Substance use in early psychosis following two years of specialized early intervention services

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Abstract

There is an important but neglected intersection between substance use problems and mental health problems, particularly psychosis. Addressing this gap, the aim of this study was to investigate substance use on a continuum among persons with first-episode psychosis (FEP) following two years of specialized early intervention, with a specific focus on alcohol and cannabis, the substances known to be most commonly used among persons with psychosis in high-income countries. A secondary analysis was conducted of a randomized controlled trial where 220 patients were randomized after 2 years of early intervetion to receive extended early intervention or regular care for the subsequent three years. Outcomes included frequency and quantity of alcohol and cannabis use at baseline, which was assessed using the Timeline Followback (TLFB) and the Chemical Use/Abuse/Dependence Scale. Descriptive statistics were used to analyze the data. Pertinent data was available for only 56 out of 220 participants from the primary study, which was included in this study. The majority of the participants used only alcohol (N=31, 55.4%), followed by both alcohol and cannabis (N=22, 39.3%). Very few used cannabis but not alcohol (N=3, 5.4%). It was more for common for cannabis users to use cannabis frequently. In contrast, although the majority of participants used alcohol, it was more common to drink infrequently than frequently. There was no relationship found between using both alcohol and cannabis and either alcohol or cannabis more frequently. Despite current attempts to reduce harmful substance use in the FEP population, high prevalence rates of substance use may persist, suggesting a fundamental need for further research on understanding this relationship. Our study was limited by its small, likely biased sample but this is reflective of other services research in psychosis and highlights the need for innovative methods to increase the participation of persons with psychosis in research.

Statement of Contribution

This current study was done as my undergraduate thesis. I conducted literature reviews, data analysis and interpretation, first draft and subsequent draft revisions based on feedback, all under the supervision of Dr. Sally Mustafa and Dr. Srividya Iyer. Dr. Mustafa's role included guidance on research topic and analysis, interpretation of findings, draft outline, and continuous feedback. Dr. Iyer provided overall guidance for the project and feedback on presentation of the draft. The larger study whose data was used in this work was conceived by Ashok Malla and Ridha Joober.

Introduction

The prevalence of substance use problems is much higher in persons with psychotic disorders than in the general population (Gregg et al., 2007). Psychotic disorders, which typically first start in adolescence and early adulthood, are characterized by the presence of hallucinations, delusions, disorganized thought and behaviour, and negative symptoms (Arciniegas, 2015; Calabrese Jordan, 2022). About half of young adults who present with psychosis have been reported to have co-occurring substance use disorders (SUD) (Ouellet-Plamondon et al., 2021; Wisdom et al., 2011). Estimations are most likely under- rather than over-estimates (Wilkins et al., 1991) and depend greatly on how substance misuse is defined within diagnostic classifications and individual studies (Gregg et al., 2007). Even with prevalence estimations being conservative within research, US epidemiological studies show the odds of suffering from any SUD were 4.6 times higher among people with psychotic disorders than in the general population (Regier, 1990). Substance use problems in young adults with psychosis are related to significant adverse effects, including prolonged illness, psychotic relapse, and overall poorer functional and clinical outcomes (Wisdom et al., 2011). However, the relationship between substance use and psychosis remains unclear (Addington & Addington, 1998; Moggi, 2018). There is no universal consensus on the etiology of the higher rates of substance use observed in people with psychosis (Gregg et al., 2007). There has also been much debate on the temporal proximity between the onset of substance use and psychosis, leaving the direction of the relationship in question (Barkus & Murray, 2010). When trying to find the reason for substance use among this population, it was proposed that people with psychosis use substances to try to counteract the side effects of antipsychotic medication, or as an alternative to their prescribed medication (Schneier & Siris, 1987). Other research suggests that the psychological processes

leading to and maintaining substance use are similar to those found in the general population, and therefore should be treated accordingly (Kendall et al., 2011).

