Understanding Changes in Social Cannabis Use among Young Adults During the COVID-19 Pandemic: A Social Network Analysis

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ABSTRACT

Introduction. As the COVID-19 pandemic has caused historic morbidity and mortality and disrupted young people's social relationships, little is known regarding change in young adults' social cannabis use following social distancing orders, or other factors associated with such changes before and during the pandemic. **Methods.** 108 young adult cannabis users in Los Angeles reported on their personal (egocentric) social network characteristics, cannabis use, and pandemic-related variables before (July 2019 – March 2020) and during the COVID-19 pandemic (August 2020 – August 2021). Multinomial logistic regression identified factors associated with increasing or maintaining the number of network members (alters) participants used cannabis with before and during the pandemic. Multilevel modeling identified ego- and alter-level factors associated with dyadic cannabis use between each ego and alter during the pandemic. **Results.** Most participants (61%) decreased the number of alters they used cannabis with, 14% maintained, and 25% increased. Larger networks were associated with a lower risk of increasing (vs. decreasing); more supportive cannabis-using alters was associated with a lower risk of maintaining (vs. decreasing); relationship duration was associated with a greater risk of maintaining and increasing (vs. decreasing). During the COVID-19 pandemic (August 2020 – August 2021), participants were more likely to use cannabis with alters they also used alcohol with and alters who were perceived to have more positive attitudes towards cannabis. **Conclusions.** The present study identifies significant factors associated with changes in young adults' social cannabis use following pandemic-related social distancing. These findings may inform social network interventions for young adults who use cannabis with their network members amid such social restrictions.

Key words: egocentric networks; social network analysis; social distancing; COVID-19; young adults; cannabis

The severe acute respiratory syndrome coronavirus (SARS-CoV-2) that causes the coronavirus disease 2019 (COVID-19) is responsible for over 950,000 deaths in the United States to date (Center for Systems Science and Engineering, 2022). Less known is the impact of social distancing and related mandates on individuals' substance use behaviors at different points during the pandemic. This is especially true for young adults, some of whom continued socializing (e.g., attending parties or large gatherings) despite social distancing

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recommendations (Park et al., 2020; Suffoletto et al., 2020). Throughout the pandemic, social alcohol use at bars and restaurants has been deemed a high-risk activity, as it may increase the risk of coronavirus transmission (Fitzgerald et al., 2021). While the link between COVID-related social stressors and increased cannabis use has been documented (Bonar et al., 2021), social cannabis use before and during the pandemic has received less attention.

Research conducted prior to the pandemic supports that cannabis is often consumed by young adults amongst small groups of friends by sharing blunts, bongs, and other devices used to consume cannabis (Dunlap et al., 2005; Kelly, 2005). Research with Dutch young adults has found that solitary cannabis use most of the time was reported by 27% and 16% of users with and without cannabis dependence, respectively (Van der Pol et al., 2013). Among young adult college student cannabis users, social cannabis use was reported almost twice as often (7 days per month) than solitary cannabis use (4 days per month) on average (Buckner et al., 2016). Given that the traditionally social nature of cannabis use—whether for recreational or medical purposes—may run counter to social distancing recommendations, particularly among young adults and, whose cannabis use during the pandemic appeared to have increased (Boehnke et al., 2021; Fedorova et al., 2021; Graupensperger et al., 2021; Schepis et al., 2021), additional research is needed to better understand how social isolation and restriction resulting from a pandemic could significantly alter social cannabis use for young adult users.

The literature is presently unclear on the extent to which social distancing, a key measure to control the pandemic which has been found to increase one's sense of social isolation and loneliness (Czeisler et al., 2022; Lee et al., 2020; Weissbourd et al., 2021), has impacted the social use of cannabis among young adults. Some evidence indicates that young adult cannabis users may have reduced their use with others (Bonar et al., 2021). On the other hand, countervailing pressures may present barriers to adherence to social distancing and limiting using cannabis use with others. Indeed, one study of Canadian adolescents reported that almost a quarter (23.6%) were still practicing in-person cannabis use with friends in April 2020, directly after social

distancing orders went into effect (Dumas et al., 2020). Given the continued protracted nature of the COVID-19 pandemic and its deleterious impacts on young adult social interactions, a greater understanding of the individual and social network factors associated with continued social cannabis use during the pandemic is needed.

