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## The Effects of Peer Connectedness and Popularity in Predicting Adolescent E-Cigarette and Binge Drinking Patterns Across the COVID-19 Pandemic

Kyla N. Lamb

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THE EFFECTS OF PEER CONNECTEDNESS AND POPULARITY IN PREDICTING  
ADOLESCENT E-CIGARETTE AND BINGE DRINKING PATTERNS ACROSS THE  
COVID-19 PANDEMIC

by

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Submitted in Partial Fulfillment  
of the requirements for the degree of  
Bachelor of Arts  
in  
Honours Psychology

Faculty of Arts and Social Science

Huron University College

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April 30, 2022

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CERTIFICATE OF EXAMINATION

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## Abstract

Despite research in adolescent substance use being a well-established discipline, little is known about the relationships between substance use during the COVID-19 pandemic when related to self-reported popularity and peer connectedness as predictors of this behaviour. This study sought to determine how binge drinking and vaping changed from the beginning of the pandemic (T1) to June 2021 (T2) and to examine how self-reported popularity and peer connectedness were predictors of this behaviour. At T1, there were 937 adolescent participants between 14-18 years of age ( $M_{age} = 16.93$ ,  $SD = .85$ ; 76.7% female, 21% male, and 2.3% other) and at T2, there were 489 adolescent participants ( $M_{age} = 17.96$ , 79.1% female, 17.6% male and 2.8% other). Participants completed online self-report surveys with questions related to their substance use frequency, peer connectedness during the pandemic and self-reported popularity at both T1 and T2. It was hypothesized that binge drinking and vaping frequency, operationalized as the number of days of use in the last three weeks, would be greater at T2 compared to T1. Furthermore, it was hypothesized that self-reported popularity and peer connectedness at T1 would predict increased substance use at T2. A paired-samples *t*-test revealed that adolescents binge drank and vaped more at T2 compared to T1. Stepwise linear regression revealed that T1 popularity was a significant predictor of vaping at T2 but not binge drinking at T2, although the results did not predict increases in vaping from T1 to T2. Last, the regression substantiated that increased peer connectedness at T1 did not predict increased substance use at T2. These findings suggest that adolescents may be at a greater risk negative consequences related to substance use and self-reported popularity. Implications, results for adolescent substance use, as well as prevention, intervention, and future directions are discussed.

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## Introduction

Adolescent substance use patterns and related risk-taking behaviours have remained a pertinent topic amongst researchers and the general public for decades. In 2019, more than 40% of Canadian adolescents (13-18 years old) engaged in alcohol use and 22.7% reported using e-cigarettes (vaping) (Boak et al., 2020). In March of 2020, shortly before the commencement of this research, the world was put into a state of emergency due to the declaration, by the World Health Organization, of a pandemic because of the circulating COVID-19 virus. The stay-at-home orders implemented by the Canadian federal and provincial governments forced all persons to stay home, reduce their contacts, limit exposures in their communities, and only leave their house for essential trips such as going to work, going to the grocery store and medical appointments. For some adolescents, home can be isolating, lonely, unsupportive and can foster increased risk of adverse childhood experiences such as physical abuse and neglect (Cohen & Bosk, 2020). Also, adolescence is characterized as a period over the course of one's development where substance use exploration becomes more salient and factors such as peer connectedness, popularity, and rewards may predict substance use behaviour (Dumas et al., 2020). As Kuntsche and colleagues (2005) found, most adolescents use substances in social contexts, and it is likely that their substance use behaviours have changed over the course of the lockdowns. Because of the circumstances of the pandemic, adolescents lacked face-to-face social interactions that are often a result of attending school, work, social gatherings, and hanging out with friends. Therefore, adolescents did not have nearly as many opportunities to experiment with substances and other risk-taking behaviours.

