Online Peers and Offline Highs: An Examination of Online Peer Groups, Social Media Homophily, and Substance Use

Abstract

Research indicates that youths are particularly susceptible to peer influence and that identifying with substance using peer groups predicts substance use. Today, youth spend more time interacting with distal peer groups via the Internet and have increased access to online drug cultures. Theoretically, this should have important implications for substance use. This study employs a nationally representative sample of U.S. youth (n=1212), ages 15-25 years old, to examine whether online peer group identification and social media homophily predict substance use. Results indicate that online belonging and social media homophily are associated with some forms of substance use. While these factors were not significantly associated with regular marijuana or alcohol use among those who had initiated use, they predicted regular stimulant and opioid use among substance users. This suggests that online peer groups may promote progression into more problematic forms of substance use. Additional analyses of adolescent and young adult subgroups revealed important similarities and differences among the groups. The findings imply several directions for future research, and suggest that prevention policies and programs should continue to consider the role of online peers, and the Internet generally, in substance use initiation, escalation, and prevention.

Keywords: social media, drugs, young people, peers, substance use

Introduction

Since the 1990s, the ways youth and adults interact have changed considerably; one of the most profound changes has been the adoption and expanding use of the Internet, social media, and online gaming. These changes have provided users with greater opportunities for social interaction and greater access to more information, including interactions and information that may promote substance use. There are numerous sites, online groups, and social media outlets that provide youths and adults the opportunity to observe drug using behaviors; to learn how to use and transport substances; and to purchase these substances (Costello & Ramo, 2017; Wax, 2002). Furthermore, companies are using innovative online strategies to market substances such as alcohol (Griffiths & Casswell, 2010). Finally, while peer group formation was once restricted by geographic proximity to others, the Internet has enabled people to find and befriend others around the world with similar interests and to interact with them on a near-constant basis.

Given that research suggests social interactions and learning processes are central to explaining substance use, these technological changes should have implications for patterns of substance use. Interestingly, many studies throughout the Western world indicate that youth and adult substance use have been declining during the same period that electronic communication and Internet use has increased, and some have suggested that these phenomena may be linked (De Looze et al., 2019). These declines may be due to technologically-facilitated parental supervision; however, the shift to online interactions may have led to reductions in face-to-face contact and opportunities for substance use (De Looze et al., 2019).

Unfortunately, despite these declines, substance use remains a major public health concern. Since there is a wide variety of psychoactive substances with varying methods of delivery, the adverse social, economic, and health consequences are too numerous to list. Substance use and abuse is associated with risk-taking behaviors, crime and delinquency, low educational attainment and achievement, and poor economic outcomes (World Health Organization, 2004). Finally, even

though youth substance use does not deterministically predict substance abuse during adulthood, substance abusing adults almost invariably began using during adolescence or earlier (Wagner & Anthony, 2002). While the Internet has been utilized to prevent and treat substance abuse (Tait & Christensen, 2010), less research has examined the relationship between online peer groups and substance use. This study examines whether: (1) belonging to online peer groups and social media homophily are associated with substance use; (2) whether these factors are associated with different forms of substance use among those who have already initiated use using a sample of young Americans; and (3) whether these relationships differ among young adults and adolescents.

Peers and Substance Use

Many online networks resemble offline networks; however, the Internet not only extends existing face-to-face relationships, but it provides users with the opportunity to connect with similar others across vast geographical spaces (Nesi et al., 2017; Mesch & Talmud, 2007; Kaakinen, Sirola, Savolainen, & Oksanen, 2020). Just as there are multiple ways that *offline* peers can influence behavior, there are multiple ways that online peer groups may influence behavior. Moreover, online and offline peer influence may complement and supplement each other. For example, research suggests that online relationships may be an important source of social support among those with a weak connection to offline social networks (Cole et al., 2017); on the other hand, strong ties with offline friends can buffer risky behaviors online (Kaakinen, Keipi, Räsänen, & Oksanen, 2018; Minkkinen et al., 2015). Despite these beneficial effects, online interactions and content can potentially promote deviant behaviors.

Research has consistently found that associating with deviant peers is strongly associated with criminal behavior (Akers, 1998) and alcohol (Akers et al., 1989; Lanza-Kaduce et al., 1984), marijuana (Akers & Cochran, 1985), stimulant (Ford & Ong, 2014), opioid (Ford, 2008), and novel drug use (Miller, Boman, & Stogner, 2013; Miller et al., 2011). Much of this research is grounded in Akers' (1998) social learning theory which suggests that individuals will be more likely to use

substances when they disproportionately associate with substance using peers and develop beliefs favorable to substance use (Akers, 1998). Specifically, Akers (1998) argues that social learning processes occur in the context of "primary groups of family and friends, other reference groups and significant others, including to some extent distal learning groups and models portrayed in the mass media" (Akers 1998: 171). Although "distal learning groups" were originally intended to refer to influences of the media and sources seen as "distant" to an individual's immediate sphere of influence (Akers, 1998), the rise of the Internet and online social networks have changed the way youth interact with their peers. Social learning theory has now been applied to a variety of online deviant behaviors including gambling (Lee, Lemanski, & Jun, 2008), academic cheating (Stogner, Miller, & Marcum, 2013), participation in online hate groups (Hawdon, 2012), and cybercrime (Miller & Morris, 2016).

