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The Influence of Online-Only Friends on the Substance use of Young Adults with a History of Childhood Maltreatment

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Abstract

Background: Existing research shows that having offline friends that use substances increases risk for individual substance use in adolescence. However, there is little research examining the influence of online social networks on substance use in young adulthood.

Objectives: The present study examined the number of online-only Facebook friends (i.e., those with no in-person contact) that were substance users in relation to the participants' alcohol and marijuana use in the past year.

Methods: The sample ($n=114$) were selected from participants enrolled in a longitudinal study on childhood maltreatment in an urban city within the United States. The mean age of the sample was 21.84 ($SD=1.43$), 61% female. With participant permission, data were downloaded from Facebook to obtain the list of online friends. A self-report questionnaire recorded the substance use of each participant. Path analysis and logistic regression was used to examine a) the number of online-only friends who drink as a predictor of participants' problem drinking, b) the number of online-only friends who smoke marijuana as a predictor of participants' marijuana use, and c) moderation by maltreatment status.

Results: The results showed a significant effect of the number of online-only friends who smoke marijuana on the participant's marijuana use. However, after including offline friends this significant effect was no longer present, but offline friends predicted individual marijuana use.

Conclusions/Importance: These findings demonstrate that substance use in online social networks may be associated with individual use in young adulthood, but that offline influence is stronger.

Keywords

peer influence; social media; substance use

According to the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2015), the highest prevalence of marijuana use and binge drinking in the United States is for young adults (18–25 years old). Estimated rates of current marijuana use were higher in 2014 than in 2002 to 2009 for young adults aged 18 to 25 and more than one third of young adults in 2014 were binge alcohol users (37.7 percent). A consistent risk factor is the prevalence of substance use within an individual's face-to-face social network (Andrews, Tildesley, Hops, & Li, 2002). However, friendships initiated or maintained on social media may provide an additional source of social interaction and potential exposure to

substance use. With the amount of time young adults spend on social media, it is likely that peer influence processes also operate via this modality. There has been minimal investigation into the associations between substance-using online friends and the substance use of young adults and no examination of the influence of relationships maintained exclusively online. To address this gap, the present study examined the substance use of online-only versus offline friends as predictors of problem drinking and marijuana use among a sample of young adults with history of childhood maltreatment.

Exposure to online posts about substance use is highly prevalent for young adults. An analysis of 200 college students' Facebook profiles indicated that 53% had photos of alcohol use (Paradise, 2012). Similarly, another study of college students found that 50% had a photo of themselves or friends consuming alcohol and 15% of the participants' profile pictures were of drinking behavior (Morgan, Snelson, & Elison-Bowers, 2010). On the other hand, posts of drug use such as marijuana were rare, perhaps due to the illegality (Morgan et al., 2010). Studies have also found that young adults' attitudes towards viewing posts regarding alcohol use were favorable (Morgan et al., 2010; Peluchette & Karl, 2008) and that perceived approval of substance use was associated with higher use among college students (Lee, Geisner, Lewis, Neighbors, & Larimer, 2007; Neighbors, Geisner, & Lee, 2008). Taken together, these findings indicate that not only are young adults exposed to frequent posts about substance use when visiting social network sites, but that this frequent exposure may bias attitudes and increase subsequent substance use.

Despite the consistent evidence of offline peer influence on substance use (Bahr, Hoffmann, & Yang, 2005; Deutsch, Chernyavskiy, Steinley, & Slutske, 2015; Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Séguin, 2014), as well as the high frequency of online exposure to substance use, little research has examined the influence of online friendships on substance use in young adulthood. The similarity between individual and peers' substance use has been attributed to either peer selection or socialization processes (Burk, van der Vorst, Kerr, & Stattin, 2012; Fite, Colder, & O'Connor, 2006). That is, an individual chooses peers that are similar to themselves in terms of substance use or they are influenced by the substance use of their peers. Peer socialization is based on social learning theory, a main tenant being that individuals will model the behavior of close friends (Bandura, 1977). Peer socialization has been widely used in the study of peer influence processes on substance use in adolescence, yet little evidence exists regarding the potential influence of online friendships. Social norms theory provides a framework to understand the influence of perceptions of peer substance use on individual use. This theory states that individuals likely overestimate the prevalence of substance use in their network and match their own substance use to the perceived norm (Berkowitz, 2005). This is supported by evidence indicating perceptions of peer substance use are better indicators of individual use than actual peer substance use (Deutsch et al., 2015; Valente, Fujimoto, Soto, Ritt-Olson, & Unger, 2013). While peer socialization has been largely studied in offline context, social norms theory might be more applicable to online interactions where true levels of peer substance use may be unknown and perceptions are formed from online self-presentations. Thus, the perception of substance use of online friends may contribute to higher personal substance use. This is supported by evidence from a sample of adolescents showing that those with online friends that drink were at higher risk for drinking (Huang et al., 2014). Similarly, another study

