*)), who they thought *were* susceptible to being influenced by smoking posts on social media.

> "I don't really think [smoking posts on social media have any influence on me]. I think I'm pretty dead set in just kind of like my, not only beliefs and mindset, but just kind of like my routine with [smoking]….I don't think [that's true for everyone]. I think that a lot

> of people that are probably either like younger or so they don't really have the… day to day of just being used to different settings, different surroundings, different choices, so I think they're a lot more influenced by seeing things on social media." (*114,M,22,S*)

> "I don't think [smoking posts on social media influence my attitudes or beliefs about tobacco use]. I think I've always been someone who's, "I don't smoke, and I don't want to smoke." …If I don't want to do it, then I wont do it. No matter what. …I don't really do things because of people's perception… Some people are more able to be persuaded, some people are more, they don't have their own opinion so they think that if this is cool, I must do it. You know?...And I think even social media. Like, there's subtle kind of like persuasion that like, 'Hey, this is trendy. This is what's happening, so you might want to take a try.'" (*104,F,20,N*)

Also see Q16 and Q17 in Table 10.

Indeed, a number of interviewees described in detail the mechanisms by which they thought smoking posts on social media influenced others.

> "I think there's some peer pressure to it. Sometimes people post a selfie of them with a cigarette in their mouth, lit or unlit, and then it'll be a thread of other people doing the same, and that feels like some form of peer pressure that's non-confrontational. But just the, "Oh, me, too." I think that's a form of peer pressure as well." (*103,M,20,N*)

> "I think [seeing pictures on social media] might make [others] more lenient…. I think if you're younger, it might change your opinion where you'll be like, "Okay, maybe I want to try this." But if you're older, you might see it and be like, "Okay, maybe it's not that bad." Not that you would try it, but you might not look down on it as much, which is kind of worrisome at the same time." (*105,F,20,N*)

Also see Q18 in Table 10.

A few interviewees also felt that though they themselves did not approve of smoking posts, their social networks responded differently, with the "cool profile picture where there would be smoke and the guy will be standing, holding [a cigarette]" getting "tons of likes" (*113,F,23,N*) and "pictures of a boy and a girl smoking together in a bed with [hashtag] goals that people [will] actually look up to" (*109,F,19,S*).

A number of participants suggested that they themselves and others who post things on social media should take into account the influence it could have on others, again underscoring the perceived impact of posts featuring smoking on peers.

> "I don't think we understand our true power, just in a sense whether it's two or three people following us that really watch all our posts. What we do can make or break those two or three people. Myself for instance, I know my niece, she idolizes me in a sense, so I'm very mindful about what I put on Snapchat or social media" (*118,F,24,S*)

> "I mean, kids aren't supposed to be on Tumblr but if they are, you don't want to send that subtle message [that smoking is cool]. It's not just kids, either. Older people too. If you're not in a good place or maybe you're trying to quit smoking, seeing stuff like that doesn't help. It's just being aware of what you're posting and trying to monitor your own activity because you're aware that it affects other people." (*106,F,21,N*)

When it came to anti-smoking posts, a few nonsmokers felt that these messages reinforced their own anti-smoking attitudes but not their peers (especially those that smoked).

> " [This antismoking ad in social media] gives me hope for people out there with a mindset like mine that don't really like tobacco…But then it's like, the people who I have on my social media won't pay attention to it. They'll just scroll past it...If I shared it [with friends who smoke], I don't feel like it would do any use. 'Cause people are so stuck into the cycle."(*109,F,19,S*)

However, most interviewees felt that these messages did not influence either themselves or their peers. Relatedly, most respondents who held anti-smoking beliefs said neither they nor their peers would share their opinions or add anti-smoking comments to a friend's post featuring smoking because it wouldn't have an effect.

> "I think, because tobacco users are so stubborn…So I think people figure that their energy is better spent elsewhere. I mean, even in politics, 'cause it's so unlikely to change someone's opinion through a post. It just never happens... I mean, social media's an echo chamber, and people get entrenched in their own ideas and beliefs." (*103,M,20,N*)

Also see Q19 in Table 10.

Smokers tended to agree. “I think it's just one of those things I commend people for their beliefs, but it's not gonna change the way I live my day to day, so ..I'm still gonna smoke, just because I'm set on it, I guess.” (*114,M,22,S*)

The one exception to anti-smoking posts and comments being seen as ineffective in changing minds was when posts expressed the poster’s personal experience (as opposed to ads or general statements against smoking). As one respondent put it, “people listen to people more than ads” (*104,F,20,N*). Smokers felt this way too, with one smoker saying the anti-smoking comments with the most impact on her are stories people share about the consequences of smoking faced by a family member or close friend (*110,F,24,S*). Another smoker said that because these personal stories are true, “I can’t say anything bad about it because what they’re saying makes sense…I say I’m not gonna do it tomorrow, I’m gonna stop, I’m gonna stop.”(*111,F,24,S*)

Table 10. Additional Quotes

Q1	“There's memes about it, how Facebook is for you putting on your best face and your best behavior. On Facebook is kind of like your family members. And then social media, like Instagram and Snapchat, is for the other side of you that lets loose. People are more willing to reveal that side of them on Instagram and Snapchat….I think it's also a well-known thing that employers look at Facebook, so maybe people are less likely to put things like that on there.” (*116,F,25,S)*
Q2	“Honestly, [whether I share a picture of myself smoking] even depends on the social network itself. Snapchat, Instagram, usually not as many people that are ... I don't want to say watchdogs. There's definitely not a bigger authoritarian crowd on there. Usually it's Twitter or Facebook that usually those people kind of stave towards.” (*117,M,21,S)*
Q3	“I'll see videos. I'll see more reckless behavior on Snapchat. On Facebook it's more, ‘How cool do I look? Look at my shoes and my coat.’ It's photography. Look at how wonderfully this photo is. You took a photo shoot. That's what I see on Facebook. On Snapchat I see the casual gatherings and how often they go and what they're doing.” (*113,F,23,N)*
Q4	“A lot of people on social media, especially on Instagram, just kind of take pictures, I don't know how to put this, like show their best life, I guess, or like taking a nice picture of them drinking a cocktail on a rooftop. But on their finstas that may happen once in a while, but on their finsta their kind of like showing their day to day everyday things. I think it’s actually more real…A lot more real.” (*114,M,22,S)*

Q5	"When they do the whole looking off into the distance, smoking, that's kind of more irritating. They're trying to show off or trying to pose for something. It's very fake….. I doubt they sit next to windows a lot and smoke like that. It would just turn me off immediately as soon as I saw the photo" (*115,M,20,N*)
Q6	"It's so forced [this social media picture of a guy smoking in his car]. His arm is even posed like you know he's taking a picture. It's so obvious. It's not off guard. It's just he's trying to get something from people, like kind of a reaction. He just looks like he's phishing for compliments, and that's not cute. I would get annoyed." (*105,F,20,N*)
Q7	"[Pictures of smoking tobacco], it's basically to show off…that they're living the high life. 'Cause now in our society even I passed through that stage where I was going through the wilding part, smoking and drinking and stuff. But, some people don't know how to get out of it and get stuck in that cycle forever…It's like they want to show off that they're into it, and it's, I don't know. It's like, for what? If you're doing it for yourself or you're for the fun of it, then just keep it to yourself" (*109,F,19,S*)
Q8	"When you're in real life…there's nobody there. You don't have an audience, but when they do it on social media, they're asking for an audience… People who smoke and stuff, that's their choice. But then again you shouldn't go around on social media bragging about it or trying to intimidate other people who don't do it" (*109,F,19,S*)
Q9	"I feel like if you take a picture and post it online, then you're taking more pride in it, versus potentially somebody just smoking outside might be trying to quit. [There's a] difference between it being stressed out and needing it, using it as a coping mechanism, and just being proud of it..." (*106,F,21,N)*
Q10	"It's irresponsible that he's smoking around other people though [in this social media post]. You have to kind of be cautious about that, like you're smoking right in their personal space. It's not cool." (*105,F,20,N*)
Q11	"It also just seems like, I don't know, be a cool rebel. Rebel against something that actually f---ing matters. Jesus. Go to a protest. Be a real adult. Don't be like, oh I smoke cigarettes, I'm so cool. No…do something that's actually interesting and useful for society." (*106,F,21,N*)
Q12	"I think if someone's smoking one cigarette for the sake of art, I would understand…there's a different connotation with art. Because, for art, I've seen people do ridiculous things for it. " (*104,F,20,N*)
Q13	"I mean, if they're wearing like a nice outfit, the setting behind them, if they were, I don't know, in like a basement wearing sweatpants, I probably wouldn't like that. But, if they were on the beach in like a sundress that's different…[Even if they are smoking,] I would still like that…Because of the surroundings, kind of overrides the [smoking]." (*114,M,22,S*)
Q14	"My brain doesn't really even react to [cigars] because it's more like I feel like it's healthier [than cigarettes], even though it's really not. It's just because you don't see it as often, so you think it's a classy, one-time thing…It's almost like there's a good connotation to it." (*104,F,20,N*)
Q15	"So cigarettes are seen as the worst I guess from ad campaigns against cigarettes, but cigars are okay ... for people to smoke. Yeah, I guess I've been indoctrinated too to think cigars aren't that bad, cigarettes are the worst. Usually when the group of people are smoking together, they're usually smoking cigars. They sometimes even post it on Facebook and it's seen as passable or okay. Like they aren't going to get public condemnation." (*115,M,20,N*)

Q16	"I used [social media] way more than right now [when I was younger]…I would start liking everything. Kind of more youthful, I guess, like more impressed by whatever social media was throwing at you. Yeah, kind of like, 'Oh, they're all smoking, why am I not smoking? Maybe I should try again' kind of, but…[now], I'm very rigid and strict…I don't really kind of change my mind that much." (*108,M,22,N*)
Q17	"Other people's posts don't affect me. I only smoke hookah when I want to. And that's mostly in social settings. [But that's not true for everyone]. Cause I have a younger sister, and I think the younger demographic, they see posts like that and it kind of looks cool. It looks like the new thing to do. So I think it affects the younger demographic a little bit more. It makes them want to kind of try it." (*116,F,25,S*)
Q18	"Someone at 13, that's the prime time for infiltrating someone's mind. They feel like they're grown, but they're not, but this is when they're going to start making those big, hard decisions. It's so easy for them to be like, "My favorite rap artist posted a picture with a bottle of Ciroc. Let me go see what Ciroc is. Let me click hashtag Ciroc." Then you see all these people drinking and taking shots of Ciroc, and now you're interested in trying it." (*118,F,24,S*)
Q19	"I think one of the things ... It's hard, because when your friends are doing it, you don't know what to say. It's one of those things where if you can't change their mind, you don't want to ruin the relationship….so is it really worth it? " (*104,F,20,N*)

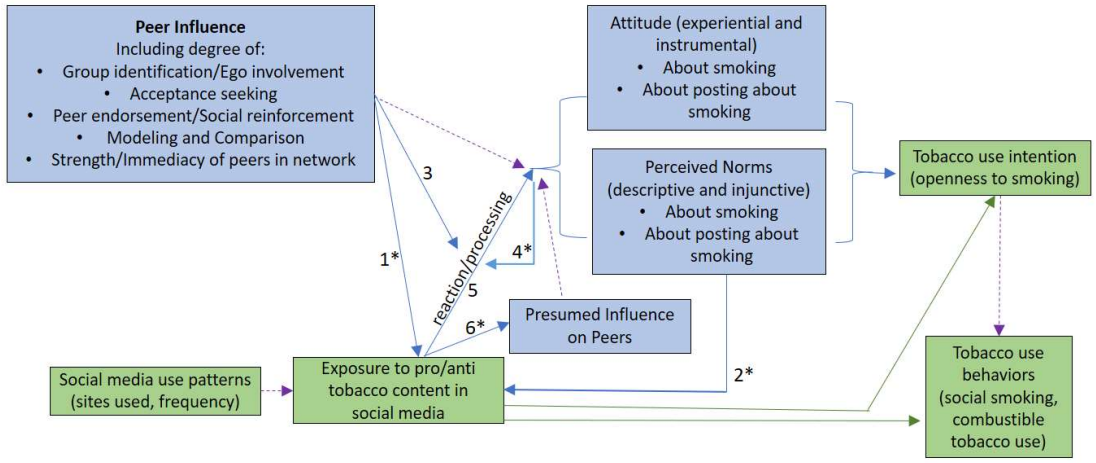
Revised Conceptual Framework

Based on the themes that emerged from the interviews, the conceptual framework was revised to reflect the experience of being exposed to tobacco content in social media, processing it, and being influenced by it, *as consciously understood by interviewees* (see Figure 7, arrows that were added to the model are denoted with an asterisk and described in the text below). As originally expected, peer influence played a key role in the reaction to and processing of tobacco-related content in social media, but it also influenced decisions about what tobacco-related content to post on social media, and thus exposure itself (arrow 1). As captured in themes described under Curating an Image to Match Group Norms, young adults reported only sharing posts focused on their smoking if group norms endorsed taking pride in smoking, which was not the case for most respondents. Perceived norms also influenced posting decisions and thus exposure (arrow 2), with respondents suggesting they and their peers were more likely to share smoking

posts on social media platforms where group norms were more accepting of such behavior. While the way in which tobacco-related social media content was processed influenced attitudes and norms (arrow 3), as expected, attitudes and norms also influenced the processing of this content in a cyclical manner (arrow 4), as captured by themes described under Look Good, Look Social, but Don't Look Like a Smoker.

Interviewees did not distinguish between behavioral beliefs/feelings and resultant attitudes or normative beliefs and resultant norms, so beliefs were excluded from the conceptual framework. They also made a strong distinction between attitudes and norms towards tobacco use itself as opposed to *posting* on social media about tobacco use, so these are highlighted as two separate categories of attitudes and norms. Based on interview responses, although respondents expressed a high degree of perceived control and self-efficacy when it came to their tobacco use or abstinence from tobacco use, they did not think tobacco-related content in social media had any influence on this control and efficacy, and thus these constructs were removed from the conceptual framework. Lastly, many interviewees stated that exposure to pro-tobacco content had limited to no influence on them directly (arrow 5) but that they did believe it influenced their peers (arrow 6), as captured by the themes described under Smoking Posts Influence My Friends, Not Me.

Figure 7. Framework Illustrating Respondents' Self-Reported Experience Receiving and Processing Tobacco-Related Content in Social Media+



*Asterisks denote arrows added to the model based on data from interviews
+Green boxes indicate variables measured quantitatively and examined qualitatively; Blue boxes indicate constructs examined through qualitative data only; Green arrows indicate relationships tested quantitatively (as associations); Blue arrows indicate relationships that were examined through qualitative data only; Purple dotted arrows indicate hypothesized relationships that were not tested quantitatively or explained qualitatively

Discussion

This exploration of young adults' subjective experience of consuming pro- and anti-tobacco content in social media suggests that peer influences, as expected, play a key role in what tobacco-related content young adults are exposed to, how they process and respond to it, and whether it changes their attitudes, norms, and behaviors.

Exposure to and Processing of Tobacco-Related Content in Social Media

These young adults' experience sharing, receiving, and processing tobacco-related content on social media aligns with applications of the Social Identity Model of Deindividuation (SIDE) to online behavior (S. D. Reicher, Spears, & Postmes, 1995). SIDE theory suggests that "people generally have consistent values and goals online and offline, but in our offline lives our personal (individual) values and goals are prioritized,

and in the online world, our community or group's (social) values and goals are prioritized" (O'Connell, 2016). Researchers have pointed to anonymity and reduced social cues online as factors that "encourage people to get caught in the norms of groups and adjust their own behavior to be consistent with those norms" (Guanxiong Huang & Li, 2016; O'Connell, 2016). In today's age of *social* media, the very nature of online social networks, which are intended first and foremost to enable social interactions between peers, likely heightens this phenomenon of getting caught up in group norms. This effect is also likely further heightened in the young adult population, given their desire for peer affirmation, social status, and group membership (Huang, Unger, et al., 2014; Kobus, 2003; Simons-Morton & Farhat, 2010).

The prioritization of group norms over personal values and goals was seen repeatedly in these young adults' experience with tobacco-related content on social media, and their efforts to curate an image in alignment with group norms (including appealing to differing group norms on different social media sites), regardless of their personal stance on tobacco use. For the vast majority of respondents, group norms discourage posts focused specifically on tobacco use but encourage sharing/endorsing artistic and socially focused posts featuring tobacco use (especially cigars and hookah) – fostering a social media environment where tobacco use (as long as you are not taking pride in it) is seen as acceptable. For a minority of respondents, primarily low-income smokers with a large number of other smokers in their networks, social media posts featuring (and even specifically focused on) tobacco use are quite common – fostering a social media environment where tobacco use (even when you are taking pride in it) is seen as acceptable.

For both sets of respondents, the group norms they experience may establish distinct networks with respect to tobacco use content and norms, where group norms dictate what is posted, and what is posted further strengthens perceived norms. It is possible that existing disparities in tobacco use are exacerbated by these distinct networks (U.S. National Cancer Institute, 2017), with those in networks where taking pride in smoking is acceptable and encouraged more likely to engage in heavy, daily smoking. Notably, based on interviewees' experiences, there do not appear to be networks where anti-tobacco content is common – across all respondents, calling smokers out publicly or aligning oneself publicly with an anti-tobacco stance were frowned upon, unless one had personal experiences to share (e.g., losing a loved one to lung cancer due to tobacco use), which was seen as more acceptable. Although the few studies that explore the online social networks of smokers vs. nonsmokers do not address composition of these networks or exposure to tobacco-related content within them (Christakis & Fowler, 2008; Fu et al., 2017; Grace C. Huang, Soto, Fujimoto, & Valente, 2014), the experiences of young adults in this study aligns with the well-established body of literature about offline social networks, which indicates smoking is highly concentrated in certain social networks, particularly those of lower SES smokers, and that young people's tobacco use especially is highly associated with their friends' behaviors (Hitchman et al., 2014; Simons-Morton & Farhat, 2010). While these qualitative results suggest the potential existence of distinct networks with differing tobacco use content and norms, similar to an "echo chamber" effect, establishing the existence of tobacco use echo chambers in social media will require further research including larger samples and systematic analyses of the tobacco-related content found in different social media peer networks.

Based on interview responses, it appears that young adults' expression and processing of both pro- and anti-tobacco content are intimately related to their identity formation (Arnett, 2000). Young adults perceive sharing content around social smoking – especially of cigars and hookah – as more indicative of being fun and social than of being a substance user. However, if a smoker "owns" their identity as a smoker on social media, that tends to be frowned upon. Similarly, taking an anti-tobacco stance on social media is inherently perceived as owning an anti-tobacco identity, which young adults interviewed did not wish to do. Examining these perceptions through the lens of attribution theory, it seems that these young adults perceive social smoking as due to situational causes (situational attribution) while taking pride in smoking or taking an anti-tobacco stance are seen as indicative of personal traits of the individual (dispositional attribution) (Heider, 1958).