Prior research suggests that peers and peer groups may be of greater causal significance in the etiology of substance use than other deviant behaviors (e.g., property and violent crime; Pratt et al., 2010). Furthermore, research has found that social learning theory can be used to understand the influence of online interactions and activities on substance use. For example, researchers have found that online exposure to depictions of peer partying behavior (e.g., posts depicting drinking and drug use) was associated with increased alcohol use (Huang et al., 2014). Likewise, Nesi and colleagues (2017) found that exposure to alcohol-related content on social media sites was associated with drinking among adolescents, and that this was due, in part, to exposure's indirect influence via norms supporting alcohol use. Finally, Moreno and colleagues (2015) found that identifying with alcohol use online, as measured by depictions of alcohol use in one's profile and cover photos, was associated with excessive drinking among a sample of U.S. college students. Others have found that the amount of time spent on the Internet and social media is associated with substance use (Brunborg, Andreas, & Kvaavik, 2017; Jones et al., 2016); this is possibly due to the influence of deviant peers online or exposure to online content that promotes substance use.

Peer Group Selection and Substance Use

Akers' (1998) social learning theory argues that the influence of the social learning processes is not unidirectional. He argues that there are reciprocal effects that may occur throughout the life course. For example, early exposure to substance using others may lead to the development of beliefs favorable to substance use, which may, in turn, lead youths to believe that associating with substance using peers is desirable. This is because youths anticipate that associating with similarly-minded others will maximize one's rewards for engaging in behaviors they already find acceptable. Once youths are embedded in homophilous networks of substance using others, then these networks should more consistently reinforce and promote behaviors that are in accord with the norms of those within the group, which may lead to an escalation of the frequency and seriousness of behavior (Akers, 1998). Furthermore, these relationships may be particularly salient and intense, as research on peers and substance use indicates relationships may be strengthened when friends share similar patterns of substance use (Boman, Stogner, & Miller, 2013).

Of course, there are several other perspectives that suggest that individuals will select into deviant peer groups; for example, some suggest that youths with weak social bonds will select into deviant peer groups while others suggest that those with an inherent propensity to use will select into deviant peer groups (Bauman & Ennett, 1996; Thornberry & Krohn, 2005). Nevertheless, research suggests that the unidirectional explanation is not sufficient; rather, there seems to be a reciprocal relationship in which individuals select into substance using peer groups, which then exerts a normative influence that further promotes substance use while also providing individuals with opportunities to use (Brechwald & Prinstein, 2011).

Social psychological literature has highlighted that people are mainly influenced by groups with whom they identify (Reicher, Haslam, Spears, & Reynolds, 2012; Turner & Oakes, 1986). Thus, both offline and online social influence is dependent on how people relate themselves with different groups. According to the Identity Bubble Reinforcement Model (IBRM; Keipi et al.,

2017), social media offers extended possibilities for identity expression and validation seeking. Due to this identity-driven online behavior, people tend to form online groups around shared identities and interests. In a similar manner, online identity bubbles, reflected in individual's strong identification with online groups, homophilic online networks, and reliance on likeminded information in social media, are indeed found to be associated with both social influence and group behavior in the context of social media (Kaakinen et al., 2020). Therefore, it is possible that youths may select into homophilous online peer groups in the same way they do in face-to-face settings.

Finally, these strands of research on the influence of peer groups must be understood in the context of the well-known sequence of substance use. While most youths who use tobacco, or alcohol never progress to substances such as cocaine and opiates, substance using adults almost invariably began using substances such as alcohol and cannabis during adolescence (Wagner & Anthony, 2002). Several quantitative studies suggest that peer influence may lead to a "ramping up" of substance use in terms of the substances used and patterns of substance use (Danielsson et al., 2010; Kandel & Chen, 2000; Henry, Oetting, & Slater, 2009). Qualitative research on the initiation of heroin and methamphetamine use also suggests that initiation often takes place in the context of using other substances with peers and significant others (Best et al., 2007; Sheridan, Butler, & Wheeler, 2009). Often, peers suggest that a new drug is pleasurable, provide the substance, and provide guidance on how to use it.

This research suggests that online peer groups and social media usage may have differential effects on different patterns of substance use. On one hand, online activity may promote the initiation of substance use because of one's exposure to substance using others and online content that promotes substance use. However, among those who have already initiated use, belonging to socially homophilous online peer groups may be associated with more problematic forms of substance use. For example, if a cannabis user selects into a network of similarly minded online

peers, this network may promote experimentation with substances such as psychedelics, opiates, and other substances.

Therefore, in this research, we examine whether: (1) belonging to online peer groups and social media homophily are associated with substance use within the full sample; and (2) whether social media homophily and online belonging are associated with different forms of substance use (i.e., alcohol, cannabis, and "other drug" use) among those who have already initiated use. Finally, given that there tends to be a developmental pattern of substance use, and since research suggests peer groups may be less influential as adolescents adopt adult roles and responsibilities (Warr, 2002), the relationships between online peer groups and substance use are examined among developmentally distinct subsamples of adolescents and young adults.

Data

The sample consists of youths aged 15 to 25 years (M=20.05, SD=3.19; 50.17% female) from the United States (see Table 1 for descriptive statistics). The study was approved by the university Academic Ethics Committee, and participants were recruited on a voluntary basis in January 2018 utilizing an online panel administrated by Dynata (formerly called Survey Sampling International). The panel was designed to be demographically balanced and a link to a LimeSurvey tool was provided to potential respondents by SSI. The resulting sample exhibited demographic characteristics resembling the US population aged 15 to 25, and participants represented all 50 states, with the following regional breakdown: Northeast (21.44%), South (36.51%), Midwest (21.94%), and West (20.12%).