Previous research has suggested that vaping among adolescents is ever present and the use of e-cigarettes is disproportionately higher amongst teenagers compared to all other age groups (Chao et al., 2019). The 2019 National Youth Tobacco Survey indicated that 10.5% of middle school students and 27.5% of high-school students reported actively using e-cigarettes in their daily lives, over five million students reported using e-cigarettes in the last 30 days and nearly one million reported vaping in the last 24 hours (Groom et al., 2021). Chao et al. (2019) also noted that vaping may be a gateway substance to cigarette smoking and other risky behaviours in adolescence such as alcohol use. Further, social influence has been known to be a factor that initiates conventional smoking and one's behaviour is often a reflection of their peers and social networks (Chao et al., 2019). The findings of Chao and colleagues' (2019) study indicate that adolescents are more intrigued to begin vaping due to curiosity rather than the intended purpose of the creators which was to help cigarette smokers to quit. In addition, they found that if the influence of vaping in society increases and adolescents are surrounded by people in their immediate circles who partake, there is an increased chance of dual smoking (vaping and cigarette use combined) as well as an increase in cigarette smoking alone. Other research indicates that all adolescents, those who use vapes and those who do not, recognize the popularity and acceptance of these tobacco products amongst their peers (Groom et al., 2021). Further, peer influence has been recognized as one of the most influential driving factors of adolescent vaping; most adolescents receive their first vaping product from a friend or identify that their first time using a vape was with the accompaniment of a friend (Groom et al., 2021). Adolescents also identify that feeling included by peers in this popular activity is an extremely strong driving force leading a teen to want to partake (Groom et al., 2021).



In continuation, Dumas and colleagues (2020) reported on how substance use changed among adolescents during the COVID-19 pandemic and noted a significant decrease during the initial shutdown in the frequency of teens who vaped and engaged in binge drinking (4+ drinks for females and 5+ drinks for males in one sitting). Due to the strict rules imposed by the governments in order to reduce the spread of the deadly virus, adolescents were not able attend school in person, participate in extracurricular activities, spend time with their friends and therefore not as readily exposed to substances such as vapes in their homes. A study conducted in California indicated that adolescents reported less e-cigarette usage at the beginning of the stay-at-home orders however, this may have been a result of diminished access to products such as vapes because of decreased in person peer interactions and the closure of non-essential stores which would have included vape stores (Chaffee et al., 2021). Moreover, adolescents with pre-existing substance use disorders might face further obstacles related to accessing mental health and substance use supports due to the limited access to appointments because of the excessive strain on the medical care system throughout the pandemic (Cohen & Bosk, 2020). This may be concerning for many reasons but notably, because adolescent substance use can lead to other substance use disorders, poorer physical and mental health that was likely already being impacted as a result of being forced to isolate in lonely home environments and lacking stimulating social interactions (Hingson & White, 2014; Mental Health Services Administration, 2017).

As Kuntsche et al. (2005) highlighted, most adolescents consume and engage in substance use for social purposes and to establish or maintain status amongst their peers and are less likely to use substances as coping mechanisms or alone. Friends and peers have been

deemed as key contributing factors in determining whether, when and how much adolescents consume alcohol (Cheadle et al., 2015). Additionally, it is well known that adolescents are very concerned with maintaining popularity and peer status and this popularity is often associated with mild-to-moderate substance use as well (i.e., drinking or vaping) (Dumas et al., 2020). Some studies indicated that by twelfth grade, 75% of adolescents report that one or more of their friends drink until drunk routinely and that over 80% drink to have a “good time” with friends and peers (Cheadle et al., 2015). These statistics suggest that peers and friendship networks must play a critical role in determining how alcohol is related to achieving high social status and popularity amongst this young and vulnerable age cohort. The relationships between adolescent drinking and friendships is quite dynamic and fluid as adolescent drinking may predict friendships but is simultaneously influenced by those relationships (Cheadle et al., 2015). Adolescents who are more connected to their friends generally have more opportunities to use various substances such as alcohol and vaping products (Dumas et al., 2020). The contributions of Cheadle et al. (2015) explained that drinking is less related to continuing pre-existing relationships and is more strongly related to the formation of new friendships. Therefore, it is possible that a higher self-reported popularity at Time 1 and increased peer connectedness at Time 1 will predict increased substance use at Time 2 because the more connected and greater an adolescent’s network size and the more popular adolescents rate themselves at the beginning of the pandemic, the more likely they may seek their friends to engage in binge drinking and vaping at Time 2.

Based on these prior findings, in the present study it is hypothesized that that increased peer connectedness, even during the pandemic where connectedness might not be physical, will

predict increased substance use in different capacities. Because freedom was being constantly increased with the presence of vaccines and vaccine passports at Time 2, adolescents will be much more likely to engage in social gatherings with friends and peers therefore potentially increasing the likelihood they partake in risky behaviours such as binge drinking and vaping to help make up for “lost time” during the lockdowns.

