Exposure to tobacco content in episodic programs and tobacco and E-cigarette initiation

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ABSTRACT

While prior research suggests a relationship between exposure to tobacco content in movies and smoking, less is known about the impact of exposure to tobacco through episodic programs. This study assessed the relationship between exposure to tobacco content in programs on Netflix and broadcast or cable TV and initiation of combustible tobacco or e-cigarette use among young people. A nationally representative, longitudinal sample (ages 15–21 at baseline) was surveyed about exposure to episodic programs previously analyzed for the presence of tobacco and subsequent use of combustible tobacco and e-cigarettes. Logistic regression models assessed associations between exposure to tobacco imagery and future initiation of combustible tobacco and e-cigarettes among those who were nicotine naïve (N = 4604). Data were collected in February–May 2018 and February–May 2019. All analyses were conducted in 2019. Results suggest a dose-response relationship between exposure to tobacco and vaping initiation, whereby the higher the exposure, the greater the odds of subsequent initiation (OR(low) = 2.19, 95%CI = 1.38–3.48; OR(medium) = 2.20, 95%CI = 1.34–3.64; OR(high) = 3.17, 95%CI = 1.71–5.88). There was no significant association between exposure to tobacco imagery and smoking initiation. Tobacco imagery is common in episodic programming popular among young people. Results suggest exposure to tobacco in episodic programs may impact future e-cigarette use. Ongoing monitoring of the impact of tobacco content in episodic programs is needed as the number of available programs continues to increase. Findings highlight the need for policy and advocacy efforts to reduce young people's exposure to tobacco content across all media platforms.

1. Introduction

Numerous studies provide evidence for a dose-response relationship between exposure to tobacco content in movies and smoking among young people (Sargent et al., 2005; Sargent et al., 2007; Dalton et al., 2003; Distefan et al., 1999; Tickle et al., 2001; Wills et al., 2008; Tickle et al., 2006; Song et al., 2007; Shmueli et al., 2010). These conclusive findings were cited by the U.S National Cancer Institute and U.S. Surgeon General, explicating a causal relationship between exposure to tobacco in movies and cigarette smoking initiation (National Cancer Institute, 2008; U.S. Department of Health Human Services, n.d.). Researchers have posited that this relationship is the result of the role one's social environment plays in smoking initiation (Sargent et al., 2005; Graham et al., 1991). The social cognitive theory highlights the

importance of the social context as an influencer of behavior. It is through the social context that norms and expectations are established and reinforced, and behavioral modeling and observational learning can occur. Images and portrayals through media are part of this social context and can be particularly influential for young people (Bandura, 2009). An abundance of research supports the significant influence of social factors in tobacco use (U.S. Department of Health Human Services, n.d.). For example, researchers found that young people's exposure to tobacco content in movies causes smoking behavior through increases in normative beliefs and more positive outcome expectancies related to their own tobacco use (Tickle et al., 2006; Song et al., 2007).

While the influence of tobacco imagery in movies on smoking behavior has been extensively studied, less is known about the impact of

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exposure to tobacco images aired across other communication platforms. Although product placements for cigarettes were prohibited by the 1998 Master Settlement Agreement, tobacco imagery continues to be depicted on TV. A content analysis of eight 2007 broadcast TV programs popular among youth found six of the eight programs and 40% of the episodes sampled included tobacco use (Cullen et al., 2011). More recently, Rath et al. (2019) performed a content analysis of tobacco imagery in top episodic programs (i.e., programs aired as a series of installments, or episodes) on the online streaming platform, Netflix, and broadcast or cable TV and found that 86% of programs included tobacco imagery, and the number of tobacco incidents in Netflix programs significantly increased over time (Rath et al., 2019). Other recent studies found similar patterns in programs that are popular in the U.K. (Lyons et al., 2014; Barker et al., 2018a; Barker et al., 2018b) Meanwhile, the prevalence of tobacco imagery in youth-rated movies has declined (Polansky et al., 2019).