Respondents' adept self and peer-monitoring of what content to share with whom on what platforms, along with the value they place on artistic and social posts, is notable, and aligns with the experiences of young adults in other qualitative studies focused more broadly on social media use among young people. A large multinational qualitative study of Millennials outlined a self-monitoring process very similar to that of respondents in this study, where decisions about what where to share posts depended on the audience of each platform and the visibility of the post, with autodelete apps like Snapchat seen as a way to connect with peers without worrying as much about self-presentation (Meyer, 2016). Young adults interviewed in another study carefully chose audiences and platforms as part of a "curation strategy aimed at establishing – and defending – their online identities", with their two key priorities being looking social and looking good

(Johnson, Steeves, Shade, & Foran, 2017). This coincides exactly with this study's respondents' greater acceptance of tobacco use in socially focused or aesthetically pleasing posts. This nuanced perspective – that not all smoking posts are perceived equally - is absent from most studies of young adults' social media posts about substance use, which broadly conclude these posts generally endorse or glamorize substance use and are positively reinforced by peers (Beullens & Schepers, 2013; Cavazos-Rehg, Krauss, Sowles, & Bierut, 2015; Lyons, Goodwin, McCreanor, & Griffin, 2015; Steers et al., 2016; Thompson, Rivara, & Whitehill, 2015). This more nuanced perspective may help explain recent results from the quantitative study of 18-24 year olds described in Chapter 3 (Study 2/Aim 2 of this dissertation), which found self-reported exposure to pro-tobacco content online (including images/videos of peers smoking) was associated with self-identified social smoking among smokers with close friends who smoke (but not among those without close friends who smoke), and associated with cigar and hookah use (but not cigarette use) in the full sample. More frequent and continuous exposure to social media posts portraying social smoking, particularly of hookah and cigars, in a positive light may influence these behaviors, especially among those with many smokers in their social media networks.

Influence of Tobacco-Related Content in Social Media

An association between seeing substance use-related posts on social media and substance use behaviors has been demonstrated in a number of studies (Cavazos-Rehg et al., 2015; Moreno et al., 2010, 2015; Steers et al., 2016). This association between posts depicting the behavior and the behavior itself has also been demonstrated for tobacco use specifically (Depue et al., 2015; Hébert et al., 2017; Link et al., 2015; van Hoof, Bekkers,

& van Vuuren, 2014; Yoo et al., 2016), including in the analyses described in Chapter 3 (Study 2/Aim 2 of this dissertation). However, respondents in the qualitative study described in the current chapter did not perceive smoking posts as having any influence on their tobacco use attitudes or behaviors when directly asked. This lends support to the idea that social media smoking posts may influence attitudes and behaviors subconsciously through the power of affective response or indirectly via presumed influence on peers.

The strong reactions experienced in response to smoking posts, both positive (in the case of posts featuring social smoking, especially of cigars and hookah) and negative (in the case of posts focused solely on a person's tobacco use, particularly if they were smoking cigarettes), likely exert a subconscious influence on attitudes and behaviors, as recent scientific evidence from psychology, neuroscience, and behavioral economics collectively demonstrate (Green, 2012; Heath, 2012).

Additionally, the fact that respondents thought these posts influenced their peers (but not themselves) aligns with what is known about the optimism bias (a cognitive bias whereby individuals believe they are less at risk of experiencing a negative event – in this case being influenced to smoke by smoking posts on social media – compared to others (Sharot, 2011; Weinstein, 1980)), and the related third-person effect hypothesis (which predicts people perceive media messages have a greater impact on others than on themselves (Davison, 1983)). Notably, respondents demonstrated third-person effects only for pro-tobacco posts. When it came to anti-tobacco posts, most respondents felt these posts had no influence on anyone (themselves or others), with the possible exception of posts featuring personal experience. However, a few felt their own anti-

smoking beliefs (or desire to quit) were reinforced by seeing these posts, but that others were not similarly affected. This is line with an extension of the third-person effect hypothesis demonstrated by Gunther and Thorson: when individuals perceive being influenced by a message as the socially desirable outcome, we see first-person effects (whereby perceived effects of media on the self are greater than on others), but when they perceive being influenced by a message as a socially undesirable outcome, we see traditional third-person effects (Gunther & Thorson, 1992).

Although respondents did not think pro- and anti-tobacco messages in social media influenced their tobacco use attitudes and behaviors, according to the influence of presumed influence (IPI model), the influence respondents assume these messages have on their peers does in fact affect their own attitudes and behaviors (Gunther & Storey, 2003). The model predicts individuals will adapt their own attitudes and behaviors to correspond to their perception of how media influences their peers – so, young adults may assume smoking posts on social media influence the tobacco use attitudes and behaviors of their peers, and these perceptions that their peers are more likely to engage in and accept tobacco use (i.e., descriptive and injunctive norms) will in turn influence their own smoking attitudes and behaviors, making them more likely to accept and engage in tobacco use. Indeed, according to the only study to explore this issue in the context of tobacco-related posts on social media, expression and reception of prosmoking messages had indirect effects on smoking through perceived peer expression of smoking messages and perceived peer smoking norms (Yoo et al., 2016).

Conclusions

While homophily of risk behaviors – including specific to tobacco use – is by no means unique to social media, and has been demonstrated in offline networks (Christakis

& Fowler, 2008; Go et al., 2012; Kobus, 2003), differences in tobacco use content and norms across networks in social media have the potential to accelerate peer influence processes (Huang, Unger, et al., 2014), thus exacerbating existing disparities in tobacco use (U.S. National Cancer Institute, 2017). Not only is social media accessible 24/7 from almost anywhere via mobile devices, it also enables the sharing of highly visible and quantifiable peer-to-peer feedback. Offline tobacco use experiences may be encouraged and heightened as they are discussed and relived through social media posts, and these social media displays may further exacerbate misperceptions about the prevalence and approval of tobacco use (Steers et al., 2016).

As underscored by the body of literature exploring the SIDE theory, strong social identity causes group behavior to be driven by group norms, and the solution to problematic group behavior is thus to change group norms (Stephen David Reicher, Spears, Postmes, & Kende, 2016). Social norms interventions delivered in the social media environment may be a promising approach, particularly if they are targeted and tailored based on the prevailing perceptions regarding what types of smoking posts are acceptable to share within a particular peer network (e.g., artistic posts, social posts, posts featuring cigar or hookah use, etc.). Though others have suggested discouraging or de-glamorizing the posting of risky pictures among young people by emphasizing the harmful impact it could have on others (Huang, Soto, et al., 2014), this could exacerbate the negative impact such posts have on young people's tobacco use attitudes and behaviors via the presumed influence on peers. Instead, given that young adults may actually be overestimating the influence these posts have on their peers' tobacco use attitudes and behaviors, normative interventions targeting the presumed influence of

smoking posts on peers may be useful. Given the potential existence of distinct networks within social media with differing tobacco use content and norms, network interventions (which purposefully use social networks or social network data to generate social influence and change behavior (Valente, 2012)) should be explored as well. Also, given young adults' use of social media to share images and videos while out socializing and using substances like alcohol and tobacco, social media may also prove to be an ideal channel to deliver messages discouraging social smoking as they are making decisions about what behaviors to engage in and what images to share on social media (Ridout & Campbell, 2014).

Although taking an anti-tobacco stance on social media was generally frowned upon, sharing of negative personal experiences with tobacco use (including the impact it had on oneself or a family member) were far more accepted. This suggests that taking a testimonial approach such as that of the Tips from Former Smokers campaign, which has been proven effective in increasing population-level quit attempts (McAfee, Davis, Alexander, Pechacek, & Bunnell, 2013), and applying it to social media – perhaps through a crowdsourced approach, where individuals are encouraged to share these experiences with their networks on social media – may be effective.

Lastly, young adults appear more willing to share posts featuring tobacco use and other risky behaviors on social media platforms that are limited to a close-knit circle of friends, limit the duration for which posts are visible, and provide anonymity. Snapchat and Instagram (especially fake Instagram profiles called Finstas) were commonly mentioned, and deserve far more attention from researchers and public health practitioners. Most studies examining young people's experience with risky content on

social media have been confined to Facebook (perceived as the most public of social media platforms by those interviewed in this study) (Beullens & Schepers, 2013; Huang, Soto, et al., 2014; Lyons et al., 2015; Moreno et al., 2012, 2015; van Hoof et al., 2014; Young & Jordan, 2013), providing a highly incomplete and possibly skewed understanding of what young adults are seeing and how it influences them. Along with researchers, public health practitioners should move beyond Twitter and Facebook, purchasing advertising as well as undertaking more creative approaches to public health campaigns (e.g., tailoring messages to take advantage of the ephemerality of posts (Keady, 2015), or using hashtags to connect users with resources and support on platforms like Snapchat and Instagram (Swant, 2017). As the social media landscape of youth and young adults changes, public health practitioners must follow. While the ever-changing social media landscape, private networks, and other aspects of social media present challenges to the development of normative interventions and public health campaigns, such interventions hold much potential for having significant public health impact among this at-risk population of young adults (Ridout & Campbell, 2014; Steers et al., 2016).

This study has some limitations. Nearly half the sample were undergraduate or graduate students, whose experiences may be quite different from less educated young adults. Most of the smokers interviewed smoked only occasionally or socially, and their attitudes towards smoking are likely quite different from heavy, daily smokers. Nonetheless, the sample was ethnically diverse and included both smokers and nonsmokers, capturing unique perspectives on tobacco-related content in social media. While most interviews were conducted in person, some were conducted via Facetime –

the use of two different interview modalities may have influenced the nature of individuals responses; however, the use of such Voice over Internet Protocol technologies enhances the ability to contact participants and can mirror face-to-face interactions, especially for young people who are generally very familiar with such technologies (Sullivan, 2012). Although transcripts were analyzed only by the primary researcher, a number of steps were taken to enhance validity and reliability. A subset of transcripts were dual coded to inform modifications to the codebook, and full transcripts were analyzed to avoid selective retention or recording of information. This study was theoretically-driven and the interview guide and example images purposively selected to garner information pertinent to the conceptual framework; different choices of questions and images to include may have led to different responses, and in turn different themes and conclusions. For example, images selected purposefully contrasted images of individuals versus groups and the use of different combustible tobacco products, but other aspects of tobacco content in social media – such as featuring a particular brand or images of celebrities smoking – were not including in these example images. While discrepant data (i.e., data not in line with the conceptual framework) was actively sought in interviews to see if alternative explanations might be more plausible than those laid out in the original framework, the questions and images selected for the interview guide undoubtedly shaped interview responses and themes in consequential ways, and the study's themes and conclusions should be interpreted with this in mind.

The resulting insights from this qualitative exploration of young adults' experiences receiving and processing tobacco-related messages in social media are a novel contribution to the literature and directly relevant to public health communication

efforts in social media. These insights provide direction as to the types of social media platforms and strategies (e.g., normative and network approaches) that should be employed in social media interventions targeting young adult tobacco use, ultimately helping enhance the effect of anti-tobacco messages and reduce the effect of pro-tobacco messages in this widely used, pervasive media channel where peer influences are heightened.

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Chapter 5: Conclusions

Summary of Findings

The overall objective of this dissertation was to better understand how young adults' social media use patterns might be related to health risks, particularly tobacco use, and how their exposure to and experience with tobacco-related content in social media might influence tobacco use outcomes, especially given peer influences in social media.

In the first study of this dissertation (Chapter 2 – Study 1/Aim 1), latent classes of young adults were identified based on what combination of sites they used and how

frequently, and differences in demographics and health risks between classes were assessed. Five classes were identified, distinguished by overall low or high use across social media sites (classes named Low Users and High Users, respectively), or high use of particular sites (a professional site, sites that involve creative user generation of content, or widely popular sites – classes named Professional Users, Creative Users, and Mainstream Users, respectively). These classes differed significantly on alcohol, tobacco, and other drug (ATOD) use. Compared to the largest group of High Users, Creative Users had higher odds of using most substances, Mainstream Users had higher odds of substances used socially (alcohol and hookah), Professional Users had higher odds of using alcohol, cigarettes, and cigars, and Low Users had higher odds of using other drugs (e.g., cocaine, heroin).

One mechanism by which social media use might influence ATOD use is via exposure to ATOD-related content in social media. The second study of this dissertation (Chapter 3 – Study 2/Aim 2) delved deeper into this issue in the context of tobacco use specifically, examining the relationship between exposure to pro- and anti-tobacco content in social media and tobacco use outcomes. Over 70% of young adults surveyed were exposed to pro-tobacco content in social media and smokers were more likely than nonsmokers to see this content. Exposure to pro-tobacco content (whether alone or along with anti-tobacco content) – in comparison to not having exposure to any tobacco content (pro or anti) – was associated with higher openness to smoking among nonsmokers (0.08 points higher on a 4 point scale), greater likelihood of social smoking among smokers with close friends who smoke (5 to 7 times higher odds), and greater likelihood of smoking cigars or hookah (1.5 to 3 times higher odds), but not cigarettes, among the full

sample. Exposure to only anti-tobacco content – in comparison to not having exposure to any tobacco content – was associated with 40 to 50% lower odds of cigarette use.

To better understand pathways through which viewing tobacco content in social media might influence tobacco use outcomes, young adults' experiences consuming this content were explored via interviews in the third study of this dissertation (Chapter 4 – Study 3/Aim 3). Based on these interviews, young adults appear to experience differing tobacco use content and norms based on their personal networks, where certain young adults (primarily low-income and minority smokers) report seeing smoking posts frequently and experiencing group norms that support taking pride in smoking; most young adults report seeing smoking posts only occasionally and experiencing group norms that frown upon taking pride in smoking – but support the sharing of posts featuring tobacco use as long as they are artistic or depict social smoking (especially of cigars and hookah); and hardly any young adults report feeling supported in taking an anti-tobacco stance on social media. These group norms prompt extreme self- and peer-monitoring to ensure the images oneself and one's peers curate match the norms of audiences found on different social media sites. Expression and processing of tobacco-content appears tied to identity formation, with sharing of social smoking posts viewed as situational and less about an individual's personal attributes whereas taking pride in smoking or taking an anti-tobacco stance on social media – both of which were frowned upon – were seen as part of one's identity. Young adults interviewed also assumed smoking posts influence their peers, potentially heightening the impact these posts have on young adults' perceptions about the prevalence and acceptability of smoking, especially with respect to social smoking and use of cigars and hookah.

Taken together, the results from these three studies suggest that patterns of use of specific social media sites are related to health risks, including tobacco use, and this may in part be due to different audiences and group norms found on different sites. As young adults mentioned in interviews in Chapter 4, they saw more smoking posts on sites featuring anonymity, impermanent posts, and networks of only close friends. Additionally, although the results of Chapter 3 are cross-sectional and preclude determining directionality, findings suggest that the nature of pro-tobacco content exposure experienced by those with close friends who smoke may be different (e.g., more images of smoking in a fun, social atmosphere), and both the nature of this content and the fact that one's close friends smoke could influence a more positive response to seeing these images, in turn prompting a greater likelihood of identifying as a social smoker. Indeed, interview responses from Chapter 4 support this idea, with smokers who have close friends who smoke reporting frequently seeing images of smoking portrayed in a positive light, and most young adults reporting being accepting of posts featuring social smoking. Similarly, Chapter 3's findings that exposure to pro-tobacco content is associated with higher odds of cigar and hookah use, but not cigarettes, may be explained by the experiences young adults shared in Chapter 4, whereby group norms they experience on social media are far more accepting of cigar and hookah use than they are of cigarette use. Indeed, findings described in Chapter 3 regarding the association between exposure to only anti-tobacco content and lower odds of cigarette use are consistent with the experience of at least one young adult interviewed, who said he felt anti-tobacco advertising was specific to cigarette use. Lastly, young adults' experiences outlined in Chapter 4 reflect the potential reinforcement of existing disparities in smoking

and smoking norms through distinct networks with differing tobacco use content and norms, whereby smoking is a source of pride and widely accepted in a small group and social smoking (especially of cigars and hookah) accepted by a much larger group, with little to no anti-tobacco support voiced in either scenario. The possible existence of these distinct networks lends support to the hypothesis that directionality of relationships found in Chapter 3 proceeds from tobacco use outcomes to exposure instead of the other way around; that is, those that engage in social smoking (and have close friends who smoke) or use of cigars and hookah are more likely to share pro-tobacco content in their networks by virtue of their own tobacco use and perceived support of their tobacco use behaviors among their social networks.

Ultimately, the results of this dissertation indicate social media use patterns broadly and exposure to tobacco-related content in social media specifically are related to tobacco use outcomes, and group norms and resulting peer influences in social media may play a key role in both what tobacco-related content young adults are exposed to as well as how they perceive and process that content, potentially reinforcing disparities in smoking and smoking norms, as well as support for social smoking and cigar and hookah use among this population.

Contribution to the Literature

This dissertation is perhaps the first to identify classes of young adults based on use and co-use of different social media sites, the first to examine health risk differences across such classes, and the first to examine the relationship between exposure to tobacco-related content in social media and specific tobacco use outcomes (including social smoking and use of different combustible tobacco products). Given that analyses

were conducted among a national sample, weighted to be nationally representative, this dissertation makes a unique contribution to the growing body of literature on social media use and health risk behaviors including tobacco use, with findings generalizable to U.S. young adults broadly. The qualitative portion of this dissertation is also a novel contribution to the literature, as the subjective experience of young adults consuming tobacco-related content in social media has not to our knowledge been previously explored.

The findings of this dissertation both support and substantially extend what is known about young adults' social media use and the relationship between social media use and content exposure with tobacco use outcomes. While there is a substantial body of research establishing that social media use among young adults is pervasive (Bennett, 2014; Kamber, 2013; Perrin, 2015), and even some research exploring frequency of use of specific social media sites and the number of sites young adults use (Greenwood, Perrin, & Duggan, 2016; Villanti, Johnson, Ilakkuvan, et al., 2017), this dissertation goes beyond examining use of different sites individually to capture nuanced patterns of use and co-use of multiple sites, revealing distinct social media site use profiles among young adults. Moreover, this dissertation establishes there is a significant relationship between these patterns of social media site use and risk behaviors, including tobacco use. While prior studies have found social media use is related to risk behaviors and factors among young adults (Depue et al., 2015; Gebremeskel et al., 2014; Lin et al., 2016; Moreno et al., 2015; Primack et al., 2017; Steers et al., 2016), they have not explored how frequency of using different sites might contribute to these relationships.

This dissertation also expands our understanding of the influence of tobacco-related content in social media on young adult's tobacco use behaviors. While a few studies have explored this question (Depue et al., 2015; Hébert et al., 2017; Link et al., 2015; Yoo et al., 2016), to our knowledge, none have done so among a national sample and none have explored differential relationships for different tobacco use outcomes, including social smoking and use of different combustible tobacco products. This analysis, in conjunction with the qualitative portion of this dissertation, suggest pro-tobacco content in social media may be particularly supportive of social smoking and cigar and hookah use (or alternatively, that those who engage in social smoking or cigar and hookah use are more likely to share pro-tobacco content). This is in line with content analyses of tobacco-related messages in social media, which have found a substantial amount of cigar and hookah related content on social media, the vast majority of which portrays use of these products in a positive light (Carroll et al., 2013; Guidry et al., 2016; Myslín, Zhu, Chapman, & Conway, 2013b; Richardson & Vallone, 2014; Step et al., 2016). However, this study goes beyond content analysis and is the first to demonstrate quantitative differences in the relationship between exposure to tobacco content on social media and use of cigars and hookah vs cigarettes, supplemented by qualitative evidence from interviews in which young adults responded much more positively to posts featuring cigars and hookah than to posts feature cigarettes, and much more positively to posts featuring social smoking than to posts featuring a single individual smoking. Similarly, in a prior study of a sample of high schoolers, researchers found that friends who were similarly exposed to risky online postings by those in their network had a tendency to maintain or form new friendship ties (Huang, Soto, et al., 2014), but this is the first study

to our knowledge in which having close friends who smoke was demonstrated to have a moderating effect on the relationship between exposure to tobacco content in social media and social smoking. While the degree of self-monitoring young people engage in on social media and how they prioritize looking social and looking good has been noted in other qualitative studies (Johnson et al., 2017; Meyer, 2016), this is the first qualitative study to our knowledge to reveal these phenomena at play in decisions about sharing and reacting to posts featuring tobacco use specifically. Similarly, while theories regarding prioritization of group norms and the existence of distinct networks (with differing content and norms) in social media have been explored in a general sense (Huang & Li, 2016; O'Connell, 2016), this qualitative study is the first to our knowledge to explore them in the context of tobacco-related content in social media. The qualitative portion of this dissertation also adds to the limited existence evidence that presumed influence on peers is one key mechanism by which smoking content on social media might influence young people's tobacco use norms and behaviors (Yoo et al., 2016).