The goal of this study is to examine how adolescents’ substance use, specifically pertaining to vaping and alcohol use, has changed from the beginning of the pandemic (April 2020; Time 1) to June of 2021 (Time 2), in addition to peer-related predictors of this substance use. Adolescents from Ontario completed online surveys at two different time points that contained questions regarding their substance use behaviours (i.e., binge drinking and vaping frequency), in addition to their peer connectedness and popularity.

I hypothesize the following:

H<sub>1</sub>A: Binge drinking will increase from Time 1 to Time 2.

H<sub>1</sub>B: Vaping will increase from Time 1 to Time 2.

H<sub>2</sub>: Self-reported popularity at Time 1 will predict increased substance use at Time 2.

H<sub>3</sub>: Increased peer connectedness at Time 1 during the pandemic will predict increased substance use at Time 2.

## Method

### Participants

The sample consisted of 1068 adolescents who completed one or more time points of this study. At Time 1, data was collected from 937 adolescents. The remainder (131 participants; 12.3%) either consented to participate and be contacted for future studies but did not complete T1 survey or only completed the demographics portion of the survey. At T1, the 937 participants were 14-18 years of age ( $M_{age} = 16.93$ ,  $SD = .85$ ; 76.7% female, 21% male, and 2.3% other), with 65.2% identifying as White/European, 16.3% as Asian, 3.9% as Black North American/African, 3.1% as Latino and 11.6% as Other. A majority were currently living with a parent or guardian (98.86%) and the remainder lived with siblings, romantic partners, or roommates (1.14%). At Time 2, data was collected from 489 adolescents ( $M_{age} = 17.96$ , 79.1% female, 17.6% male and 2.8% other). Reported participant numbers do not reflect individuals who failed to appropriately answer validation questions/attention checks (i.e., “for this item, check the *strongly agree* box”) in one or both surveys in the study ( $n = 512$ ).

### Procedure

First, ethical approval was obtained via Huron University College’s ethics board. Recruitment and data collection for Time 1 survey occurred from April 4<sup>th</sup> to April 16<sup>th</sup>, 2020, approximately three weeks after secondary schools in Ontario, Canada were closed indefinitely due to the declaration of the COVID-19 pandemic. Participants were recruited through an ad posted to the Huron Health & Peer Relationships Lab’s *Instagram* page and promoted on 16–18-year-olds Ontarians’ *Instagram* pages via the promotion feature for one week. Adolescents under the age of 16 were not recruited in this manner due to the challenges of obtaining

parental consent, which is mandatory for this age cohort according to Canada's research ethics policy. The survey link was also emailed to a group of 155 adolescents between the ages of 14-18 who were, at the time, completing a longitudinal survey for the Health & Peer Relationships Lab and for whom those under the age of 16 had already received parental consent.

Survey 1 contained demographic questions pertaining to gender identity, age, and education level. Participants were then asked questions regarding their substance use, specifically binge drinking and vaping. Participants were also asked questions related to their peer connectedness and self-reported popularity. After the survey was completed, participants were asked to create a unique participant ID in order to maintain anonymity but also have a way to link their data during Survey 2, should they choose to participate in future, related, studies. The participant ID that they created consisted of the first initial of their first name, the first initial of their last name, as well as the first four letters of the name of the street they live on.

Participants were contacted again in June 2021, approximately fifteen months after they completed Survey 1, by the researchers via email. The email invited participants to complete Survey 2 through a link provided using their participant ID. Survey 2 contained the same measures as Survey 1, however, slightly different wording to account for the time lapse of a year between surveys. Each survey took participants about 30 minutes to complete.

Reimbursement for Time 1 survey included entry to a draw to win one of ten \$50 gift cards or *Apple AirPods* and reimbursement for Time 2 survey included a guaranteed \$15 e-gift card.

### **Measures**

The measures specific to this study are described below.

### ***Substance Use Behaviour***

Participants were asked to report the number of days in the past three weeks that they engaged in substance use behaviours including: (1) binge drinking (i.e., consumed 4+/5+ standard drinks for females/males in one sitting) and (2) used e-cigarettes (i.e., nicotine vapes) (Collins et al., 1985).