Changes to the media landscape have resulted in shifts in how young people consume entertainment media. Movie theater admissions have declined, while subscriptions to paid online streaming services have increased (Motion Picture Association of America, 2016; Nielsen, 2019). The increasing availability of streaming services has also led to declines in traditional live TV viewership among young people (Nielsen, 2019). An estimated 87% of young adults report accessing TV content through the internet (PQ Media, 2018). Additionally, 61% of young adults report online streaming services as the primary mechanism for viewing episodic programming (Rainie, 2017).

There are several factors that highlight the need to assess the impact of exposure to tobacco imagery through episodic programming across media platforms on smoking behavior. For one, there have been dramatic changes in the tobacco product landscape and tobacco use trends in recent years, with a significant increase in e-cigarette use (i.e., vaping) among young people (Cullen et al., 2019), while cigarette use has continued to decline (Gentzke et al., 2019). Prior research assessing the impact of exposure to tobacco content in movies on youth smoking focused on cigarette use since that was the most commonly-used tobacco product at the time. Second, the evolving media landscape has led to greater accessibility of video content and changes in how young people consume entertainment media. Finally, the increasing prevalence of tobacco imagery in episodic programs, in contrast to declining tobacco prevalence in movies, raises concerns regarding the impact of this exposure on young people's tobacco use behavior. This study assessed the relationship between exposure to tobacco content in programs on the streaming platform, Netflix, and broadcast or cable TV and initiation of combustible tobacco or e-cigarette use among youth and young adults. This study assessed e-cigarette initiation, in addition to combustible tobacco initiation, due to the rapid increase in e-cigarette use prevalence among young people (Trump Administration, 2019), and the similarities in the behaviors of smoking and vaping (Soneji et al., 2017; Primack et al., 2015).

2. Methods

2.1. Study sample

The sample included participants of the Truth Longitudinal Cohort (TLC), a nationally representative longitudinal sample of U.S. youth and young adults (ages 15–21 years at baseline). Recruitment of participants occurred primarily through address-based sampling, with subsamples recruited via random digit dialing and from an existing nationally representative online panel (Ipsos' KnowledgePanel®). Data were collected online. Approximately 14,000 participants completed the baseline survey in April–August 2014, with follow-up assessments every six months to one year. Additional study details have been published elsewhere (Cantrell et al., 2017). The sample for the current study included those who participated in waves 7 and 8 (N = 9381), and had never used a combustible tobacco product or e-cigarette at any

data collection wave through wave 7 (n = 4604). Wave 7 data were collected February–May 2018 and wave 8 were collected February–May 2019. The retention rate from wave 7 to wave 8 was 91.6%. Small differences were observed between those retained across the two waves and those who were not (i.e., those lost to follow-up were slightly younger, more likely to be current smokers, and had higher sensation seeking). However, analytic weights adjusted for nonresponse. Advarra IRB approved the study (https://www.advarra.com/).

2.2. Measures

2.2.1. Exposure measure

A prior study identified the Netflix and broadcast or cable TV programs most popular among youth and young adults and included a content analysis of these programs to quantify tobacco imagery (Rath et al., 2019). Programs were restricted to those that were scripted (i.e., programs that are based on a script and are not live or reality programs) and were original to the platform on which they aired. As viewership data of online streaming programs are not publicly available, we surveyed a convenience sample of 15–24 year-olds to identify the most popular programs. The youth and young adult sample used to identify the most popular programs was recruited from a national online panel and data were weighted based on U.S. Census targets to be nationally representative. A list of 14 programs were identified as having viewership rates of at least 15% – a threshold established to ensure study feasibility – and were included in the content analysis. The content analysis involved quantifying all tobacco incidents in two seasons of each program. Two trained coders performed the content analysis for each program and reliability was assessed using intraclass correlation coefficients (ICC > 0.85 considered acceptable) (Rath et al., 2019). Additional details about the content analysis have been published elsewhere (see Rath et al., 2019).