--- TABLE 1 HERE ----

Measures

Drug and alcohol use. Participants' drug use was measured using multiple questions. First, respondents were asked if they had "used or experimented with substances other than alcohol or tobacco to get high?" Respondents were given four choices, including lifetime abstinence,

occasional experimentation, past use, and current regular use. Those who indicated that they were currently regular users were then asked to specify the type of the drugs used and their frequency of the use. The analyses of specific types of drugs focus especially on the regular use of drugs. Regular use of drugs included categories for regular cannabis users and regular users of other drugs (e.g. stimulant, opiates/opioids, gamma/GBL and other pharmaceutical drug users). Finally, the Alcohol Use Disorders Identification Test-Concise (AUDIT-C) consumption frequency question was used to screen alcohol users. Those who reported at least monthly use of six or more drinks were categorized in the "regular alcohol intoxication" group.

Independent variables. Belonging to offline peer groups and belonging to online peer groups was measured using three questions regarding how strongly the respondents felt they belong to a) friendship group, b) school or work friends, or c) online community. The scale was from 1 (*not at all*) to 10 (*very strongly*). The first two items were combined into a measure of offline friends by summing them (Cronbach's alpha=0.80); this measure was then divided by two so that it would have the same range as the measure of online peer group belonging. The measure of whether respondents belonged to an online peer group was created using the latter question. Finally, social media homophily was measured with the homophily subscale of Identity Bubble Reinforcement Scale consisting of items in scale of 1 (*does not describe me at all*) to 10 (*describes me completely*): (1) "In social media, I prefer interacting with people who are like me," (2) "In social media, I prefer interacting with people who share similar interests with me," and (3) "In social media, I prefer interacting with people who share my values" (Kaakinen et al., 2020). The measure showed excellent inter-item reliability (Cronbach's alpha=0.90).

Control variables. Gender, age, and social media activity were included as controls. For the measure of gender, women were coded as "1" and men were coded as "0." Age was a continuous measure ranging from 15 to 25. Social media activity was measured with a set of 12 questions

involving how often the respondents used the most popular social media sites. Responses to these items were aggregated and then dichotomized using a median split (*0=low*, *1=high*).

Analytic Strategy

After examining overall sample characteristics (n=1212) and the features of the substance using portion of the sample (n=665; Table 1), multinomial regression was used to predict use of using only alcohol, only drugs, and drugs *and* alcohol within the full sample (Table 2). This analysis provides insight into the relationship between online and offline peer group identification and using differing types of substances, Table 2 reports relative risk ratios (RRR); these are interpreted in manner similar to odds ratios (OR) in logistic regression (i.e., RRR>1 indicates higher risk, while RRR<1 indicates lower risk). However, in the case of multinomial regression, all parameter estimates refer to the risk of the outcome relative to a referent category; in this study, those who abstained from any alcohol or drug use are the referent group. Standard errors (SE) of RRR coefficients and p-values are also reported. While the initial portion of Table 2 presents models estimated with the full sample, subsequent sections present models limited to adolescents (aged 15-17, n=329) and young adults (18-25, n=883). The partitioning of the data is critical as it allows for an exploration of relationships during distinct developmental stages. It also separates the sample into groups for which marijuana restrictions are clearly meaningful (marijuana remains banned for minors) and for which marijuana use *may* be permissible at the state level (some states allow medical and/or recreational marijuana although it remains a Schedule I substance per federal policy).

Next, to further explore the relationships between peer group belonging and substance use, and social media homophily and substance use, logistic regression analyses were used to predict regular alcohol, cannabis, and other drug use among substance users (n=665). Once again, the presentation of models estimated using the full age range is followed by separate analysis for adolescents and young adults. To guarantee the robustness of the analyses and to avoid small-

sample bias, penalized maximum likelihood logistic regression was conducted (Firth, 1993; van Smeden et al., 2016) using the firthlogit command in Stata 15.1. The Firth correction is necessary because in samples fewer than 500, traditional logistic regression models may yield biased coefficients (generally higher in absolute value and potentially leading to over confidence in results). The correction also minimizes the estimation issues associated with rare events. When one outcome is far more common than the other, estimates are biased towards prediction of the majority outcome (Firth, 1993; van Smeden et al., 2016). Firth's (1993) penalized maximum likelihood logistic regression procedure adds a penalty term which makes the estimates more conservative to a degree proportional to the limitations of the data (e.g., size of small sample, frequency of rare events). Table 3 includes the odds ratios, SEs and p-values.

Results

In this sample, 33.99% of respondents reported using only alcohol, 3.80% reported using only other drugs, 17.08% reported using alcohol *and* drugs, while 45.13% reported that they had not used alcohol or other drugs (Table 1). Among those who indicated they had used drugs, 90.12% indicated that they had used cannabis, which was the most widely used drug among users in the sample. The rightmost two columns in Table 1 describe the subsample of substance users. Substance users are significantly more likely to be classified as high online activity than nonusers, are older, and report lower belonging scores (both online and offline).