using a sample of young adults found that a higher proportion of online friends that discussed or were accepting of drug use was associated with individual substance use (Cook, Bauermeister, Gordon-Messer, & Zimmerman, 2013; Cook, Bauermeister, & Zimmerman, 2016). However, neither of these studies distinguished “online-only” friends-- those whom the participant does not currently see in person. Importantly, online friendships may be initiated offline but no longer include face to face contact or may be initiated and maintained exclusively online. Additionally, online friendships may have more age variation than purely offline relationships and include both friends and family members. As there is data indicating the majority of online friends are also offline (Ellison, Steinfield, & Lampe, 2007), differentiating purely online influence will be a significant contribution to our knowledge regarding the impact that the online world has on offline behavior.

Importantly, maltreated individuals are particularly high risk for substance use (Danielson et al., 2009; Moran, Vuchinich, & Hall, 2004; Noll, Trickett, & Putnam, 2003), but the evidence on the susceptibility to peer influence for maltreated youth is equivocal. Some findings show that peers’ behavior affects the substance use of maltreated adolescents (Perkins & Jones, 2004) and maltreated youth who report more peer pressure also engage in more risk behavior (Ellis & Wolfe, 2009). However, other research shows that exposure to delinquent peers does not matter as much in the development of delinquency for maltreated adolescents as it does for comparison adolescents (Negriff, Ji, & Trickett, 2011). No studies have examined the associations between online influence and substance use for maltreated individuals. Given the higher risk for substance use, delineating online influence mechanisms will expand our knowledge of the etiology of risk behavior for young adults with childhood maltreatment experiences.

Hypotheses

Based on the gaps in the literature, the present study examined the influence of online-only friends versus offline friends on the substance use of a sample of young adults in an urban city within the United States. The young adults included both those who had childhood maltreatment reported to child welfare and a comparison group from the same community. Following theory and evidence regarding offline influence, it was hypothesized that a higher number of online-only friends who use substances (i.e., alcohol, marijuana) would predict higher substance use for participants (i.e., problem drinking, marijuana use). Additionally, given the strong and consistent evidence for offline influence effects in prior studies, it was hypothesized that online influence effects would diminish after controlling for offline substance-using friends. Lastly, there was an opportunity for exploratory analyses regarding the interaction between online-only substance using friends and maltreatment status. Maltreatment is a consistent risk for substance use yet there is little existing research comparing peer influence effects for maltreated versus comparison youth.

Methods

Participants

For the current study, a pilot sample was drawn from an ongoing longitudinal study examining the effects of maltreatment on adolescent development. The original enrolled

sample was 454 adolescents aged 9–13 years at baseline (n=303 maltreated, n=151 comparison; 241 males and 213 females). The cross-sectional pilot assessment took place approximately 11 years after baseline when the participants were mean age of 21.84 (SD=1.46). The participants for the pilot study were selected from all those enrolled in the larger study and restricted to those participants who had a current Facebook profile and completed the online survey. The study design required approximately equal number of maltreated and comparison participants, which deviated from the original proportions of the full sample. This resulted in a sample of n=114 for the current study (n=78 maltreated, n=74 comparison; males=63 females=89). The ethnic/racial composition of pilot sample was 39% Latinx, 38% Black, 11% White, 16% Biracial, which was similar to the distribution at baseline for the full sample. In terms of education, (48.9%) of the pilot sample had completed at least some college or greater, (41.3%) had a High School Diploma or GED while 8% did not complete high school, and 2% were still in high school.