In the TLC Wave 7 instrument, participants were asked to provide estimates of their viewership for nine of the programs included in the earlier content analysis. The nine programs were selected to avoid excess participant burden and to have representation of programs with high numbers (> 100), low numbers (< 100), and no tobacco incidents across the seasons analyzed. These shows included *Big Bang Theory, Daredevil, Once Upon a Time, American Horror Story, Modern Family, Fuller House, Orange is the New Black, The Walking Dead,* and *Stranger Things.* Participants were provided with the program list and asked, "How much of each of the following shows have you watched?" with response options 0 = never watched, 1 = one or two episodes, 2 = more than two episodes but less than one season, and 3 = at least one season. We created the exposure measure to account for variation in the number of tobacco incidents by program. For each program, we multiplied participants' reported viewership (0–3) by the proportion of all tobacco incidents that were in that particular program. For example, *Stranger Things* had a total of 444 tobacco incidents, representing 37% of all tobacco incidents from the entire sample of programs. A participant who reported watching "3 = at least one season" of *Stranger Things* would be assigned a value of 1.11 (0.37 × 3) for that program. A weighted sum of this value for all programs was calculated to generate a total exposure measure (range = 0–3). A categorical exposure variable was created from the continuous total exposure measure, with the categories: none = 0, low ≥ 0–1, medium ≥ 1–2, and high ≥ 2–3.

2.2.2. Outcome measures

Outcomes included: 1) combustible tobacco use initiation (i.e., smoking initiation) and 2) e-cigarette use initiation (i.e., vaping initiation). The following items measured ever combustible use: "Have you ever tried cigarette smoking?", "Have you ever tried smoking a cigar?", "Have you ever smoked hookah?", and "Have you ever smoked a pipe with tobacco?" Ever e-cigarette use was measured with the items: "Have you ever used an e-cigarette?" and "Have you ever used or tried a JUUL?" Response options for all questions included 1 = yes and

0 = no. Participants were defined as initiating smoking or vaping if they were ever smokers (i.e., ever use of one or more combustible product) or vapers (i.e., ever use of e-cigarettes) at wave 8.

2.2.3. Covariates

Covariates included the following self-reported variables: age in years (15–17 / 18–21 / 22–24), gender (male / female), race/ethnicity (white, non-Hispanic / black and/or African American, non-Hispanic / Hispanic / other, non-Hispanic), financial situation (Williams et al., 2017) (live comfortably / meet needs with a little left over / just meet basic expenses / don't meet basic expenses), region (Northeast / South / Midwest / West), parent education (less than high school / high school graduate / some college / college graduate), household smoking (no one I live with smokes / only e-cigarettes / combustibles and e-cigarettes), sensation seeking (continuous; measured with the Brief Sensation Seeking Scale (Hoyle et al., 2002) with higher score indicating higher sensation seeking; α = 0.84), and anxiety (continuous; measured with the 2-item Generalized Anxiety Disorder Scale (Plummer et al., 2016) with higher scores representing more anxiety; α = 0.91). Since prior research has found associations between TV viewing, regardless of the content, and smoking behavior (Hancox et al., 2004; Gutschoven and Van den Bulck, 2005; Gutschoven and Van den Bulck, 2004), overall media use was also included as a control variable. Overall media use was measured with: "On an average day, how much time do you spend viewing shows, movies, or other video content (for example, on broadcast, cable, streaming)?" Response options included 0 = none, 1 = less than 1 h, 2 = 1 h to less than 3 h, 3 = 3 h to less than 6 h, and 4 = 6 or more hours. All control variables were measured at wave 1, except for overall media use and financial situation, which were measured at wave 7.