Practice Implications

Beyond contributing to the literature, the results of this dissertation have important implications for public health practice, particularly with respect to social media interventions that aim to mitigate the influence of pro-tobacco content or disseminate anti-tobacco content. Given the relationship between distinct patterns of social media site use and health risk factors and behaviors, targeting public health messages about these different risks based on the sites most used by those engaging in these risk behaviors may be an effective strategy. Additionally, the degree of self-monitoring based on social media site uncovered in the qualitative study – with young adults reporting being more

likely to share and see smoking posts on social media sites and accounts that feature anonymity, impermanence of posts, and closed networks of close friends – suggests that public health campaigns and interventions must move beyond Facebook and Twitter to develop innovative interventions on sites like Instagram, Snapchat, and Tumblr (Jacobs et al., 2016; Keady, 2015; Swant, 2017).

Given quantitative and qualitative findings that indicate social smoking and cigar and hookah use may be viewed far more positively in the social media context than smoking alone or smoking cigarettes, social media interventions to reduce tobacco use among young adults should specifically and explicitly address social smoking and cigar and hookah use. The results of this dissertation, in conjunction with prior research on social smokers (Schane et al., 2009b; Hayeon Song, Kim, & Kim, 2014), suggest that traditional anti-tobacco messages may be ineffective for young adults who smoke only socially, particularly if they are smoking cigars or hookah, as they may disregard these messages as pertaining only to cigarette use or only to regular, daily smokers.

With respect to anti-tobacco efforts in social media more broadly, young adults interviewed indicated that personal testimonials from peers are perceived to be the most effective form of anti-tobacco communication and are viewed much more positively than anti-tobacco advertisements. This suggests that taking a testimonial approach such as that of the Tips from Former Smokers campaign, which has been proven effective in increasing population-level quit attempts (McAfee et al., 2013), and applying it to social media – perhaps through a crowdsourced approach, where individuals are encouraged to share these experiences with their networks on social media – may be effective. Social media also provides the advantage of potentially reaching young adults at the moment

they are deciding to engage in and/or share pictures or videos of smoking, and effective interventions could capitalize upon this to dissuade such behavior.

Given young adults' experiences with social media group norms that support sharing posts featuring smoking as long as they are artistic, aesthetically pleasing, or focused on social smoking (especially of cigars and hookah), interventions aiming to change these norms could help reduce the volume of user generated smoking content on social media, as well as foster a less positive reaction to such content. Similarly, given that young adults interviewed thought smoking posts influenced their friends, but not themselves, normative interventions to correct misperceptions about the presumed influence smoking posts have on peers could help mitigate the influence smoking posts have on perceived norms and tobacco use behaviors among young adults.

Lastly, given that having close friends who smoke moderated the relationship between

exposure to tobacco content and social smoking, and given that young adults experiences as shared in interviews suggests the existence of distinct networks with differing acceptability of smoking/smoking posts, network interventions that purposefully use social networks or social network data to generate social influence and change behavior may be useful. For instance, the deliberate seeding and diffusion of targeted information (Cobb et al., 2011) – including anti-tobacco messages from peers, public health campaign advertisements, and smoking cessation interventions – among specific networks (i.e., a network of smokers who take pride in their smoking, a network of young adult social smokers who often share images of social smoking, etc.) may be an effective strategy,

particularly if implemented in a way that leverages key influencers within a network (Valente, 2012).

Limitations

Although this dissertation is a unique contribution to the literature with important implications for tobacco-related interventions in social media, it is not without limitations. A key limitation of the quantitative analyses is the use of cross-sectional data, which preclude understanding of directionality and causality. Thus, it is possible that use and co-use of certain social media sites influences tobacco use, but it is also possible that those that smoke seek out and use different sites than nonsmokers. Similarly, it is possible that exposure to pro-tobacco content leads to increased openness to smoking or smoking, but it is also possible that smokers/those open to smoking are more likely to be in networks where such content is shared (including because they may be more likely to initiate and maintain friendships with those that share smoking content), or – perhaps most likely – a combination thereof.

Another limitation in the quantitative analyses is the use of self-reported data. In Chapter 2 (Paper 1), the use of this self-reported data may paint an incomplete picture of social media use (due to an incomplete list of sites or misinterpretation of sites listed) and is subject to recall bias (especially when use of sites blends together, as with watching a YouTube video on Facebook). However, prior research has found self-reports of social network site use can be accurate (Scharkow, 2016), and self-report requires fewer resources and demands on participant privacy compared to tracking use on devices (Boase & Ling, 2013). In Chapter 3 (Paper 2), the use of self-reported survey data on exposure and tobacco use outcomes may be subject to recall bias, although with respect

to exposure, one's perceptions of exposure may have more bearing on changes in tobacco use attitudes and behaviors than objective exposure. Survey measures in Chapter 4 also lacked specificity (asking about exposure to combustible tobacco use generally, without specifying which products or whether the context of the posts was social).

Finally, the quantitative analyses may be limited by the study sample's low completion and cumulative response rates. However, these rates are similar to other studies that have relied on KnowledgePanel (Grande et al., 2013; Kelly et al., 2015; Kumar et al., 2012), and there is little indication of nonresponse bias on core variables in other KnowledgePanel samples or in this sample specifically (Garrett et al., 2010; Heeren et al., 2008; Rath et al., 2012).

With respect to the qualitative portion of this dissertation in Chapter 4 (Paper 3), although

qualitative research does not aim to generalize to a broader population, biases in the sample influence the nature of experiences captured – and not captured – in the analysis. Nearly half the sample were undergraduate or graduate students, whose experiences may be quite different from less educated young adults. Most of the smokers interviewed smoked only occasionally or socially, and their attitudes towards smoking are likely quite different from heavy, daily smokers. Nonetheless, the sample was ethnically diverse and included both smokers and nonsmokers, capturing unique perspectives on tobacco-related content in social media. The qualitative study also has some methodological limitations, include the use of different interview modalities (in-person and via Facetime) and analysis of transcripts by only the primary researcher. However, a number of steps were taken to enhance validity and reliability including dual coding of a subset of transcripts to

inform modifications to the codebook, analysis of full transcripts to avoid selective retention or recording of information, and active collection of discrepant data (i.e., data not in align with the original conceptual framework). Lastly, the findings of the qualitative study are shaped by the questions asked and images presented to interviewees, and must be interpreted with this context in mind.

Further Research Needs

There are a number of areas of future research that could address some of these limitations and build upon the results of this study as well as the aforementioned practice implications. First, longitudinal analyses of the relationship between social media site use patterns and health risks, and of the relationship between exposure to tobacco-related content on social media and specific tobacco use outcomes (including social smoking and use of different tobacco products), is necessary to begin understanding the directionality of associations found in this dissertation. These longitudinal studies should also include measures of potential mediators and moderators, especially perceived descriptive and injunctive norms, so that the pathways by which social media site use might influence health risks (including via exposure to risk-related content) and the pathways by which tobacco-related content might influence tobacco use outcomes can be better understood.

More information is needed to determine exactly what type of tobacco-related content young adults are seeing on social media, and the degree to which this content features different tobacco products, social smoking, artistic portrayals of smoking, and so on. While the qualitative portion of this dissertation suggests young adults have different responses to different types of smoking content, further quantitative and qualitative research is needed to understand exactly how responses to different kinds of smoking

content varies and whether this reaction is moderated by demographic characteristics, the proportion of smokers in one social network, or other factors. To that end, content analyses of social media content should expand to include the reactions (likes, shares, comments, etc.) to such content, and where possible, the demographic characteristics and smoking status of posters and reactors.

This dissertation suggests young adults may experience differing tobacco use content and norms in social media depending on their personal networks, but additional quantitative and qualitative research is needed to test and expand upon this finding. While tobacco use in online social networks has been explored in a few studies, no one has conducted a network analysis of whether smokers are connected to more smokers (and social smokers connected to more social smokers, and nonsmokers connected to more nonsmokers) on social media and how that might influence the tobacco-related content – and reactions to such content – that they see. Such analyses should also capture demographic characteristics, including those known to be associated with tobacco use, to assess whether differing tobacco content and norms across networks might reinforce or exacerbate existing disparities. In additional, further qualitative exploration of networks of friends (including by conducting mixed methods network analyses that complement quantitative assessment of network structure with qualitative understanding of the content and processes of networks from the perspective of network members (Edwards, 2010)) is necessary to understand how network composition and dynamics influence sharing of and reaction to pro- and anti-tobacco content in social media, and how such processes might differ based on groups' smoking norms and behaviors.

Perhaps most importantly, as noted by Yonker et al (Yonker, Zan, Scirica, Jethwani, & Kinane, 2015), the vast majority of studies to date focus on evaluating how young adults use social media and the resulting health implications, with little attention paid to further exploration and development of these strategies into building effective interventions. While this dissertation provides some indication of types of interventions that may be effective to mitigate influence of pro-tobacco content and enhance effectiveness of anti-tobacco content in social media, far more research focused specifically on developing and testing social media campaigns and interventions is necessary to understand what will resonate and be effective for young adults. This includes research to determine whether young adults will be responsive to any type of anti-tobacco or health message in social media, or if this a channel they do not wish to use for health purposes. This also includes going beyond anti-tobacco campaigns and programs to develop interventions intended to mitigate and counter the peer-generated smoking content young adults see in social media.

In addition to these intervention related approaches, there may be policy approaches to addressing pro-smoking content on social media. Further research is needed to understand the degree to which applying strategies used to address smoking in movies and pro-tobacco marketing more generally (such as the display of static antismoking messages for the duration of smoking scenes in movies, or efforts to restrict marketing to youth) are applicable to social media, in terms of feasibility, public reaction, and effectiveness in changing attitudes and behaviors.

While there is much research to be done to better understand young adults' experiences with pro- and anti-tobacco content in social media, this dissertation serves as

an important first step in exploring patterns of social media site use and exposure to pro- and anti-tobacco content in social media among young adults, how these factors may be related to tobacco use outcomes, and the potential role of peers and group norms in this process. By taking a mixed-methods approach - including quantitative analyses among a national sample along with in-depth qualitative interviews – this dissertation provides a more holistic understanding of young adults' experiences with tobacco-related content in social media than currently exists in the literature, as well as concrete directions for future research and intervention development and testing. Indeed, this dissertation is an intial building block for a body of research that can inform mitigating the influence of pro-tobacco content and enhancing the effectiveness of anti-tobacco content in the pervasive and highly influential channel of social media, ultimately helping reduce combustible tobacco use and improve the health of young adults.

References

AdWeek. (2014). New Legacy Ads Trade Anger for Empowerment. Retrieved from http://www.adweek.com/news/advertising-branding/new-legacy-ads-trade-anger-empowerment-159432

Arnett, JJ. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, *55*, 469–480.

Asch, Solomon E. (1956). Studies of independence and conformity: I. A minority of one against a unanimous majority. *Psychological Monographs: General and Applied*, *70*(9), 1–70. https://doi.org/10.1037/h0093718

Bandura, Albert. (1978). Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy*, *1*(4), 139–161. https://doi.org/10.1016/0146-6402(78)90002-4

Bandura, Albert. (1986). *Social foundations of thought and action: A social cognitive theory*. *Englewood Cliffs, N.J: Prentice-Hall, 1986. xiii, 617 pp.* Prentice-Hall, Inc. https://doi.org/http://dx.doi.org/10.1037/13273-005

Barnett, Tracey E., Smith, Thalia, He, Ying, Soule, Eric K., Curbow, Barbara A., Tomar, Scott L., & McCarty, Christopher. (2013). Evidence of emerging hookah use among university students: a cross-sectional comparison between hookah and cigarette use. *BMC Public Health*, *13*, 302. https://doi.org/10.1186/1471-2458-13-302

Baskerville, Neill Bruce, Azagba, Sunday, Norman, Cameron, McKeown, Kyle, & Brown, K.Stephen. (2016). Effect of a Digital Social Media Campaign on Young Adult Smoking Cessation. *Nicotine & Tobacco Research : Official Journal of the Society for Research on Nicotine and Tobacco*, *18*(3), 351–360. https://doi.org/10.1093/ntr/ntv119

Bennett, Shea. (2014). Social Media Addiction Statistics & Trends. Retrieved from http://www.adweek.com/socialtimes/social-media-addiction-stats/504131

Berg, Carla J., Ling, Pamela M., Hayes, Rashelle B., Berg, Erin, Nollen, Nikki, Nehl, Eric, … Ahluwalia, Jasjit S. (2012). Smoking frequency among current college student smokers: distinguishing characteristics and factors related to readiness to quit smoking. *Health Education Research*, *27*(1), 141–150. https://doi.org/10.1093/her/cyr106

Berg, Carla J., Lust, Katherine A., Sanem, Julia R., Kirch, Matthias A., Rudie, Maria, Ehlinger, Edward, … An, Lawrence C. (2009). Smoker self-identification versus recent smoking among college students. *American Journal of Preventive Medicine*, *36*(4), 333–336. https://doi.org/10.1016/j.amepre.2008.11.010

Berkman, Lisa F. (2000). Social Support, Social Networks, Social Cohesion and Health. *Social Work in Health Care*, *31*(2), 3–14. https://doi.org/10.1300/J010v31n02_02

Bernat, Debra H., Klein, Elizabeth G., & Forster, Jean L. (2012). Smoking Initiation During Young Adulthood: A Longitudinal Study of a Population-Based Cohort. *Journal of Adolescent Health*, *51*(5), 497–502. https://doi.org/10.1016/j.jadohealth.2012.02.017

Beullens, Kathleen, & Schepers, Adriaan. (2013). Display of Alcohol Use on Facebook: A Content Analysis. *Cyberpsychology, Behavior, and Social Networking*, *16*(7), 497–503. https://doi.org/10.1089/cyber.2013.0044

Biener, Lois, & Albers, Alison B. (2004). Young adults: vulnerable new targets of tobacco marketing. *American Journal of Public Health*, *94*(2), 326–330. https://doi.org/10.2105/AJPH.94.2.326

Boase, Jeffrey, & Ling, Rich. (2013). Measuring Mobile Phone Use: Self-Report Versus Log Data. *Journal of Computer-Mediated Communication*, *18*(4), 508–519. https://doi.org/10.1111/jcc4.12021

Bold, Krysten W., Hanrahan, Tess H., O'Malley, Stephanie S., & Fucito, Lisa M. (2016).

Exploring the Utility of Web-Based Social Media Advertising to Recruit Adult Heavy-Drinking Smokers for Treatment. *Journal of Medical Internet Research*, *18*(5), e107. https://doi.org/10.2196/jmir.5360

Boyle, Sarah C., LaBrie, Joseph W., Froidevaux, Nicole M., & Witkovic, Yong D. (2016). Different digital paths to the keg? How exposure to peers' alcohol-related social media content influences drinking among male and female first-year college students. *Addictive Behaviors*, *57*, 21–29. https://doi.org/10.1016/j.addbeh.2016.01.011

Braun, Virginia, & Clarke, Victoria. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Burton, Suzan, Soboleva, Alena, & Khan, Aila. (2015). Smoke spots: promoting smoking with social media. *Tobacco Control*, *24*(3), 313–314. https://doi.org/10.1136/tobaccocontrol-2013-051317

Campbell, John L., Quincy, Charles, Osserman, Jordan, & Pedersen, Ove K. (2013). Coding In-depth Semistructured Interviews: Problems of Unitization and Intercoder Reliability and Agreement. *Sociological Methods & Research*, *42*(3), 294–320. https://doi.org/10.1177/0049124113500475

Carroll, Mary V, Shensa, Ariel, & Primack, Brian A. (2013). A comparison of cigarette- and hookah-related videos on YouTube. *Tobacco Control*, *22*(5), 319–323. https://doi.org/10.1136/tobaccocontrol-2011-050253

Cavazos-Rehg, Patricia A., Krauss, Melissa J., Sowles, Shaina J., & Bierut, Laura J. (2015). "Hey Everyone, I'm Drunk." An Evaluation of Drinking-Related Twitter Chatter. *Journal of Studies on Alcohol and Drugs*, *76*(4), 635–643. https://doi.org/10.15288/JSAD.2015.76.635

Cavazos-Rehg, Patricia A., Krauss, Melissa J., Spitznagel, Edward L., Grucza, Richard A., & Bierut, Laura Jean. (2014). Hazards of new media: youth's exposure to tobacco Ads/promotions. *Nicotine & Tobacco Research : Official Journal of the Society for Research on Nicotine and Tobacco*, *16*(4), 437–444. https://doi.org/10.1093/ntr/ntt168

Centers for Disease Control and Prevention. (2008). Smoking-attributable mortality, years of potential life lost, and productivity losses--United States, 2000-2004. *MMWR Morb Mortal Wkly Rep*, *57*(45), 1226–1228.

Centers for Disease Control and Prevention. (2011). Vital signs: current cigarette smoking among adults aged≥ 18 years--United States, 2005-2010. *MMWR Morb Mortal Wkly Rep.*, *60*(35), 1207–1212.

Centers for Disease Control and Prevention. (2016). "About the Campaign." Retrieved from http://www.cdc.gov/tobacco/campaign/tips/about/index.html?s_cid=OSH_tips_D9393

Centers for Disease Control and Prevention (CDC). (2005). Cigarette smoking among adults--United States, 2003. *Morbidity and Mortality Weekly Report*, *54*(20), 509–513. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15917735

Chatzisarantis, Nikos L. D., Hagger, Martin S., Wang, C. K.John, & Thøgersen-Ntoumani, Cecilie. (2009). The Effects of Social Identity and Perceived Autonomy Support on Health Behaviour Within the Theory of Planned Behaviour. *Curr Psychol*, *28*, 55–68. https://doi.org/10.1007/s12144-009-9043-4

Chen, Serena, & Chaiken, Shelly. (1999). *The heuristic-systematic model in its broader context.* Guilford Press.