### ***Peer Connectedness During the Pandemic***

Participants were presented with one statement related to peer connectedness that read: “In general, I have friends I can talk to, who care about my feelings and what happens to me” and were asked to rate this statement using a 4-point Likert-type scale, with 1 = Not at all true for me, 2 = Sometimes true for me, 3 = Often true for me and, 4 = very true for me.

### ***Self-Reported Popularity***

In order to measure self-reported popularity, participants were asked to use a slide scale to rate how popular they are compared to the rest of their grade/their friends (Dumas et al., 2019). The scale ranged from 1 = least popular to 10 = most popular.

### **Analytic Plan**

To test H<sub>1A</sub>, that binge drinking will increase from Time 1 to Time 2, a paired-samples *t*-test was conducted with time as the independent variable and binge drinking as the dependent variable. Subsequently, to test H<sub>1B</sub> that vaping will increase from Time 1 to Time 2, another paired-samples *t*-test was conducted with time as the independent variable and vaping as the dependent variable.

To examine if greater self-reported popularity (H<sub>2</sub>) and peer connectedness at T1 (H<sub>2</sub>) will predict more substance use at T2, two stepwise linear regressions were conducted using

IBM SPSS Version 27 with binge drinking and vaping as the dependent variable. For both regressions, the first step included gender, age, self-reported popularity, and peer connectedness at Time 1 as predictors. In the second step, Time 1 substance use (binge drinking/vaping) was included as a covariate in order to test if self-reported popularity and peer connectedness predict increases in substance use from Time 1 to Time 2. This allows for the dependent variable to represent a marker of change, i.e., increases or decreases in binge drinking/vaping relative to initial levels of that same behaviour (Cohen & Cohen, 1983).

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## Results

### Descriptive Statistics

Table 1 reports the means, standard deviations, and correlations for the variables of interest at Time 1 and Time 2. The average adolescent engaged in binge drinking 0.19 days on average in the past three weeks at Time 1 and 1.51 days at Time 2. The average adolescent engaged in vaping for 0.47 days on average in the past three weeks at Time 1 and 1.26 days at Time 2.

Pearson correlations conducted on the variables of interest found that both Time 1 and Time 2 binge drinking were significantly and positively correlated with Time 1 and Time 2 vaping (see Table 1). Further, significant positive correlations emerged between age and binge drinking at Time 1 and Time 2 as well as vaping at Time 1. Peer connectedness at Time 1 was positively and significantly correlated with self-reported popularity at Time 1 and Time 2 and peer connectedness at Time 2. Next, binge drinking and vaping at Time 1 were also found to be positively and significantly correlated with self-reported popularity at Time 1. Binge drinking at Time 2 was correlated with peer connectedness and self-reported popularity at Time 2. Last,

more positive and significant correlations arose between vaping and self-reported popularity at Time 2.

### **Hypothesis Testing**

Consistent with H<sub>1A</sub>, a paired-samples *t*-test revealed that adolescents binge drank significantly more frequently at Time 2 ( $M = 1.51, SD = 2.58$ ) compared to Time 1 ( $M = 0.19, SD = 1.14$ ),  $t(389) = -10.03, p < .001$ . Further, consistent with H<sub>1B</sub>, another paired-samples *t*-test indicated that adolescents vaped significantly more frequently at Time 2 ( $M = 1.26, SD = 4.31$ ) compared to Time 1 ( $M = 0.47, SD = 2.38$ ),  $t(387) = -4.21, p < .001$ . Therefore, H<sub>1A</sub> and H<sub>1B</sub> were fully supported by the data collection.

The results of the linear regression analyses are presented in Table 2. H<sub>2</sub> was partially supported in that Time 1 self-reported popularity was a significant predictor of vaping at Time 2 (see Model 2, Step 1), but not binge drinking at Time 2 (see Model 1, Step 1). That being said, when Time 1 vaping was included as a covariate (see Model 2, Step 2), Time 1 self-reported popularity was no longer a significant predictor. This suggests that while greater self-reported popularity was associated with more vaping, it did not predict increases in vaping from Time 1 to Time 2. Other significant predictors included older age for binge drinking and gender (identifying as female) for vaping. Finally, H<sub>3</sub> was not supported in that increased peer connectedness at Time 1 did not predict increased vaping or binge drinking at T2.

