Changes in Cannabis Use Risk Behaviors during the First and Second COVID-19 Lockdown in Israel: A Short-term 2-wave Longitudinal Study

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Background: The COVID-19 pandemic, and stringent lockdown measures implemented to curb transmission, might be related to increased cannabis use risk behaviors. This rapid response short-term longitudinal study investigated predictors of increased cannabis use risk behaviors and their association with severity of cannabis dependence during 2 separate COVID-19 lockdown periods.

Methods: Analyses were based on data from 116 monthly cannabis users who responded to 2 survey waves, corresponding to the first and the second lockdown periods in Israel. Multinomial regressions predicted risk of increased cannabis use, solitary use, and morning use during 1 or both of the lockdown periods as a function of sociodemographic factors and coping motives. Robust regression analyses assessed whether changes in cannabis use risk behaviors predicted severity of cannabis dependence at wave 2.

Results: A substantial proportion reported increased cannabis use, solitary use, and use before noon during both lockdown periods. Coping motives were related to reported increases in cannabis use and more frequent use before noon at 1 and both lockdown periods. Respondents who reported increases in cannabis use and use before noon at both lockdown periods, but not those who reported increases at only 1 lockdown period, had more severity of cannabis dependence at wave 2.

Conclusions: The COVID-19 pandemic is likely to have ongoing and long-term effects on the health of the population, including those related to increased cannabis use risk behaviors. Continued monitoring of individual differences and long-term changes in cannabis use is needed to assess consequences of lockdown restrictions.

Key Words: adults, cannabis, coping, COVID-19, longitudinal study, severity of cannabis dependence

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The COVID-19 pandemic has substantially changed everyday life across the globe, increasing psychosocial stressors.[1] This has raised concerns that people may turn to maladaptive coping behaviors, including those related to cannabis use. The motivation of using cannabis to cope with psychological stressors, or coping related use of cannabis, is common[2–5] and may be associated with increased use, solitary use, and use before midday during stressful periods, such as the COVID-19 pandemic.[6,7]

Cannabis use, although not related to harm at the same level as other commonly used psychoactive substances,[8–10] is not harmless as it is associated with various detrimental health outcomes,[11–13] including cannabis use disorder (CUD). The risk of CUD increases with frequent use[13] and CUD is related to early daytime use and using cannabis when alone.[14,15] It is possible that cannabis users increase these cannabis use risk behaviors as a way to cope with psychosocial distress associated with the COVID-19 pandemic[6,7,16,17] and as lockdown and social distancing regulations prevent cannabis use in social gatherings and disrupt daily routines that may otherwise limit use and prevent morning use.[18]

This study is an exploratory investigation of the coping and socio-demographic predictors of reported change in cannabis use risk behaviors (ie, increased use, increased solitary use, and increased use before noon) in the period of the first (March 29–May 24th, 2020) and the second (October 11–November 20th, 2020) COVID-19 lockdowns in Israel in a convenience sample of monthly adult cannabis users. The study also tests whether changes in cannabis use risk behaviors during the lockdown periods are associated with severity of cannabis dependence.

The 2 first Israeli lockdown measures involved strict social isolation, prolonged periods in which citizens were only allowed to leave their house within a perimeter of 500–1000

meters or for necessary errands, closure of malls/stores (except groceries and pharmacies), leisure places and schools and minimizing gatherings to 10 people maximum.

As far as the authors are aware, the vast majority of studies related to cannabis use during the COVID-19 pandemic have so far used cross-sectional data. Most,[17–22] but not all[23] have reported on increased cannabis use during the pandemic. Few studies examine other cannabis use related behaviors such as solitary use and use before midday. An exception is a Canadian study that showed that adolescents with greater COVID-19 fears of infection were more likely to engage in solitary substance use, including cannabis use.[18]