Choi, S. (2015). The Two-Step Flow of Communication in Twitter-Based Public Forums. *Social Science Computer Review*, *33*(6), 696–711. https://doi.org/10.1177/0894439314556599

Choi, W. S., Pierce, J. P., Gilpin, E. A., Farkas, A. J., & Berry, C. C. (1997). Which adolescent experimenters progress to established smoking in the United States. *American Journal of Preventive Medicine*, *13*(5), 385–391. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9315272

Choi, Youjin, Choi, Sejung Marina, & Rifon, Nora. (2010). "I Smoke but I Am Not a Smoker":

Phantom Smokers and the Discrepancy Between Self-identity and Behavior. *Journal of American College Health*, *59*(2), 117–125. https://doi.org/10.1080/07448481.2010.483704
Christakis, Nicholas A., & Fowler, James H. (2008). The Collective Dynamics of Smoking in a Large Social Network. *New England Journal of Medicine*, *358*(21), 2249–2258. https://doi.org/10.1056/NEJMsa0706154
Cialdini, Robert B., Reno, Raymond R., & Kallgren, Carl A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, *58*(6), 1015–1026. https://doi.org/10.1037/0022-3514.58.6.1015
Cillessen, Antonius H., Schwartz, David, & Mayeux, Lara. (2011). *Popularity in the peer system*. Guilford Press.
Cobb, Caroline, Ward, Kenneth D., Maziak, Wasim, Shihadeh, Alan L., & Eissenberg, Thomas. (2010). Waterpipe tobacco smoking: an emerging health crisis in the United States. *American Journal of Health Behavior*, *34*(3), 275–285. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20001185
Cobb, Nathan K., Graham, Amanda L., Byron, M.Justin, Niaura, Raymond S., Abrams, David B., & Workshop Participants, Workshop. (2011). Online social networks and smoking cessation: a scientific research agenda. *Journal of Medical Internet Research*, *13*(4), e119. https://doi.org/10.2196/jmir.1911
Cornacchione, Jennifer, Wagoner, Kimberly G., Wiseman, Kimberly D., Kelley, Dannielle, Noar, Seth M., Smith, Margaret H., & Sutfin, Erin L. (2016). Adolescent and Young Adult Perceptions of Hookah and Little Cigars/Cigarillos: Implications for Risk Messages. *Journal of Health Communication*, *21*(7), 818–825. https://doi.org/10.1080/10810730.2016.1177141
Cranwell, Jo, Murray, Rachael, Lewis, Sarah, Leonardi-Bee, Jo, Dockrell, Martin, & Britton, John. (2015). Adolescents' exposure to tobacco and alcohol content in YouTube music videos. *Addiction*, *110*(4), 703–711. https://doi.org/10.1111/add.12835
Creswell, John W. (2007). *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*. Thousand Oaks, CA: SAGE Publications, Inc.
Davis, Kevin C., Alexander, Robert L., Shafer, Paul, Mann, Nathan, Malarcher, Ann, & Zhang, Lei. (2015). The Dose–Response Relationship Between Tobacco Education Advertising and Calls to Quitlines in the United States, March–June, 2012. *Preventing Chronic Disease*, *12*, 150157. https://doi.org/10.5888/pcd12.150157
Davis, Kevin C., Farrelly, Matthew C., Messeri, Peter, & Duke, Jennifer. (2009). The impact of national smoking prevention campaigns on tobacco-related beliefs, intentions to smoke and smoking initiation: results from a longitudinal survey of youth in the United States. *International Journal of Environmental Research and Public Health*, *6*(2), 722–740. https://doi.org/10.3390/ijerph6020722
Davison, W.Phillips. (1983). The Third-Person Effect in Communication. *Public Opinion Quarterly*, *47*(1), 1. https://doi.org/10.1086/268763
Debevec, Kathleen, & Diamond, William D. (2012). Social smokers: Smoking motivations, behavior, vulnerability, and responses to antismoking advertising. *Journal of Consumer Behaviour*, *11*(3), 207–216. https://doi.org/10.1002/cb.1373
Depue, Jacob B., Southwell, Brian G., Betzner, Anne E., & Walsh, Barbara M. (2015). Encoded exposure to tobacco use in social media predicts subsequent smoking behavior. *American Journal of Health Promotion*, *29*(4), 259–261. https://doi.org/10.4278/ajhp.130214-ARB-69
Deutsch, Morton, & Gerard, Harold B. (1955). A study of normative and informational social influences upon individual judgment. *The Journal of Abnormal and Social Psychology*, *51*(3), 629–636. https://doi.org/10.1037/h0046408
DiStefano, Christine, & Kamphaus, R. W. (2006). Investigating Subtypes of Child Development. *Educational and Psychological Measurement*, *66*(5), 778–794.

https://doi.org/10.1177/0013164405284033
Dube, Shanta R., Arrazola, René A., Lee, Joann, Engstrom, Martha, Malarcher, Ann, Services, U. S.Department of Health and Human, … (CDC), Centers for Disease Control and Prevention. (2013). Pro-tobacco influences and susceptibility to smoking cigarettes among middle and high school students--United States, 2011. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, *52*(5 Suppl), S45-51. https://doi.org/10.1016/j.jadohealth.2012.07.007
Duggan, Maeve. (2015). The Demographics of Social Media Users. Retrieved February 25, 2018, from http://www.pewinternet.org/2015/08/19/the-demographics-of-social-media-users/
Duke, Jennifer C., Hansen, Heather, Kim, Annice E., Curry, Laurel, & Allen, Jane. (2014). The use of social media by state tobacco control programs to promote smoking cessation: a cross-sectional study. *Journal of Medical Internet Research*, *16*(7), e169. https://doi.org/10.2196/jmir.3430
Dunlop, Sally, Freeman, Becky, & Perez, Donna. (2016). Exposure to Internet-Based Tobacco Advertising and Branding: Results From Population Surveys of Australian Youth 2010-2013. *Journal of Medical Internet Research*, *18*(6), e104. https://doi.org/10.2196/jmir.5595
DuRant, R. H., Rome, E. S., Rich, M., Allred, E., Emans, S. J., & Woods, E. R. (1997). Tobacco and alcohol use behaviors portrayed in music videos: a content analysis. *American Journal of Public Health*, *87*(7), 1131–1135. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9240102
Edwards, Gemma. (2010). Mixed-method approaches to social network analysis. *National Centre for Research Methods*, (Discussion Paper). Retrieved from http://eprints.ncrm.ac.uk/842/
Elkin, Lucy, Thomson, George, & Wilson, Nick. (2010). Connecting world youth with tobacco brands: YouTube and the internet policy vacuum on Web 2.0. *Tobacco Control*, *19*(5), 361–366. https://doi.org/10.1136/tc.2010.035949
Emarketer. (2014). Younger Users Spend More Daily Time on Social Networks. Retrieved February 25, 2018, from https://www.emarketer.com/Article/Younger-Users-Spend-More-Daily-Time-on-Social-Networks/1011592
Emery, Sherry L., Szczypka, Glen, Abril, Eulàlia P., Kim, Yoonsang, & Vera, Lisa. (2014a). Are You Scared Yet? Evaluating Fear Appeal Messages in Tweets About the Tips Campaign. *Journal of Communication*, *64*(2), 278–295. https://doi.org/10.1111/jcom.12083
Emery, Sherry L., Szczypka, Glen, Abril, Eulàlia P., Kim, Yoonsang, & Vera, Lisa. (2014b). Are You Scared Yet? Evaluating Fear Appeal Messages in Tweets About the Tips Campaign. *Journal of Communication*, *64*(2), 278–295. https://doi.org/10.1111/jcom.12083
Facebook. (2016a). Advertising Policies. Retrieved from https://www.facebook.com/policies/ads/
Facebook. (2016b). Facebook Pages Terms. Retrieved from https://www.facebook.com/page_guidelines.php
Farrelly, Matthew C., Davis, Kevin C., Haviland, M.Lyndon, Messeri, Peter, & Healton, Cheryl G. (2005). Evidence of a dose-response relationship between "truth" antismoking ads and youth smoking prevalence. *American Journal of Public Health*, *95*(3), 425–431. https://doi.org/10.2105/AJPH.2004.049692
Festinger, L. (1954). A Theory of Social Comparison Processes. *Human Relations*, *7*(2), 117–140. https://doi.org/10.1177/001872675400700202
Fiegerman, Seth. (2015). Inside the failure of Google+, a very expensive attempt to unseat facebook. Retrieved from http://mashable.com/2015/08/02/google-plus-history/
Fogg, B. J. (2008). Mass Interpersonal Persuasion: An Early View of a New Phenomenon. In *Persuasive Technology* (pp. 23–34). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-540-68504-3_3
Foldes, SS, An, LC, Rode, P., Schillo, BA, Davern, M., Alesci, NL, … Manley, MW. (2010). The prevalence of unrecognized tobacco use among young adults. *American Journal of Health Behavior*, *34*(3), 309–321.

Food and Drug Administration. (2016). “The Real Cost Campaign.” Retrieved from http://www.fda.gov/TobaccoProducts/PublicHealthEducation/PublicEducationCampaigns/TheRealCostCampaign/default.htm

Forsyth, Susan R., & Malone, Ruth E. (2010). "I’ll be your cigarette--light me up and get on with it": examining smoking imagery on YouTube. *Nicotine & Tobacco Research*, *12*(8), 810–816. https://doi.org/10.1093/ntr/ntq101

Fournier, Angela K., Hall, Erin, Ricke, Patricia, & Storey, Brittany. (2013). Alcohol and the social network: Online social networking sites and college students’ perceived drinking norms. *Psychology of Popular Media Culture*, *2*(2), 86–95. https://doi.org/10.1037/a0032097

Frandsen, Mai, Walters, Julia, & Ferguson, Stuart G. (2014). Exploring the viability of using online social media advertising as a recruitment method for smoking cessation clinical trials. *Nicotine & Tobacco Research*, *16*(2), 247–251. https://doi.org/10.1093/ntr/ntt157

Freeman, Becky. (2012). New media and tobacco control. *Tobacco Control*, *21*(2), 139–144. https://doi.org/10.1136/tobaccocontrol-2011-050193

Freeman, Becky, & Chapman, Simon. (2008). Gone viral? Heard the buzz? A guide for public health practitioners and researchers on how Web 2.0 can subvert advertising restrictions and spread health information. *Journal of Epidemiology & Community Health*, *62*(9), 778–782. https://doi.org/10.1136/jech.2008.073759

Freeman, Becky, & Chapman, Simon. (2010). British American Tobacco on Facebook: undermining Article 13 of the global World Health Organization Framework Convention on Tobacco Control. *Tobacco Control*, *19*(3), e1-9. https://doi.org/10.1136/tc.2009.032847

Fu, Luella, Jacobs, Megan A., Brookover, Jody, Valente, Thomas W., Cobb, Nathan K., & Graham, Amanda L. (2017). An exploration of the Facebook social networks of smokers and non-smokers. *PLOS ONE*, *12*(11), e0187332. https://doi.org/10.1371/journal.pone.0187332

Garrett, Joe, Dennis, J.Michael, & Disogra, Charles. (2010). *Non-Response Bias: Recent Findings from Address-based Panel Recruitment. Annual Conference of the American Association for Public Opinion Research*. Chicago, IL.

Gebremeskel, Roman H., Sessoms, Krysten, Krehnbrink, Marni, Haney, Chassidy J., & Coyne-Beasley, Tamera. (2014). Social Media Use and Adolescent Risk Taking Behavior. *Journal of Adolescent Health*, *54*(2), S46–S47. https://doi.org/10.1016/j.jadohealth.2013.10.106

Glaser, Beate, Shelton, Katherine H., & van den Bree, Marianne B. M. (2010). The moderating role of close friends in the relationship between conduct problems and adolescent substance use. *The Journal of Adolescent Health*, *47*(1), 35–42. https://doi.org/10.1016/j.jadohealth.2009.12.022

Go, Myong-Hyun, Tucker, Joan S., Green, Harold D., Pollard, Michael, & Kennedy, David. (2012). Social distance and homophily in adolescent smoking initiation. *Drug and Alcohol Dependence*, *124*(3), 347–354. https://doi.org/10.1016/J.DRUGALCDEP.2012.02.007

Goldstein, Jeff. (2011, May 25). The Remarkable Power of Twitter: A Water Cooler for the 21st Century. *Huffington Post*. Retrieved from https://www.huffingtonpost.com/jeff-goldstein/the-remarkable-power-of-t_b_570607.html

Google. (2016). Advertising Policies Help. Retrieved from https://support.google.com/adwordspolicy/answer/6008942?visit_id=1-636127579583344046-1499691893&rd=1

Grande, David, Mitra, Nandita, Shah, Anand, Wan, Fei, Asch, David A., J, King, … JW, Peabody. (2013). Public Preferences About Secondary Uses of Electronic Health Information. *JAMA Internal Medicine*, *173*(19), 1798. https://doi.org/10.1001/jamainternmed.2013.9166

Green, Laurence. (2012, April 7). Think Tank: It’s the subconscious that makes ads work. *The Telegraph*. Retrieved from

http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9191107/Think-Tank-Its-the-subconscious-that-makes-ads-work.html
Greenwood, Shannon, Perrin, Andrew, & Duggan, Maeve. (2016). *Social Media Update 2016*. Retrieved from http://www.pewinternet.org/2016/11/11/social-media-update-2016/
Grekin, Emily R., & Ayna, Dinah. (2012). Waterpipe smoking among college students in the United States: a review of the literature. *Journal of American College Health*, *60*(3), 244–249. https://doi.org/10.1080/07448481.2011.589419
Griggs, Richard A. (2012). *Psychology : a concise introduction*. Worth Publishers.
Guidry, Jeanine, Jin, Yan, Haddad, Linda, Zhang, Yuan, & Smith, Joshua. (2016). How Health Risks Are Pinpointed (or Not) on Social Media: The Portrayal of Waterpipe Smoking on Pinterest. *Health Communication*, *31*(6), 659–667. https://doi.org/10.1080/10410236.2014.987468
Gunther, Albert C., & Storey, J.Douglas. (2003). The Influence of Presumed Influence. *Journal of Communication*, *53*(2), 199–215. https://doi.org/10.1111/j.1460-2466.2003.tb02586.x
Gunther, Albert C., & Thorson, Esther. (1992). Perceived Persuasive Effects of Product Commercials and Public Service Announcements. *Communication Research*, *19*(5), 574–596. https://doi.org/10.1177/009365092019005002
Haines-Saah, Rebecca J., Kelly, Mary T., Oliffe, John L., & Bottorff, Joan L. (2015). 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*, *17*(1), e27. https://doi.org/10.2196/jmir.4061
Hammond, D. (2005). Smoking behaviour among young adults: beyond youth prevention. *Tobacco Control*, *14*(3), 181–185. https://doi.org/10.1136/tc.2004.009621
Hausmann, Jonathan S., Touloumtzis, Currie, White, Matthew T., Colbert, James A., & Gooding, Holly C. (2017). Adolescent and Young Adult Use of Social Media for Health and Its Implications. *Journal of Adolescent Health*, *60*(6), 714–719. https://doi.org/10.1016/J.JADOHEALTH.2016.12.025
Heath, Robert. (2012). *Seducing the subconscious : the psychology of emotional influence in advertising*. Wiley. Retrieved from https://www.wiley.com/en-us/Seducing+the+Subconscious%253A+The+Psychology+of+Emotional+Influence+in+Advertising-p-9780470974889
Hébert, Emily T., Case, Kathleen R., Kelder, Steven H., Delk, Joanne, Perry, Cheryl L., & Harrell, Melissa B. (2017). Exposure and Engagement With Tobacco- and E-Cigarette–Related Social Media. *Journal of Adolescent Health*, *61*(3), 371–377. https://doi.org/10.1016/j.jadohealth.2017.04.003
Heeren, Timothy, Edwards, Erika M., Dennis, J.Michael, Rodkin, Sergei, Hingson, Ralph W., & Rosenbloom, David L. (2008). A Comparison of Results From an Alcohol Survey of a Prerecruited Internet Panel and the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcoholism: Clinical and Experimental Research*, *32*(2), 222–229. https://doi.org/10.1111/j.1530-0277.2007.00571.x
Hefler, M., Freeman, B., & Chapman, S. (2012). Tobacco control advocacy in the age of social media: using Facebook, Twitter and Change. *Tobacco Control*. Retrieved from http://tobaccocontrol.bmj.com/content/early/2012/10/07/tobaccocontrol-2012-050721.short
Heider, Fritz. (1958). *The Psychology of Interpersonal Relations*. New York: Wiley.
Hitchman, Sara C., Fong, Geoffrey T., Zanna, Mark P., Thrasher, James F., Chung-Hall, Janet, & Siahpush, Mohammad. (2014). Socioeconomic status and smokers' number of smoking friends: findings from the International Tobacco Control (ITC) Four Country Survey. *Drug and Alcohol Dependence*, *143*, 158–166. https://doi.org/10.1016/j.drugalcdep.2014.07.019
Hoek, Janet, Maubach, Ninya, Stevenson, Rachel, Gendall, Philip, & Edwards, Richard. (2013). Social smokers' management of conflicted identities. *Tobacco Control*, *22*(4), 261–265. https://doi.org/10.1136/tobaccocontrol-2011-050176

Hoelzel, Mark. (2015). Update: A breakdown of the demographics for each of the different social networks. Retrieved February 25, 2018, from http://www.businessinsider.com/update-a-breakdown-of-the-demographics-for-each-of-the-different-social-networks-2015-6

Hoffman, Eric W., Pinkleton, Bruce E., Weintraub Austin, Erica, & Reyes-Velázquez, Wanda. (2014). Exploring College Students' Use of General and Alcohol-Related Social Media and Their Associations With Alcohol-Related Behaviors. *Journal of American College Health*, *62*(5), 328–335. https://doi.org/10.1080/07448481.2014.902837

Holson, Laura. (2014, July 3). Social Media's Vampires: They Text by Night. *New York Times*. Retrieved from http://www.nytimes.com/2014/07/06/fashion/vamping-teenagers-are-up-all-night-texting.html

Hornik, Robert C. (2002a). Exposure: Theory and Evidence About All the Ways It Matters. https://doi.org/10.1080/15245000214135

Hornik, Robert C. (2002b). Exposure: Theory and Evidence About All the Ways It Matters. https://doi.org/10.1080/15245000214135

Huang, Grace C., Soto, Daniel, Fujimoto, Kayo, & Valente, Thomas W. (2014). The interplay of friendship networks and social networking sites: longitudinal analysis of selection and influence effects on adolescent smoking and alcohol use. *American Journal of Public Health*, *104*(8), e51-9. https://doi.org/10.2105/AJPH.2014.302038

Huang, Grace C., Unger, Jennifer B., Soto, Daniel, Fujimoto, Kayo, Pentz, Mary Ann, Jordan-Marsh, Maryalice, & Valente, Thomas W. (2014). Peer Influences: The Impact of Online and Offline Friendship Networks on Adolescent Smoking and Alcohol Use. *Journal of Adolescent Health*, *54*(5), 508–514. https://doi.org/10.1016/j.jadohealth.2013.07.001

Huang, Guanxiong, & Li, Kang. (2016). The Effect of Anonymity on Conformity to Group Norms in Online Contexts: A Meta-Analysis. *International Journal of Communication*, *10*, 398–415. Retrieved from http://ijoc.org.

Hwang, Y. (2012). Social Diffusion of Campaign Effects: Campaign-Generated Interpersonal Communication as a Mediator of Antitobacco Campaign Effects. *Communication Research*, *39*(1), 120–141. https://doi.org/10.1177/0093650210389029

Ilakkuvan, Vinu, Cantrell, Jennifer, Hair, Elizabeth C., & Vallone, Donna M. (2015). truth® Trends: A Cross-Platform Analysis of Social Media Audience Growth and Engagement with the New truth® Campaign. *American Academy of Health Behavior Annual Meeting, San Antonio*.

Institute of Medicine. (2002). *Speaking of Health: Assessing Health Communication Strategies for Diverse Populations*. *Speaking of Health: Assessing Health Communication Strategies for Diverse Populations*. Washington, DC: National Academies Press. https://doi.org/10.17226/10018

Institute of Medicine and National Research Council Committee on the Science of Adolescence. (2011). *The Science of Adolescent Risk-Taking: Workshop Report*. *The Science of Adolescent Risk-Taking: Workshop Report*. National Academies Press (US). https://doi.org/10.17226/12961

Jacobs, Megan A., Cha, Sarah, Villanti, Andrea C., & Graham, Amanda L. (2016). Using Tumblr to Reach and Engage Young Adult Smokers: A Proof of Concept in Context. *American Journal of Health Behavior*, *40*(1), 48–54. https://doi.org/10.5993/AJHB.40.1.6

Jarobe, Greg. (2015). VidCon 2015 Haul: Trends, Strategic Insights, Critical Data, and Tactical Advice. Retrieved from http://tubularinsights.com/vidcon-2015-strategic-insights-tactical-advice/

Jarrett, Traci, Blosnich, John, Tworek, Cindy, & Horn, Kimberly. (2012). Hookah use among U.S. college students: results from the National College Health Assessment II. *Nicotine & Tobacco Research*, *14*(10), 1145–1153. https://doi.org/10.1093/ntr/nts003

Jeong, Michelle, Tan, Andy S. L., Brennan, Emily, Gibson, Laura, & Hornik, Robert C. (2015). Talking About Quitting: Interpersonal Communication as a Mediator of Campaign Effects

on Smokers' Quit Behaviors. *Journal of Health Communication*, *20*(10), 1196–1205. https://doi.org/10.1080/10810730.2015.1018620

Jiang, Nan, Lee, Youn O., & Ling, Pamela M. (2014). Young adult social smokers: their co-use of tobacco and alcohol, tobacco-related attitudes, and quitting efforts. *Preventive Medicine*, *69*, 166–171. https://doi.org/10.1016/j.ypmed.2014.09.013

Johnson, Matthew, Steeves, Valerie, Shade, Leslie Regan, & Foran, Grace. (2017). *To Share or Not to Share: How Teens Make Privacy Decisions about Photos on Social Media*. Ottawa. Retrieved from https://mediasmarts.ca/sites/mediasmarts/files/publication-report/full/to-share-or-not-share.pdf

Kamber. (2013). Active Monthly Users of the "Big 9." Retrieved from http://kamber.com.au/wp-content/uploads/2013/11/social-media-trends-2014-active-monthly-users-of-the-big-nine-social-media-platforms.png.