The multinomial logistic regression analyses (Table 2) showed that high online activity (RRR=1.62; p=0.002) and older age (RRR=1.42; p<0.001) predicted alcohol use in the full sample. Furthermore, among the full sample, offline belonging was associated with lower likelihood of using drugs (RRR=0.83; p=0.011). The use of both drugs and alcohol was predicted by lower online belonging (RRR=0.90; p=0.005), greater social media homophily (RRR=1.15; p=0.002), high online activity (RRR=1.83) and older age (RRR=1.37; p<0.001). In the adolescent subsample, alcohol use was predicted by high online activity (RRR=4.43; p<.001) as was use of both alcohol

and drugs (RRR=3.17; p=0.034). Online belonging was also associated with lower likelihood of using both alcohol and drugs (RRR=0.75; p=.008). Within the young adult model, younger age was predictive of being classified as an alcohol only user (RRR=0.78, p<0.001). Lower offline belonging (RRR=0.72, p<0.001), being female (RRR=4.47, p=0.002), and younger age (RRR=0.82, p=0.019) were all associated with using only drugs.

--- TABLE 2 HERE ---

Penalized maximum likelihood logistic regression models were used to predict regular alcohol intoxication, regular use of cannabis, and other drugs (i.e. stimulants, opiates and other similar drugs; see Table 3). The results showed that regular alcohol users reported high online activity (OR=1.51; p=0.044) and were, on average, older (OR=1.11, p=0.003); additionally, males were more likely to use alcohol regularly than females (OR=2.63, p<0.001). None of the factors were significant predictors of regular cannabis use among the full subsample of users, or the adolescent and young adult subsamples of users. Regular users of other drugs reported lower offline belonging (OR=0.78; p=0.034) and higher online belonging (1.38, p=0.004). Finally, regular users of other drugs reported higher social media homophily (OR=1.35; p=0.025) and males were more likely to use other drugs regularly (OR=3.25; p=0.020).

Separate analyses for adolescents and young adults are displayed in the lower portions of Table 3. While not significant in the full sample, higher offline belonging was associated with a lower likelihood of alcohol use for adolescents (OR=0.51, p=0.012). In the young adult subsample, females were significantly less likely to report alcohol use (OR=0.39, p<0.001); moreover, high online activity was significantly linked to alcohol use in the young adult sample (OR=1.57, p=0.034) as was age (OR=1.15, p=0.003). Finally, among young adult substance users, those who reported higher online belonging (OR=1.34, p=0.007) and higher social media homophily (OR=1.34, p=0.032) were more likely to report other drug use, while those who reported greater

offline belonging (OR=0.78, p=0.035) and females (OR=.36, p=0.045) were less likely to report other drug use.

--- TABLE 3 HERE ---

Discussion

This study revealed complex relationships between belonging to online and offline peer groups and various measures of substance use. Within the full sample, offline belonging was significantly and negatively associated with only using drugs while online belonging was *not* associated with this outcome. The opposite was true for alcohol *and* drug users – online belonging was *negatively* associated with using alcohol *and* drugs, while offline belonging was not associated with this outcome. A partitioning of the data to explore these relationships in different developmental stages revealed that adolescent online belonging was negatively associated with using alcohol and drugs, but this was not the case for young adults (although the coefficient approached significance at p=0.072). In contrast, the aforementioned finding related to offline belonging was still noted in the young adult sample, but not for adolescents. This may indicate that different types of belonging affect substance use at different stages of development: perceptions of online belonging may be more important to adolescents whereas offline belonging is more influential for young adults.

Therefore, to further examine these relationships, we examined whether online belonging and social media homophily predicted different forms of substance use among those who had already initiated use. These analyses revealed that online belonging and social media homophily did not significantly predict regular alcohol or cannabis use among users; however, these were both significant predictors of other drug use (i.e., opiates, stimulants, and other similar substances) among users. Once again, we partitioned the sample into adolescents (15-17) and young adults (18-25). For young adults *and* adolescents, offline belonging had a negative association with other drug use relative to the other categories. Alternatively, online belonging and social media homophily was

positively associated with use of other drugs relative to alcohol or cannabis only among young adults. This finding needs to be explored much more, but among the young adults, the negative effect may be interpreted according to the age-graded theory of social control which suggests that roles associated with adulthood (e.g., legitimate employment and parenthood) shape the nature of peer groups and their influence (Warr, 2002). It is possible that other drug use is less compatible with these offline roles than alcohol and marijuana use. Accordingly, offline peer groups, which are often formed around these activities might tend to restrain other drug use, but not marijuana or alcohol.

Regarding the results with the full sample, it is possible that belonging to online and offline peer groups constrains youths from using substances from a control perspective, especially since the plurality of youths do not use substances. Presumably, this would promote conformity rather than deviance (Akers, 1998). Alternatively, as mentioned at the outset, it is possible that these peer groups serve as a source of social support or supplement offline social support (Cole et al., 2017); thereby reducing substance use. The question is - why are there differential effects of offline and online peer groups for using drugs and alcohol or drugs alone. Given that *offline* belonging was negatively associated with using drugs only among the young adult subsample, and *online* belonging was negatively associated with alcohol and drug use among the adolescent subsample, developmental differences may play a key role in this differential effect of offline and online belonging on these different types of substance use. Future research should continue to explore these differential effects by age group and type of belonging (i.e., offline vs. online).