While individual substance use behaviors have been associated with non-adherence to social distancing during the pandemic (Fendrich et al., 2021; Taylor et al., 2021), characteristics of one's immediate social network members may offer important insights on understanding changes in the nature of social cannabis use among young adults. In social network terminology, egocentric social networks (or *ego networks*) are made up of network members (*alters*) who have direct ties to a focal individual (the *ego*) (Perry et al., 2018). This allows egos to report on the characteristics of each alter and their relationship (e.g., used cannabis together). Young adults with ego networks composed of a stronger core structure (Borgatti & Everett, 2000; Wellman et al., 1997), characterized by greater level of trust in alters, may be more likely to maintain (rather than decrease) the number of alters they use cannabis with during the pandemic (Völker, 2023). Young adults may also be more likely to use cannabis with alters they consider to be close friends (Mason et al., 2014) and alters they use other substances with, such as alcohol (Meisel et al., 2021). Propinquity, or close proximity to alters (Cairns et al., 1995), may be a significant factor as well, possibly leading to a greater tendency for young adults to use cannabis with household members because of lower perceived risks and fewer opportunities to use substances with individuals outside of the household during a pandemic (Jackson et al., 2021). Finally, since social norms play a strong role in young adults' cannabis use (Arbour-Nicitopoulos et al., 2011; Neighbors et al., 2008) and intentions to practice social distancing (Ang et al., 2021), young adults may be more likely to use cannabis with alters who they perceive to have more positive attitudes toward cannabis, and less likely to use cannabis with alters whom they perceive to have negative attitudes towards cannabis (LaBrie et al., 2011).

The present study uses egocentric social network data to identify factors associated with changes in young adults' social cannabis use during the COVID-19 pandemic, a time of

increased stress and fluctuations in public health policies associated with prescribed social distancing that has been found to increase social isolation and loneliness (Czeisler et al., 2022; Lee et al., 2020; Weissbourd et al., 2021). Thus, we address three research questions: 1) To what extent did the number of alters young adults use cannabis with change from before to during the COVID-19 pandemic? 2) What factors are associated with young adults' tendency to increase or maintain the number of alters they use cannabis with from before to during the COVID-19 pandemic? 3) What ego and alter-level characteristics are associated with using cannabis with a particular alter during the COVID-19 pandemic? Due to the novelty of this research topic, no a priori hypotheses are proposed. Therefore, we use an inductive approach to select and determine which variables may be significantly associated with young adults' cannabis use with their network members during the pandemic.

METHODS

Participants were Los-Angeles-based young adult cannabis users participating in a longitudinal study about the impact California's legalization of adult-use cannabis on cannabis use and health (Lankenau et al., 2018). Inclusion criteria were: either having a current valid doctor's recommendation for medical cannabis issued in California or never having a recommendation for medical cannabis (40% of the sample were medical cannabis patients); using cannabis at least four times in the past 30 days; residing in the Los Angeles metro area; ability to read and speak English; 18 to 20 years old at the time of enrollment. Additional participant characteristics are displayed in Table 1.

Participants (n = 139) were enrolled via targeted and chain-referral sampling at medical and recreational cannabis dispensaries, college campuses, and Craigslist, and completed a baseline survey between July 2019 and August 2020. Follow-up surveys were completed one year later, from August 2020 through August 2021. Participants were surveyed face-to-face in private (i.e., study office) and semi-private (e.g., coffeeshops, parks) locations up until the start of the COVID-19 pandemic in March 2020, and via Zoom or WebEx after March 2020 to reduce COVID-19 transmission risks. To examine the potential impact of the COVID-19 pandemic on young adults' social cannabis use behaviors, 124 participants who completed their baseline survey prior to March 1, 2020 were selected for inclusion. Of these, 16 participants with no follow-up data were excluded, resulting in an analytic sample of 108 participants with longitudinal data. A majority of participants (88%) completed their follow-up survey prior to April 15, 2021, before individuals aged 16 and older in Los Angeles were eligible to receive the COVID-19 vaccine. Data collection instruments and all study procedures were approved by the Institutional Review Boards at Children's Hospital Los Angeles and Drexel University.