2.3. Statistical analysis

We conducted analyses in 2019 in STATA SE 15.1 (StataCorp LP, 2017). Chi-square statistics and *t*-tests assessed for differences in wave 7 tobacco exposure and covariates by wave 8 smoking and vaping initiation status. Two weighted logistic regression models assessed the relationships between exposure to tobacco content in episodic programs at wave 7 and smoking initiation (model 1) and vaping initiation (model 2) at wave 8. Both models controlled for all covariates. Data were weighted to be nationally representative based on U.S. Census targets (US Census Bureau, 2016) and to account for wave-specific nonresponse (Fahimi, 1994). Data missing due to item non-response were less than 2% for all study variables, with the exception of parent education, which was missing for 5.4% of participants. Missing data were listwise deleted.

3. Results

3.1. Sample description

Table 1 displays the characteristics of the sample. The majority was female (56.8%), white, non-Hispanic (67.1%), had a parent with a college education or higher (59.8%), and did not live with a tobacco user (87.6%). Among the entire sample, the mean sensation seeking score was 2.7 (range 1–5), and the mean anxiety score was 0.7 (range 0–3).

Table 1 also presents differences in participant characteristics between those who did and did not initiate smoking or vaping. A total of 204 (4.4%) participants initiated smoking, while 393 (8.5%) initiated vaping. Compared to non-initiators, a larger proportion of smoking initiators reported younger age, non-white race, lower financial comfort, and household smoking. Compared to those who did not initiate vaping during the study period, a larger proportion of vaping initiators reported younger age, household smoking, and higher exposure to tobacco in episodic programs. The mean sensation seeking and anxiety

scores were also significantly higher among smoking and vaping initiators compared with non-initiators.

3.2. Tobacco exposure in episodic programs

Fig. 1 includes the number of tobacco incidents in the episodic programs sampled from a prior content analysis (Rath et al., 2019). Netflix's *Stranger Things* had the most with 444 total incidents. Most tobacco incidents (99.3%) featured combustible tobacco products. There was a total of nine incidents of e-cigarettes across all programs sampled – eight in *Fuller House* and one in *Orange is the New Black*.

3.3. Association between tobacco exposure and smoking and vaping initiation

Table 2 presents results of the logistic regression models predicting smoking and vaping initiation. Compared with those with no tobacco exposure through the episodic programs sampled, those with low, medium, or high exposure had significantly higher odds of initiating vaping (OR(low) = 2.19, 95%CI = 1.38–3.48; OR(medium) = 2.20, 95%CI = 1.34–3.64; OR(high) = 3.17, 95%CI = 1.71–5.88). An apparent dose-response relationship was observed, whereby the higher the exposure level, the greater the odds of initiation. Other significant predictors of vaping initiation included younger age, living in the Northeast region compared to the West, living with a combustible tobacco or e-cigarette user, higher sensation seeking, and greater anxiety.

There were no significant associations between tobacco exposure in episodic programming and smoking initiation. Significant predictors of smoking initiation included African American race compared with white race, lower parental education, living with a tobacco user, higher sensation seeking, and greater anxiety.

3.4. Sensitivity analysis

We performed a sensitivity analysis to determine if exposure to tobacco in episodic programs was associated with any other future risk-taking behavior. Logistic regression models assessed the associations between exposure and initiation of binge drinking and marijuana use. Binge drinking was defined as consuming five or more alcoholic beverages in a single occasion. Results indicated no significant association between tobacco exposure in programs and initiation of marijuana use. Models assessing the effect on initiation of binge drinking could not be run due to the small number of participants who reported never binge drinking at wave 7. Informed by literature reporting that not all young people who ever use a tobacco product become established users (Hair et al., 2017), we also assessed the effect of tobacco exposure on past 30-day use (i.e., current use) of combustible tobacco and e-cigarettes, among those who initiated ever use between the two data collection waves. Findings were consistent with the effect of tobacco exposure on ever use – compared to those with no exposure, those with low, medium, or high exposure had significantly higher odds of current vaping, while there was no significant effect on current smoking. All sensitivity analyses results are available from the authors.