Recruitment.—The maltreatment group was recruited from active cases in the Children and Family Services (CFS) of a large west coast city. The inclusion criteria were: (1) a new substantiated referral to CFS in the preceding month for any type of maltreatment; (2) child age of 9–12 years; (3) child identified as Latino, African-American, or Caucasian (non-Latino); (4) child residing in one of 10 zip codes in a designated county at the time of referral to CFS. With the approval of CFS and the Institutional Review Board of the affiliated university, potential participants were contacted and asked their willingness to participate.

The comparison group was recruited using names from school lists of children aged 9–12 years residing in the same 10 zip codes as the maltreated sample. Comparison caregivers were contacted the same way as the maltreated group. Comparison families indicated they had no previous or ongoing experience with child welfare agencies.

For the pilot study, study participants were contacted by phone by research personnel. Contact was attempted for all enrolled participants (N=433; 21 requested to be dropped from the study at Time 2 or Time 3) and continued for one year, while taking care to maintain the planned design of equal numbers in the maltreated and comparison groups. Of those contacted, 26 declined to participate, 3 were deceased, 5 were in the military and unable to have contact, 4 were incarcerated, one was likely in Mexico with no contact, and one was in a treatment facility. In addition, 18 were consented and given the study instructions but did not complete any section of the assessments. There were 76 who did not complete the previous timepoint (Time 4), none were able to be reached. Of the remaining 300, there were 152 participants who completed at least some part of the study assessment, while the remaining 148 could not be reached (either because no contact information could be located or the participant would not return our messages). Multiple methods were used to locate and contact participants: back-up contacts (given by participant at previous assessments), Facebook messages, texts, email, and internet database searches (e.g., pipl, spokeo).

Demographic Composition of the Pilot Sample

Within the pilot sample, the demographic characteristics of the maltreated and comparison groups were very similar. Chi-square tests showed there were no differences in the proportion of males and females in each group nor in the ethnic composition of each group. Based on these data the pilot sample is very similar to the full sample which provides confidence the findings are not biased by the selection of the pilot sample.

Although none of the data from previous assessments with the full sample was used in the current study, chi-square analyses were conducted to determine if there were any significant differences in the composition of the pilot sample versus the full sample. Demographic variables were group (maltreated vs comparison), sex (male, female), and ethnicity (Black, Hispanic, White, Biracial). Analyses showed that fewer maltreated youth and males were selected for the pilot sample versus the proportions in the full sample ($p < .05$). In part, this is due to the equal proportion of maltreated and comparison youth for the pilot study design versus the 2/3 maltreated that were enrolled in the original sample. Nonetheless, both of these variables would have biased the outcome variables upward, such that inclusion of more maltreated youth or more males would result in more variability and likely amplify any significant findings.

Procedures

Facebook data were downloaded via an application developed for the current study. After verbal consent was obtained, the research staff directed the participant to the URL to access the Facebook application from their personal computer. Upon signing in with their Facebook login, they were informed of the permissions and data accessed by the application. Depending on the amount of data, the time needed to complete the Facebook application ranged from 5 minutes to 10 hours. The participant did not need to be at the computer while the application ran. All data was downloaded to a secure sever and encrypted.

After completion of the Facebook application, research staff used a MySQL function to calculate the 5 people whom the participant had the most communication with on Facebook in the past 6 months. "Communication" was defined as: 1) participant post to friend, 2) friend post to participant, and 3) friend comment on participant post (note that we refer to "friends" but these may include both peers and family members). The names of these 5 friends were entered into an online survey (hosted by Qualtrics) and the link was emailed to the participant. The online survey asked follow-up questions about each of the 5 Facebook friends, such as "how often do you hang out in person" and "does this person use marijuana." The participant was also asked to name the 5 people they see most in-person (and the same follow-up questions as the Facebook friends). Participant were asked to name five friends based on data that this represents the close friends sublayer of the social network (Ennett et al., 2006). The survey also included questionnaires about individual substance use and demographics. Participants were paid according to the guidelines of the National Institutes of Health standard compensation rate for healthy volunteers.

Measures

Online-Only Substance-Using Friends.—In the online survey, for each of the 5 Facebook friends (determined as described above) participants were asked: 1) how often they hang out in person (never, occasionally, often, very often), 2) whether this person drinks alcohol (yes/no), and 3) whether this person smokes marijuana (yes/no). The number of online-only friends who drink was computed by summing those who the participant “never hang out in person” and “drinks alcohol” (range 0–5 friends). Similarly, the number of online-only friends who use marijuana was computed from the sum of “never hang out in person” and “uses marijuana” (range 0–3 friends).