Very few studies with data collected over different time points over the course of the COVID-19 pandemic have been published. One such study, based on Dutch cannabis users, showed that cannabis use increased from the pre-to-during lockdown period whereas CUD did not change.[24] Another study of young adults from Washington State found no intraindividual changes in cannabis use from before to during the COVID-19 pandemic.[25] Although these studies have strength in that they rely on longitudinal data and can thus examine relations with changes over time, they do not test changes in cannabis use risk behaviors associated with cumulative lockdown periods. The current COVID-19 pandemic is an ongoing and prolonged event with multiple lockdown periods and repeated disruptions to everyday live. Understanding potential cumulated risk of multiple versus 1 lockdown is important to begin to better understand the long-term effects of policy restrictions related to the COVID-19 pandemic. This is in turn useful to identify potential factors that may be targeted in prevention efforts to counteract long-term development of cannabis use risk behaviors during this unprecedented situation.

STUDY AIMS

The aim of this short-term 2-wave longitudinal study was to explore reported increases in cannabis use risk behaviors (eg, cannabis use, solitary use, and midday use) during the first and second lockdown periods in a convenience sample of Israeli monthly cannabis users. Specifically, the aim was to identify potential demographic correlates of the short-term cannabis-related behavioral changes and whether coping motivated cannabis use is related to subsequent increases in cannabis use risk behavior. The study also assessed whether increased cannabis use risk behavior during the pandemic is associated with severity of cannabis dependence. The analyses distinguish between reported changes at 1 versus both of the lockdown periods to test potential cumulative risk related to sustained as opposed to short-lived increases in cannabis use risk behaviors.

METHODS

During the first lockdown period a link to the online survey and age eligibility screener (≥ 18) was placed on the Israeli Cannabis Magazine and the moderator of the popular online community promoted the survey on social media. At the end of this survey (hereafter wave 1) respondents who were interested in taking part in a follow-up survey (hereafter wave 2) provided their emails. The wave 2 survey was sent by mail to those who provided their email addresses towards the

end of the second lockdown period. Up to 3 reminders were sent to nonresponders. No reimbursement for participation was provided. The Institutional Ethics review board of the University of Haifa approved the study protocol. Of the 755 wave 1 participants, 214 provided emails for follow-up, among which 116 provided background data and data for at least one of the study outcome variables. Drop outs were more likely to be medical cannabis license holders, male, younger, and of low income. These socio-demographic background factors were controlled for in multivariate models.

Measures

Increase in cannabis use behaviors was measured at wave 1 and 2 by asking participants to report the extent to which they agreed with 3 statements: "My use of cannabis has increased," "I have increased the frequency at which I use cannabis alone," and "I have begun to use cannabis before 12 PM more frequently" since (a) the start of the COVID-19 outbreak [Wave 1] and (b) the start of the second COVID-19 lockdown [Wave 2]. Responses ranged from 1 = "Not at all" to 5 = "To a great extent." Because the prime interest was to measure well-defined and mutually exclusive categories of increase in the cannabis use behaviors across the 2 lockdown periods, responses from wave 1 and 2 variables were first recoded to 0 = not at all and 1 = reported at least some increase. These variables were subsequently combined into variables with the following 4 categories: 0 = no increase at any wave, 1 = increase at wave one but not at 2, 2 = increase at wave 2 but not at wave 1, and 3 = increase at both waves. Preliminary analyses showed that the categories 1 and 2 had low frequencies (n = 6–15) and that some of the models would not run appropriately with these cut offs due to low number of respondents or empty cells. Therefore, the variables were recoded to 3 category variables: 0 = no increase at any wave, 1 = increase at wave 1 or 2, 2 = increase at both waves. The 3 category variables are presented in the main models whereas the 4 category variables are presented in supplementary analyses for the models that successfully calculated the estimates.

Demographic variables included sex (0 = women, 1= men) and age (measured continuously). Income was recorded by asking respondents about their income compared to the average in the country (0 = equal or higher, 1 = lower). A variable indicated whether respondents were medical cannabis license holders (0 = no, 1 = yes). At wave 1 respondents were asked about their typical frequency of cannabis use in the last year, using answer categories ranging from 1 = less than once a year to 11 = 2 times daily or more. The variable was highly skewed with 84.5% reporting using cannabis 1 time daily or more (eg, endorsing the 2 categories indicating the 2 most frequent use options) and the variable was therefore collapsed: 0 = nondaily and 1 = daily users.