4. Discussion

Prior research revealed a causal relationship between exposure to tobacco imagery in movies and smoking initiation among young people (Sargent et al., 2005; U.S. Department of Health Human Services, n.d.). The science directly linking tobacco imagery to youth use has resulted in advocacy and policy efforts focused on encouraging filmmakers to reduce tobacco imagery in movies, particularly those most popular among young people. While these efforts have contributed to a decline in tobacco imagery in youth-rated movies (Polansky et al., 2019), the prevalence of tobacco-related content in episodic programming has been increasing as the viewing habits of young people have changed

Table 1
Sample Characteristics (never smokers or vapers at wave 7).

	Full sample N = 4604	Initiated smoking		p-value[b]	Initiated Vaping		p-value[b]
		Yes n = 204	No n = 4400		Yes n = 393	No n = 4211	
				Unweighted %			
Age							
15–17	20.9%	23.0%	20.8%	< 0.001	31.3%	19.9%	< 0.001
18–21	42.9%	55.4%	42.3%		63.7%	41.9%	
22–24	30.7%	17.7%	31.3%		13.5%	32.3%	
25–26	5.5%	3.92%	5.6%		1.5%	5.9%	
Gender							
Female	56.8%	52.5%	57.1%	0.20	54.2%	52.2%	0.27
Male	43.2%	47.5%	43.0%		45.8%	42.9%	
Race/ethnicity							
White, non-Hispanic	67.1%	59.6%	67.6%	< 0.001	66.5%	67.4%	0.99
Black, non-Hispanic	8.0%	15.3%	7.7%		8.2%	8.0%	
Hispanic	13.3%	14.8%	13.2%		13.8%	13.3%	
Other, non-Hispanic	11.4%	10.3%	1.5%		11.5%	11.4%	
Parent education							
Less than high school	3.4%	6.4%	3.5%	0.14	3.6%	3.6%	0.26
High school graduate	10.3%	11.2%	10.8%		8.5%	11.0%	
Some college	21.2%	18.6%	22.4%		20.2%	22.6%	
College graduate	59.8%	63.8%	63.2%		67.7%	62.8%	
Financial situation							
Live comfortably	43.3%	44.3%	43.5%	0.04	2.3%	43.5%	0.38
Meet needs with a little left over	37.6%	31.0%	38.0%		15.1%	39.1%	
Just meet basic expenses	14.8%	21.2%	14.6%		39.1%	15.1%	
Don't meet basic expenses	3.9%	3.5%	3.9%		43.5%	2.3%	
Region							
Northeast	20.4%	23.0%	20.3%	0.14	23.2%	20.2%	0.12
South	33.2%	37.8%	33.1%		29.6%	33.6%	
Midwest	27.0%	25.5%	27.2%		30.1%	26.8%	
West	19.1%	13.7%	19.4%		17.1%	19.4%	
Household smoking							
No one I live with smokes	87.6%	78.9%	88.6%	< 0.001	79.8%	89.0%	< 0.001
Only e-cigarette use	1.7%	3.4%	1.7%		4.6%	1.6%	
Both combustible and e-cigarette use	10.0%	17.7%	9.6%		15.6%	9.5%	
Tobacco exposure in programs							
None	14.2%	9.8%	14.4%	0.13	6.4%	14.9%	< 0.001
Low	54.9%	62.3%	54.5%		58.8%	54.5%	
Medium	25.3%	23.0%	25.4%		27.0%	25.1%	
High	5.7%	4.9%	5.7%		7.9%	5.5%	
Overall media use							
None	7.9%	9.3%	7.9%	0.33	6.6%	8.1%	0.24
Less than 1 h	24.9%	20.6%	25.3%		22.1%	25.4%	
1 h to < 3 h	48.0%	47.6%	48.5%		50.4%	48.3%	
3 h to < 6 h	15.3%	19.6%	15.3%		16.5%	15.4%	
6 h or more	3.0%	2.9%	3.0%		4.3%	2.9%	
				Unweighted means			
Sensation seeking (range: 1–5)							
Mean	2.7	2.9	2.6	< 0.001	2.9	2.6	< 0.001
SD	0.8	0.8	0.8		0.7	0.8	
Anxiety (range: 0–3)[a]							
Mean	0.7	1.0	0.7	< 0.001	1.0	0.7	< 0.001
SD	0.9	1.0	0.9		0.9	0.9	

[a] Anxiety measured with the average of the following items: *Over the past 2 weeks, how often have you been bothered by the following problems: a) feeling nervous, anxious, or on edge; b) not being able to stop or control worrying?* 0 = not at all; 1 = several days; 2 = more than half the days; 3 = nearly every day.