Offline Substance-Using Friends.—The participant was also asked to name the 5 people they see most in-person. The number of offline friends who drink was the sum of those who the participant reported “drinks alcohol” (range 0–5 friends) and the number of offline friends who use marijuana was the sum of those reported to use marijuana (range 0–5 friends).

Substance Use.—Participants reported on the Adolescent Delinquency Questionnaire (Huizinga & Elliott, 1986) how many times they had passed out drunk in the past 12 months (0 to 5 or more times), defined as problem drinking, and how many times they had used marijuana in the past 12 months (0 to 5 or more times). In addition, two dichotomous variables were created, problem drinker (1= yes, 0=no) was defined as report of passing out drunk one or more time in the last 12 months. Similarly, marijuana user (1=yes, 0=no) was defined as using marijuana one or more times in the last 12 months.

Data Analysis

Substance use data is often skewed, with a high frequency of participants reporting little to no use. As such, two different analyses were used to account for this nonnormality and converge the findings. First, we examined path models using the maximum likelihood with robust standard errors estimator (MLR) in Mplus 7.0. Model 1 (see Figure 1) included the number of online-only friends who drink as a predictor of the number of times the participant passed out drunk (problem drinking), and the number of online-only friends who use marijuana as a predictor of the number of times the participant used marijuana (controlling for age, sex, and maltreatment status). Model 2 (see Figure 2) included both the number of online-only and offline friends who drink as a predictor of problem drinking, and the both the number of online-only and offline friends who use marijuana as a predictor of marijuana use (controlling for age, sex, and maltreatment status). To examine moderating effects, multiple-group models were tested in which the parameter(s) of interest (e.g., # online-drinking friends to participant problem drinking) were allowed to vary between maltreated and comparison groups. Next, the parameter was constrained to equality and the Satorra Bentel Scaled Chi-square difference test was used to determine significant interaction effects (Satorra, 2000). In all models exogenous variables (i.e. independent variables) were allowed to covary (the default in Mplus) and the residuals of two outcome variables were allowed to covary. No cross-substance type parameters were included (i.e.,

friend marijuana use to participant alcohol use or friend alcohol use to participant marijuana use).

Second, two dichotomous variables were created for the outcomes 1) passed out drunk in the past 12 months (yes/no) and 2) used marijuana in the past 12 months (yes/no). Using logistic regression in SPSS 24.0, four models were run. Model 1 included online-only friends who drink as a predictor of participants' problem drinking, controlling for age, sex, and maltreatment status (Step 1), and the interaction between online-only friends and maltreatment status (Step 2). Model 2 included the covariates, online-only drinking friends, and offline drinking friends as predictors of problem drinking. Model 3 included the number of online-only friends who use marijuana as a predictor of participants' marijuana use controlling for age, sex, and maltreatment status (Step 1), and the interaction between online-only friends and maltreatment status (Step 2). Lastly, Model 4 entered the covariates, online-only friends who use marijuana, and offline friends who use marijuana as predictors of participant marijuana use.

Results

Descriptive Statistics

Means, standard deviations, and frequencies of study variables can be found in Table 1. Bivariate correlations between study variables showed that online-only friends who used marijuana was correlated with a) online-only friends that were drinkers ($p < .01$) b) offline friends that used marijuana ($p < .01$), and c) self-reported marijuana use ($p < .01$). Offline substance use by friends was correlated for alcohol and marijuana ($p < .01$). Self-reported marijuana use was correlated with offline friends who drink and use marijuana ($ps < .01$). (See Table 2). The percent of problem drinkers (as defined in measures) was 16.4% and marijuana users was 51.1%. The mean number of hours spent on social network sites was 2.21($SD=1.20$) for weekday and 2.36 ($SD=1.38$) for the weekend and was not significantly different between maltreated and comparison participants This was equivalent to approximately 3.5 hours as the scale ranged from 0–10 with 2=1 to 3hrs and 3=4 to 6 hrs.

Path Models

Model 1: Online-only substance-using friends.—The model fit the data well ($\chi^2=3.24$ (2); $RMSEA=.07$; $CFI=.93$). There was a not a significant main effect for the number of online-only friends who drink on the participant's problem drinking. There was a significant effect of the number of online-only friends that smoke marijuana on the participant's marijuana use ($\beta=.28$, $p < .001$) (See Figure 1).