The two most important directions for research on the role of online peers and the internet involves: (1) examining how online and offline peer groups shape the effects of the other, respectively, and (2) examining how the nature and influence of online and offline peer groups change during adolescence and early adulthood. From a risk and resiliency perspective (Fergus & Zimmerman, 2005; Hawkins, Catalano, and Miller, 1992), it is important to understand how social

support received within online and offline peer groups may buffer the effects of online and offline deviant peer groups, as well as how social learning processes within conforming online peer groups may buffer the influence of substance using peers in offline contexts, and vice versa. Social learning theory suggest that peers matter because of learning processes that promote the acceptance of beliefs favorable to substance use (Akers, 1998). This may explain why offline and online belonging are differentially related to different forms of substance use relative to non-use. Unfortunately, this study was not able to examine this because the substance using behaviors of members in online and offline peer groups were not captured in the data.

Second, from a developmental and life course perspective, it is important to understand how associations with online and offline peers change during developmental periods, and how offline peer groups in adolescence shape online peer associations during early adulthood and vice versa. This will allow researchers to disentangle the influence of peer socialization vs. peer selection in these contexts as well as how they affect one another. For example, among those who had already initiated substance use, online belonging and social media homophily were only significantly associated with regularly using other drugs. It is possible that this is due to the escalation of substance use within socially homophilous peer groups. Alternatively, it is possible that this relationship is attributable, not to peer influence, but to youths' selection into peer groups. Youths may initiate substance using behaviors in offline contexts, and then select into homophilous, niche online peer groups of others with similar interests in psychoactive substances. This seems especially likely to happen during emerging adulthood when peer groups are changing and are oriented primarily around adult roles (Arnett, 2000; Warr, 2002). Since the prevalence of use in the population is quite limited, access to offline peers with similar substance use interests may not be available to youths and young adults; however, the Internet may provide an opportunity for youths to find others with similar, niche substance using interests.

Future research should explore these findings, and pursue additional explanations; however, like any study, this study has limitations, and the last point reveals one of the limitations of the current study. First, in order to establish a causal relationship, temporal precedence must be established; unfortunately, this study is cross-sectional. Scholars should collect longitudinal data on substance use, social media use, and online and offline peer groups to further explore the novel questions asked by this study. For example, youths might select into online peer groups because of their rejection by peers in face-to-face contexts, such as school and work. From a strain perspective (Agnew, 2001), this might give youths a reason to seek friendship with others online, but it might also give them reason to turn to substance use to cope with peer rejection in these face-to-face contexts. In other words, the relationship is spurious because strain causes socially rejected individuals to cope through seeking support online as well as by using substances. Finally, this study was not able to examine how the legal status of cannabis in youths' jurisdiction affect these relationships because this data was not collected, nor were we able to examine differences among those who are over versus those who were under age 21 because the study was not sufficiently powered to do so. While research suggests that alcohol availability is very prevalent among youths under 21 (Stogner et al., 2016), both the legal status of youths by age and legality of cannabis by jurisdiction should be taken into consideration in future research.

This study makes an important contribution to the research on the relationship between online peer groups and substance use among youths and young adults in the U.S. Future research should continue to examine how the characteristics of online peer groups (e.g., types and frequency of interactions) influence substance use. It also suggests that prevention researchers should continue to develop interventions that leverage the Internet to reduce substance use. Peer based intervention programs could utilize social media platforms (Moreno et al., 2012). Since the Internet is a rapidly changing technology and there is a constant supply of new apps, social media sites, and ways to interact, research on the role of online interactions and peer groups should provide ongoing

opportunities for researchers to answer a variety of questions from old and new theoretical

perspectives.

References

Agnew, R. (2001). *Juvenile Delinquency: Causes and Control*. Roxbury Publishing Company.

Akers, R. L. (1998). *Social learning and social structure: A general theory of crime and deviance*. Boston: Northeastern University Press.

Akers, R. L., & Cochran, J. K. (1985). Adolescent marijuana use: A test of three theories of deviant behavior. *Deviant Behavior*, *6*(4), 323-346.

Akers, R. L., La Greca, A. J., Cochran, J., & Sellers, C. (1989). Social learning theory and alcohol behavior among the elderly. *Sociological Quarterly*, *30*(4), 625-638.

Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, *55*(5), 469.

Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: Commonly neglected considerations. *Addiction*, *91*(2), 185–198.

Best, D., Manning, V., & Strang, J. (2007). Retrospective recall of heroin initiation and the impact on peer networks. *Addiction Research & Theory*, *15*(4), 397–410.

Boman, J. H., Stogner, J., & Miller, B. L. (2013). Binge Drinking, Marijuana Use, and Friendships: The Relationship Between Similar and Dissimilar Usage and Friendship Quality. *Journal of Psychoactive Drugs*, *45*(3), 218–226.

Brechwald, W. A., & Prinstein, M. J. (2011). Beyond homophily: A decade of advances in understanding peer influence processes. *Journal of Research on Adolescence*, *21*(1), 166–179.

Brunborg, G. S., Andreas, J. B., & Kvaavik, E. (2017). Social Media Use and Episodic Heavy Drinking Among Adolescents. *Psychological Reports*, *120*(3), 475–490.

Cole, D. A., Nick, E. A., Zelkowitz, R. L., Roeder, K. M., & Spinelli, T. (2017). Online social support for young people: Does it recapitulate in-person social support; can it help? *Computers in Human Behavior*, 68, 456–464.