Measures

Demographics. Participants self-reported their sex at birth, race/ethnicity, college student status, and relationship status (monogamous partner, open/non-monogamous partner, single). For regression analyses, relationship status was dummy coded with "single" as the reference group.

Egocentric Network Characteristics

Aggregate network variables (baseline). Participants reported their egocentric network characteristics at each survey with the help of a trained interviewer. Participants were asked to list up to 10 alters who a) provided social support, b) used cannabis with the ego, or c) served both roles in the past three months, and were then asked a series of questions about each alter (see DiGuiseppi et al. [in press] for more information). From this, total network size, number of alters who provide social support, number of alters who use cannabis with the ego, and number of alters who provide social support and use cannabis with the ego variables were calculated. Egocentric network variables were also averaged across alters, generating unique values for each ego. These variables included frequency of communication with network (1 = "Never communicate" to 6 = "Communicate every day"), trust in network (1 = "Don't trust at all" to 10 = "Trust with my life"), duration of relationship with network (1 = "known less than 1 year" to 8 = "known 31-35 years"), attitudes towards cannabis (range: 1 = "very negative" to 5 = "very positive"), and ego network density, a proportional measure of connectedness

within a network, defined by the number of actual connections between alters divided by all possible connections between alters (Perry et al., 2018, p. 175). Alter-alter connections were determined from ego's reports (1 = connection, 0 = no connection) after all alters were listed.

Alter-level variables (follow-up). A number of alter-level variables were calculated to describe characteristics of each alter and their relationship to the ego during the COVID-19 pandemic at follow-up. These included relationship type (parent, other family member, boyfriend/girlfriend, friend, drug seller, casual acquaintance, other), gender (0 = male; 1 = female; due to low sample sizes, n = 7 alters identified as transgender were recoded as missing in regression models), and young adult age group (0 = 27 years or older; 1 = less than 27 years). In addition, duration of relationship, frequency of communication, and level of trust were examined at the alter-level, as well as cannabis, alcohol, and other drug use with each alter. Variables measuring substance use with each alter were measured on a six-point scale (ranging from "Never" to "Everyday"), but were dichotomized such that 1 = monthly or more and 0 = less than monthly. This cutoff was chosen as a reasonable measure of high-risk substance use with each alter (given COVID-19 risks) and because it corresponds with our dyadic cannabis use outcome in Aim 3. Alter attitudes towards cannabis, reported by the ego, were also examined.

Pandemic-related variables (follow-up). Living situation during the pandemic was a multiple-choice item (i.e., lived with others related by marriage or birth, lived with partner, lived with roommates/friends) with categories dummy coded and "lived alone" used as the reference group in regression analyses. Social distancing was assessed with the question, "To what extent did you practice social distancing (e.g., limiting in-person communication with family members/friends not living with you; limiting time outside; or limiting excursions except for essential activity, e.g., food, medicine)". Responses were on a five-point scale ranging from 1 = "No social distancing – behaved as usual" to 5 = "Exclusive social distancing". Participants were also asked whether they experienced any of 14 mental health problems due to COVID-19 (e.g., difficulty with sleep, anxiety, depressed mood or sadness, etc.; items developed by study authors). Affirmative responses were summed to create a scale ranging

from 0-14 which demonstrated good inter-item reliability ($\alpha = 0.88$).

Ego's cannabis use, cannabis patient status, and medicinal/recreational orientation (at baseline). Medical cannabis patient was defined as having a current medical cannabis recommendation. Past 90-day cannabis use was measured using number of cannabis use days (range: 0 to 90) and typical number of hits per day ("pull off of a pipe, joint, bong, etc.") (range: 1 to "more than 100"). Medicinal/recreational orientation towards cannabis was assessed by asking participants to classify their use as "medicinal" or "recreational" on a five-point scale ranging from 1 = "exclusively medical (no recreational use)" to 5 = "exclusively recreational (no medical use)".