Model 2: Online-only and offline substance-using friends.—This model also fit the data well ($\chi^2=2.94$ (4); $RMSEA=.00$; $CFI=1.00$). When the main effect of offline friends was added to the model the effect of online-only friends who drink was still not significant whereas the effect of offline friends who drink was a significant predictor of problem drinking ($\beta=.22$, $p < .001$). For marijuana use, after controlling for offline friends who use marijuana, the effect of online-only friends was not significant but the main effect of offline friends was significant ($\beta=.58$, $p < .001$) (See Figure 2).

Model 3: Moderating effect of maltreatment.—The interaction effect between maltreatment status and online-only friends' substance use was not significant for either outcome variable. That is, there were no significant differences in the Chi-square for the models after restricting the parameters to equality across the maltreatment and comparison groups.

Logistic Regression

Results from the logistic regression models can be found in Table 3. Model 1 showed no significant effects of online-only friends who drink or the interaction with maltreatment on the participant's likelihood of passing out drunk in the past 12 months. When offline friends who drink (Model 2) was added to the model it significantly predicted the likelihood of being a problem drinker ($OR=1.86$, $95\%CI=1.13-3.08$, $p=.02$), but online-only friends was not a risk for problem drinking. For marijuana use (Model 3), online-only friends who used marijuana increased the odds of marijuana use by the participant by nearly two and a half times ($OR=2.41$, $95\%CI=1.13-5.16$, $p=.02$). However, the interaction with maltreatment was not significant. In Model 4, the addition of offline friends who use marijuana was a significant risk for being a marijuana user ($OR=2.87$, $95\%CI=1.94-4.26$, $p<.00$), but online-only friends who use marijuana was not.

Discussion

Online social media is clearly a substantial presence in the lives of young adults, yet few studies have examined the effects that online friends may have on the development of substance use. The findings from the current study demonstrate that substance use in online social networks may be associated with individual use in young adulthood, depending on the substance. We specifically examined online-only friends which allows stronger inferences regarding the importance of online influence. Because online-only friends were determined based on the participant's reported offline contact with each friend, this research should be replicated but nonetheless provides preliminary evidence of the propagation of substance use through relationships that are maintained exclusively online.

The results from the path model and the logistic regression converged, providing confidence for our interpretations. In both analyses, having a higher number of online-only friends that used marijuana was a significant predictor of the participant's marijuana use, which is consistent with the offline influence literature (Tucker, de la Haye, Kennedy, Green, & Pollard, 2014). The odds ratio indicated that an increase of one online-only friend that uses marijuana increased the participant's odds of use by nearly two and a half times. On the other hand, online-only drinking friends did not have a significant effect on problem drinking. Perhaps this is due to the severity of the alcohol use outcome variable (passing out drunk), which may be less affected by the perceptions of alcohol use of the online friends. The current findings extend the offline peer-influence literature by specifying the effects of online-only friends on marijuana use. Although these results are similar to studies of offline peer influence, the mechanisms are likely very different. According to social norms theory, participants are likely overestimating the prevalence of substance use in their network, and matching their own substance use to the perceived norm (Berkowitz, 2005). For online-only

friends, it is likely that the participants' perception of their friends' substance use was formed via their viewing of the Facebook posts. As found by Moreno and colleagues (Moreno, Briner, Williams, Walker, & Christakis, 2009), exposure to online substance use references creates more positive and accepting attitudes towards alcohol and marijuana use thus increasing individual substance use. Several studies have shown that perceived approval of alcohol or marijuana use from parents and/or peers is associated with higher use among college students (LaBrie, Hummer, & Lac, 2011; Larimer, Turner, Mallett, & Geisner, 2004; Lee et al., 2007; Neighbors et al., 2008). Therefore, online influence may operate through the perceptions of approval formed via positive endorsement of substance use by online friends. On the other hand, perception of offline friends' substance use may be based on observation of actual use in combination with perceived attitudes or approval of substance use. Given that peer pressure is more likely offline, it may spur the individual to increase their use to match that of their friends. These data have significant implications for online interventions targeted at substance use. For example, reduced exposure to online substance use references by close friends will likely have an impact on individual's perceived favorability of substance use.