Costello, C. R., & Ramo, D. E. (2017). Social Media and Substance Use: What Should We Be Recommending to Teens and Their Parents? *Journal of Adolescent Health*, *60*(6), 629–630.

Danielsson, A.-K., Wennberg, P., Tengström, A., & Romelsjö, A. (2010). Adolescent alcohol use trajectories: Predictors and subsequent problems. *Addictive Behaviors*, *35*(9), 848–852.

De Looze, M., van Dorsselaer, S., Stevens, G. W. J. M., Boniel-Nissim, M., Vieno, A., & Van den Eijnden, R. J. J. M. (2019). The decline in adolescent substance use across Europe and North America in the early twenty-first century: A result of the digital revolution? *International Journal of Public Health*, *64*(2), 229–240.

Fergus, S., & Zimmerman, M. A. (2005). Adolescent Resilience: A Framework for Understanding Healthy Development in the Face of Risk. *Annual Review of Public Health*, *26*(1), 399–419.

Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika*, *80*(1), 27–38.

Ford, J. A. (2008). Social learning theory and nonmedical prescription drug use among adolescents. *Sociological Spectrum*, *28*(3), 299-316.

Ford, J. A., & Ong, J. (2014). Non-medical use of prescription stimulants for academic purposes among college students: a test of social learning theory. *Drug and alcohol dependence*, *144*, 279-282.

Griffiths, R., & Casswell, S. (2010). Intoxigenic digital spaces? Youth, social networking sites and alcohol marketing. *Drug and alcohol review*, *29*(5), 525-530.

Hawdon, J. (2012). Applying differential association theory to online hate groups: a theoretical statement. Research on Finnish Society Vol. 5 (2012), pp. 39–47

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and Protective Factors for Alcohol and other Drug Problems in Adolescence and Early Adulthood: Implications for Substance Abuse Prevention. *Psychological Bulletin*, *112*(1), 64–105.

Henry, K. L., Oetting, E. R., & Slater, M. D. (2009). The role of attachment to family, school, and peers in adolescents' use of alcohol: A longitudinal study of within-person and between-persons effects. *Journal of Counseling Psychology*, *56*(4), 564–572.

Huang, G. C., Unger, J. B., Soto, D., Fujimoto, K., Pentz, M. A., Jordan-Marsh, M., & Valente, T. 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.

Huang, G. C., Soto, D., Fujimoto, K., & Valente, T. 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-e59.

Jones, S. C., Robinson, L., Barrie, L., Francis, K., & Lee, J. K. (2016). Association Between Young Australian's Drinking Behaviours and Their Interactions With Alcohol Brands on Facebook: Results of an Online Survey. *Alcohol and Alcoholism*, *51*(4), 474–480.

Kaakinen, M., Sirola, A., Savolainen, I., & Oksanen, A. (2020). Shared identity and shared information in social media: development and validation of the identity bubble reinforcement scale. *Media Psychology*, 23(1), 25-51.

Kaakinen, M., Keipi, T., Räsänen, P. & Oksanen, A. (2018). Cybercrime Victimization and Subjective Well-Being: An Examination of the Buffering Effect Hypothesis Among Adolescents and Young Adults. Cyberpsychology, Behavior, and Social Networking, 21(2), 129–137.

Kandel, D. B., & Chen, K. (2000). Types of marijuana users by longitudinal course. *Journal of Studies on Alcohol*, *61*(3), 367–378.

Keipi, T., Oksanen, A., Hawdon, J., Näsi, M., & Räsänen, P. (2017). Harm-advocating online content and subjective well-being: a cross-national study of new risks faced by youth. *Journal of Risk Research*, *20*(5), 634-649.

Krohn, M. D., Lizotte, A. J., Thornberry, T. P., Smith, C., & McDowall, D. (1996). Reciprocal Causal Relationships among Drug Use, Peers, and Beliefs: A Five-Wave Panel Model. *Journal of Drug Issues*, *26*(2), 405–428.

Lee, H.-S., Lemanski, J. L., & Jun, J. W. (2008). Role of Gambling Media Exposure in Influencing Trajectories Among College Students. *Journal of Gambling Studies*, *24*(1), 25–37.

Mesch, G. S., & Talmud, I. (2007). Similarity and the quality of online and offline social relationships among adolescents in Israel. *Journal of Research on Adolescence*, *17*(2), 455-465.

Moreno, M. A., Cox, E. D., Young, H. N., & Haaland, W. (2015). Underage college students' alcohol displays on Facebook and real-time alcohol behaviors. *Journal of Adolescent Health*, *56*(6), 646-651.

Moreno, M. A., Grant, A., Kacvinsky, L., Egan, K. G., & Fleming, M. F. (2012). College students' alcohol displays on Facebook: Intervention considerations. *Journal of American College Health*, *60*(5), 388-394.

Miller, B. L., Boman, J. H., & Stogner, J. (2013). Examining the measurement of novel drug perceptions: Salvia divinorum, gender, and peer substance use. *Substance Use & Misuse*, *48*(1-2), 65-72.

Miller, B. L., Stogner, J. M., Khey, D. N., Akers, R. L. Boman, J., & Griffin III, O. H. (2011) Magic mint, the internet, and peer associations: A test of social learning theory using patterns of Salvia divinorum use. *Journal of Drug Issues, 41*(3), 305-325.