Coping motives, measured at wave 1, was based on the mean scores of 2 items assessing the agreement to the following statements: "I use cannabis to cope with the stress that stems from the COVID-19 outbreak" and "Cannabis helps me to cope mentally with the COVID-19 outbreak" (Cronbach a = 0.82).

Severity of cannabis dependence was measured at wave 2 using the Severity of Dependence Scale (SDS) which is a

5-item questionnaire with a 4-point Likert scale (from 0 to 3). Items regarding cannabis use were asked in reference to the last month and had acceptable internal consistency (Cronbach $\alpha = 0.67$). Scores were summarized, range 0–15, with higher scores indicating higher levels of dependence severity. Previous research has shown that the SDS has good internal consistency[26–28] but that it cannot be reliably used to discriminate between dependent and nondependent young adult users.[27] Therefore, the SDS was not treated as a dichotomous variable to distinguish dependent and nondependent individuals but rather as a continuous dependent variable.

Data Analytic Strategies

Data analyses were conducted using Stata.[29] Three separate multinomial logistic regressions examined short-term changes (no change vs change at 1 or 2 waves and no change vs change at both waves) in cannabis use behaviors (increased use, increased solitary use, increased use before noon) and prospective relationships with socio-demographic factors and coping. Furthermore, multinomial logistic regressions tested short term change in cannabis use risk behaviors where no change was compared to each of the following categories: increase at wave 1 but not at 2, increase at wave 2 but not at 1, and increase at both waves. Robust linear regression predicted whether reported changes in the 3 cannabis use behaviors during the lockdown periods predicted severity of cannabis dependence while controlling for sociodemographic background factors and prepandemic daily use of cannabis. Robust regression calculates standard errors that are more robust than regular regression to failure to meet assumptions concerning normality and homogeneity of variance of the residuals.[30]

RESULTS

Table 1 shows means and percentages of study variables. The analytical sample included 116 cannabis users (65.8% male, mean age = 21.3, [standard deviation = 1.1, range = 19–71]) who reported at least monthly use. The sample included 50.1% respondents who reported lower than national average income and 26.7% medical cannabis licenses holders. The majority (84.5%) were daily users before the pandemic. The mean wave 1 coping motive score was 2.43 (corresponding approximately to 2 = to a small extent). A substantial proportion of the sample reported increases in the cannabis use risk behaviors at 1 and both of the lockdown periods. For details about the more fine-grained 4 category variables see Supplementary Table S1, http://links.lww.com/JAM/A337. The mean severity of cannabis dependence at wave 2 was 9.27.

Table 2 shows the results from multinomial logistic regression analyses. Respondents who were daily users before the pandemic were more likely to report increased use before noon at both lockdown periods compared to those who reported no increase during the lockdown periods (relative risk ratio [RRR] = 10.987, 95% confidence interval [CI] = 1.931, 62.520). None of the other socio-demographic background variables were significantly related to the cannabis use behavior risk outcome variables.

Coping was related to increased use and increased use before noon. More specifically, respondents reporting higher coping motives at wave 1 were more likely to report increased cannabis use at one of the waves (RRR = 1.773, 95% CI = 1.006, 3.126) and at both waves (RRR = 1.898, 95% CI = 1.114, 3.234) relative to respondents reporting no increase in use. Furthermore, respondents reporting higher coping motives at wave 1 were more likely to report increased cannabis use before noon at both waves (RRR = 1.877, 95% CI = 1.047, 3.367) relative to respondents reporting no increase in use. Coping motives at wave 1 were not related to increased use before noon at only one of the waves and it was not related to changes at any waves in reported solitary use.

In additional analyses using increase in risk behaviors reported at 1 lockdown period as the reference category, results show that there was no significant difference in background variables and coping motivated use between those who reported increases at 1 versus at both lockdown periods (results available upon request).