Dependent Variables

Change in number of cannabis use alters (baseline and follow-up). For each alter, participants answered the question "Does this person use cannabis with you?" (with six response options ranging from "Never" to "Everyday"). The number of alters egos used cannabis with "1 time a year or more", "1 time a month or more", "1 time a week or more", and "Everyday" were summed at the baseline and follow-up surveys. A three-category variable was then created, first by calculating change scores, and then categorizing whether egos decreased (0), maintained (1), or increased (2) the number alters they used cannabis with from baseline to follow-up.

Dyadic cannabis use during the COVID-19 pandemic (follow-up). A binary variable was created to indicate cannabis use with each alter (0 = ego did not use cannabis with the alter monthly or more; 1 = ego did use cannabis with the alter monthly or more often) at the follow-up survey.

Data Analysis

Our first research question regarding the extent to which young adults changed the number of alters they used cannabis with from before to during the pandemic was addressed by presenting simple descriptive statistics. Our second research question (What factors are associated with young adults' tendency to increase or maintain the number of alters they used cannabis with, from before to during the COVID-19 pandemic?) was

addressed using multinomial logistic regression. Model results are expressed in terms of relative risk ratios (RRR), with egos who decreased the number of cannabis use alters as the reference group. Model building was carried out in two steps. First, a series of bivariate multinomial logistic regression models were performed to model the association between each predictor and the outcome. As described above, we examined demographics, baseline cannabis use behaviors, baseline aggregate egocentric network characteristics, and pandemic related variables (e.g., social distancing, living situation) measured at follow-up as predictor variables. The outcome variable was change in the number of cannabis use alters from before to during the COVID-19 pandemic. As a data reduction step, predictors that were significant at the bivariate level (p < 0.10) were included in a final multivariate model (Hosmer & Lemeshow, 2000).

Our third research question (What ego and alter-level characteristics are associated with using cannabis with a particular alter during the COVID-19 pandemic?) was addressed with multilevel modeling (MLM). Since alters are nested within egos, dyadic analysis using egocentric network data often violates the assumption of non-independence in ordinary least squares regression (Perry et al., 2018). MLM is an appropriate analytical strategy to account for variance within and between each ego network by adding random or fixed effects for intercepts and slopes (Raudenbush & Bryk, 2002). Dyadic cannabis use with a particular alter was modeled as a binary outcome using the melogit command in Stata version 15.1 (StataCorp, 2021).

MLM model building was carried out in multiple steps outlined by Perry, Pescosolido and Borgatti (2018). In step 1, we ran a null random intercept model with baseline intraclass correlations to determine if clustering is present. In step 2, conceptually important covariates were selected a priori (i.e., ego birth sex, recreational/medicinal orientation; and alter-level covariates) and added in a single step to the random intercept model. Likelihood ratio tests were run to determine if adding covariates significantly improved model fit. In step 3, random coefficients were added for each significant covariate (p > 0.05) to determine if the relationship

between the predictor and outcome varied significantly between egos. Random coefficients were added one at a time, with likelihood ratio tests used to determine if they improved model fit until a final model was determined.

RESULTS

Factors Associated with Change in the Number of Alters Egos Used Cannabis With

As shown in Table 1, most participants (61.1%) decreased the number of alters they used cannabis with in the past year from before to during the COVID-19 pandemic, while 13.9% maintained and 25.0% increased the number of cannabis use alters. It should also be noted that the overall number of alters decreased from 769 at baseline to 660 at follow-up, representing a decrease of about one alter named in each ego network, on average. This, as well as other descriptive social network characteristics, are displayed in Table 2. In bivariate multinomial logistic regression models, recreational/medicinal cannabis use orientation, relationship status, ego network size, number of supportive cannabis-using alters, average length of time known alters, and living situation during the pandemic were associated with a maintaining or increasing (vs. decreasing) the number of alters egos used cannabis with (see Supplemental Table 1). Demographics, ego's pre-pandemic cannabis use, medical cannabis patient status, COVID-19 related mental health problems, social distancing, and other aggregate network variables (i.e., frequency of communication, level of trust, network density, etc.) were not associated with changes in cannabis use with network members ($p > 0.10$), and therefore were not included in the multivariate model in the next step.