### **Discussion**

The results of this study support H<sub>1A</sub> and H<sub>1B</sub>, such that adolescents engaged in binge drinking and vaping more days in the past three weeks at Time 2 compared to Time 1. This finding extends past research from Bonar et al. (2021) which found that approximately 40% of



university students reported binge drinking less when their campus was initially closed as a result of public health measures (T1). Despite still being in lockdown at Time 2, the prevalence of vaccines was increasing, outdoor gatherings became more common and socially accepted and students were more familiar with adapting to life in lockdown compared to April 2020 (T1). Given that most adolescents consume substances for social purposes such as maintaining social status and popularity, this may help to explain the lack of use at Time 1 when social gatherings were strictly prohibited by government officials (Dumas et al., 2020). Data at Time 1 was collected in April 2020 right at the beginning of the pandemic when there was extreme uncertainty and families were forced to adapt and navigate unfamiliar circumstances. Results from Miech et al. (2021) revealed that the beginning of the pandemic marked the most notable adolescent substance use decrease in nearly forty-five years. The results of the present study reflect minimal binge drinking and vaping at Time 1 which might have been attributed to the unknown circumstances at the beginning of the pandemic. This unprecedented time decreased substance availability for adolescents, which is also likely a key reason for decreased frequency of binge drinking and vaping use during this time (Miech et al., 2021).

When parents and adolescents were required to isolate together for extended periods of time during lockdown, Dumas et al. (2020) noted that there were significant changes to drinking behaviours that included adolescents drinking more frequently with their parents. When adolescents were drinking in the presence of their parents, their parents were able to carefully monitor their adolescents' alcohol intake, leading many parents to believe that this was a safer practice for exploring substance use (Friese et al., 2012). However, Dumas et al. (2020) discovered an interesting result that adolescents who drank with their parents during lockdown

were more likely to binge drink in contexts beyond their household environment. Considering that the findings of the present study reveal increased substance use at Time 2 compared to Time 1, it would be interesting to consider if this increase could have been influenced by adolescents drinking with their parents at T1; a behaviour that was not always previously condoned by parents and the increase in drinking may have been result of permissive parenting at T1 (Dumas et al., 2020; Friese et al., 2012). Future research should extend these findings as drinking with parents during lockdown (T1) appears to be an important variable when predicting increased adolescent binge drinking in other settings and not a protective factor against binge drinking like many parents once believed.

Moreover, at Time 2 (June 2021), pandemic-related restrictions were being removed as a consequence of increased vaccination rates and lower coronavirus case counts in Ontario. Despite social distancing measures and masking requirements still being enforced by the government, the prevalence of binge drinking amongst older adolescents and young returned to levels similar to those prior to March 2020's initial lockdown in the summer months following the first lockdown, according to the research of Miech et al. (2021), which was also reflected in the data analysis of the present study.

It is necessary to consider the possibility that substance use patterns changed as a function of an adolescents' age. Kirst and colleagues (2014) explained that as adolescents approach young adulthood, substance use has shown to increase and is especially notable during the transition from high school to university, college, or the workforce. The discrepancies in substance use during this transition period can be attributed to many exterior factors such as increased independence and autonomy, new peer groups, and increased social norms surrounding

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alcohol consumption (Kirst et al., 2014). At Time 1, all participants were not of legal drinking age however by the completion at Time 2, nearly fourteen months had passed, meaning that a significant portion of the participants had completed high school and likely shifted paths to post-secondary education and careers, which could also have contributed to the increased binge drinking at Time 2 (Neighbors et al., 2007). Furthermore, Sylvestre et al. (2022) noted from their study that increased prevalence of vape usage was associated with young adults who lived alone compared to those who resided with others. Thus, as this participant pool aged, it was increasingly likely that they gained autonomy and independence by moving away from home to pursue a school opportunity, which may account for the increase in vape use at Time 2.

It has been previously established by Pepper and colleagues (2018) that most adolescents owned a vaping device that they either acquired by purchasing it at a store, buying it from another person, or giving someone money to purchase for them. Given the circumstances of the lockdown measures at Time 1, it is likely that adolescents did not have this opportunity as stores were closed and opportunities for adolescents to gather were substantially lessened. Further, Pepper et al. (2018) explained that nearly 75% of adolescents had reported using a friend's vaping paraphernalia in the past month. Adolescents who reported vaping most frequently did not own vape products themselves, and those who vaped in social situations were most likely to use a friend's vape (Pepper et al., 2018). The findings of Pepper et al. (2018) highlight the crucial social experience that appears to be an essential factor in adolescents acquiring, using, and obtaining vape products. This was severely limited at Time 1 and much more likely as restrictions lifted at Time 2, helping to reflect the finding that usage was increased at Time 2 compared to Time 1.