Interestingly, the inclusion of offline friends into the model altered the effect of online-only friends. The number of online-friends who drink predicted problem drinking only at the trend level after controlling for offline friends who drink. For marijuana use, the previous significant effect of online-only friends was no longer significant after including offline-friends into the model. Perhaps because marijuana is still illegal in most states (and was illegal in the state when data collection occurred) it may be more difficult to acquire and young adults may use offline personal connections to obtain it. This is supported by data from a National survey indicating the majority of people (89%) reported obtaining marijuana from a friend or relative (Caulkins & Pacula, 2006). For problem drinking, the online-friends effect was only at trend level, necessitating further research with a larger sample. The effect of offline-friends on both alcohol and marijuana use is similar to previous research showing that alcohol use in offline friendships increases individual use (Borsari & Carey, 2001). The odds ratio indicates that an increase of one offline friend who drinks doubles the likelihood of the participant reporting passing out drunk, a concerning trend.

This is the first study to distinguish online-only friends from offline, and though a small sample size, the results pave the way for understanding the possible transmission of influence through online interactions. Although a fairly new field, online influence has been demonstrated in several studies. One study of young adults found that online exposure to criminal behavior was sensitive to the size of the network, in larger networks there is saturation point after which exposure to additional deviant behavior is no longer influential (McCuddy & Vogel, 2015). A study of college students found that a higher proportion of drug references within the online network predicted individual drug use (Cook et al., 2013). However other studies have shown that close friends have more influence on substance use behavior than the larger friendship group (Ennett et al., 2006; Kobus & Henry, 2010; Urberg, De irmencio lu, & Pilgrim, 1997). This corresponds with the current results which indicate that close friends (as indicated by the frequency of online communication) are salient influences on marijuana use. Future studies would benefit from comparison of the close friends to the full online network as well as differentiating between peer and family who are

“online friends”. Importantly, most of the peer influence literature is founded on the conceptual framework of selection versus socialization (Kandel, 1978). That is, do individuals choose friends with similar behavior or does the behavior of friends change the individual? While this is an important distinction it should be noted, in the current study these mechanisms cannot be determined given the cross-sectional design. Our discussion has framed online and offline peers as predictors of substance use. However, it is also possible that participants with higher substance use are choosing other substance users as friends (both offline and online), leading to our significant associations. Further studies are needed to tease apart these important conceptual distinctions.

There are important limitations to this research. First, although the online friends were calculated directly from Facebook interaction data, the offline friends and the substance use of online and offline friends was reported by the participant. Studies have shown that individuals tend to think the substance use of their friends is similar to their own use, which accounts for the high correlations (Bauman & Ennett, 1996). However, research has also shown the perception of substance use within the social network is a strong predictor of individual use (Deutsch et al., 2015; Valente et al., 2013), perhaps because it reflects the individual’s cognitive appraisal of the prevalence of substance use within the friendship network. Second, because the Facebook posts are not yet coded for substance use, there is an inference that the participants’ perception of each friend’s substance use is based on information gleaned from their social media accounts. Future research should use the content of posts to support this inference. Third, “friends” may have included both peers and family members. As such, the variable reflected the definition of “Facebook friends” rather than how it is conventionally defined in the peer influence literature. In addition, as noted previously, causal inferences cannot be drawn from this study. The cross-sectional data cannot determine whether participants already use substances then select substance-using friends (offline and online), or if they are influenced by the substance use of their friends. Lastly, the sample for the study was a subsample of the enrolled participants. Although this study found few differences between those retained for the current assessment it is possible there are systematic differences for those who were not included that may have altered the results. As noted previously, replication is necessary to corroborate these findings.

This is one of the first studies to directly compare online-only versus offline friends and the associations with substance use in young adulthood. Online social media is clearly a significant presence in the daily lives of young adults, and will likely only increase in future years. Understanding the associations that online-only relationships may have with substance use will yield important insights into the development and persistence of risk behavior. The results from this study show that online friends may influence marijuana use, but offline friends still maintain a stronger association with both problem drinking and marijuana use. Although there are limitations of this data, this research is a first step toward isolating how online interactions may increase risk for substance use. These findings provide the initial evidence needed to develop online interventions targeting problematic substance use.

Abbreviations:

CFS Children and Family Services

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Figure 1.