In the final multivariate multinomial logistic regression model (Table 3), number of supportive cannabis-using alters was associated with a lower risk of maintaining the number of alters ego use cannabis with (vs. decreasing; RRR = 0.55, 95% CI = [0.32, 0.93]), while total network size was associated with a lower risk of increasing the number of alters ego used cannabis with (vs. decreasing; RRR = 0.66, 95% CI = [0.47, 0.93]).

Table 1. *Participant (Ego) Characteristics (N = 108)*

Variable	*n* (%)	M (SD)	Range
Demographics at Baseline			
Age (in years)		19.0 (0.8)	18 – 20
Birth sex (male)	50 (46.7%)		
Race/Ethnicity			
Non-Hispanic Black/African American	17 (15.9%)		
Non-Hispanic White/Caucasian	27 (25.2%)		
Non-Hispanic Multiracial	6 (5.6%)		
Hispanic/Latinx	46 (43.0%)		
Non-Hispanic Asian	11 (10.3%)		
College student	79 (73.2%)		
Relationship status			
Monogamous partner	33 (30.6%)		
Open/non-monogamous partner	11 (10.2%)		
Single	63 (58.9%)		
Pandemic Related Variables at follow-up			
Living situation			
Lived with others related by marriage/birth	76 (70.4%)		
Lived with partner	18 (16.7%)		
Lived with friends/roommates	24 (22.2%)		
Lived alone	13 (12.0%)		
Social distancing			
No social distancing - behaved as usual	4 (3.7%)		
Some social distancing but largely behaved as usual	8 (7.4%)		
Social distancing in some situations and behaved as usual in other situations	18 (16.7%)		
Social distancing in most situations	47 (43.5%)		
Exclusive social distancing	31 (28.7%)		
Num. of COVID-19 mental health problems		5.5 (4.1)	0 – 14
Cannabis Use at Baseline			
Medical Cannabis Patient	43 (40.2%)		
Medicinal/Recreational Orientation		3.6 (1.1)	1 - 5
Number of Cannabis Use Days (Past 90)		61.6 (30.7)	2 - 90
Typical Number of Cannabis Hits Per Day		22.0 (30.6)	1 - 101
Change in Cannabis Use Alters (Past Year)			
Decreased	66 (61.1%)		
Maintained / Stayed Same	15 (13.9%)		
Increased	27 (25.0%)		

Note. Living situation categories are not mutually exclusive

Table 2. *Egocentric Social Network Characteristics*

Variable	*n* (%)	M (SD)	Range
Aggregate Network Variables at Baseline (N = 108)			
Number of alters (Total *N* = 769):			
Total		7.2 (2.7)	1 – 10
Provide social support only		2.6 (1.9)	0 – 7
Provide social support and use cannabis with ego		3.9 (2.2)	0 – 10
Frequency of communication		5.2 (0.6)	1 – 6
Level of trust		8.1 (1.4)	2.8 – 10
Relationship duration		2.7 (0.8)	1.1 – 6.3
Attitudes toward cannabis		4.1 (0.6)	2.6 – 5
Ego network Density		0.60 (0.34)	0.00 – 1.00
Alter Characteristics at follow-up (N = 660)			
Alter gender			
Male	336 (50.9%)		
Female	316 (47.9%)		
Transgender / non-binary / gender fluid	8 (1.2%)		
Alter age <= 26 years	556 (84.2%)		
Alter's attitude toward cannabis		4.0 (1.0)	1 – 5
Dyadic Characteristics at follow-up (N = 660)			
Relationship Type			
Parent	51 (7.7%)		
Other family member	84 (12.7%)		
Boyfriend/girlfriend	49 (7.4%)		
Friend	439 (66.5%)		
Other relationship, drug seller, casual acquaintance	37 (5.6%)		
Relationship duration		3.0 (1.4)	1 – 8
Frequency of communication		1.9 (0.8)	1 – 5
Level of trust		8.2 (2.1)	1 – 10
Substance use with alter (monthly or more)			
Used alcohol with alter?	266 (40.3%)		
Used other drugs besides cannabis with alter?	105 (15.9%)		
Used cannabis with alter?	349 (52.9%)		

Table 3. *Multinomial Logistic Regression Model of Change in Number of Cannabis Use Alters From Before to During COVID-19*