Results partially support H2, such that self-reported popularity at the commencement of the study was a significant predictor of vaping at Time 2 but was not a significant predictor of binge drinking at Time 2. Despite the significant findings for vaping substance use patterns, when Time 1 vaping was included as a covariate, Time 1 self-reported popularity was no longer a significant predictor of this behaviour. These results extend the findings of Allen et al. (2006) and their work with the popularity-socialization hypothesis. This hypothesis states that high levels of popularity in adolescence would be associated with increases in mild-to-moderate deviance such as alcohol experimentation (Allen et al., 2006). Further, the popularity-socialization hypothesis was not to predict increases in behaviours that are less accepted or less normative that could threaten relationships with peers (Allen et al., 2006). Binge drinking may be considered a behaviour that is less accepted by peers as this form of problem drinking is associated with immediate consequences such as motor vehicle crashes, intentional or unintentional injuries, academic problems and risky sexual behaviours as well as long-term consequences such as alcohol abuse problems (McCarty et al, 2004). These findings by Allen et al. (2006) and McCarty et al. (2004) may help to support why self-reported popularity at Time 1 was a significant predictor of vaping at Time 2 but not binge drinking due to the heavy physical, psychological, and social consequences associated with binge drinking in adolescence compared to vaping.

It is possible that self-reported popularity at the beginning of the pandemic (T1) predicted increased vaping at Time 2 because of technophilia. Technophilia is defined as a positive orientation to new technology (Barrientos-Gutierrez et al., 2018). E-cigarettes have been developed and advertised as a high-tech adaptation or alternative to cigarette smoking, ultimately

making it more attractive to adolescents who are largely technologically advanced and motivated (Barrientos-Gutierrez et al., 2018). Technophilia has been related to increased use of electronic media and social media which was one of the only methods of communication or ability to establish social status and popularity at Time 1 (Barrientos-Gutierrez et al., 2018). E-cigarette companies have targeted their advertising campaigns to popular social media platforms such as Twitter and Facebook for years. This heavy marketing exposure is likely to expose youth to this new, “cool”, alternative to smoking (Barrientos-Gutierrez et al., 2018). It is known that adolescents are particularly vulnerable to peer influence and maintaining status on social media platforms (Sun et al., 2021). Platforms that emerged before the pandemic, that gained popularity and significant attention such as TikTok have been promoting or getting famous influencers to promote trends before and throughout the pandemic, such as “nicotine addiction check” memes which trivialize and glorify this terribly harmful addictive substance (Sun et al., 2021). Lastly, it may be due to this technological exposure before and at the beginning of the pandemic amongst self-reported popular youth that helps to account for increased vaping among adolescents at time 2, however, does not account for the increase from Time 1 to Time 2.

Despite the fact that the present study did not support that self-reported popularity at Time 1 would predict more frequent binge drinking at Time 2, this might have been a result of confusion regarding social status and popularity at the beginning of the pandemic. Popularity is thought to be based on the foundational developmental changes from early adolescence and is severely intertwined with substance use (Malamut et al., 2020). With the uncertainty and uncharted territories that the COVID-19 pandemic presented adolescents with during the time of completion of the first survey (T1), it is possible that this created increased inflated stress,

anxiety, and helpless feelings (Singh et al., 2020). These unforeseeable circumstances may have impacted the participants' ability to reflect and report on their social status and reported popularity since it relied heavily on in-person peer interactions, which were significantly decreased because of being confined to one's home. Furthermore, there was only one-item related to self-reported popularity in the survey which was a scale where participants had to rate how popular they believed themselves to be compared to their peers from 1 (least popular) to 10 (most popular). This single scale unit may not have been accurately representative of an adolescent's true popularity at the time of the survey and did not consider other measures of popularity, such as peer nominations or ratings of popularity, teacher ratings or observational methods. Further, it may have been beneficial to give participants a standard definition of what popularity is to decrease the variability in the meaning of popularity which can vary as a function of age, gender, ethnicity, and culture (Cillessen et al., 2011). Comparable to the definition of friendship, there are a wide variety of definitions and meanings of popularity between adolescents of different ages and the meaning and importance of popularity is also likely to change and adapt as a function of age (Cillessen et al., 2011; LaFontana & Cillessen, 2010). Future studies should consider this fault in the present study and provide a standard definition to develop a more concrete understanding in what popularity meant to youth and therefore, yield a more accurate findings to support the relationship between popularity and substance use frequency.