Supplementary Files, http://links.lww.com/JAM/A337 show the results from multinomial logistic regression analyses in which increase at wave 1 but not at 2, increase at wave 2 but not at wave 1 and increase at both waves were compared to no increase in cannabis use risk behaviors (the referent category). In these more fine grained analyses, results showed that lower income respondents were less likely than higher income respondents to report increase in cannabis use before noon at wave 1 compared to reporting no change (RRR = 0.136, 95% CI = 0.025, 0.743). The models further confirmed the findings from the 3 category main models reported on above in terms of the associations between increased use before noon at both waves and daily cannabis users and coping motives. Furthermore, results further specify that coping motives were related to increased cannabis use at wave 1 (RRR = 2.041, 95% CI = 1.114, 3.738) and at both waves (RRR = 1.913, 95% CI = 1.123, 3.261) but not at wave 2 only

TABLE 1. Means or Percentages of Study Variables

	Total (n = 116)
Male, N (%)	75 (65.8)
Age, mean (SD)	21.3 (1.1)
Low income, N (%)	59 (50.1)
Medical cannabis license holders, N (%)	31 (26.7)
Daily cannabis use in the year before the pandemic	98 (84.5)
Coping motives (wave 1), mean (SD)	2.43 (0.11)
Increased use	
No increase, N (%)	21 (18.1)
Increase at 1 time point, N (%)	35 (30.2)
Increase at 2 time points, N (%)	60 (51.7)
Increased solitary use	
No increase, N (%)	10 (11.1)
Increase at 1 time point, N (%)	23 (25.6)
Increase at 2 time points, N (%)	57 (63.3)
Increased use before noon	
No increase, N (%)	22 (23.9)
Increase at 1 time point, N (%)	28 (30.4)
Increase at 2 time points, N (%)	42 (45.7)
CUD severity, mean (SD)	9.27 (0.28)

Two respondents had missing data on the gender variable, 26 respondents had missing data on the solitary use variable, 24 respondents had missing data on the use before noon variable, and 15 respondents had missing CUD severity data.

CUD indicates cannabis use dependence; SD, standard deviation.

TABLE 2. Multinomial Logistic Regression Results Predicting Increase in Cannabis Use Behaviors (No Increase = Reference Category)

	Increased Cannabis Use (n = 114)				Increased Solitary Use (n = 89)				Increased Use Before Noon (n = 90)			
	RRR	*P*	[95% CI]		RRR	*P*	[95% CI]		RRR	*P*	[95% CI]	
Increase at 1 time point												
Male	0.593	0.431	0.161	2.179	0.542	0.545	0.075	3.932	4.457	0.065	0.909	21.858
Age	0.978	0.437	0.923	1.035	1.037	0.397	0.953	1.129	0.955	0.197	0.890	1.024
Low income	0.718	0.599	0.209	2.472	0.677	0.640	0.132	3.466	0.366	0.127	0.100	1.332
Medical Cannabis License Holders	0.719	0.678	0.151	3.416	0.611	0.689	0.055	6.831	6.309	0.137	0.558	71.281
Daily cannabis use in the year before the pandemic	0.757	0.706	0.179	3.206	0.278	0.296	0.025	3.063	2.225	0.257	0.559	8.854
Coping motives	**1.773**	**0.048**	**1.006**	3.126	1.244	0.549	0.609	2.540	1.611	0.129	0.871	2.979
Intercept	1.767	0.671	0.128	24.368	4.114	0.461	0.096	176.401	0.305	0.426	0.016	5.677
Increase at 2 time points												
Male	0.992	0.990	0.290	3.396	0.638	0.633	0.100	4.046	2.997	0.131	0.721	12.458
Age	0.987	0.599	0.939	1.037	0.990	0.820	0.912	1.076	0.949	0.116	0.890	1.013
Low income	0.549	0.299	0.177	1.703	0.806	0.777	0.181	3.593	0.552	0.351	0.159	1.923
Medical Cannabis License Holders	0.960	0.954	0.240	3.848	0.812	0.854	0.089	7.382	8.244	0.073	0.823	82.600
Daily cannabis use in the year before the pandemic	1.328	0.693	0.325	5.421	0.412	0.445	0.042	4.020	**10.987**	**0.007**	**1.931**	62.520
Coping motives	**1.898**	**0.018**	**1.114**	**3.234**	1.714	0.103	0.897	3.274	**1.877**	**0.035**	**1.047**	**3.367**
Intercept	1.021	0.987	0.086	12.177	6.865	0.287	0.197	238.810	0.093	0.111	0.005	1.728

CI indicates confidence interval; RRR, relative risk ratio.