			95% CI	
Maintaining (vs. decreasing)	RRR	LL	UL	*p*
Pre-pandemic Cannabis Use				
Recreational use (vs. medicinal use)	0.80	0.37	1.69	0.55
Pre-pandemic Ego Network Variables				
Monogamous relationship status (single ref.)	4.68	0.85	25.92	0.08
"Open" relationship status (single ref.)	0.39	0.02	7.14	0.53
Total network size	0.83	0.57	1.22	0.35
Num. Supportive cannabis using alters	**0.55**	**0.32**	**0.93**	**0.03**
Average time known alters	**6.09**	**2.22**	**16.71**	**0.00**
Pandemic Living Situation (lived alone ref.)				
Lived with family	4.39	0.34	56.92	0.26
Lived with partner	4.40	0.33	58.26	0.26
Live with friends/roommates	6.52	0.96	44.06	0.054
Intercept	0.01	0.00	1.19	0.06
Increasing (vs. decreasing)	RRR	LL	UL	*p*
Pre-pandemic Cannabis Use				
Recreational use (vs. medicinal use)	**1.84**	**1.00**	**3.36**	**0.048**
Pre-pandemic Ego Network Variables				
Monogamous relationship status (single ref.)	0.65	0.16	2.60	0.55
"Open" relationship status (single ref.)	0.32	0.05	2.30	0.26
Total network size	**0.66**	**0.47**	**0.93**	**0.02**
Num. Supportive cannabis using alters	1.03	0.69	1.53	0.90
Average time known alters	**4.87**	**2.03**	**11.67**	**<0.001**
Pandemic Living Situation (lived alone ref.)				
Lived with family	0.24	0.06	1.03	0.06
Lived with partner	0.75	0.11	4.93	0.76
Live with friends/roommates	2.15	0.49	9.47	0.31
Intercept	0.02	0.00	1.01	0.05

N = 104; Likelihood ratio Chi Square = 59.4, df = 18, p < 0.001; Psuedo R^2 = 0.31

Note. CI = Confidence Interval; RRR = Relative Risk Ratio; LL = Lower Limit; UL = Upper Limit. Significant associations are in bold.

Alternatively, average length of time known alters was associated with a higher risk of maintaining (vs. decreasing; RRR = 6.09, 95% CI = [2.22, 16.71]) and a higher risk of increasing (vs. decreasing; RRR = 4.87, 95% CI = [2.03, 11.67]). Recreational use orientation (vs. medicinal use) was associated with a greater risk of increasing (vs. decreasing; RRR = 1.84, 95% CI = [1.00, 3.36]) as well.

Factors Associated with Dyadic Cannabis Use During COVID-19

In step 1 of MLM building to predict dyadic cannabis use during the COVID-19 pandemic, the null (intercept only) model estimated that egos had 12% higher odds of using cannabis with a particular alter than not using cannabis with a

particular alter (unadjusted OR 1.12, 95% CI = [0.76, 1.67]). The null model produced an ICC = 0.49, indicating 49% of the variance in using cannabis with particular alters was between egos. The likelihood ratio test was also significant ($p <$ 0.001), indicating the need to use a random intercept to adjust for clustering within egos. In step 2 of model building, covariates were added to the random intercept model. Egos had lower odds of using cannabis with female alters (compared to male alters). In addition, using alcohol and using drugs with a particular alter were strongly related to using cannabis with a particular alter. Egos were also more likely to use cannabis with alters who were perceived to have more positive attitudes towards cannabis.

In step 3 of model building, random coefficients for the significant covariates were added to determine if those improved model fit. Separate models revealed that adding a random coefficient for alter gender (χ^2 [2] = 1.83, p = 0.40) and alter's attitude toward cannabis (χ^2 [2] = 1.12, p = 0.57) did not result in better model fit. However, adding random coefficients for alcohol use with an alter (χ^2 [2] = 8.18, p = 0.02) and other drug use with an alter (χ^2 [2] = 9.59, p = 0.01) did result in improved model fit. Confidence intervals for the dyadic drug use with an alter estimate were unacceptably wide, however (OR = 26.05, 95% CI = [1.36, 499.45]). Therefore, this variable was removed from the final model. In the final MLM model displayed in Table 4, alcohol use with a particular alter (OR = 24.64, 95% CI = [8.11, 74.89]) and alter's positive attitudes towards cannabis (reported by ego; OR = 9.30, 95% CI = [5.16, 16.78]) were significantly associated with greater odds of using cannabis with a particular alter during COVID-19.