Katz, E., & Lazarsfeld, PF. (1955). Images of the mass communications process. In *Personal influence: The part played by people in the flow of communication* (pp. 15–42). New York, NY: Free Press.

Keady, Cameron. (2015). UNICEF And Snapchat Join Together To Protect Children Affected By Boko Haram. *Huffington Post*. Retrieved from https://www.huffingtonpost.com/2015/04/17/unicef-snapchat-bring-back-childhood_n_7081708.html

Kelly, Bridget, Squiers, Linda, Bann, Carla, Stine, Alexander, Hansen, Heather, Lynch, Molly, … Folayan, MO. (2015). Perceptions and plans for prevention of Ebola: results from a national survey. *BMC Public Health*, *15*(1), 1136. https://doi.org/10.1186/s12889-015-2441-7

Kim, Kyongseok, Paek, Hye-Jin, & Lynn, Jordan. (2010). A content analysis of smoking fetish videos on YouTube: regulatory implications for tobacco control. *Health Communication*, *25*(2), 97–106. https://doi.org/10.1080/10410230903544415

Klucharev, Vasily, Hytönen, Kaisa, Rijpkema, Mark, Smidts, Ale, & Fernández, Guillén. (2009). Reinforcement learning signal predicts social conformity. *Neuron*, *61*(1), 140–151. https://doi.org/10.1016/j.neuron.2008.11.027

Knoll, Lisa J., Magis-Weinberg, Lucía, Speekenbrink, Maarten, & Blakemore, Sarah-Jayne. (2015). Social influence on risk perception during adolescence. *Psychological Science*, *26*(5), 583–592. https://doi.org/10.1177/0956797615569578

Kobus, Kimberly. (2003). Peers and adolescent smoking. *Addiction*, *98*(s1), 37–55. https://doi.org/10.1046/j.1360-0443.98.s1.4.x

Kornfield, Rachel, Smith, Katherine Clegg, Szczypka, Glen, Vera, Lisa, & Emery, Sherry. (2015). Earned media and public engagement with CDC's "Tips from Former Smokers" campaign: an analysis of online news and blog coverage. *Journal of Medical Internet Research*, *17*(1), e12. https://doi.org/10.2196/jmir.3645

Kostygina, Ganna, Tran, Hy, Shi, Yaru, Kim, Yoonsang, & Emery, Sherry. (2016). "Sweeter Than a Swisher": amount and themes of little cigar and cigarillo content on Twitter. *Tobacco Control*, *25*(Suppl 1), i75–i82. https://doi.org/10.1136/TOBACCOCONTROL-2016-053094

Kostygina, Ganna, Tran, Hy, Szczypka, Glen, Binns, Steven, & Emery, Sherry. (2015). Check Out That #Rollgame: Amount and Themes of Little Cigar and Cigarillo Content on Twitter. American Public Health Association, Annual Meeting 2015. Retrieved from https://apha.confex.com/apha/143am/webprogram/Paper329624.html

Kroenke, Kurt, Spitzer, Robert L., & Williams, Janet B. W. (2003). The Patient Health Questionnaire-2. *Medical Care*, *41*(11), 1284–1292. https://doi.org/10.1097/01.MLR.0000093487.78664.3C

Kroenke, Kurt, Spitzer, Robert L., Williams, Janet B. W., Monahan, Patrick O., & Löwe, Bernd. (2007). Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Annals of Internal Medicine*, *146*(5), 317–325. Retrieved from

http://www.ncbi.nlm.nih.gov/pubmed/17339617
Kumar, Supriya, Quinn, Sandra Crouse, Kim, Kevin H., Daniel, Laura H., & Freimuth, Vicki S. (2012). The Impact of Workplace Policies and Other Social Factors on Self-Reported Influenza-Like Illness Incidence During the 2009 H1N1 Pandemic. *American Journal of Public Health*, *102*(1), 134–140. https://doi.org/10.2105/AJPH.2011.300307
Lantz, P. M. (2003). Smoking on the rise among young adults: implications for research and policy. *Tobacco Control*, *12 Suppl 1*(suppl 1), i60-70. https://doi.org/10.1136/TC.12.SUPPL_1.I60
Laranjo, Liliana, Arguel, Amaël, Neves, Ana L., Gallagher, Aideen M., Kaplan, Ruth, Mortimer, Nathan, … Lau, Annie Y. S. (2014). The influence of social networking sites on health behavior change: a systematic review and meta-analysis. *Journal of the American Medical Informatics Association*.
Latane, Bibb. (1981). The psychology of social impact. *American Psychologist*, *36*(4), 343–356. https://doi.org/10.1037/0003-066X.36.4.343
Lazarsfeld, P., Berelson, B., & Gaudet, H. (1948). *The People's Choice*. New York, NY: Columbia University Press.
Liang, Yunji, Zheng, Xiaolong, Zeng, Daniel Dajun, Zhou, Xingshe, Leischow, Scott James, & Chung, Wingyan. (2015a). Characterizing Social Interaction in Tobacco-Oriented Social Networks: An Empirical Analysis. *Scientific Reports*, *5*, 10060. https://doi.org/10.1038/srep10060
Liang, Yunji, Zheng, Xiaolong, Zeng, Daniel Dajun, Zhou, Xingshe, Leischow, Scott James, & Chung, Wingyan. (2015b). Exploring How the Tobacco Industry Presents and Promotes Itself in Social Media. *Journal of Medical Internet Research*, *17*(1), e24. https://doi.org/10.2196/jmir.3665
Lin, Liu Yi, Sidani, Jaime E., Shensa, Ariel, Radovic, Ana, Miller, Elizabeth, Colditz, Jason B., … Primack, Brian A. (2016). Association Between Social Media Use and Depression Among U.S. Young Adults. *Depression and Anxiety*, *33*(4), 323–331. https://doi.org/10.1002/da.22466
Ling, Pamela M., & Glantz, Stanton 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. https://doi.org/10.2105/AJPH.92.6.908
Link, Alissa R., Cawkwell, Philip B., Shelley, Donna R., & Sherman, Scott E. (2015). An exploration of online behaviors and social media use among hookah and electronic-cigarette users. *Addictive Behaviors Reports*, *2*, 37–40. https://doi.org/10.1016/j.abrep.2015.05.006
Lisha, Nadra E., Delucchi, Kevin L., Ling, Pamela M., & Ramo, Danielle E. (2015). Prevalence and Correlates of Social Smoking in Young Adults: Comparisons of Behavioral and Self-Identified Definitions. *Nicotine & Tobacco Research*, *17*(9), 1076–1084. https://doi.org/10.1093/ntr/ntu242
Litt, Dana M., Lewis, Melissa A., Stahlbrandt, Henriettae, Firth, Perry, & Neighbors, Clayton. (2012). Social comparison as a moderator of the association between perceived norms and alcohol use and negative consequences among college students. *Journal of Studies on Alcohol and Drugs*, *73*(6), 961–967. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/23036214
Litt, Dana M., & Stock, Michelle L. (2011). Adolescent alcohol-related risk cognitions: The roles of social norms and social networking sites. *Psychology of Addictive Behaviors*, *25*(4), 708–713. https://doi.org/10.1037/a0024226
Lovato, Chris, Linn, Gilat, Stead, Lindsay F., & Best, Allan. (2003). Impact of tobacco advertising and promotion on increasing adolescent smoking behaviours. In Chris Lovato (Ed.), *Cochrane Database of Systematic Reviews*. Chichester, UK: John Wiley & Sons, Ltd. https://doi.org/10.1002/14651858.CD003439
Lyons, Antonia C., Goodwin, Ian, McCreanor, Tim, & Griffin, Christine. (2015). Social

networking and young adults' drinking practices: Innovative qualitative methods for health behavior research. *Health Psychology*, *34*(4), 293–302. https://doi.org/10.1037/hea0000168
Mahler, Heike I. M., Kulik, James A., Gerrard, Meg, & Gibbons, Frederick X. (2010). Effects of upward and downward social comparison information on the efficacy of an appearance-based sun protection intervention: a randomized, controlled experiment. *Journal of Behavioral Medicine*, *33*(6), 496–507. https://doi.org/10.1007/s10865-010-9279-3
McAfee, Tim, Davis, Kevin C., Alexander, Robert L., Pechacek, Terry F., & Bunnell, Rebecca. (2013). Effect of the first federally funded US antismoking national media campaign. *Lancet (London, England)*, *382*(9909), 2003–2011. https://doi.org/10.1016/S0140-6736(13)61686-4
McCloud, Rachel F., Kohler, Racquel E., & Viswanath, K. (2017). Cancer Risk-Promoting Information: The Communication Environment of Young Adults. *American Journal of Preventive Medicine*, *53*(3S1), S63–S72. https://doi.org/10.1016/j.amepre.2017.03.025
McCormick, LK. (1999). Social smokers: the progression of teen smoking. *Paper Presented at: Annual Meeting of the Society for Research on Nicotine and Tobacco; March 6, 1999; San Diego, CA.*
Mead, Erin L., Rimal, Rajiv N., Ferrence, Roberta, & Cohen, Joanna E. (2014). Understanding the sources of normative influence on behavior: the example of tobacco. *Social Science & Medicine*, *115*, 139–143. https://doi.org/10.1016/j.socscimed.2014.05.030
Meyer, Kate. (2016). Social Media Natives: Growing Up with Social Networking. Retrieved from https://www.nngroup.com/articles/social-media-natives/
Mickle, Tripp, & Valentino-DeVries, Jennifer. (2016, September 13). Newport's "Pleasure Lounge" Aims to Ignite Cigarettes Sales. *Wall Street Journal*. Retrieved from https://www.wsj.com/articles/newports-pleasure-lounge-aims-to-ignite-cigarettes-sales-1473801325
Montano, Daniel E., & Kasprzyk, Danuta. (2008). Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model. In Karen Glanz, Barbara Rimer, & K. Viswanath (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed., pp. 67–92).
Moran, Susan, Wechsler, Henry, & Rigotti, Nancy A. (2004). Social smoking among US college students. *Pediatrics*, *114*(4), 1028–1034. https://doi.org/10.1542/peds.2003-0558-L
Moreno, Megan A., Briner, Leslie R., Williams, Amanda, Brockman, Libby, Walker, Leslie, & Christakis, Dimitri A. (2010). A Content Analysis of Displayed Alcohol References on a Social Networking Web Site. *Journal of Adolescent Health*, *47*(2), 168–175. https://doi.org/10.1016/j.jadohealth.2010.01.001
Moreno, Megan A., Christakis, Dimitri A., Egan, Katie G., Brockman, Libby N., Becker, Tara, A, Abbey, … MA, Moreno. (2012). Associations Between Displayed Alcohol References on Facebook and Problem Drinking Among College Students. *Archives of Pediatrics & Adolescent Medicine*, *166*(2), 157. https://doi.org/10.1001/archpediatrics.2011.180
Moreno, Megan A., Cox, Elizabeth D., Young, Henry N., & Haaland, Wren. (2015). Underage College Students' Alcohol Displays on Facebook and Real-Time Alcohol Behaviors. *Journal of Adolescent Health*, *56*(6), 646–651. https://doi.org/10.1016/j.jadohealth.2015.02.020
Moreno, Megan A., & Whitehill, Jennifer M. (2014). Influence of Social Media on Alcohol Use in Adolescents and Young Adults. *Alcohol Research : Current Reviews*, *36*(1), 91–100. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/26259003
Mosley, Sarah, Tomc, Katrina, Tracy, Danielle, Walker, Kaala, & Bracken, Cheryl. (2014). Cigarillo and Little Cigar (CLC) Portrayals on Instagram. *Undergraduate Research Posters 2014*. Retrieved from http://engagedscholarship.csuohio.edu/u_poster_2014/26
Muthén, Bengt. (2004). Latent Variable Analysis: Growth Mixture Modeling and Related Techniques for Longitudinal Data. The SAGE Handbook of Quantitative Methodology for

the Social Sciences (pp. 346–369). Thousand Oaks, California: SAGE Publications, Inc. https://doi.org/10.4135/9781412986311.n19
Muthén, L. K., & Muthén, B. O. (2012). *Mplus Version 7.0*.
Myslín, Mark, Zhu, Shu-Hong, Chapman, Wendy, & Conway, Mike. (2013a). Using twitter to examine smoking behavior and perceptions of emerging tobacco products. *Journal of Medical Internet Research*, *15*(8), e174. https://doi.org/10.2196/jmir.2534
Myslín, Mark, Zhu, Shu-Hong, Chapman, Wendy, & Conway, Mike. (2013b). Using twitter to examine smoking behavior and perceptions of emerging tobacco products. *Journal of Medical Internet Research*, *15*(8), e174. https://doi.org/10.2196/jmir.2534
National Association of Attorneys General. The Master Settlement Agreement (1998).
National Cancer Institute. (2008). The Role of the Media in Promoting and Reducing Tobacco Use. *Tobacco Control Monograph No. 19. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. NIH Pub. No. 07-6242, June 2008.*
Noar, Seth M., Francis, Diane B., Bridges, Christy, Sontag, Jennah M., Ribisl, Kurt M., & Brewer, Noel T. (2016). The impact of strengthening cigarette pack warnings: Systematic review of longitudinal observational studies. *Social Science & Medicine*, *164*, 118–129. https://doi.org/10.1016/j.socscimed.2016.06.011
Nylund, Karen L., Asparouhov, Tihomir, & Muthén, Bengt O. (2007). Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation Study. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(4), 535–569. https://doi.org/10.1080/10705510701575396
O'Connell, Joe. (2016). 3Qs: Trapped in social media "echo chambers" (interview with Brooke Foucault Welles). Retrieved from https://news.northeastern.edu/2016/07/3qs-trapped-in-social-media-echo-chambers/
Oberski, Daniel. (2016). Mixture Models: Latent Profile and Latent Class Analysis. In *Modern Statistical Methods for HCI. Human-Computer Interaction Series.* (pp. 275–287). Springer, Cham. https://doi.org/10.1007/978-3-319-26633-6_12
Oetting, E. R., & Donnermeyer, J. F. (1998). Primary socialization theory: the etiology of drug use and deviance. I. *Substance Use & Misuse*, *33*(4), 995–1026. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9548633
Oetting, Eugene R., Deffenbacher, Jerry L., & Donnermeyer, Joseph F. (1998). Primary socialization theory: The role played by personal traits in the etiology of drug use and deviance: II. *Substance Use & Misuse*, *33*(6), 1337–1366. https://doi.org/10.3109/10826089809062220
OK2Talk. (2015). OK2Talk. Retrieved February 3, 2018, from http://ok2talk.org
Paek, Hye-Jin, Kim, Kyongseok, & Hove, Thomas. (2010). Content analysis of antismoking videos on YouTube: message sensation value, message appeals, and their relationships with viewer responses. *Health Education Research*, *25*(6), 1085–1099. https://doi.org/10.1093/her/cyq063
Paek, Hye-Jin, Jun Bae, Beom, Hove, Thomas, & Yu, Hyunjae. (2011). Theories into practice: a content analysis of anti-smoking websites. *Internet Research*, *21*(1), 5–25. https://doi.org/10.1108/10662241111104857
Papasolomou, Ioanna, & Melanthiou, Yioula. (2012). Social Media: Marketing Public Relations' New Best Friend. *Journal of Promotion Management*, *18*(3), 319–328. https://doi.org/10.1080/10496491.2012.696458
Parenthood, Planned. (2014). Planned Parenthood. Retrieved from plannedparenthood.tumblr.com/
Patel, Neil, Savani, Krishna, Dave, Paresh, Shah, Kapil, Klemmer, Scott R., & Parikh, Tapan S. (2013). Power to the Peers: Authority of Source Effects for a Voice-Based Agricultural Information Service in Rural India. *Information Technologies & International Development*,

9(2), 81–93.
Pechmann, Cornelia, Delucchi, Kevin, Lakon, Cynthia M., & Prochaska, Judith J. (2016). Randomised controlled trial evaluation of Tweet2Quit: a social network quit-smoking intervention. *Tobacco Control*. https://doi.org/10.1136/tobaccocontrol-2015-052768
Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *BMJ (Clinical Research Ed.)*, *316*(7139), 1236–1238. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9553006
Perrin, Andrew. (2015). Social Media Usage: 2005-2015. Pew Research Center. Retrieved February 25, 2018, from http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/
Petraitis, John, Flay, Brian R., & Miller, Todd Q. (1995). Reviewing theories of adolescent substance use: Organizing pieces in the puzzle. *Psychological Bulletin*, *117*(1), 67–86. https://doi.org/10.1037/0033-2909.117.1.67
Pew Research Center. (2013). Social Networking Fact Sheet. Retrieved from http://www.pewinternet.org/fact-sheets/social-networking-fact-sheet/
Pierce, J. P., Choi, W. S., Gilpin, E. A., Farkas, A. J., & Merritt, R. K. (1996). Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychology*, *15*(5), 355–361. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8891714
Primack, Brian A., Shensa, Ariel, Escobar-Viera, César G., Barrett, Erica L., Sidani, Jaime E., Colditz, Jason B., & James, A.Everette. (2017). Use of multiple social media platforms and symptoms of depression and anxiety: A nationally-representative study among U.S. young adults. *Computers in Human Behavior*, *69*, 1–9. https://doi.org/10.1016/j.chb.2016.11.013
Prinstein, M. (2009). *Peer influences and interventions. Presentation at the Workshop on Social and Environmental Influences and Adolescent Risk Behavior*. Washington, DC.
Prochaska, Judith J., Pechmann, Cornelia, Kim, Romina, & Leonhardt, James M. (2012). Twitter=quitter? An analysis of Twitter quit smoking social networks. *Tobacco Control*, *21*(4), 447–449. https://doi.org/10.1136/tc.2010.042507
QSR International. (2015). *NVivo qualitative data analysis Software, Version 11.*
Ramo, Danielle E., Rodriguez, Theresa M. S., Chavez, Kathryn, Sommer, Markus J., & Prochaska, Judith J. (2014). Facebook Recruitment of Young Adult Smokers for a Cessation Trial: Methods, Metrics, and Lessons Learned. *Internet Interventions*, *1*(2), 58–64. https://doi.org/10.1016/j.invent.2014.05.001
Ramo, Danielle E., Thrul, Johannes, Chavez, Kathryn, Delucchi, Kevin L., & Prochaska, Judith J. (2015). Feasibility and Quit Rates of the Tobacco Status Project: A Facebook Smoking Cessation Intervention for Young Adults. *Journal of Medical Internet Research*, *17*(12), e291. https://doi.org/10.2196/jmir.5209
Rath, Jessica M., Villanti, Andrea C., Abrams, David B., & Vallone, Donna M. (2012). Patterns of tobacco use and dual use in US young adults: the missing link between youth prevention and adult cessation. *Journal of Environmental and Public Health*, *2012*, 679134. https://doi.org/10.1155/2012/679134
Reicher, S. D., Spears, R., & Postmes, T. (1995). A Social Identity Model of Deindividuation Phenomena. *European Review of Social Psychology*, *6*(1), 161–198. https://doi.org/10.1080/14792779443000049
Reicher, Stephen David, Spears, Russell, Postmes, Tom, & Kende, Anna. (2016). Disputing deindividuation: Why negative group behaviours derive from group norms, not group immersion. *Behavioral and Brain Sciences*, *39*, e161. https://doi.org/10.1017/S0140525X15001491
Reitz, Anne K., Zimmermann, Julia, Hutteman, Roos, Specht, Jule, & Neyer, Franz J. (2014). How Peers Make a Difference: The Role of Peer Groups and Peer Relationships in Personality Development. *European Journal of Personality*, *28*(3), 279–288. https://doi.org/10.1002/per.1965