[b] Results of chi-square or *t*-test comparing those who did initiate smoking or vaping with those who did not initiate smoking or vaping.

(Rath et al., 2019). To our knowledge, this is the first study to assess the relationship between exposure to tobacco content aired through online streaming and broadcast and cable platforms and subsequent tobacco use among young people. Results suggest a dose-response relationship between tobacco exposure and initiation of vaping, after controlling for overall media use and other factors known to be associated with tobacco use. In contrast to the research on tobacco imagery in movies and youth tobacco use, the current study did not find a significant relationship between tobacco exposure on these communication platforms and use of combustible tobacco. Given that the prevalence of cigarette use has now declined to less than 5% among teens and 10% among young adults, while the prevalence of e-cigarette use has risen to almost 28% (Trump Administration, 2019; Wang et al., 2018; National Institute on Drug Abuse, 2018), this new generation of young people are more likely to vape overall. The lack of a significant association between exposure to tobacco imagery in the sampled programs and smoking initiation may be due to the low prevalence of smoking initiation in the sample.

While not specifically explored in the present study, the mechanism through which exposure to tobacco content in episodic programming affects behavior is likely similar to that of exposure through movies. Exposure to tobacco content in movies has been found to increase normative beliefs about tobacco use, which in turn lead to tobacco use (Tickle et al., 2006). The high and increasing prevalence of tobacco content in popular episodic programs (Rath et al., 2019) may result in changes to descriptive norms regarding tobacco use, leading young
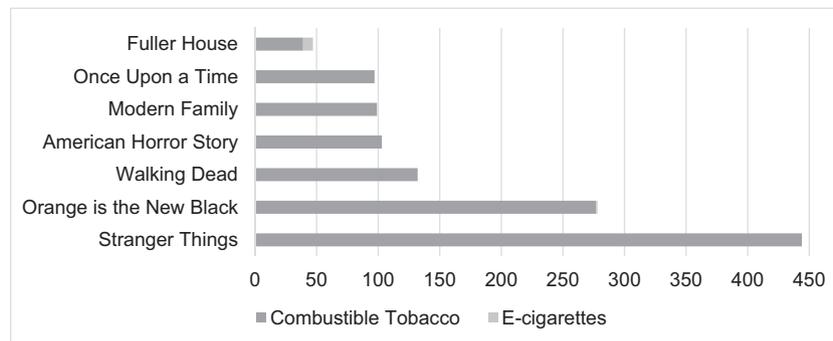
Fig. 1. Number of Combustible Tobacco and *E*-cigarette Incidents in Episodic Programs
Note: Daredevil and Big Bang Theory had no tobacco incidents in the seasons coded.

people to believe tobacco use is a common and normative behavior (Rimal and Real, 2003). In addition, researchers have posited that behavioral modeling and observational learning may explain associations between exposure to tobacco imagery in movies and youth smoking (Sargent et al., 2005; Sargent et al., 2001). Among all tobacco incidents from the episodic programs assessed in this study, approximately three-quarters included tobacco products placed in a user's hand or mouth, suggesting active use of the product (Rath et al., 2019). The behaviors of cigarette smoking and e-cigarette use are extremely similar, including the hand to mouth movement, inhalation, and exhalation (Soneji et al., 2017; Primack et al., 2015). Therefore, youth and young adults may be modeling smoking behavior observed in episodic programs, but replacing a cigarette with the more popular, socially acceptable e-cigarette.