The results of this study did not support H3, in that peer-connectedness at Time 1 did not predict increased vaping or binge drinking at Time 2. It is known that peer connectedness is defined as perceptions of support, caring and trust in one's peer group (Bernat & Resnick, 2009).

Furthermore, Pardini and colleagues (2012) highlighted that adolescents who affiliate with peers who engage in risk taking behaviours are more likely to engage in these behaviours themselves. Because each participant's peer connectedness was threatened by the confounds of the pandemic, it is possible that the data obtained at this time point was not an accurate representation of true peer connectedness and therefore did not result in any significance found with relation to Time 2 substance use.

Similar to the self-reported popularity measure, there was only a single item measure of peer connectedness at Time 1 which required participants to report, using a Likert scale, their feelings regarding supportive peers at this time. Peer connectedness is a complex variable that may contribute to an enhanced sense of belonging, increased social network, active engagement in the community, and engagement of pro-social activities (Foster et al., 2018). This might have been a limitation of this study as it is possible that it was not a comprehensive measure of the complex factors that go into establishing and reporting peer connectedness, especially during an extremely vulnerable period of one's life (adolescence) and the circumstances of the beginning of the pandemic. Future research studies should consider using a more complex scale such as an adaptation of the Hemingway's Adolescent Connectedness Scale (Karcher & Sass, 2010) that provides more comprehensive and representative items that completely assess adolescents' perceived support by peers and friends.

The lack of significance in the data obtained with regards to H3 may also be an extension of the Prototype-Willingness model, which states that adolescent risk behaviours, such as binge drinking or vaping, are reactions to social situations and are not planned or intended actions (Teunissen et al., 2014). This emphasizes that with lack of opportunity to establish peer

connectedness or report on feelings of peer connectedness at the beginning of the pandemic by attending school in person or planning social gatherings with peers, it is likely that adolescents did not engage in alcohol use due to lack of opportunities to encountering situations in which they had opportunities to drink and partake in vaping behaviours (Teunissen et al., 2014).

Another limitation of this study that should be acknowledged is the fact that these surveys required participants to self-report their responses. Although self-report measures are fairly easy to administer and straight-forward to follow, especially during COVID and times of limited person-to-person contact, they do have limitations. For example, the social desirability hypothesis may have played a role in participants' ability to accurately report their findings (Lavrakas, 2008). The social desirability hypothesis refers to the tendency of respondents to report answers to surveys in such a way that are more socially acceptable than what their true response would be (Lavrakas, 2008). In this case, it is possible that respondents underreported their substance use since it is considered a socially undesirable behaviour, in an attempt to report frequencies that are more socially respectable. In addition, adolescents might have overreported peer connectedness and popularity to favourably portray their self-image.

In the future, it may be beneficial for researchers to consider parental influence on binge drinking and vaping beyond the COVID-19 pandemic. As confirmed by the data of the study, binge drinking and vaping were significantly higher at the end of the pandemic compared to the beginning, which is likely a result of many interacting variables. Parents are considered to be "the best role models" for their children and one's home to be one of the best places to learn essential life skills such as coping with stress in healthy manner, problem solving and learning how to appropriately express emotion (Singh et al., 2020). As reported in Dumas et al.'s (2020)



research, an alarming number of adolescents were using substances with their parents during lockdown periods of the COVID-19 pandemic. Despite alcohol use with parents being highly monitored, research has revealed the negative implications of such some of which being that adolescents who drink moderately with their parents being more likely to engage in binge drinking outside of their home (Dumas et al., 2020). This is a major point of concern when reflecting on the learned alcohol consumption habits for adolescents from their parents during lockdown considering that parents are supposed to set standards for desirable and appropriate behaviours for their offspring. By demonstrating approval with the consumption of alcohol may have led to the increase binge drinking in other contexts beyond the home environment (Dumas et al., 2020; Pape & Bye, 2017). Additionally, the Norwegian health authorities have extensively expressed that no parent should offer their underage adolescents any alcohol in any context because of the harmful and heavy consumption relationships that exist (Pape & Bye, 2017). Future studies should assess the lasting mental health or addiction rates amongst teenagers beyond the pandemic, parental-child attachment styles that lead to variations in alcohol consumption and analyze adolescents' perception of appropriate alcohol use (i.e., as a coping mechanism, social tool, etc.). Simultaneously, research should consider frequency and amount of parental alcohol consumption in front of their children and why parents drink or drank during the pandemic and compare such results to those of their adolescents to determine if any significant relationships exist between these entities.