Miller, B., & Morris, R. G. (2016). Virtual peer effects in social learning theory. *Crime & Delinquency*, *62*(12), 1543-1569.

Minkkinen, J., Oksanen, A., Näsi, M., Keipi, T., Kaakinen, M., & Räsänen, P. (2015). Does social belonging to primary groups protect young people from the effects of pro-suicide sites?. *Crisis*.

Nesi, J., Rothenberg, W. A., Hussong, A. M., & Jackson, K. M. (2017). Friends' alcohol-related social networking site activity predicts escalations in adolescent drinking: mediation by peer norms. *Journal of Adolescent Health*, *60*(6), 641-647.

Pauwels, L., & Schils, N. (2016). Differential online exposure to extremist content and political violence: Testing the relative strength of social learning and competing perspectives. *Terrorism and Political Violence*, *28*(1), 1-29.

Pevalin, D. J. (2000). Multiple applications of the GHQ-12 in a general population sample: an investigation of long-term retest effects. *Social psychiatry and psychiatric epidemiology*, *35*(11), 508-512.

Pratt, T. C., Cullen, F. T., Sellers, C. S., Thomas Winfree Jr, L., Madensen, T. D., Daigle, L. E., ... & Gau, J. M. (2010). The empirical status of social learning theory: A meta-analysis. *Justice Quarterly*, *27*(6), 765-802.

Reicher, S.D., Alexander Haslam, S., Spears, R., Reynolds, K.J. (2012). A social mind: The context of John Turner's work and its Influence. European Review of Social Psychology 23(1), 344-385.

Sheridan, J., Butler, R., & Wheeler, A. (2009). Initiation into Methamphetamine Use: Qualitative Findings from an Exploration of First Time Use Among a Group of New Zealand Users. *Journal of Psychoactive Drugs*, *41*(1), 11–17.

Stogner, J., Martinez, J. A., Miller, B. Lee., & Sher, K. J. (2016). How Strong is the "Fake ID Effect?" An Examination Using Propensity Score Matching in Two Samples. *Alcoholism: Clinical and Experimental Research*, *40*(12), 2648–2655.

Stogner, J. M., Miller, B. L., & Marcum, C. D. (2013). Learning to e-cheat: A criminological test of internet facilitated academic cheating. *Journal of Criminal Justice Education*, *24*(2), 175-199.

Tait, R. J., & Christensen, H. (2010). Internet-based interventions for young people with problematic substance use: A systematic review. *Medical Journal of Australia*, *192*(11), S15–S21.

Thornberry, T. P., & Krohn, M. D. (2005). Applying interactional theory to the explanation of continuity and change in antisocial behavior. In D. P. Farrington (Ed.), *Integrated Developmental & Life-Course Theories of Offending*. New Brunswick: Transaction Publishers.

Turner, J. C., & Oakes, P. J. (1986). The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence. British Journal of Social Psychology, 25, 231–252.

van Smeden, M., de Groot, J. A. H., Moons, K. G. M., Collins, G. S., Altman, D. G., Eijkemans, M. J. C., & Reitsma, J. B. (2016). No rationale for 1 variable per 10 events criterion for binary logistic regression analysis. *BMC Medical Research Methodology*, *16*.

Wax, P. M. (2002). Just a click away: Recreational drug web sites on the Internet. *Pediatrics*, *109*(6), e96–e96.

Wagner, F. A., & Anthony, J. C. (2002). From first drug use to drug dependence: Developmental periods of risk for dependence upon marijuana, cocaine, and alcohol. *Neuropsychopharmacology*, *26*(4), 479–488.

Warr, M. (2002). *Companions in crime: The social aspects of criminal conduct*. Cambridge University Press.

World Health Organization. (2004). *Neuroscience of psychoactive substance use and dependence*. https://www.who.int/substance_abuse/publications/en/Neuroscience.pdf?ua=1

Table 1. Descriptive Statistics

Categorical variables	Coding	Full Sample %	n	Substance Users %	n
Drug and alcohol use	None	45.13	547	0%	0
	Alcohol use only	33.99	412	61.95%	412
	Drug use only	3.80	46	6.92%	46
	Drug and alcohol use	17.08	207	31.13%	207
Regular alcohol intoxication	No	86.39	1047	76.09%	506
	Yes	13.61	165	23.91%	159
Regular use of cannabis	No	92.49	1121	86.32%	574
	Yes	7.51	91	13.68%	91
Regular use of other drugs	No	98.02	1188	96.39%	641
	Yes	1.98	24	3.61%	24
Online activity	Low	51.16	620	46.17%	307
	High	48.84	592	53.83%	358
Gender	Male	49.83	604	48.12%	320
	Female	50.17	608	51.88%	345
Continuous variables	*Range*	*M*	*SD*	*M*	*SD*
Offline belonging	1–10	6.77	2.24	6.55	2.21
Online belonging	1–10	5.38	2.69	5.23	2.73
Social media homophily	1–10	6.65	2.31	6.74	2.17
Age	15–25	20.05	3.19	21.36	2.76

Table 2. Multinomial Regression Model Predicting Alcohol and Other Drug Use among American Youths