In a changing tobacco landscape, where rates of cigarette use have dramatically declined (Gentzke et al., 2019; Wang et al., 2018), and vaping rates have substantially increased (Trump Administration, 2019), tobacco imagery in entertainment media may now normalize nicotine use through vaping, which youth may see as more socially acceptable than smoking. Vaping is now the most prevalent nicotine delivery system among youth and young adults, and a number of studies have found social influences to be a commonly cited reason for e-cigarette use among young people (Kong et al., 2014; Alexander et al., 2019; Tsai et al., 2018). Evolving trends in tobacco product use and studies on the influence of the social environment may help explain the current findings that exposure to tobacco imagery was not associated with combustible tobacco use, but instead was associated with e-cigarette use.

4.1. Strengths and limitations

Strengths of the current study include the longitudinal design, which allowed us to confirm the level of tobacco exposure in the programs sampled prior to tobacco use initiation. Additionally, this study was able to control for a wide range of demographic and psychosocial characteristics that may predict initiation. However, we were unable to control for all possible confounders, and were unable to account for tobacco exposure through other media channels. In order to reduce participant burden, TLC participants were only asked to report viewership of nine programs. Given the large number of programs on TV and the rapidly increasing number on streaming platforms, we restricted the sample to a small number of original scripted programs. It is likely that participants were exposed to tobacco content through other programs not measured in this study and future research could expand the sample of programs to include non-scripted programs. Youth and young adults are also likely being exposed to tobacco content in other forms of media, such as social media (Czaplicki et al., 2019), which was not assessed in this study. Additionally, our analyses did not distinguish whether tobacco use in the program was presented within a pro- or anti-tobacco context, which may have implications for the effect on

smoking and vaping behavior. Further, the age range for this study included youth and young adults (ages 15–26 years), and younger youth may be more susceptible to the influence of tobacco imagery in media. Nonetheless, this age range represents a key period during which tobacco use initiation occurs (Cantrell et al., 2018). Finally, this study did not assess the prevalence of other substances, such as alcohol or marijuana use, in the sample of programs and the possible impact of exposure to these substances on behavior. Future research is needed to more fully examine the range of possible exposures to risk-taking behavior through streaming and TV programs and the implications for behavior change.

5. Conclusions

Tobacco imagery is common in episodic programming aired through online streaming and cable and broadcast TV platforms that are popular among young people and the prevalence appears to be increasing (Rath et al., 2019). This study provides some of the first evidence that exposure to tobacco imagery in episodic programs may impact future tobacco product use. Ongoing monitoring of the impact of tobacco content in episodic programs is needed as the number of available programs continues to rapidly increase (Spangler, 2018), and more novel products, such as JUUL, become featured in these programs (Farley, 2018). Given the age range of the current sample, future research is needed to assess this relationship among younger individuals who may be more susceptible to the influence of media. While the mechanism through which exposure to tobacco content via episodic programs influences tobacco use is likely similar to that of exposure through movies, differences in the viewing patterns of episodic programs versus movies (e.g., binging multiple hours of an on-demand episodic program compared to watching a movie on a single occasion) may result in differences in how tobacco imagery influences young people's behavior. Therefore, research is needed to more fully explore how exposure to tobacco imagery on episodic programs may lead to initiation of vaping. Additionally, future research should explore the impact of individual-level audience characteristics, viewing behaviors, and the context of the tobacco portrayal in the program in order to help elucidate the findings from the current study. Finally, given public health concerns around associations between e-cigarette use and combustible tobacco use (Rigotti, 2015), future research is needed to explore possible effects of tobacco imagery exposure in media on dual- and poly-use behaviors over longer follow up periods.