DISCUSSION

The present study used egocentric network analysis to describe important changes in young adults' social cannabis use from before to during the earlier part of the COVID-19 pandemic that prescribed social distancing and restrictions which are particularly challenging for young adults. Although over half of young adults decreased the number of alters they used cannabis with, a quarter of the sample increased, and 14 percent maintained the number of

cannabis use alters from before to during the pandemic. Even as this is consistent with other recent studies reporting decreased in-person socialization during the pandemic among young adult cannabis users (Bonar et al., 2021; Fedorova et al., 2021), the proportion of young adults who reported increasing or maintaining the number of alters they used cannabis with is greater than in a recent report among Canadian adolescents (Dumas et al., 2020). This suggests a general tendency among young adults to decrease in-person social cannabis use, but also highlights that a significant proportion of may have continued to engage in social cannabis use with their personal network members during the pandemic.

Recent studies have reported that increases in cannabis use among young adults during the pandemic have been accompanied by greater feelings of loneliness, mental health problems, and loss of employment (Bonar et al., 2021; Fedorova et al., 2021; Pocuca et al., 2022). Although our study did not investigate changes in the *amount or frequency* of young adults' cannabis consumption during the pandemic, our results do not support that COVID-19 related mental health problems—or pre-pandemic cannabis consumption—are related to changes in the number of ego network members young adults' used cannabis with. However, our results indicate that a greater orientation towards recreational use (vs. medicinal use) was associated with a greater risk of increasing (vs. decreasing) the number of people young adults' used with. This is consistent with typical conceptualizations of recreational users as social cannabis users (Fedorova et al., 2019; Lankenau et al., 2018), but also may be indicative of greater precautions taken by medicinally oriented users, who may have perceived greater risks associated with COVID-19 due to their medical conditions. Our results also showed that the length of time young adults reported knowing their ego network members (on average) appeared to have the strongest associations with increasing or maintaining (relative to decreasing) the number of network members egos used cannabis with. This makes sense, as the duration of one's relationships to their close network members may indicate a stronger core network structure, which may be associated with greater social pressures to use cannabis together (Urberg et al., 2003).

Table 4. *Multilevel Logistic Regression Model of Dyadic Cannabis Use During COVID-19*

	OR	95% CI LL	UL	p
Ego-level covariates				
Female	0.44	0.15	1.29	0.13
Recreational use (vs. medicinal use)	0.70	0.43	1.14	0.15
Alter-level covariates				
Female	0.53	0.27	1.04	0.07
Young Adult (Older adult ref.)	2.93	0.74	11.64	0.13
Parent (friend ref.)	2.21	0.31	15.54	0.43
Other family member (friend ref.)	2.74	0.74	10.22	0.13
Romantic partner (friend ref.)	0.81	0.26	2.54	0.72
Other relationship (friend ref.)	0.64	0.11	3.94	0.63
Time known	0.89	0.62	1.27	0.53
Level of trust	1.04	0.85	1.27	0.71
Alcohol use with alter	**24.64**	**8.11**	**74.89**	**< 0.001**
Alter pos. attitude toward cannabis	**9.30**	**5.16**	**16.78**	**< 0.001**
Intercept	0.001	< 0.001	0.04	< 0.001
Variance (Alcohol use with alter)	6.78	2.18	21.05	n/a
Variance (Intercept)	6.48	3.21	13.08	n/a
Covariance (Alcohol use with alter, Intercept)	-4.82	-9.65	-0.001	0.05

$N_{egos} = 102$

$N_{alters} = 596$, $M = 5.8$ (Minimum = 2, Maximum = 10)

Wald $\chi^2 = 73.05$, p = < 0.001

Note. OR = Odds Ratio; CI = Confidence Interval; LL = Lower Limit; UL = Upper Limit. Significant associations are in bold.