Fewer studies have examined substance use in first-episode psychosis (FEP). FEP refers to individuals when they first present typical symptoms of psychosis such as distortion of reality, hallucinations, and delusions, which cannot be explained by another disorder (Shiers & Lester, 2004). FEP has become the new focus for treatment intervention as it usually occurs at a critical developmental life stage in terms of career choices, relationships, personality development, and education outcomes (Rinaldi et al., 2010). When indiviudals with FEP first present for treatment, cannabis and alcohol are found to be the two most predominant substances of abuse (Addington & Addington, 1998; Cantwell et al., 1999; Sevy & et al., 2001). There is strong consensus for the need for improved substance use management in treatment programs for psychosis (Penn et al., 2005).

A study examining the correlates of substance misuse in FEP found that men, younger individuals and those who were younger upon onset of psychosis were more likely to report problematic substance use (Van Mastrigt et al., 2004). The persistence of substance use for young adults with FEP negatively impacts their symptomatic and functional outcomes (Ouellet-Plamondon et al., 2021), making early intervention of vast importance. One study suggests that the functional and symptomatic outcomes two years after FEP are predictive of outcomes 15 years later (Shiers & Lester, 2004). Thus, managing substance use during the early stages will likely have a large effect on the course of illness, and neglecting proper treatment will largely impact both treatment adherence and long-term outcomes.

The most recent clinical guidelines recommend specialized early intervention services for psychosis. Early intervention services emerged based on strong evidence that long-term

course and outcome are highly predicted by the early trajectory of psychosis, and longer periods of untreated psychosis are predictive of poorer outcomes (Singh, 2010). The effectiveness of early intervention services compared to routine care has been well-established in the past two decades (Nolin & et al., 2016). However, there is still a lack of standardization in treatment guidelines about the ideal duration for early intervention (Nolin & et al., 2016). While early intervention services are typically offered for 1-3 years, some have argued that they should be offered for five years, considered the critical period for establishing long-term outcome trajectories (Birchwood et al., 1998).

Many recent attempts including the primary study have been made to find the optimial duration for treatment services, showing strong evidence for extending early intervention services (Lutgens et al., 2015). To address substance use problems, early intervention services include elements of case management, motivational interviewing, CBT, comprehensive assessment feedback on SUD and psychosis, harm reduction interventions, and pharmacotherapy (Iyer et al., 2015; Ouellet-Plamondon et al., 2021). Although early intervention services play a large role in preventing the onset of severe mental illness or at the very least, preventing or reducing impaired functioning and other secondary morbidities that comes with severe mental illness (Rosen, 2014), research findings particularly for the efficacy of early intervention services with respect to substance use-related outcomes are less clear.

Some studies demonstrate a significant decrease in substance use and abuse from as little as 12 months of early intervention services (Addington & Addington, 1998; Archie & et al., 2006). Other studies claim that current early intervention services programs are not sufficient in managing substance abuse in early psychosis and better innovations need to be offered (Ouellet-Plamondon et al., 2021). A systematic review assessing early intervention services in FEP

compared nine studies that used early intervention services with five studies that did not. Approximately half the individuals reduced or abstained from alcohol and drug use immediately after the onset of their episode; however, rates for abstinence or reduction were no better for early intervention services compared to regular care (Wisdom & Manuel, 2011). Another review found similar findings where some cessation of substance use was found before individuals sought treatment for psychosis, but there were no significant changes in substance use following early intervention services (Wisdom & Manuel, 2011). Overall, the literature suggests that early intervention services for psychosis are associated with some reductions in SUD over the treatment course. However, substance use can be persistent at least for a sub-group of persons with psychosis and persistent substance use is associated with non-compliance, treatment dropout, and weak remission rates (Lambert et al., 2005). Thus, optimal outcomes for youth with FEP and comorbid SUD might need an integrated treatment for both disorders, rather than relying on early intervention services alone. An improvement in substance management and intervention within early intervention services remains a predominant research goal, as it is much less likely that individuals with FEP will seek two treatment programs rather than one.