Findings highlight the need for policy and advocacy efforts to reduce young people's exposure to tobacco imagery across all entertainment media platforms. Such efforts could include the consideration of tobacco imagery when assigning a TV parental guideline rating to a program, and changes to state subsidy policies that would incentivize studios and production companies to exclude tobacco imagery from their content. Another possible effort to counter the effects of tobacco imagery in on-screen media is airing anti-tobacco ads before any

Table 2

Logistic regression results predicting smoking initiation (Model 1) and vaping initiation (Model 2).

	Model 1	Model 2
	Smoking initiation	Vaping initiation
	OR (95% CI)	
Tobacco exposure		
None	Ref	
Low	1.57 (0.93–2.63)	2.19 (1.38–3.48)
Medium	1.19 (0.67–2.14)	2.20 (1.34–3.64)
High	1.22 (0.53–2.82)	3.17 (1.71–5.88)
Age		
15–17	1.72 (0.74–3.98)	5.57 (2.38–13.03)
18–21	1.89 (0.86–4.17)	4.30 (1.86–9.93)
22–24	0.83 (0.36–1.90)	1.43 (0.60–3.40)
25–26	Ref	
Gender		
Female	Ref	
Male	0.84 (0.62–1.15)	0.84 (0.66–1.07)
Race/ethnicity		
White, non-Hispanic	Ref	
Black, non-Hispanic	2.19 (1.33–3.62)	1.33 (0.85–2.08)
Hispanic	1.25 (0.78–1.98)	0.99 (0.69–1.43)
Other, non-Hispanic	0.95 (0.57–1.59)	1.09 (0.76–1.55)
Parent education		
Less than high school	Ref	
High school graduate	0.62 (0.29–1.30)	0.76 (0.37–1.54)
Some college	0.49 (0.24–0.98)	0.79 (0.41–1.53)
College graduate	0.66 (0.34–1.29)	1.05 (0.56–1.99)
Financial situation		
Live comfortably	Ref	
Meet needs with a little left over	0.79 (0.56–1.11)	1.14 (0.89–1.46)
Just meet basic expenses	1.46 (0.96–2.19)	1.28 (0.91–1.81)
Don't meet basic expenses	0.76 (0.30–1.95)	0.53 (0.22–1.25)
Region		
Northeast	1.53 (0.94–2.51)	1.49 (1.03–2.16)
South	1.34 (0.84–2.14)	1.06 (0.74–1.51)
Midwest	1.25 (0.76–2.07)	1.43 (1.00–2.04)
West	Ref	
Household smoking		
No one I live with smokes	Ref	
Only e-cigarette use	1.48 (0.58–3.75)	2.49 (1.40–4.43)
Both combustible and e-cigarette use	1.60 (1.04–2.47)	1.53 (1.10–2.11)
Overall media use		
None	Ref	
Less than 1 h	0.72 (0.38–1.35)	0.80 (0.49–1.31)
1 h to < 3 h	0.84 (0.47–1.51)	0.97 (0.61–1.56)
3 h to < 6 h	0.95 (0.49–1.85)	0.90 (0.53–1.54)
6 h or more	0.77 (0.28–2.08)	1.28 (0.62–2.64)

Table 2 (*continued*)

	Model 1	Model 2
	Smoking initiation	Vaping initiation
Sensation seeking	1.52 (1.24–1.86)	1.60 (1.38–1.84)
Anxiety	1.26 (1.01–1.48)	1.35 (1.20–1.51)

OR = odds ratio.
CI = confidence interval.
Ref = reference group.

program that includes tobacco imagery (Truth Initiative, 2019). Such ads could be based in health behavior theories, such as the inoculation theory, and present the risks associated with exposure to tobacco imagery in order to inoculate, or create resistance, against the pro-to-bacco imagery (Compton et al., 2016). Additionally, entertainment media creators and distributors must be held accountable for establishing company-wide policies that protect the public's health. In July 2019, the streaming platform Netflix announced a new policy prohibiting tobacco and e-cigarette use in all original youth-rated programs and movies, with the exception of programs portraying historical content (Romo, 2019). Ongoing surveillance is needed to assess the implementation of this policy and its impact on tobacco use behavior.

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