Richardson, Amanda, Ganz, Ollie, & Vallone, Donna. (2014). The cigar ambassador: how Snoop Dogg uses Instagram to promote tobacco use. *Tobacco Control*, *23*(1), 79–80. https://doi.org/10.1136/tobaccocontrol-2013-051037

Richardson, Amanda, Rath, Jessica, Ganz, Ollie, Xiao, Haijun, & Vallone, Donna. (2013). Primary and dual users of little cigars/cigarillos and large cigars: demographic and tobacco use profiles. *Nicotine & Tobacco Research : Official Journal of the Society for Research on Nicotine and Tobacco*, *15*(10), 1729–1736. https://doi.org/10.1093/ntr/ntt053

Richardson, Amanda, & Vallone, Donna M. (2014). YouTube: a promotional vehicle for little cigars and cigarillos? *Tobacco Control*, *23*(1), 21–26. https://doi.org/10.1136/tobaccocontrol-2012-050562

Ridout, Brad, & Campbell, Andrew. (2014). Using Facebook to deliver a social norm intervention to reduce problem drinking at university. *Drug and Alcohol Review*, *33*(6), 667–673. https://doi.org/10.1111/dar.12141

Rimal, Rajiv N., & Real, Kevin. (2003). Understanding the Influence of Perceived Norms on Behaviors. *Communication Theory*, *13*(2), 184–203. https://doi.org/10.1111/j.1468-2885.2003.tb00288.x

Rimal, RN, & Real, K. (2005). How Behaviors are Influenced by Perceived Norms: A Test of the Theory of Normative Social Behavior. *Communication Research*, *32*(3), 389–414. https://doi.org/10.1177/0093650205275385

Rollins, S., Malmstadt Schumacher, JR, & Ling, PM. (2002). Exploring the phenomenon of social smoking — why do so many young adults socially smoke? *Paper Presented at: National Conference on Tobacco or Health; November 20, 2002; San Francisco, CA.*

Sadasivam, Rajani S., Cutrona, Sarah L., Luger, Tana M., Volz, Erik, Kinney, Rebecca, Rao, Sowmya R., … Houston, Thomas K. (2016). Share2Quit: Online Social Network Peer Marketing of Tobacco Cessation Systems. *Nicotine & Tobacco Research : Official Journal of the Society for Research on Nicotine and Tobacco*, ntw187. https://doi.org/10.1093/ntr/ntw187

Sargent, J. D., Dalton, M., & Beach, M. (2000). Exposure to cigarette promotions and smoking uptake in adolescents: evidence of a dose-response relation. *Tobacco Control*, *9*(2), 163–168. https://doi.org/10.1136/tc.9.2.163

Sargent, J. D., Gibson, J., & Heatherton, T. F. (2009). Comparing the effects of entertainment media and tobacco marketing on youth smoking. *Tobacco Control*, *18*(1), 47–53. https://doi.org/10.1136/tc.2008.026153

Schane, Rebecca E., Glantz, Stanton A., & Ling, Pamela M. (2009a). Nondaily and social smoking: an increasingly prevalent pattern. *Archives of Internal Medicine*, *169*(19), 1742–1744. https://doi.org/10.1001/archinternmed.2009.315

Schane, Rebecca E., Glantz, Stanton A., & Ling, Pamela M. (2009b). Social smoking implications for public health, clinical practice, and intervention research. *American Journal of Preventive Medicine*, *37*(2), 124–131. https://doi.org/10.1016/j.amepre.2009.03.020

Schane, Rebecca E., Ling, Pamela M., & Glantz, Stanton A. (2010). Health effects of light and intermittent smoking: a review. *Circulation*, *121*(13), 1518–1522. https://doi.org/10.1161/CIRCULATIONAHA.109.904235

Scharkow, Michael. (2016). The Accuracy of Self-Reported Internet Use—A Validation Study Using Client Log Data. *Communication Methods and Measures*, *10*(1), 13–27. https://doi.org/10.1080/19312458.2015.1118446

Shannon, Claude E., & Weaver, Warren. (1949). *The Mathematical Theory of Communication*. Chicago, IL: University of Illinois Press . Retrieved from https://books.google.com/books?hl=en&lr=&id=IZ77BwAAQBAJ&oi=fnd&pg=PP1&dq=mathematical+theory+of+communication&ots=hklA6RwR5u&sig=Bo8wi_23v8mf1Gss-6lbNWashtY#v=onepage&q=mathematical theory of communication&f=false

Sharot, Tali. (2011). The optimism bias. *Current Biology*, *21*(23), R941–R945.

https://doi.org/10.1016/J.CUB.2011.10.030
Sherman, L. E., Payton, A. A., Hernandez, L. M., Greenfield, P. M., & Dapretto, M. (2016). The Power of the Like in Adolescence: Effects of Peer Influence on Neural and Behavioral Responses to Social Media. *Psychological Science*, *27*(7), 1027–1035. https://doi.org/10.1177/0956797616645673
Shiffman, Saul, Kirchner, Thomas R., Ferguson, Stuart G., & Scharf, Deborah M. (2009). Patterns of intermittent smoking: An analysis using Ecological Momentary Assessment. *Addictive Behaviors*, *34*(6–7), 514–519. https://doi.org/10.1016/j.addbeh.2009.01.004
Simons-Morton, Bruce G., & Farhat, Tilda. (2010). Recent findings on peer group influences on adolescent smoking. *The Journal of Primary Prevention*, *31*(4), 191–208. https://doi.org/10.1007/s10935-010-0220-x
Sly, David F., Trapido, Ed, & Ray, Sarah. (2002). Evidence of the dose effects of an antitobacco counteradvertising campaign. *Preventive Medicine*, *35*(5), 511–518. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12431900
Song, Hayeon, Kim, Jihyun, & Kim, Sang-Yeon. (2014). Smoker identity among social smokers: theory-based approaches for anti-smoking interventions. *Journal of Substance Use*, *19*(5), 346–350. https://doi.org/10.3109/14659891.2013.820799
Song, Anna V, & Ling, Pamela M. (2011). Social smoking among young adults: investigation of intentions and attempts to quit. *American Journal of Public Health*, *101*(7), 1291–1296. https://doi.org/10.2105/AJPH.2010.300012
StataCorp. (2013). *Stata Statistical Software: Release 13*. College Station, TX: StataCorp LP.
Steers, Mai-Ly N., Moreno, Megan A., & Neighbors, Clayton. (2016). The Influence of Social Media on Addictive Behaviors in College Students. *Current Addiction Reports*, *3*(4), 343–348. https://doi.org/10.1007/s40429-016-0123-x
Step, Mary M., Bracken, Cheryl C., Trapl, Erika S., & Flocke, Susan A. (2016). User and Content Characteristics of Public Tweets Referencing Little Cigars. *American Journal of Health Behavior*, *40*(1), 38–47. https://doi.org/10.5993/AJHB.40.1.5
Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: SAGE Publications, Inc.
Sullivan, Jessica R. (2012). The Hilltop Review Skype: An Appropriate Method of Data Collection for Qualitative Interviews? *The Hilltop Review*, *6*(1). Retrieved from http://scholarworks.wmich.edu/hilltopreview
Swant, Marty. (2017). Instagram Launches Campaign to Promote Mental Health Awareness. *AdWeek*. Retrieved from http://www.adweek.com/digital/instagram-launches-campaign-to-promote-mental-health-awareness/
Szczypka, Glen. (2015). Smoking Selfies: Using Instagram to examine smoking behavior. APHA.
Szczypka, Glen, Binns, Steven, Ilakkuvan, Vinu, Hair, Elizabeth, Vallone, Donna, & Emery, Sherry. (2015). Traditional Versus Social Media: How the Truth® Campaign Reaches and Engages Youth. *National Conference on Health Communication, Marketing, and Media, Atlanta, GA*.
Tavousi, M., Hidarnia, Ar, Montazeri, A., Hajizadeh, E., Taremian, F., & Ghofranipour, F. (2009). Are perceived Behavioral Control and Self-Efficacy Distinct Constructs? *European Journal of Scientific Research*, *30*(1), 1450–216. Retrieved from http://www.eurojournals.com/ejsr.htm
Thackeray, Rosemary, Neiger, Brad L., Smith, Amanda K., & Van Wagenen, Sarah B. (2012). Adoption and use of social media among public health departments. *BMC Public Health*, *12*(1), 242. https://doi.org/10.1186/1471-2458-12-242
Thomas, Roger E., McLellan, Julie, & Perera, Rafael. (2013). School-based programmes for preventing smoking. *The Cochrane Database of Systematic Reviews*, (4), CD001293. https://doi.org/10.1002/14651858.CD001293.pub3
Thompson, Leah, Rivara, Frederick P., & Whitehill, Jennifer M. (2015). Prevalence of

Marijuana-Related Traffic on Twitter, 2012-2013: A Content Analysis. *Cyberpsychology, Behavior and Social Networking*, *18*(6), 311–319. https://doi.org/10.1089/cyber.2014.0620
Thorson, K., & Wells, C. (2012). From two-step to one-step to curated flows: Technology, social change and contingent information exposure. *Conference of the International Association of Communication in Phoenix, AZ, USA*.
Thrasher, J. F., Niederdeppe, Jeffrey D., Jackson, Christine, & Farrelly, Matthew C. (2006). Using anti-tobacco industry messages to prevent smoking among high-risk adolescents. *Health Education Research*, *21*(3), 325–337. https://doi.org/10.1093/her/cyl001
Thrasher, James F., Abad-Vivero, Erika N., Huang, Liling, O'Connor, Richard J., Hammond, David, Bansal-Travers, Maansi, … Hardin, James. (2016). Interpersonal communication about pictorial health warnings on cigarette packages: Policy-related influences and relationships with smoking cessation attempts. *Social Science & Medicine*, *164*, 141–149. https://doi.org/10.1016/j.socscimed.2015.05.042
Tomé, Gina, Matos, Margarida, Simões, Celeste, Diniz, José Alves, & Camacho, Inês. (2012). How Can Peer Group Influence the Behavior of Adolescents: Explanatory Model. *Global Journal of Health Science*, *4*(2), 26.
Tumblr Staff. (2012). A new policy against self harm blogs. Retrieved February 3, 2018, from https://staff.tumblr.com/post/18563255291/follow-up-tumblrs-new-policy-against
Tuten, Tracy L. (2008). *Advertising 2.0 : Social Media Marketing in a Web 2.0 World*. Praeger.
U.S. Department of Health and Human Services. (1998). *Tobacco use among U.S. racial/ethnic minority groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A report of the Surgeon General*. Atlanta, Georgia.
U.S. Department of Health and Human Services. (2012). *Preventing Tobacco Use Among Youth and Young Adults*. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22876391
U.S. Department of Health and Human Services. (2014). *The Health Consequences of Smoking—50 Years of Progress*. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General*. Atlanta, GA: U.S. 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. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24455788
U.S. National Cancer Institute. (2017). *A Socioecological Approach to Addressing Tobacco Related Health Disparities*. *National Cancer Institute Tobacco Control Monograph 22. NIH Publication No. 17-CA-8035A.* Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute.
US Government Printing Office. Public Health Cigarette Smoking Act of 1969, HR 6543. (1970).
US Government Printing Office. Family Smoking Prevention and Tobacco Control Act, HR 1256 (2009).
Valente, Thomas W. (2012). Network interventions. *Science (New York, N.Y.)*, *337*(6090), 49–53. https://doi.org/10.1126/science.1217330
van Hoof, Joris J., Bekkers, Jeroen, & van Vuuren, Mark. (2014). Son, you're smoking on Facebook! College students' disclosures on social networking sites as indicators of real-life risk behaviors. *Computers in Human Behavior*, *34*, 249–257. https://doi.org/10.1016/J.CHB.2014.02.008
Villanti, A. C., Rath, J. M., & Vallone, D. M. (2012). Quit Behaviors in Young Adults: Comparing "smokers" and "social smokers". Paper presented at the 2012 SRNT 18th Annual Meeting, Houston, TX.
Villanti, Andrea C., Johnson, Amanda L., Ilakkuvan, Vinu, Jacobs, Megan A., Graham, Amanda L., & Rath, Jessica M. (2017). Social Media Use and Access to Digital Technology in US

Young Adults in 2016. *Journal of Medical Internet Research*, *19*(6), e196. https://doi.org/10.2196/jmir.7303

Villanti, Andrea C., Johnson, Amanda L., Rath, Jessica M., Williams, Valerie, Vallone, Donna M., Abrams, David B., … Mermelstein, Robin J. (2017). Identifying "social smoking" U.S. young adults using an empirically-driven approach. *Addictive Behaviors*, *70*, 83–89. https://doi.org/10.1016/J.ADDBEH.2017.02.004

Walker, M. B., & Andrade, M. G. (1996). Conformity in the Asch task as a function of age. *The Journal of Social Psychology*, *136*(3), 367–372. https://doi.org/10.1080/00224545.1996.9714014

Warner, Kenneth E. (1985). Cigarette Advertising and Media Coverage of Smoking and Health. *New England Journal of Medicine*, *312*(6), 384–388. https://doi.org/10.1056/NEJM198502073120627

Waters, Kimberly, Harris, Kari, Hall, Sandra, Nazir, Niaman, & Waigandt, Alex. (2006). Characteristics of social smoking among college students. *Journal of American College Health*, *55*(3), 133–139. https://doi.org/10.3200/JACH.55.3.133-139

Weinstein, Neil D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology*, *39*(5), 806–820. https://doi.org/10.1037//0022-3514.39.5.806

Williams, Valerie F., Smith, Alexandria A., Villanti, Andrea C., Rath, Jessica M., Hair, Elizabeth C., Cantrell, Jennifer, … Vallone, Donna M. (2017). Validity of a Subjective Financial Situation Measure to Assess Socioeconomic Status in Us Young Adults. *Journal of Public Health Management and Practice*, *23*(5), 487–495. https://doi.org/10.1097/phh.0000000000000468

Yonker, Lael M., Zan, Shiyi, Scirica, Christina V, Jethwani, Kamal, & Kinane, T.Bernard. (2015). "Friending" Teens: Systematic Review of Social Media in Adolescent and Young Adult Health Care. *Journal of Medical Internet Research*, *17*(1), e4. https://doi.org/10.2196/jmir.3692

Yoo, Woohyun, Yang, JungHwan, & Cho, Eunji. (2016). How social media influence college students' smoking attitudes and intentions. *Computers in Human Behavior*, *64*, 173–182. https://doi.org/10.1016/j.chb.2016.06.061

Young, Sean D., & Jordan, Alexander H. (2013). The influence of social networking photos on social norms and sexual health behaviors. *Cyberpsychology, Behavior and Social Networking*, *16*(4), 243–247. https://doi.org/10.1089/cyber.2012.0080

Zaki, Jamil, Schirmer, Jessica, & Mitchell, Jason P. (2011). Social influence modulates the neural computation of value. *Psychological Science*, *22*(7), 894–900. https://doi.org/10.1177/0956797611411057

Appendix A: Measures – Chapter 2 (Study 1/Aim 1)

Measure	Response Options	Variable Type in Analyses
SOCIAL MEDIA USE **How often do you use the following social media services? (asked for Twitter, Facebook, Instagram, Snapchat, Vine, Pinterest, Tumblr, Google+, LinkedIn, and YouTube)**	• Multiple times per day • Daily • Weekly • Monthly • Less than one time per month • Never	Continuous
GENDER	• Male • Female	Dichotomous (male or female)
AGE		Dichotomous (18-20 or 21-24)
EDUCATION **What is the highest level of school you have completed?**	• No formal education • 1st, 2nd, 3rd, or 4th grade • 5th or 6th grade • 7th or 8th grade • 9th grade • 10th grade • 11th grade • 12th grade, no diploma • High school graduate, high school diploma or the equivalent (GED) • Some college, no degree • Associate degree • Bachelor's degree • Master's degree • Professional or Doctorate degree	Categorical (less than high school, high school, some college/associate's degree, bachelor's degree or higher)

RACE/ETHNICITY		Categorical (Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Other, Hispanic)
FINANCIAL SITUATION **Consider your own income and the income from any other people who help you, how would you describe your overall personal financial situation? Would you say you:**	• Live comfortably • Meet needs with a little left • Just meet basic expenses • Don't meet basic expenses	Categorical (according to response options)
PAST 30 DAY MARIJUIANA USE AND PAST 30 DAY OTHER DRUG USE **How often, if ever, do you currently use the following products?** • **Marijuana** • **Other drugs (cocaine, heroin, ecstasy, meth, etc.)** **During the last 30 days, on how many days did you use the following products?** • **Marijuana** • **Other drugs (cocaine, heroin, ecstasy, meth, etc.)**	• Every day • Some days • Not at all [enter 0-30 days]	Dichotomous - Respondents were coded as having used marijuana or other drugs in the past 30 days if they responded every day or some days to the first item and ≥1 for the second item.
PAST 30 DAY ALCOHOL USE **How often did you have a drink containing alcohol in the past year?** **During the last 30 days, on how many days did you use the following products?** • **Alcohol**	• Never • Monthly or less • 2-4 times a month • 2-3 times a week • 4 or more times a week [enter 0-30 days]	Dichotomous - Respondents were coded as having used alcohol in the past 30 days if they selected any of the responses except "never" for the first item and responded ≥1 for the second item.

EVER USE OF COMBUSTIBLE TOBACCO PRODUCTS **Which, if any of the following tobacco or nicotine products have you ever used or tried?** • **Cigarettes, even one puff** • **Cigars (like Cohiba or Romeo y Julieta), even one puff** • **Little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters), even one puff** • **Hookah/shisha/waterpipe (hookah tobacco)** • **[item includes other non-combustible products]** **Have you ever tried [each item below presented along with an image of the item]** • **A cigarette, even one puff** • **A cigar (like Cohiba or Romeo y Julieta), even one puff** • **Little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters), even one puff** • **Hookah/shisha/waterpipe (hookah tobacco)** • **[item includes other non-combustible products]**	[Select all that apply] • Yes • No	Dichotomous variables indicating self-reported ever use of: • any combustible tobacco product (cigarettes, cigars or little cigars/cigarillos, OR hookah) • cigarettes • cigars or little cigars/cigarillos • hookah Respondents received one or the other or both of these ever use questions, so this dichotomous variable is coded as a "yes" response to EITHER of these questions.