Despite this, research exploring patterns of substance use among FEP individuals following early intervention services is limited. The current literature on psychosis varies in definitions and outcome measures for substance use, which presents significant challenges (Kendall et al., 2011). Differences remain in criteria for substance use problems in current diagnostic classifications- *The ICD-11 Classification of Mental and Behavioural Disorders* and the *Diagnostic and Statistical Manual of Mental Disorders* - which create inconsistencies in the literature (Hasin et al., 2006), compounded by problems around measurement of alcohol and drugs in studies, such as limited use of standardized measures (Kendall et al., 2011). The terms

"substance misuse", "substance abuse", "substance dependency", and "substance use disorder" have been used interchangeably; yet, they may have very different clinical implications. Research often uses SUDs as the outcome measure, so that they can be guided by diagnostic criteria, around which there may be some more consistency than when using other outcome measures. Consequently, only those who meet the diagnostic criteria for SUD are included and the broader prevalaence and effects of substance use among all substance users in early psychosis are much less understood. Substance use amongst individuals with early psychosis is associated with non-adherence to medication, poor treatment engagement, increased suicide, and poorer overall prognosis, regardless of whether or not it fulfills diagnostic criteria for SUD (Kendall et al., 2011). Moreover, it is necessary to analyze substance use in all ranges of consumption to get a full picture.

To this end, the aim of the present study was to investigate overall substance use following the first two years of early intervention services for psychosis, regardless of SUD diagnoses. Not excluding any substance users, regardless of a clincal diagnosis, allowed us to analyze substance use on a continuum in this population, hitherto rarely done in the field. Using data collected at the end of two years of early intervention services, the aim of the present study was to estimate the proportions of FEP patients who use the two most commonly consumed substances; namely, alcohol and cannabis. A second aim was to measure the frequency and the quantity of both the alcohol and cannabis consumed. A final aim was to examine the association between alcohol and cannabis use among users; this association has not been examined carefully in prior research particularly in early psychosis. This was done through comparing the frequency and extent of substance use among those who consumed both alcohol and cannabis versus either alone.

Methods

Study setting and design

The data for this report was obtained from a single-blind parallel randomized control trial (RCT) (Lutgens et al., 2015; Malla et al., 2017).This RCT was conducted at the Prevention and Early Intervention Program for Psychosis (PEPP-Montreal) and two other EI services in the McGill University network which provide equivalent specialized two-year early intervention services. The main study examined whether individuals randomized into a 3-year extension for early intervention services had better therapeutic gains compared to those in regular care, following the initial 2 years of specialized intervention services. The primary outcome measure was total (positive and negative symptoms) remission. A number of secondary outcomes were assessed, including substance use, which is the focus of this report.

Study sample

To be eligible for early intervention services, participants had to have a DSM-IV diagnosis of a psychotic disorder (schizophrenia spectrum psychosis or affective psychosis), an intelligence quotient (IQ) greater than 70, the ability to speak English or French and the ability to provide informed consent. Patients with comorbid SUD were not excluded. For the RCT, 220 participants between the ages of 18-35 were recruited. Randomization was stratified to ensure that sex and substance abuse were balanced between both groups as they were factors known to influence psychosis outcomes. All participants who presented substance use problems at the initial onset or throughout the first 2 years of treatment were offered substance use education and

monitoring. Importantly, substance use interventions were not exclusively offered to those who met the diagnostic criteria for co-morbid substance use disorders.