In conclusion, this study expanded on previous findings by linking substance use, specifically binge drinking and vaping, peer connectedness and self-reported popularity during the recent COVID-19 pandemic through a longitudinal design. The results found that there was

more frequent substance use in June 2021 (T2) compared to April 2020 (T1) (H<sub>1</sub>A and H<sub>1</sub>B) and that greater self-reported popularity in April 2020 predicted more vaping in June 2021 (H<sub>2</sub>). These findings have important implications and emphasize the importance of addressing current and past adolescent binge drinking and vaping frequency and establishing relationships between self-reported popularity and peer connectedness with substance use behaviours. Future researchers may wish to consider the implications of increased binge drinking and vaping and the consequences this may have on the mental and physical well-being of adolescents as they transition into adult life as well as considering the influence that parental-condoned drinking may have on an adolescents' relationship with substance use. Because the COVID-19 pandemic is still on-going there is still much to learn about the lasting impacts, especially for vulnerable adolescents are their ability to connect with peers, establish and experience popularity and use substances during unprecedented times.

**Table 1.** Means, standard deviations and correlations between binge drinking, peer connectedness, vaping, and self-reported popularity at Time 1 and Time 2.

	<i>M (SD)</i>	1	2	3	4	5	6	7	8	9
1. Age	16.93 (0.85)	--	<b>.068*</b>	.040	<b>.088**</b>	-.049	<b>.114*</b>	.039	-.029	-.019
2. Binge Drinking (T1)	0.31 (1.35)	--	--	-.009	<b>.300**</b>	<b>.082*</b>	<b>.369**</b>	<b>.362**</b>	.094	.052
3. Peer Connectedness (T1)	3.22 (0.87)	--	--	--	.027	<b>.210**</b>	.036	-.024	<b>.459**</b>	<b>.221**</b>
4. Vaping (T1)	1.02 (3.92)	--	--	--	--	<b>.141**</b>	<b>.232**</b>	<b>.516**</b>	.003	.094
5. Self-Reported Popularity (T1)	5.21 (2.25)	--	--	--	--	--	.058	.076	<b>.207**</b>	<b>.716**</b>
6. Binge Drinking (T2)	0.43 (1.25)	--	--	--	--	--	--	<b>.277**</b>	<b>.094*</b>	<b>.119**</b>
7. Vaping (T2)	1.40 (4.56)	--	--	--	--	--	--	--	.018	<b>.105*</b>
8. Peer Connectedness (T2)	3.09 (0.82)	--	--	--	--	--	--	--	--	<b>.221**</b>
9. Self-Reported Popularity (T2)	4.75 (2.34)	--	--	--	--	--	--	--	--	--

Note: \*. Correlation is significant at the 0.05 level (2-tailed)

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 2. Results of Regression Analyses Predicting Substance Use.**

	Model 1		Model 2	
	Predicting Binge Drinking		Predicting Vaping	
	Step 1	Step 2	Step 1	Step 2
	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)	<i>B</i> (SE)
Peer				
Connectedness	.016 (.065)	.019 (.061)	-.055 (.255)	.000 (.221)
Self-Reported				
Popularity	.064 (.026)	.036 (.025)	<b>.106 (.104)</b>	.025 (.090)
Gender	.043 (.141)	.025 (.132)	<b>.136 (.550)</b>	<b>.128 (.473)</b>
Age	<b>.142 (.064)</b>	<b>.105 (.060)</b>	.055 (.250)	-.017 (.217)
Binge Drinking	--	<b>.355 (.046)</b>	--	--
Vaping	--	--	--	<b>.518 (.080)</b>

Note: *Bold* = significant  $p < 0.05$

Commented [KNL5]: is this table formatted properly? do I need to make a statement at the bottom that the bolded numbers are significant? or is this the proper way?

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