(RRR = 1.318, 95% CI = 0.617, 2.816, see Supplementary Table S2, http://links.lww.com/JAM/A337).

Table 3 shows results from the linear regression predicting severity of cannabis dependence. Respondents who reported increased use of cannabis use and increased cannabis use before noon during both lockdown periods had higher severity of cannabis dependence than those who did not report such increases (increased cannabis use RRR = 2.223, 95% CI = 0.976, 3.471; increased use before noon RRR = 2.879, 95% CI = 1.382, 4.376). Increased cannabis risk behaviors at only 1 lockdown period were not associated with more cannabis use dependence severity. None of the other variables in the model were associated with cannabis dependence severity. Regression models with the 4 category cannabis use risk behavior variables entered as predictors confirmed these results (see S3 in Supplementary File, http://links.lww.com/JAM/A337).

DISCUSSION

The current study echoes previous reports of changes in cannabis use during the ongoing COVID-19 pandemic. A substantial proportion of monthly cannabis users surveyed in this study reported increased use of cannabis both during the first and second lockdown period. The current study expands the evidence base in relation to cannabis use behavioral change during the COVID-19 pandemic as it also focuses on solitary and morning use. A substantial proportion of respondents in this study reported increases in these behaviors as well.

Results did not find strong evidence to suggest that sociodemographic background is related to changes in cannabis use risk behaviors. Only in the more fine grained analyses did results show that lower income respondents were less likely than higher income respondents to report increase in cannabis use before noon at wave 1. It is possible that this

TABLE 3. Robust Regression Results Predicting Cannabis Use Dependence Severity

	Model 1 (n = 99)					Model 2 (n = 87)					Model 3 (n = 87)				
	Coeff	Robust Standard Errors	*P*	[95%	CI]	Coeff	Robust Standard Errors	*P*	[95%	CI]	Coeff	Robust Standard Errors	*P*	[95%	CI]
Male	0.612	0.543	0.263	−0.467	1.690	0.897	0.672	0.186	−0.441	2.235	0.470	0.612	0.445	−0.748	1.688
Age	−0.014	0.023	0.546	−0.060	0.032	−0.015	0.031	0.627	−0.078	0.047	−0.001	0.026	0.963	−0.053	0.050
Low income	0.418	0.565	0.461	−0.704	1.539	0.332	0.662	0.617	−0.985	1.649	0.264	0.590	0.656	−0.911	1.439
Medical Cannabis License Holders	−0.009	0.583	0.987	−1.168	1.150	0.330	0.792	0.678	−1.247	1.906	−0.050	0.832	0.952	−1.707	1.606
Daily use	1.245	0.675	0.069	−0.097	2.586	**1.653**	**0.781**	**0.037**	**0.099**	**3.206**	0.924	0.669	0.171	−0.407	2.254
Increased use (model 1)/Increased solitary use (model 2)/Increased use before noon (model 3)															
Increase at 1 time point	0.359	0.697	0.608	−1.026	1.744	0.281	0.920	0.761	−1.550	2.112	1.320	0.722	0.071	−0.118	2.757
Increase at 2 time points	2.223	**0.628**	**0.001**	**0.976**	**3.471**	−0.057	0.774	0.941	−1.598	1.484	**2.879**	**0.752**	**0.000**	**1.382**	**4.376**
Intercept	**6.641**	**1.135**	**0.000**	**4.386**	**8.895**	**7.451**	**1.316**	**0.000**	**4.831**	**10.072**	**6.554**	**1.053**	**0.000**	**4.458**	**8.649**

CI indicates confidence interval; Coeff, coefficient.