Study Assessments

Baseline data were collected at randomization, i.e., at the end of the initial 2 years of early intervention services (month 24 +/- 3). Participants were evaluated every 3 months, for a total of 3 years following randomization, by a trained research assitant. Chemical Use/Abuse/Dependence Scale (CUAD) (McGovern & Morrison, 1992) and Time Line Follow Back (TLFB) (Sobell & Sobell, 1992) were the two instruments used to assess substance use at baseline and every successive evaluation, both of which have well-established psychometric properties. CUAD is a semi-structured interview used to derive reliable scores for substance use severity and SUD diagnoses. It is an ordinal scale, splitting the frequency of usage into categories; <1x/month, >1x/month, less than 1x/week, less than 3x per week, and daily. The TLFB is a timeline summary to obtain precise quantity estimates of daily alcohol and drug consumption. In this study, the TLFB assessed substance use over the 90-day period prior to the assessment. The scale of measurement is interval numbers. TLFB provided data for alcohol quantity ("average number of drinks per week") and cannabis frequency ("number of days drugs were used over the past 90 days"). As outlined earlier, alcohol and cannabis were the substances of interest as they are most utilized among psychosis patients (Spencer et al., 2002) (and as also borne out in our descriptive analysis as described in detail later).

The main outcome measures in this study were the frequency and quantity of alcohol and cannabis used over the three years following the two years of early intervention services. The quantity of substance recorded was equated into standard units to make the data comparable. For

alcohol, we defined a standard drink unit (SDU) based on the TLFB interview instructions (Sobell & Sobell, 1992). According to these instructions guiding TLFB administration, one SDU contains about 14 grams of pure alcohol, which is about 0.6 ounces of fluid. One beer, one glass of wine, and one vodka shot are equal to one SDU. The frequency variable was the average number of days participants drank per week. The quantity variable was measured as the average number of SDU participants consume per day. This was found by taking the reports from the two instruments, converting the forms of alcohol into units of SDU, then multiplying by the frequency variable. We then divided by 7, giving us average quantity of alcohol (SDU) patients consumed per day. The same process was done for cannabis. Cannabis frequency was measured as the number of days cannabis was used per week. The quantity was reported as joints or grams. To convert all forms into one unit, we had to assume an approximate quantity for the number of grams in one joint. In this study, we used the same approximations made by other scientific literature where one joint was equated to 0.5 grams (Turner et al., 2014). After converting the cannabis quantity to grams, the data on cannabis frequency was used to calculate the average number of grams used per day. Cannabis frequency variable was multiplied by cannabis quantity (cannabis consumption per week), then divided by 7 to obtain the average daily consumption. For the participants who reported daily consumption, the only calculation made was converting the units from joints to grams when units were not given in grams. Frequency and quantity outcome measures that were <0.001 were considered negligible.

Based on the frequency of substance use, we subdivided the sample into frequent and infrequent users. For alcohol, participants who drank 3 times or more per week were considered "frequent drinkers". Similarly, participants who used cannabis 3 or more times a week were considered "frequent users". This subdivision was based on how substance use frequency was

organized in the CUAD. Our data was presented in categories of less than once a month, greater than once a month, , less than once a week, less than 3 times a week, and daily, making 3 times a week a rational split for defining “frequent” and “infrequent” users.

Data analysis

Descriptive statistics were presented as means, standard deviations (SD), and ranges for continuous variables, and frequency and percentages for categorical variables. We first analyzed alcohol users and cannabis users separately. The descriptive statistics for alcohol included all alcohol drinkers, regardless of their cannabis use. The frequency (number of days alcohol is used per week) and quantity (average number of alcohol units per day) were presented as means and standard deviations (SDs). We also looked at the distribution (frequencies, percentage) of the sample with respect to the frequency of use measure. The frequency and percentage of each category (frequent and infrequent drinkers) were estimated. The quantity for average number of alcohol units per day was then calculated separately for frequent drinkers and infrequent drinkers, in terms of means and SDs.

Similar analysis was done for cannabis use. The frequency (number of days cannabis is used per week) and quantity (average number of grams used per day) were presented as means and SDs. The frequency and percentage of each category (frequent and infrequent cannabis users) were estimated cz and the quantity of grams used per day were calculated separately for frequent users and infrequent users.