PAST 30 DAY USE OF COMBUSTIBLE TOBACCO PRODUCTS **Which of the following products have you used in the past 30 days?** • **cigarettes?** • **cigars (like Cohiba or Romeo y Julieta)?** • **little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters)?** • **hookah/shisha/waterpipe?** • **[item includes other non-combustible products]** **During the past 30 days, on how many days did you smoke:** • **cigarettes?** • **cigars (like Cohiba or Romeo y Julieta)?** • **little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters)?** • **hookah/shisha/waterpipe?** • **[item includes other non-combustible products]**	[Select all that apply] • 0 days • 1 or 2 days • 3 to 5 days • 6 to 9 days • 10 to 19 days • 20 to 24 days • 25 to 30 days	Dichotomous variables indicating self-reported past 30 day use of: • any combustible tobacco product • cigarettes • cigars or little cigars/cigarillos • hookah Respondents received one or the other or both of these past 30 day use questions, so this dichotomous variable is coded as a "yes" response to EITHER of these questions (with "yes" to the second question consisting of any response options besides "0 days")
DEPRESSION AND ANXIETY **Over the last 2 weeks, how often have you been bother by any of the following problems?** • **Little interest or pleasure in doing things**	1. Not at all 2. Several days 3. More than half the days 4. Nearly every day	Per the scoring rubric for the PHQ (items about frequency of depressed mood and loss of interest in activities) and the

• **Feeling down, depressed, or hopeless** • **Feeling nervous, anxious or on edge** • **Not being able to stop or control worrying**		GAD (items about frequency of uncontrollable worry and feelings of anxiety), individuals who received a score at or about the cut off (>3) were coded as having symptoms of depression or anxiety, respectively.
ACCESS TO DIGITAL DEVICES WITH INTERNET ACCESS [used only in sensitivity analysis] Which of the following types of digital devices do you have access to or use? • **A smartphone with internet access (for example, iPhone, Android, Blackberry etc.)** • **A tablet with internet access (for example iPad, Samsung Galaxy Tab etc.)** • **A desktop or laptop computer with internet access** • **A Smart TV or video game console that has internet access** • **A cell phone without internet access (to talk and text)** • **None of these**	• Yes • No	Dichotomous variables will be used in the latent class analysis, with variables indicating access to each type of device with internet access, and with having a cell phone without internet access and having none of the mentioned devices reverse coded (since these correspond to limited access to digital devices with internet access)

Appendix B: Measures – Chapter 3 (Study 2/Aim 2)

Measure	Response Options	Variable Type in Analyses
Dependent Variables		
OPENNESS TO SMOKING (among nonsmokers) • **Will you smoke a cigarette soon?** • **Will you smoke a cigarette any time in the next year?** • **If one of your friends or somebody close to you offered you a cigarette, would you smoke/use it?**	• Definitely yes • Probably yes • Probably no • Definitely no	Index averaging responses across three items (definitely no=1, probably no=2, probably yes=3, definitely yes=4)
SOCIAL SMOKING (among smokers) • **Which of the following best describes how you think of yourself?**	• Smoker • Social smoker • Occasional smoker • Ex-smoker • Someone who tried smoking • Non-smoker	Dichotomous: 1 if responded social smoker or occasional smoker 0 if any other response
EVER COMBUSTIBLE TOBACCO USE (among all respondents) **Which, if any of the following tobacco or nicotine products have you ever used or tried?** • **Cigarettes, even one puff** • **Cigars (like Cohiba or Romeo y Julieta), even one puff** • **Little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters), even one puff** • **Hookah/shisha/waterpipe (hookah tobacco)** • **[item includes other non-combustible products]**	[Select all that apply]	Dichotomous variables indicating self-reported ever use of (response "yes"): • any combustible tobacco product (cigarettes, cigars or little cigars/cigarillos, OR hookah) • cigarettes • cigars or little cigars/cigarillos • hookah

Have you ever tried [each item below presented along with an image of the item] • **A cigarette, even one puff** • **A cigar (like Cohiba or Romeo y Julieta), even one puff** • **Little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters), even one puff** • **Hookah/shisha/waterpipe (hookah tobacco)** **[item includes other non-combustible products]**	• **Yes** • **No**	**Respondents received one or the other or both of these ever use questions, so this dichotomous variable is coded as a "yes" response to EITHER of these questions.**
PAST 30 DAY COMBUSTIBLE TOBACCO USE (among all respondents) **Which of the following products have you used in the past 30 days?** • **cigarettes?** • **cigars (like Cohiba or Romeo y Julieta)?** • **little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters)?** • **hookah/shisha/waterpipe?** **During the past 30 days, on how many days did you smoke:** • **cigarettes?** • **cigars (like Cohiba or Romeo y Julieta)?** • **little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters)?** • **hookah/shisha/waterpipe?**	[Select all that apply] • 0 days • 1 or 2 days • 3 to 5 days • 6 to 9 days • 10 to 19 days • 20 to 24 days • 25 to 30 days	Dichotomous variables indicating self-reported past 30 day use of: • any combustible tobacco product • cigarettes • cigars or little cigars/cigarillos • hookah Respondents received one or the other or both of these past 30 day use questions, so this dichotomous variable is coded as a "yes" response to EITHER of these questions (with "yes" to the second question consisting of any response options besides "0 days")

Moderating Variables		
NUMBER OF FRIENDS WHO SMOKE CIGARETTES **How many of your 4 closest friends smoke cigarettes?**	Respondents asked to enter a number 0-4	Dichotomous (0 or 1-4)
NUMBER OF FRIENDS WHO SMOKE HOOKAH* **How many of your 4 closest friends smoke hookah?** ***Assessed as potential moderator in only one set of analyses – association between exposure to tobacco content on social media and ever/past 30 day hookah use**	Respondents asked to enter a number 0-4	Dichotomous (0 or 1-4)
Covariates		
GENDER	• Male • Female	Dichotomous (male or female)
AGE		Dichotomous (18-20 or 21-24)
EDUCATION **What is the highest level of school you have completed?**	• No formal education • 1st, 2nd, 3rd, or 4th grade • 5th or 6th grade • 7th or 8th grade • 9th grade • 10th grade • 11th grade • 12th grade, no diploma • High school graduate, high school diploma or the equivalent (GED) • Some college, no degree • Associate degree • Bachelor's degree • Master's degree • Professional or Doctorate degree	Categorical (less than high school, high school, some college/associate's degree, bachelor's degree or higher)

FINANCIAL SITUATION **Consider your own income and the income from any other people who help you, how would you describe your overall personal financial situation? Would you say you:**	• Live comfortably • Meet needs with a little left • Just meet basic expenses • Don't meet basic expenses	Categorical (according to response options)
REGULAR USE OF SOCIAL MEDIA **How often do you do the following?** - **Use social media sites (Facebook, Twitter, Instagram, etc.)** - **[other types of media use not included in this analysis]**	• Multiple times per day • Daily • Weekly • Monthly • Less than 1 time per month • Never	Dichotomous: 0 if monthly, less than 1 time per month or never 1 if weekly, daily, or multiple times per day
Independent Variable		
EXPOSURE TO TOBACCO CONTENT IN SOCIAL MEDIA **When you are using social media, how often do you see posts, images, or videos against using cigarettes, cigars, little cigars/cigarillos, or hookah? (This might include posts from friends/groups or advertisements that explain the harms of using these products, discourage using these products, or encourage quitting of these products).** ***NOT INCLUDING* such anti-tobacco posts, when you are using social media, how often do you see…** ○ **Text posts about people smoking or using cigarettes, cigars, little cigars, or hookah? (This might include someone saying they are smoking or going to buy one of these products)**	• Multiple times per day • Daily • Weekly • Monthly • Less than one time per month • Never • Multiple times per day • Daily • Weekly • Monthly • Less than one time per month • Never	Categorical Overall Exposure Variable - Neither pro nor anti exposure - Anti exposure only [coded as any exposure to anti-tobacco content and no exposure to pro-tobacco content] - Pro exposure only [coded as any exposure to any of the types of pro-tobacco content and no exposure to anti-

○ **Images or videos of people with cigarettes, cigars, little cigars, or hookah or smoking/using cigarettes, cigars, little cigars, or hookah? (This might include smoking selfies or someone holding a pack of cigarettes)** ○ **Advertisements for cigarettes, cigars, little cigars, or hookah** ○ **Reviews of cigarettes, cigars, little cigars, or hookah** ○ **Other posts, images or videos that feature a particular brand of cigarettes, cigars, little cigars, or hookah** ○ **Other posts, images, or videos that are pro smoking cigarettes, cigars, little cigars, or hookah**		tobacco content] - Both pro and anti exposure *Looking at any level of pro or anti exposure because 70-90% of respondents fall into last two categories (less than one time per month or never)

Appendix C: Demographic and Social Media Use Questionnaire

1. How did you hear about this study?
    - An email from a faculty or staff member at the college/university I attend
    - A flier – please specify where it was posted _____
    - A handout – please specify where you received it _____
    - A friend who participated in this study referred me
    - Craigslist
    - Social media site – please specify which organization's/individual's page/post _____
    - Other – please specify _____

2. How old are you? _____ years old

3. Are you…
    - Female
    - Male
    - Other: _____

4. Are you of Hispanic or Latino origin, such as Latin American, Mexican, Puerto Rican, or Cuban?
    - Yes, of Hispanic or Latino origin
    - No, not of Hispanic or Latino origin

5. If no to the above question, which of the following categories describe your race or races? If yes to the above question, in addition to being Hispanic or Latino, which of the following categories describe your race or races?

   Do you consider yourself…?
    - White/European American
    - Black/African American
    - American Indian/Alaskan Native/Native American
    - Asian/Asian American
    - Pacific Islander/Native Hawaiian
    - Other race (Please specify: _____)

6. Considering your own income and the income from any other people who help you, how would you describe your overall personal financial situation? Would you say you:
    - Live comfortably
    - Meet needs with a little left
    - Just meet basic expenses
    - Don't meet basic expenses

7. Are you currently…
    - In high school
    - At a community college – please specify:
        which college: _____ and your field of study _____
    - At a college/university pursuing a bachelor's degree – please specify:
        which college: _____ and your field of study _____
    - At a college/university pursuing a graduate degree – please specify:
        which college: _____ and your field of study _____
    - Working part-time – please specify your profession: _____
    - Working full-time – please specify your profession: _____
    - Other – please specify: _____

8. What is the highest level of school you have completed?
    - Less than high school/GED
    - Completed GED
    - Completed high school
    - Completed associate's degree
    - Completed bachelor's degree
    - Completed graduate degree

9. Have you ever tried any of the following tobacco products, even one puff? If yes, during the last 30 days, on how many days have you used any of the following tobacco products? Please complete the table below with your responses.

	Have you ever tried this tobacco product, even one puff? **Please enter Y for "yes" and N for "no"**	If yes, during the last 30 days, on how many days have you used this product, even one puff? **Please enter a number from 1 – 30.**
Cigarettes		
Cigars (like Cohiba or Romeo y Julieta)		
Little cigars/cigarillos/bidis (like Black&Milds, Swisher Sweets, or Dutch Masters)		
Hookah/shisha/waterpipe (hookah tobacco)		

10. How often do you use social media sites (e.g., Facebook, Twitter, Instagram, etc.)?
    - Multiple times per day
    - Daily
    - Weekly
    - Monthly
    - Less than 1 time per month
    - Never

11. How often do you use the following social media services? Please mark your selection (with an "X") for each social media site in the grid below.

	Multiple times per day	Daily	Weekly	Monthly	Less than 1 time per month	Never
Twitter						
Facebook						
Instagram						
Snapchat						
Vine*						
Pinterest						
Tumblr						
Google+						
LinkedIn						
YouTube						
Other, including blogs, four-square (please specify below)						

If you selected other, please specify here:

*Vine was shut down at the end of 2016, so please indicate how often you used it prior to it being shut down.

12. Which of the following types of digital devices do you have access to or use? Please select all that apply (place a checkmark or color in the oval(s)).

- ○ A smartphone with internet access (for example, iPhone, Android, Blackberry etc.)
- ○ A tablet with internet access (for example iPad, Samsung Galaxy Tab etc.)
- ○ A desktop or laptop computer with internet access
- ○ A Smart TV or video game console that has internet access
- ○ A cell phone without internet access (to talk and text)
- ○ None of these

Appendix D: Semi-Structured Interview Guide

Before Beginning the Interview:

- Provide Questionnaire to Complete
- Provide Informed Consent Form to Sign

- Summarize the project.

Hello, my name is Vinu Ilakkuvan. I am a doctoral student at GW, and I wanted to start off by saying thank you so much for agreeing to participate today! The goal of this study is to understand your experience perceiving messages on social media. We are interested in how various aspects of social media – for example, who shared a post, how many likes or what kinds of comments a post has, and so on – might influence your experiencing of interpreting social media messages, especially messages related to tobacco use.

- Review ground rules and confidentiality policy:

    1. The discussion in this interview is completely confidential
    2. Written and oral reports and other written material coming out of this project will present only aggregate data and information. Your responses will be kept confidential and your name will not be cited.
    3. There are no right or wrong answers
    4. In some cases, the appropriate response may reflect the participant's opinion or impression.
    5. The interview is being tape recorded to ensure accuracy of your responses.
    6. We expect this discussion to last approximately one hour.
    7. You are free to stop the interview at any time or decline to answer questions that make you feel uncomfortable.

- Ask if the interviewee has any questions.

- Confirm they are ok with audio recording, and begin recording – clearly state participant ID #, date/time/location of interview

INTERVIEW QUESTIONS

Introductory Questions

- What do you most like about social media? What do you most dislike about social media?
    - Ask about their social media network's tobacco use – About how many or what percentage of your friends on social media do you think smoke cigarettes or other tobacco products? Do they post about smoking or pictures of them or their friends smoking? About how many or what

percentage of your friends on social media do you think are against smoking tobacco? Do they post or share anti-smoking messages?

Exposure to and Processing of Pro-Tobacco Content in Social Media

- Can you describe any pro-tobacco content you have seen in social media (Facebook, Twitter, YouTube, etc.)?
    - Probe: This might be a picture of a friend smoking at a party, a smoking selfie, a picture of a tobacco product, a friend's status saying they're about to go smoke, a tobacco advertisement, a review of a tobacco product, or anything alone those lines.
    - How often would you say you see this kind of content? Are there certain kinds of pro-tobacco content you see more often than others?
- What did you think of this content?
    - Probe: Did you trust this content? Dismiss it? Were you intrigued by it? Why or why not?
- What makes you more/less likely to notice these messages? To trust them? To like/comment/share them?
    - Probe: Who posted or shared it (friend, brand/company, celebrity) play a role? How about what the message says (content of the messages)? How the message looks (aesthetics)? The focus of the message (e.g., picture of a cigarette vs. picture of a group at a party in which one person is smoking)? How many likes or comments it has? What the comments say? Hashtags used? What social media site you see it on? Your context when you see the message (time of day/how busy or tired you are/where you are/etc)?
    - Probe: What is the source of messages you see – posts from friends, industry advertisements, etc. Does source of message matter to you? Do you interpret messages from different people – a close friend, an acquaintance, a celebrity, a company you follow – differently, and if so, how?
        - Probe: Does your perception of a message differ based on who the person is smoking – if it's a close friend you know is a smoker? A close friend you didn't know smoked? A celebrity you admire? An acquaintance? A stranger?
    - Probe: Does response to the message differ based on tobacco product – if it's a friend smoking a cigarette vs. cigar vs. hookah – do you react the same or differently? And what about the context of the picture – if it's a friend smoking a cigar at a frat party vs. alone in his/her backyard, does that make a difference in how you perceive the message?
- How is the experience of seeing a friend smoking in a picture on social media different from seeing that friend smoking in real life?
- Have you posted pictures or videos of tobacco products or of yourself or anyone else using tobacco? Have you posted a status update or other text to social media about using tobacco? What about any other pro-tobacco content? Can you imagine a situation in which you might? Would you post a picture of your friends at a party if someone was smoking in the background?

    - Probe: How did posting about your tobacco use make you feel? Did it make you feel more positively or negatively about it? Did it make you feel more like it's a part of your identify?
    - Probe: How did others' responses to that posted content impact your behavior – your behavior line? Your behavior offline?
- When it comes to you posting or reacting to other posts featuring tobacco use, is your behavior on social media different based on how anonymous/not you are on a particular social media site? How much of your social network on a site is composed of smokers? What other factors matter?

Influence of Pro-Tobacco Content in Social Media

- Did this pro-tobacco content influence you in any way? Did you think or act differently because of this content?
    - Probe: Did these messages influence… (and if yes, how? If no, why not?)
        - Your beliefs or feelings about tobacco use?
        - Your attitudes about tobacco use?
        - Your thoughts on how many of your friends smoke? On how many people your age smoke?
        - Your thoughts on whether your friends approve of smoking?
        - Your beliefs about whether you could avoid smoking tobacco if you wanted to?
    - Probe: Did these messages influence… (and if yes, how? If no, why not?)
        - Your intention to use tobacco? If yes, how, and what exactly about the message and its influence on the things we just talked about impacted your intention to smoke or not smoke?
        - Your actual tobacco use behavior?
- What kinds of pro-tobacco content is more/less impactful in influencing how you feel? How you think? Your tobacco use behaviors?
- What about pro-tobacco content in social media matters most in terms of how you feel/think/act – source, content, likes, comments, your context when viewing the message, etc.
    - Probe: If you see a friend engaging in a certain behavior on social media, are you more likely to try it? If friends post pictures of them engaging in a risky behavior, what does that make you think about whether that behavior is approved or disapproved?
- Is there a difference between how seeing a friend smoking in a picture on social media would influence you vs. seeing that friend smoking in real life? Why or why not?

Exposure to and Processing of Anti-Tobacco Content in Social Media

- Can you describe any anti-tobacco messages you have seen in social media?
    - Probe: This might be an anti-tobacco advertisement, a friend posting about how smoking is bad for you, an article encouraging a local university to go smoke-free, or anything along those lines.
    - How often would you say you see this kind of content? Are there certain kinds of anti-tobacco content you see more often than others?

- What did you think of this content?
    - Probe: Did you trust this content? Dismiss it? Were you intrigued by it? Why or why not?
- What makes you more/less likely to notice these messages? To trust them? To like/comment/share them?
    - Probe: Does who posted or shared it (friend, brand/company, celebrity) play a role? How about what the message says (content of the messages)? How the message looks (aesthetics)? How many likes or comments it has? What the comments say? Hashtags used? What social media site you see it on? Your context when you see the message (time of day/how busy or tired you are/where you are/etc)?
    - Probe: What is the source of messages you see – posts from friends, industry advertisements, etc. Does source of message matter to you? Do you interpret messages from different people – a close friend, an acquaintance, a celebrity, a company you follow – differently, and if so, how?
        - Probe: Does your perception of a message differ based on who is posting – if it's a close friend you know is an anti-smoking advocate? A close friend you didn't know cared about smoking? A celebrity you admire? An acquaintance? A stranger?
- How is the experience of getting anti-tobacco messages via social media different from getting them in person (e.g., a friend telling you how harmful smoking is)?
- Have you posted any anti-tobacco content to social media? Can you imagine a situation in which you might?
    - Probe: How did posting an anti-tobacco message make you feel? Did it make you feel more positively or negatively about being anti-tobacco? Did it make you feel more like it's a part of your identify?
    - Probe: How did others' responses to that posted content impact your behavior – your behavior line? Your behavior offline?
- When it comes to you posting or reacting to other posts featuring anti-tobacco content, is your behavior on social media different based on how anonymous/not you are on a particular social media site? How much of your social network on a site is composed of smokers or anti-smoking advocates? What other factors matter?

Influence of Anti-Tobacco Content in Social Media

- Did this anti-tobacco content influence you in any way? Did you think or act differently because of this content?
    - Probe: Did these messages influence… (and if yes, how? If no, why not?)
        - Your beliefs or feelings about tobacco use?
        - Your attitudes about tobacco use?
        - Your thoughts on how many of your friends smoke? On how many people your age smoke?
        - Your thoughts on whether your friends approve or disapprove of smoking?

        - Your beliefs about whether you could avoid smoking tobacco if you wanted to? About whether you could influence your friends who smoke if you wanted to?
    - Probe: Did these messages influence… (and if yes, how? If no, why not?)
        - Your intention to use tobacco? If yes, how, and what exactly about the message and its influence on the things we just talked about impacted your intention to smoke or not smoke?
        - Your actual tobacco use behavior?
- What kinds of anti-tobacco content is more/less impactful in influencing how you feel? How you think? Your tobacco use behaviors?
- What about anti-tobacco content in social media matters most in terms of how you feel/think/act – source, content, likes, comments, your context when viewing the message, etc.
- Is there a difference between how a friend posting an anti-smoking message in social media would influence you vs. having that friend make the same statement to you in person? Why or why not?