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reflects that lower income respondents are more likely to have other obligations that prevented morning cannabis use during lockdown (eg, child care). It is also possible that low income respondents were more likely to be part of the essential workforce that continued working outside of the home during the lockdown, which in turn may be associated with less morning use compared to those working from home.

Solitary use was not associated with coping. This is not totally surprising as COVID-19 related lockdown measures force people to socialize less and thereby solitary cannabis use may increase independent of coping motivated use. Yet, coping motives were associated with both increased use and more frequent morning use. These results diverge from those of a previous study that found insufficient evidence that coping motives were associated with increased use and CUD symptom severity during the COVID-19 pandemic.[24] The current study assesses coping as a way of dealing with the ongoing COVID-19 pandemic specifically, whereas the previous study measured coping generally. This difference may account for the divergent results and this should be tested in future studies.

The fact that coping motives predict increased use and increased use before midday is of significance as coping related use is related to problematic cannabis use.[31,32] The current study specifies that increased use and increased use before noon at both waves were independently associated with higher severity of cannabis dependence. Cannabis users who reported increase in these risk behaviors at only 1 lockdown period did not have higher severity of cannabis dependence. It is important to note that the data does not include measures of severity of cannabis dependence at wave 1. Although daily use before the pandemic is controlled for in the analyses, the models could not directly test whether increased use and increased morning use between the 2 waves relate to changes in severity of cannabis dependence.

Combined, these results suggest that using cannabis to cope with the pandemic is associated with increases in risky cannabis use. Furthermore, when increased use and morning use is sustained across lockdown periods it is associated with severity of cannabis dependence. There may, therefore, be an increased need for treatment and prevention efforts during the ongoing pandemic. Because continued social distancing regulations reduce access to drug treatment services, there may be a need to implement online support, although intervention effects of online services have been found to be small.[33] Yet, in light of lack of other available options during lockdown periods, these efforts should be considered and they should include a focus on developing healthy coping mechanisms other than coping-related cannabis use (see for instance ref.[34]).

Limitations

This study is the result of a rapid response to a dynamic and new situation, and the survey was designed to be short. Therefore, questions about reduction in cannabis use risk behaviors and use of other substances were not asked and measures of coping motives were developed for this study as there were no available validated scales at the time of data collection. We also lack pre-pandemic estimates (except retrospective reports). Despite the longitudinal nature of the data, the small convenience sample prevents making causal conclusions. Nonprobability sampling, as used in the current study, lacks a strong theoretical basis for statistical inference[35] and results cannot be generalized to the Israeli cannabis user population. Therefore, basic descriptive analyses and explorations of potential associations are justified while measures of uncertainty (eg, CIs around estimates of prevalence) are generally not valid. Furthermore, the ability to run fine-grained analyses with 4 category outcome variables were limited due to few cases in each cell. Nevertheless, the current study can provide rapid evidence on how cannabis use patterns among regular users may have changed during the COVID-19 pandemic and preliminary directions for a better understanding of the factors influencing the changes and potential effects. These need to be confirmed in future longitudinal studies with larger and representative samples.

The measure for severity of cannabis dependence (SDS) cannot be used to differentiate dependent from nondependent individuals.[33] Future studies should rely on other short screeners that can make this distinction (eg, cannabis use disorder identification test-revised, see ref.[36]) to test the relation between the COVID-19 pandemic and the development of cannabis dependence.

The current study does not account for the possibility of decreases in cannabis use risk behaviors which may be driven by lockdown measures that disrupt established methods for cannabis supply and distribution,[37] make it unfeasible to interact with other cannabis users and increase financial constraints.

CONCLUSIONS

The COVID-19 pandemic is likely to have ongoing and long-term effects on the health of the population, including changes in cannabis use behavior as indicated by the current results. There may be additive risks associated with maladaptive coping and increased cannabis use risk behaviors which are sustained across subsequent lockdown periods. There is an urgent need for continued monitoring of individual differences and long-term changes in cannabis use to assess consequences of the lockdown restrictions. Interventions focusing on coping with the stressors related specifically to the COVID-19 pandemic may be particularly important.

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