We then compared those who only used one of the substances with those who used both. The sample was categorized into only alcohol users, only cannabis users and both substance users. Participants who reported any use of alcohol and cannabis use were included in the latter

category irrespective of the quantity used (except for when outcome measures were <0.001 which was considered negligible). Percentage and frequency for these categories were obtained. We then took these categories and performed a cross tab with frequent vs infrequent users for alcohol and then cannabis. Chi square test was used to compare the proportions of frequent vs. infrequent users in the alcohol only, cannabis only and users of both substances categories. T-tests were used to test if there was a statistical difference between frequent and infrequent users regarding the amount of substance they used. The chi square test was done to assess the relationship between substance(s) used and frequency of use. Cross tabs allowed us to see whether frequent users were more likely to use more substances in general or use one alone, and whether this relationship was different for alcohol and cannabis. The software used was SPSS, version 28. A p value less than or equal to 0.05 was considered significant.

Results

Participants

Of the 220 participants of the parent study, data on substance use was only available for 83 participants at randomization. Of these, 27 persons did not use cannabis or alcohol and 56 persons used alcohol or cannabis, the latter being the sample of interest for the present report. Data was missing on alcohol quantity for 2 of the participants and cannabis quantity for 1 participant. These participants were removed only when estimating substance quantity but otherwise retained or analyses. Information from both the CUAD and TLFB was available for 58.9% (N=33) of the participants, and data from the CUAD but not the TLFB was collected for the other 41.1% (N=23) of the sample. The majority of the sample only drank alcohol (N=31,

55.4%) or used both substances (N=22, 39.3%). Few participants used cannabis but not alcohol (N=3, 5.4%).

The demographics of the sample are presented in **Table 1**. As is often the case in psychosis samples, the sample group had a higher proportion of males [83.9% males (N=47)] than females [16.1%, (N=9)]. Participants' average age at FEP onset was 22.35 (SD=4.44). Their average age at signing the consent form for this study was 25.24 (SD=4.39).

Outcome Measures

Alcohol

Out of the total sample (N=56), 51 participants (91.1%) drank alcohol. Alcohol users drank between 0.25 and 7 times per week as seen in **Figure 1.** On average, they drank 1.61 (SD=1.87) times per week. Two participants were omitted from quantity variable analysis as they only provided date for type of alcohol and the frequency of use but not quantity. Thus, analysis of alcohol quantity use was computed on N=49 participants**.** Participants drank an average of 0.58 standard units (SD=0.69) of alcohol per day. There were significantly more infrequent drinkers (72.5%) than frequent drinkers (27.5%) as seen in **Figure 2**. Frequent drinkers drank an average of 1.28 SDU of alcohol per day (SD=0.56), whereas infrequent drinkers drank an average of 0.34 standard units of alcohol per day (SD=0.55). The difference in alcohol quantity between frequent and infrequent was statistically significant, $t(47) = 5.237$, $p < 0.001$. These results are summarized in **Table 2**.

Cannabis

Cannabis use was less common than alcohol but still nearly half the individuals in the sample of users (N=25, 44.64%) were using cannabis at randomization baseline, i.e., following two years of early intervention services. At this time (two years after early intervention), these individuals

used cannabis an average of 4.27 days per week (SD=3.10) and consumed approximately 1.28 grams (SD=1.38) per day. Approximately half the individuals (N=13, 54.2%) reported using cannabis daily**.** There were more frequent cannabis users (N=14, 60.9%) than infrequent users (N=9, 39.1%) as seen in **Figure 3**. Although infrequent cannabis users consumed less than half the quantity consumed by frequent users [0.73 (SD=1.18) vs. 1.68 (SD=1.40) grams per day, respectively], this difference was not statistically significant; t(20)=1.627, p=.119. These results are summarized in **Table 3.**

Total sample

When analyzing the sample, we found that 39.3% (N=22) of participants reported using both substances at least once over the past 90 days. 55.4% of participants (N=31) used alcohol but not cannabis, and only 5.4% (N=3) used cannabis but not alcohol. Among those who used both substances (N=22), we found a higher proportion of infrequent alcohol drinkers (60%, N=12) than frequent drinkers (40%, N=8) whereas infrequent cannabis users (35%, N=7) were less common than frequent cannabis users (65%, N=13), as seen in **Figure 4**. No significant relationship was found between using both substances and being a more frequent cannabis user; $X^2(1) = 1.098$, $p = 0.538$, $N = 23$, or alcohol user, $X^2(1) = 2.602$, $p = 0.107$.