Research with cannabis-using young adults shows that their positive attitudes toward cannabis generally match the attitudes of their close friends (LaBrie et al., 2011). Since relationship duration is a measure of the strength of one's relationships, young adults who knew their network members longer, on average, seemed to have been more likely to maintain or increase their cannabis use with these network members overall. In fact, recent research suggests that young adults may have been more likely to maintain their relationships with core network members (compared with more peripheral network members) in various ways during the pandemic (Völker, 2023).

On the other hand, a number of variables were associated with *lower risk* of increasing or maintaining the number of cannabis use alters during the pandemic. Put another way, these variables were associated with a *decrease* in the number of alters young adults' used cannabis with during the pandemic. Such characteristics included having a greater number of supportive cannabis-using alters in one's ego network and a larger ego network size prior to the pandemic. Our results suggest that those with larger pre-pandemic ego networks may have been more likely to decrease the number of people they used cannabis with out of shared concern for each other's health, as larger networks may indicate greater risk for COVID-19.

In addition to these aggregate network variables predicting change in the number alters egos used cannabis with before and during the pandemic, the present study identified significant correlates of cannabis use with a particular alter *during* the pandemic. Using alcohol with a particular alter and perceiving that the alter had

a more positive attitude towards cannabis emerged as significant. While it is not clear whether cannabis and alcohol were used on the same occasion (Meisel et al., 2021), this finding suggests that young adult dyads may be more likely to engage in cannabis and alcohol co-use during the pandemic than cannabis use alone. However, our model also suggests that significant variation in the tendency to engage in poly-substance use with one's alters exists between young adults. Results also highlight the importance of perceived norms within dyads. Given broader societal norms of disapproving of in-person cannabis use during the pandemic (Dumas et al., 2020), young adults may have only used cannabis with alters whom they perceived may be more approving of this practice. Interestingly, relationship type (friend, family member, etc.), relationship duration, and other characteristics were not significantly associated with dyadic cannabis use during the pandemic. It appeared that young adults were more likely to use cannabis with female alters, but this relationship became non-significant in the final model.

Limitations

Results from this study should be considered in light of several limitations. Despite the unique opportunity to collect egocentric social network data before and during the COVID-19 pandemic, the present analyses are limited by the small sample size, possibly leading to Type II error and limiting our ability to detect significant associations between variables. The small sample size also limited the number of covariates we could select as predictors in multivariate models. In addition, the present study cannot account for the evolving social dynamics that have occurred throughout the pandemic, including changes to social distancing policies and widespread vaccine availability in April 2021 in Los Angeles County that may have affected participants' behaviors. Still, given that the COVID-19 pandemic is an ongoing, chronic stressor, research that includes an ongoing assessment of young adults' engagement with their network members is of value. Finally, there were limitations on the number of alters egos could nominate (a maximum of 10), which could have excluded some important network members from our analysis.

Furthermore, we were not able to determine whether there was turnover in young adults' ego networks, as our survey did not identify individual alters and whether they were lost, retained, added from the baseline to follow-up survey.

Conclusions

The present study reflects a unique opportunity to observe changes in young adults' social cannabis use with their egocentric network members before and during the COVID-19 pandemic. These findings highlight that while a majority of young adults in Los Angeles County decreased their cannabis use with their close network members, a large minority may have continued to use cannabis socially with their ego network. Young adults' tendency to expand or contract their cannabis use network during a time of great uncertainty and mandate for social restrictions appears to be related to the strength of their core network (relationship duration), or possibly due to risk-mitigation (larger pre-pandemic network). During the pandemic, poly-substance use (i.e., alcohol and cannabis) and perceived positive attitudes toward cannabis appear to be catalysts for cannabis use among dyads. These factors should be considered when developing future risk-mitigation strategies when social distancing is warranted, or in other situations that may increase social isolation or abrupt changes to young adults' social networks. For example, these results may be generalizable to young adults leaving home to attend college, military service, or who are socially isolated due to a medical condition. More research is needed to determine how these types of situations may differentially impact young adults' decisions to use cannabis with their network members. In a pandemic context, decisions to use cannabis with close network members should be made by individuals in light of evidence-based public health recommendations, while also considering young adults' need for socialization during a time of significant social distancing.

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