	Alcohol Only			Drugs Only			Alcohol & Drugs		
Full Sample	*RRR*	*SE*	*p*	*RRR*	SE	*p*	*RRR*	*SE*	*p*
Offline Belonging	1.01	0.04	0.860	0.83	0.06	0.011	0.94	0.04	0.151
Online Belonging	0.98	0.03	0.531	1.08	0.08	0.305	0.90	0.03	0.005
Social Media Homophily	1.05	0.04	0.153	1.09	0.08	0.256	1.15	0.05	0.002
High Online Activity	1.62	0.25	0.002	1.37	0.44	0.330	1.83	0.34	0.001
Female	1.06	0.16	0.704	3.40	1.23	0.001	1.13	0.20	0.506
Age	1.44	0.04	0.000	1.13	0.06	0.026	1.37	0.04	0.000

$\chi^2 = 342.82$, df=18, pseudo $R^2 = .274$, n=1212

	Alcohol Only			Drugs Only			Alcohol & Drugs		
Adolescents (15-17)	*RRR*	*SE*	*p*	*RRR*	SE	*p*	*RRR*	*SE*	*p*
Offline Belonging	0.96	0.10	0.711	1.31	0.25	0.159	1.00	0.12	0.980
Online Belonging	0.98	0.09	0.889	0.89	0.12	0.401	0.75	0.08	0.008
Social Media Homophily	0.93	0.09	0.451	1.00	0.15	0.990	1.26	0.17	0.077
High Online Activity	4.43	1.95	0.001	3.52	2.34	0.059	3.17	1.72	0.034
Female	1.00	0.38	0.991	1.60	0.95	0.426	1.30	0.65	0.599
Age	1.24	0.29	0.347	0.74	0.27	0.421	1.77	0.58	0.083

$\chi^2 = 36.15$, df=18, pseudo $R^2 = .079$, n=329

	Alcohol Only			Drugs Only			Alcohol & Drugs		
Young Adults (18-25)	*RRR*	*SE*	*p*	*RRR*	SE	*p*	*RRR*	*SE*	*p*
Offline Belonging	0.98	0.04	0.617	0.72	0.06	0.001	0.93	0.04	0.083
Online Belonging	0.99	0.04	0.713	1.17	0.09	0.052	0.93	0.04	0.072
Social Media Homophily	0.93	0.04	0.064	1.06	0.09	0.526	1.07	0.05	0.120
High Online Activity	0.80	0.14	0.197	0.70	0.28	0.372	1.16	0.22	0.424
Female	0.92	0.15	0.632	4.47	2.12	0.002	1.05	0.19	0.777
Age	0.78	0.03	0.000	0.82	0.07	0.019	0.95	0.04	0.192

$\chi^2 = 110.33$, df=18, pseudo $R^2 = .0529$, n=883

Table 3. Penalized Maximum Likelihood Logistic Regression Models Predicting Regular Substance Use among Substance Users (n=665).

	Alcohol			Cannabis			Other Drugs		
All Substance Users	*OR*	*SE*	*P*	*OR*	*SE*	*P*	*OR*	*SE*	*P*
Offline Belonging	0.96	0.05	0.418	0.94	0.05	0.266	0.78	0.09	0.034
Online Belonging	1.07	0.04	0.082	0.92	0.04	0.073	1.38	0.15	0.004
Social Media Homophily	0.98	0.05	0.738	1.02	0.06	0.677	1.35	0.18	0.025
High Online Activity	1.51	0.31	0.044	1.12	0.27	0.642	1.57	0.81	0.383
Female	0.38	0.08	0.000	0.95	0.22	0.843	0.31	0.16	0.020
Age	1.11	0.04	0.003	0.97	0.04	0.406	1.17	0.10	0.062
	χ^2 =46.36, df=6			χ^2 =7.80, df=6			χ^2 =27.04, df=6		

	Alcohol			Cannabis			Other Drugs		
Adolescents (15-17)	*OR*	*SE*	*P*	*OR*	*SE*	*P*	*OR*	*SE*	*P*
Offline Belonging	0.51	0.14	0.012	1.39	0.32	0.160	0.44	0.42	0.394
Online Belonging	1.07	0.19	0.700	0.84	0.12	0.224	1.66	0.97	0.383
Social Media Homophily	1.53	0.39	0.092	1.32	0.33	0.261	5.23	8.21	0.292
High Online Activity	0.92	0.79	0.920	0.49	0.42	0.404	0.19	0.53	0.554
Female	0.25	0.19	0.064	0.50	0.36	0.330	0.02	0.05	0.174
Age	0.96	0.40	0.918	1.50	0.65	0.345	9.62	13.57	1.108
	χ^2 =8.88, df=6			χ^2 =4.43, df=6			χ^2 =3.46, df=6		

	Alcohol			Cannabis			Other Drugs		
Young Adults (18-25)	*OR*	*SE*	*P*	*OR*	*SE*	*P*	*OR*	*SE*	*P*
Offline Belonging	0.99	0.05	0.850	0.91	0.05	0.108	0.78	0.09	0.035
Online Belonging	1.08	0.05	0.087	0.92	0.05	0.125	1.34	0.15	0.007
Social Media Homophily	0.95	0.05	0.321	1.01	0.06	0.870	1.34	0.18	0.032
High Online Activity	1.57	0.33	0.034	1.13	0.29	0.620	1.45	0.76	0.483
Female	0.39	0.08	0.001	1.01	0.26	0.958	0.36	0.18	0.045
Age	1.15	0.05	0.003	0.99	0.05	0.898	1.24	0.14	0.053
	χ^2 =46.57, df=6			χ^2 =8.99, df=6			χ^2 =24.21, df=6		