Discussion

In the present study, we found that the majority (94.7%) of participants using substances (N= 56) drank alcohol, ranging in frequency from daily to rarely. It was much more common for alcohol users to drink infrequently than frequently. Nearly half the sample used cannabis in addition to alcohol and very few only used cannabis but not alcohol. Frequent cannabis use was much more common than frequent alcohol use, with half of users consuming cannabis daily. Frequent cannabis users consumed almost double the amount that infrequent users consumed but

the difference between groups was not statistically significant. There was no relationship found between using substances more frequently and consuming more substances (i.e., using both alcohol and cannabis).

Studies that analyzed substance use on a continuum are rare. While we presented substance use for all users regardless of the frequency or quantity, the literature predominantly only presents data for those who reach the threshold for what they define as "substance abuse", "substance misuse" or the DSM criteria for SUD. Thus, there is no available data for minimal or moderate use of substances in the FEP population. Even among substance users who are included in the studies, descriptive statistics for substance frequency and quantity are rarely specified. Nonetheless, studies investigating substance use among FEP patients show similar age of onset and gender distributions as our sample (Lange & et al., 2014). A longitudinal study on substance use in FEP showed that more men than woman used illicit drugs, with cannabis and alcohol being the most popular (Lange & et al., 2014; Saunders & et al., 1993). Because our sample was majority male, we did not systematically examine sex and gender differences in relation to the outcome variables of focus.

There are few studies that compare those who use cannabis and alcohol simultaneously vs. concurrently. One such study found that cannabis was the most commonly used drug among those who drink (Subbaraman & Kerr, 2015). This was also reflected in our findings, where a large proportion of those who drink are also cannabis users, and there are very few participants who are cannabis only users.

According to a national survey on the Canadian population, only 7.3% reported using cannabis at least once in the past year. In contrast, out of the 83 participants we had data on, 27.8% were cannabis users with half of them consuming cannabis daily (Ogborne & Smart,

2000). The higher prevalence rates for cannabis use in the FEP population is well known (Archie et al., 2007; Kamali et al., 2009; Kovasznay et al., 1997; Mauri et al., 2006; Wade et al., 2005; Wade et al., 2006). In contrast, the percentage of participants who use alcohol (94.7%) was not much higher than that of the general young adult population in Canada. A survey from 2017 reported 82.3% of 18-24 year old's drank alcohol in the past year (Vallance et al., 2021). However, when looking at the level of alcohol use, only 8.9% of the general population were clinically diagnosed as having alcohol abuse disorders, compared to 43% of people with FEP who are suggested to have alcohol abuse disorders in the literature (Barnett et al., 2007; Thomas & Rockwood, 2001). Although we were not interested in analyzing the prevalence of substance abuse from a diagnostic criteria, there are still notable differences in alcohol use that can be seen in our results. 72.5% the alcohol users were infrequent drinkers, meaning they drank less than 3 times a week. This suggests that when looking at alcohol use on a continuum, the sample from our study may be more similar to the general population than to other FEP patients in prior research on alcohol abuse.

When looking at the sample in terms of those who use alcohol, cannabis, or both, it is apparent that alcohol use alone or in conjunction with cannabis is much more common than cannabis use alone. Those statistics summarize the percentage of participants who reported any use of either substance, regardless of if they used it one time over 90 days or daily. However, once the sample was categorized as frequent or infrequent users, we were able to see which substances were being used more predominately. Opposite trends were found. It was more common for alcohol users to drink less frequently and more common for cannabis users to consume more frequently. Frequent users consumed more substances on average than infrequent users for both alcohol and cannabis. While we analyzed quantity as a daily average, further

research should analyze the quantity of alcohol and cannabis used among episodic substance users versus daily substance users.