Response to Specific Examples

- Now, we will look at some specific examples* [show printed sheets with examples; each example printed on an 8.5x11 piece of paper] of tobacco-related messages on social media and discuss your thoughts.
    - What would you think if you saw this message in your newsfeed? Would you notice it? Does it catch your attention? Why or why not?
        - If they say no, probe further – what might make them notice a similar message?
        - For pictures of groups in which one person is smoking, etc., probe to find out what about what the message of the image is to them – is it about having a good time, or being with friends, or having a social life, or smoking – and what about the message they are reacting to.
    - Do you trust the message?
    - Do you agree with it or disagree with it?
    - Do you like it? Why or why not?
    - Now imagine….go through each scenario below and whether that changes how they feel about the message.
        - your friend shared the message. A celebrity shared the message. The message has thousands of likes. The message has hundreds of negative comments.

*see next page for examples

beantown_spliffy
beantown_spliffy SPLIFFY 35mm
#modernsmoker #35mm
#newsmokeraesthetic #cigagram
#cigcommunity
#smokeemifyougotem #smokecloud
#girlswhosmokecigs #420 girls #tbt
ozguraydogdu wow!
fizzinmymouth 35mm super cool
51 likes
4 DAYS AGO
Log in to like or comment.

PIRATES
_c1c4l0n3_
Rome, Italy
_c1c4l0n3_ Abbelli! 😎|| #party #fun #partying
#partybus #friends #love #girls #instagood
#smile #happy #music #instaparty #friend
#night #goodtimes #memories #instafun
#goodtime #crazy #bestoftheday #outfit
#funtimes #cool #chilling #chill #besties
#tagsforlikes #kickit #kickinit #guys
funny_picgifvid Великолепно!
angel_flowers38 Хороший снимок
smichael.84 Fantasticiiiii 😍😍
204 likes
1 DAY AGO
Log in to like or comment.

swishersweets
swishersweets Swisher so Sweet
#LemonIce
centralgirlmonce sweeeeettttt @king.rosaa
abdulgreen12 I wanna try it so bad
king.rosaa Stop it @centralgirlmonce
cade_pothen @John_costell0 @jake_boll
s.f.e.jayyyy Just tried sum last night
brandonlorek @h_sweeterman
@kennyakillin
liampatel21 @nicolaskozachuk
supreme.6x Y'all leaves are fake
og.hunter__ 😍😍
carlee.anna KEEP THE LEMON MANGO
ONES OUT. PLS AND THX
ford_boyy__zz_ Are these out
kowed2201_ @supreme.6x your supreme is
1,023 likes
JULY 14
Log in to like or comment.

Hipster Man @Im_hipster_man · 16 May 2016

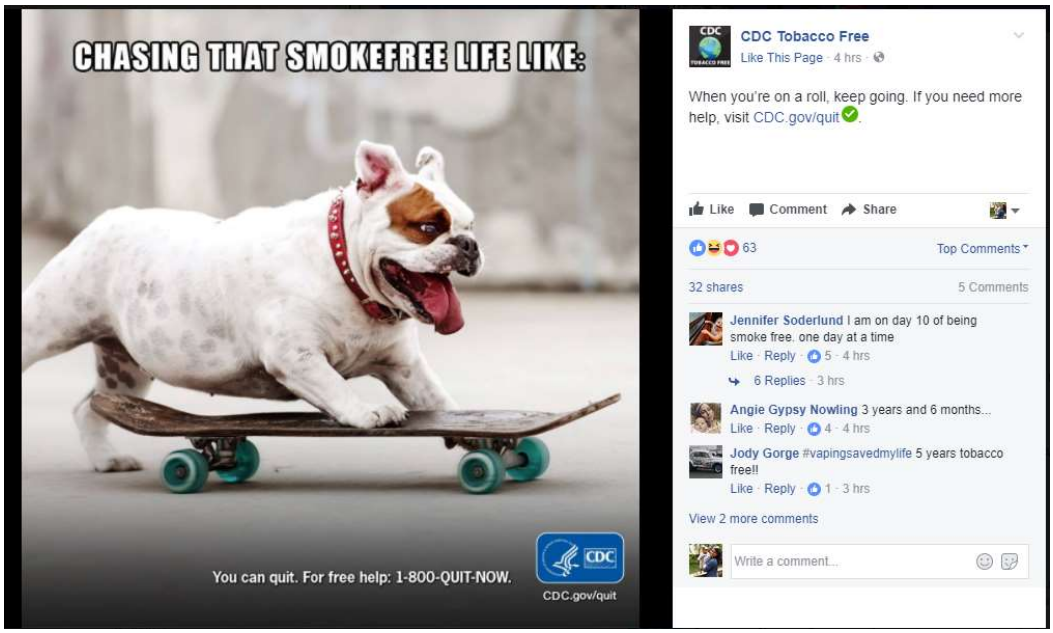
//I just sat in self-pity and cried in the car// (note didn't cry) (note maybe on tear) #smokingselfie #the1975 #ch...

1

WE ARE THE GENERATION
THAT WILL END SMOKING
truthorange
Follow
truthorange We're calling out Big Tobacco with art. Watch @ernestoyerena's process then download a copy of the poster w/ the link in our bio.
lucky_the_kid_ Tobacco companies sell tobacco to people who use tobacco. Riveting
johngatica No generation will end smoking ever
2p3nc3r_ @truthorange Sorry, but have your ever heard something called
2,231 views
MAY 22
Log in to like or comment.

Cigarettes
don't match
my accessories.
therealcost
Follow
therealcost Don't let smoking ruin your #OOTD.
#ReasonsNotToSmoke #Smoking #Cigarettes #Cigarette #Tobacco #Cigs #TheRealCost #fashion #instagirl #instafashion #accessories #bags #coffee #fw
load more comments
cebully I quit a few months ago. I feel great now! :) @therealcost
therealcost @cebully Congratulations on quitting!
_kisstina @therealcost im addicted to cigarettes and i want to quit but i dont know how?? Im only 16 and i smoke a pack a day and its ruining my life. Im having a hard time quitting
therealcost @_kissitina It's great that you
1,908 likes
JANUARY 8, 2016
Log in to like or comment.

CSPI and 4 others follow
Vital Strategies @VitalStrat · Jun 20
A #SmokeFree olympics would leave a positive legacy for #Tokyo2020 and be a turning point for Japan's tobacco policy
TOBACCO
A smoke-free Tokyo as an Olympic legacy | The Ja...
Tokyo Gov. Yuriko Koike has vowed to make the capital a smoke-free metropolis in time for hte 2020 Games if her party and its allies secure a majority in the July 2 electi...
japantimes.co.jp
2
2


CHASING THAT SMOKEFREE LIFE LIKE:
You can quit. For free help: 1-800-QUIT-NOW.
CDC
CDC.gov/quit
CDC Tobacco Free
Like This Page · 4 hrs ·
When you're on a roll, keep going. If you need more help, visit CDC.gov/quit.
Like
Comment
Share
63
Top Comments
32 shares
5 Comments
Jennifer Soderlund I am on day 10 of being smoke free. one day at a time
Like · Reply · 5 · 4 hrs
6 Replies · 3 hrs
Angie Gypsy Nowling 3 years and 6 months...
Like · Reply · 4 · 4 hrs
Jody Gorge #vapingsavedmylife 5 years tobacco free!!
Like · Reply · 1 · 3 hrs
View 2 more comments
Write a comment...

Lil Wayne
March 8, 2016 ·
Like Page
That's crazy. Good reason to quit.
WHAT HAPPENS WHEN A SMOKER QUITS
A 15 YEAR TIMELINE
20 MINUTES
after quitting
2 WEEKS
after quitting
1 YEAR
after quitting
10 YEARS
after quitting
What Happens 20 Minutes After You Quit Smoking Cigarettes: A Timeline of How Your Body Heals
If you've ever tried to quit smoking cigarettes, then you know that it can be quite a challenge. However, even just 20 minutes after saying goodbye to your smoke,...
SHIREDDIN.TV
6K Reactions 999 Comments 2.4K Shares
Like
Comment
Share
6K
Top Comments
2,424 shares
999 Comments

Appendix E: Pilot Study

This qualitative study's conceptual framework, research questions, methodology (including recruitment, sampling, and the semi-structured interview guide), and analysis plans were informed by an IRB-approved pilot study conducted in the Spring of 2016. In-depth individual interviews were conducted with five 18-24 year old social media users enrolled in an undergraduate degree program at George Washington University. Purposeful, criteria sampling based on smoking status was attempted, but only nonsmokers were successfully recruited for this pilot phase of the study. All interviews were audio recorded and transcribed. Transcriptions were coded thematically using NVivo and a comparative "cutting and sorting" process - in which participant statements were sorted into various codes – was used to identify themes.

Results suggested that the source of a message played a primary role in how study participants processed tobacco-related messages in social media. Additionally, aesthetics (whether an image was "pretty", "classy", or otherwise appealing) and the focal point of social media images (whether the presence of a tobacco product was the focus of an image or simply incidental) were critical to determining response, so much so that the presence of tobacco products in images was often seen as irrelevant to how one would react to the message. However, when it came to anti-tobacco messages, study participants valued substantive information and personal relevance. Some key findings and quotes pertaining to each of these themes are included in the table below.

The pilot study – the experience of recruiting for and conducting the study, as well as the key findings – informed the conceptualization and planned methodology and interview guide for this qualitative study. Based on the difficulty of recruiting smokers through broad recruitment methodologies such as email and flyers in the pilot study, recruitment strategies for this study were revised to include targeted approaches, such as recruiting via gatekeepers who can provide connections to smokers in the target age range. During the pilot study, interviews ran long and much of the information elicited through extensive questions about social media use broadly were not directly relevant to the research questions; thus, the interview guide for this study was narrowed to focus specifically on exposure to tobacco-related content in social media and the response to that content. A key piece of the interview guide – getting participants to respond to specific examples of tobacco-related content in social media – proved incredibly useful in eliciting information relevant to the research question during the pilot study. However, given the importance pilot study participants placed on aesthetics of the images, they found many of the sample images to be unsophisticated and much less aesthetically pleasing than they were used to seeing in social media. As a result, the sample content used in the interview guide for this study were revised to include more aesthetically pleasing content similar to what young people are likely to see in their social media feeds.

Pilot Study Themes, Key Findings, and Quotes

Theme	Key Findings and Quotes
Message source matters the most in how respondents perceive, trust,	All interviewees pointed to the source of a social media message as the most important factor in how they respond to a message. Their relationship with the person posting a message, and how close they are to that person, was key to whether they pay attention, trust, and react to

and react to a post.

the message. By far, the source with the greatest impact was a close friend. As one respondent said,

> "The main thing [determining how I respond to a post] is definitely who posts it, so if my friend is posting it, I will definitely click it. Even if I'm not interested in it or it has nothing to do with me, it's still a part of my friend's life, so I'll be interested in it."

This sentiment held true across different kinds of social media messages, including both anti-tobacco and pro-tobacco messages.

> "[I would not pay attention to an anti-tobacco post or how many likes, comments, and shares it had received], but if a friend were sharing it – that changes everything, I'd look at everything. I'd wonder, why are they posting this. It wouldn't change my response to the message, but I'd be curious".

> "So because I only see tobacco friendly stuff on a regular basis on Tumblr [which is a lot more anonymous], I don't react to it and not think anything of the person posting it, because there's not even the guarantee that the person who posted that picture is actually the person in the picture."

When it comes to people they know posting on social media, how interviewees perceived the message also depended on their prior knowledge of the person – for instance, their expertise ("If it's one of my best friends who's also a foodie, then of course I'll pay more attention to it, particularly if it's about food"), their views on different topics ("Some people, I wouldn't really trust in a way just because of their views…because you know them personally, you kind of know where's it's coming from"), how often they post on social media ("If it's somebody that posts all the time, then I'm probably just gonna scroll by it. But then if it's someone who rarely posts, then I'll definitely click on it, like oh, they found this *really* interesting"), and how the interviewee perceives the person ("[Whether I like a post] really depends on whether I like the person or not.")

Aesthetics of images on social media are critical to how one reacts to the message.

Interviewees placed a high level of importance on the degree to which images posted in social media are aesthetically pleasing. As one student put it:

> "Unless something is presented on social media in a classy manner, I'm automatically turned off. So for me, there's a huge difference between - I'll put in terms of two nightlife situations. So if you are out at a restaurant but sitting at the bar having a few drinks, these are drinks that are presented well, they look pretty, and you're probably looking nice. Cool if you post a picture toasting all your cocktails. But if you're in a club and you take a Snapchat of all the tiny plastic cups you have with some weird mixed drink, then you just look trashy…there's a different

> aesthetic and there's a different message that you're sending behind… what you're trying to present."

As with the source of the message, the importance of aesthetics held across different types of social media messages, including pro and anti-tobacco ones. In speaking about a specific anti-tobacco post, one respondent said she was more likely to feel positively about the post if it "appeal[ed] to my aesthetic taste" which involved a subtler color scheme than in the post at hand. When it comes to pro-smoking messages, one student pointed out that she more often saw the more "artistic pictures of blowing smoke" from e-cigarettes and marijuana on Facebook – compared to unartistic photographs – "Because I think there's some sort of idea that if it looks better, it's more acceptable for a platform like that where you probably have family, friends, old parents, colleagues."

Moreover, interviewees felt strongly about the role of aesthetics in their response to a picture of someone smoking on social media. When shown an example of a social media image featuring a hand holding a cigar, one respondent remarked, "It's a horrible picture, first of all. Like what is this? That doesn't even look like your hand, it looks like a massive blob of flesh". This respondent went on to say that she feels differently about this example compared to pictures her own friends post of themselves smoking because the fact that it is not artistic makes it seem more coercive, as if it is an active promotion of smoking.

> "What I've noticed with a lot of those pictures [my friends post] is people aren't trying to collude others into doing what they're doing. They're just posting it because it's pretty or cool because of the smoke, but they're not saying, come join me, you have to do this. Versus this [example of a social media image] is borderline an advertisement."

Another respondent also had a negative reaction to this example, calling the picture "stupid" and "irrelevant". But when asked what the response would be if this were a picture of the same cigar, but one that was artistic, the respondent said that would be completely different: "Then it's art, I'm ok with that. I'm admiring art."

Anti-tobacco messages were rarely seen and generally dismissed as not personally relevant.

Among this group of respondents, all of whom identified as nonsmokers, anti-tobacco messages were rarely seen on social media and when they were, they were dismissed as not personally relevant. While this was also a broader theme, with any content being less noticed if it did not "relate to me", it was particularly salient in the context of anti-tobacco messages. Interviewees mentioned scrolling past anti-tobacco posts without a second glance because "it didn't pertain to me" or because "I look at this and I'm like, well, that's not for me".

> "So this [anti-tobacco ad] I completely think is going to be targeted to people who are in high school, or late middle school I

guess. So, I look at this and I'm like, well, that's not for me. Been there, done that."

"So I might read be the generation that ends smoking. And then I'll be like ugh, this is all stuff I've read before, and then I'll scroll past it. I don't see what kind of, I can't imagine a situation that would actually make me stop and read it other than maybe to look at who posted it."

"I haven't given much thought to this topic [of taking a stand against tobacco]. I think it might just be a vice of mine to see this kind of thing and then scroll past it without giving it a second thought. Not because of the delivery but simply because of the message."

One common exception to anti-tobacco posts being rarely seen and generally dismissed was anti-tobacco posts that pertained specifically to George Washington University, because then the conversation became personally relevant. Namely, the university's recent smoke-free policies have spurred conversation on social media among students on both sides of the argument. One respondent said:

"I think the last time [I saw an anti-tobacco message on social media]…it involved the sign that said "GW's a smoke-free campus" and then there was a huge debate in the comments about leave them alone, it's their right to smoke. Versus their smoking is screwing the rest of us over because secondhand smoke. And beyond that, I think that post was last year. And I haven't seen any explicitly anti-tobacco…since."

Another respondent said the only time she saw an anti-tobacco message shared by a peer on social media was in response to an email from the university reminding students about the smoke-free policy, and that she believed this increased engagement was "absolutely" due to it being specific to their university.

"I mean it's something that was affecting their daily lives so why wouldn't they comment on it? Especially when the school puts out a statement about what you can and can't do, people are going to comment on it no matter what. No matter how they feel about it, just wanna say something."

The substance of a social media post matters, particularly for anti-tobacco messages.

In general and especially for anti-tobacco messages, interviewees highlighted the importance of a post having substance - some kind of factual or meaningful information. When shown an anti-tobacco message about ending youth smoking versus one in the form of a news article about how indoor smoking bans have saved lives, respondents generally found the former message to be "repetitive [with] no substance" and "idealistic", but were more receptive to the latter. One respondent said "I think this post [with the news article] feels like it has more substance.

Like it's not just do this. It's yes, this works, so do this." Another said they found the latter example "more interesting" and that he would probably click on the link to read the article and might "like" the post depending on the message in the article. This respondent also highlighted the fact that he responds more positively to advertisements about the health consequences of smoking.

> "Showing the health effects on people, it's important, people should care about their health. But the "you're 18, tell your friends to stop smoking" – no. It doesn't do a thing for me. I'm not going to my friend and be like – hey I saw an ad, now quit smoking. But I could say hey, if you keep smoking, you'll lose your voice."

The presence of a tobacco product in an image is usually seen as irrelevant to how one perceives and responds to a message.

In general, interviewees felt that their response to a social media image would not be swayed one way or the other based on the presence of a tobacco product, particularly if the tobacco product is not the core focal point of the photograph. As one respondent said:

> "My reaction to a picture with a cigarette in it is not any different than my reaction to a picture without a cigarette…The same stuff matters.... The cigarette in it isn't important. It doesn't change my reaction to the image at all. The cigarette is never the focus, so not important."

Another respondent echoed these sentiments:

> "I think that I would react to it in the same way if it was the same photo without the cigarette. So if I usually like their photos, I'll like it, if not, I probably won't unless it's like a really cool photo. So, I guess that the cigarette in the photo doesn't change my reaction to it."

Other respondents also highlighted the fact that their friends do not post photos in which tobacco products are the core focus. When asked to respond to an example social media post featuring a hand holding a cigar, one interviewee said she would scroll past it because she does not agree with the behavior, although she had said previously that she would "like" photographs of her friends smoking. When asked about the distinction between the example image and images from her friends, she said,

> "I think it's the focus of the picture, so this picture is clearly - this is what he wants us to see, whereas if it just happened that that were in my friend's hand, the bigger picture's not really related to that, I would probably like it."

In addition to whether or not the tobacco product is the focal point of the image, aesthetics also play a key role in how pro-tobacco social media images are perceived, as outlined previously.

One perspective at odds with the idea that the presence of a tobacco product is irrelevant to how respondents react to a social media post is that of actively avoiding reacting to posts featuring tobacco due to the impact it might have on how the respondent is perceived. One interviewee who espoused this viewpoint said,

> **“**I think while I might be inclined to drop a like or to like it or otherwise react to [a post] if it didn’t have a cigarette, I probably wouldn’t want it recorded anywhere [if it did have a cigarette]. I wouldn’t want my reaction to it to be recorded anywhere. So if it has a cigarette or something else, [I would] ignore it, keep scrolling I suppose.**”**

However, in general, liking a post featuring tobacco smoking was not seen as endorsement of the behavior. As one respondent put it:

> **“**I like all my friends photos, but I dunno, I guess to me liking it isn't really encouraging [smoking], it's just saying I like the photo…I honestly feel like not liking it is more of a statement than liking it, especially if it's a close friend, just to make not a big deal about it.**”**