Path model testing the main effects of online-only friends' substance use on participant substance use. Covariates (not shown) include T5 age, sex, and maltreatment status. Note:

** $p < .01$, [†] $p < .10$

Figure 2.

Path model testing online-only and offline substance-using friends' effect on participant substance use. Covariates (not shown) include T5 age, sex, and maltreatment status. Note:

** $p < .01$, [†] $p < .10$

Table 1.

Descriptive Statistics for Study Variables

	N	Mean	SD	Range	0	1	2	3	4	5
Passed out drunk past 12 mo	122	.26	.70	0–5	83.6	9.0	6.6	0	0	.8
Marijuana use past 12 mo	133	2.00	2.21	0–5	48.9	4.5	6.0	8.3	3.0	29.3
Number of “online only” friends-drinkers	114	.69	1.21	0–5	65.8	16.7	7.0	6.1	1.8	2.6
Number of “online only” friends-marijuana	114	.26	.67	0–3	83.3	9.6	4.4	2.6	0	0
Number of offline friends-drinkers	133	3.21	1.63	0–5	9.8	8.3	13.5	15.8	24.8	27.8
Number of offline friends-marijuana	133	1.57	1.71	0–5	43.6	12.8	12.0	12.0	13.5	6.0

Table 2.

Correlations between Study Variables

	Online-only friends- drinkers	Online-only friends- marijuana	Offline friends- drinkers	Offline friends- marijuana	# times passed out drunk in the last 12 months	# times used marijuana in the last 12 months?
Online-only friends-drinkers	1.00					
Online-only friends-marijuana	0.57**	1.00				
Offline friends-drinkers	-0.05	0.04	1.00			
Offline friends-marijuana	-0.02	0.28**	0.35**	1.00		
# times passed out drunk in the last 12 months	0.19	0.19	0.19	0.15	1.00	
# times used marijuana in the last 12 months?	0.04	0.28**	0.29**	0.62**	0.12	1.00

Table 3.

Logistic Regression Models Testing the Main Effects and, and Interaction Effects Between Maltreatment Status, Online and offline Substance Using Friends on Problem Drinking and Marijuana Use

	Odds Ratio	95% Confidence Interval	p
Outcome: Problem Drinking (% problem drinkers=16.4)			
<i>Model 1: IVs Maltreatment x online friends</i>			
<u>Step 1</u>			
T5 age	1.24	.81–1.89	.33
Sex (ref: male)	2.51	.78–8.08	.12
Maltreatment (ref) vs comparison	2.80	.87–9.07	.09
# Friends online-only & drinkers	1.26	.84–1.86	.26
<u>Step 2</u>			
Maltreatment (ref) x # Friends online-only & drinkers	.72	.33–1.58	.41
<i>Model 2: IVs Maltreatment, online friends, offline friends</i>			
T5 age	1.26	.81–1.97	.30
Sex	2.52	.72–8.85	.15
Maltreatment	4.39	1.18–16.20	.03
# Friends online-only & drinkers	1.47	.94–2.30	.09
# Friends offline & drinkers	1.86	1.13–3.08	.02
Outcome: Marijuana Use (% marijuana users=51.1)			
<i>Model 3: IVs Maltreatment x online friends</i>			
<u>Step 1</u>			
T5 age	.79	.59–1.04	.09
Sex (ref: male)	1.43	.64–3.21	.38
Maltreatment (ref) vs comparison	1.12	.51–2.45	.78
# Friends online-only & mj users	2.41	1.13–5.16	.02
<u>Step 2</u>			
Maltreatment (ref) x # Friends online-only & mj users	1.00	.20–5.01	.99
<i>Model 4: IVs Maltreatment, online friends, offline friends</i>			
T5age	.78	.55–1.11	.17
Sex (ref: male)	1.53	.54–4.31	.42
Maltreatment (ref) vs comparison	.81	.29–2.25	.68

	Odds Ratio	95% Confidence Interval	<i>p</i>
# Friends online-only & mj users	1.24	.53–2.87	.62
# Friends offline & mj users	2.87	1.94–4.26	.00

Note: IVs=independent variables; mj-marijuana; problem drinker (yes/no) defined as passing out drunk at least once in the past 12 months; marijuana use (yes/no) defined as using marijuana one or more times in the past 12 months