Research shows that although there is a large association between alcohol and cannabis use, those who are heavy cannabis users tend to use one substance predominately at any one time (Patton & et al., 2007). In our sample, among those who use both alcohol and cannabis, most users were labelled to be frequent cannabis users and the majority were seen to be infrequent drinkers. This trend is seen within the general population as well. One study found that weekly or more frequent cannabis users in the absence of high alcohol use in teenagers predicted a seven fold higher rate of daily cannabis use in young adults but only a twofold increase in high-risk alcohol use (Patton & et al., 2007).

Studies examining the prevalence of substance use in FEP show that cannabis is a more common substance of abuse than alcohol (Archie & et al., 2006; Barnett et al., 2007; Lange & et al., 2014). We did not assess substance in terms of "substance abuse". Similarly, studies that examine "substance misuse" conclude that prevalence rates of misuse is highest with cannabis (Addington & Addington, 1998; Saddichha & et al., 2010).

Our study did not find a relationship between using both substances and using either of them more frequently. Previous findings showed that co-use of alcohol and cannabis were associated with more frequent consumption compared to single substance use (Gunn et al., 2021). More recent findings suggests that the relationship is less straightforward and rather depends on various factors. A study using the TLFB found that for people who co-use, on cannabis use days, participants were more likely to drink more frequently (Metrik et al., 2018). In contrast, another study found that cannabis use first within a co-use day was associated with lower daily alcohol consumption but greater cannabis consumption (Gunn et al., 2021). Whether

alcohol and cannabis are consumed at the same time also changes the outcome (Lutgens et al., 2015). A study looking at substance use, and mental health outcomes found that higher frequency of simultaneous co-use of both alcohol and cannabis was associated with heavier use of substances and heavier symptoms of psychosis (Thompson et al., 2021). Further research is needed among patients with FEP who co-use to better understand how the frequency of substance use is influenced by various factors.

Limitations

The primary limitation to this study was the small sample size. Investigating substance use was not the primary RCT's primary objective and therefore a lot of participants did not complete the TLFB and CUAD at baseline. Only 83 participants completed these measures at baseline and only 56 out of these used alohol or cannabis and were included in the study. There was also missing data, especially on the TLFB (N=23) within our study, which meant having to rely only on the CUAD for 41.1% of the sample. The small sample size played a role on the results as it decreased the statistical power and generalizability of the findings. This was especially true for the data analysis on cannabis. It may also be that the people who provided data may have been more or less likely to use subtsances, i.e., there may be a selection bias at play here. To overcome this limitation in the future, substance use data needs to be collected from a larger sample, where the frequency and quantity data is reported in a complete and clear fashion.

Our study is not unique in suffering from limited participation and incomplete data. The nature of studying substance use quantitatively poses challenges in general which has limited research focused on assessments of substance consumption (Prince et al., 2018). While researchers should

exploit data on substance use to better understand the role it plays in the population, it is important to address common challenges inherent in such research and their impact on findings: 1) our estimations rely on self-recall which is subject to various biases (e.g., selective memory), 2) our estimations rely on participants' estimations for substance quantity which is not precise, 3) there is a lack of standardization for substances units, especially cannabis making self-report instruments inadequate for accurate quantification of cannabis (Norberg et al., 2012) and, 4) studies on drug use show that participants tend to underreport the extent of their consumption (Harrison, 1995). Better quantification and standardization of substance units is necessary to improve future studies in this field. Study instruments including the CUAD and TLFB will subsequently benefit from these improvements, minimizing the impact self-report biases and estimation errors have on the results. In addition to these four, our study highlights an additional challenge: poor and arguably, not representative participation of help-seeking persons with psychosis and likely other mental health problems. Indeed, this challenge has been previously highlighted in psychosis research (Iyer et al., 2020; Shah & Peters, 2019) and may be even more compounded in substance use focused studies where persons using substances may be less likely to participate due to social desirability. Innovative methods to build trust and increase research participation are needed, ideally co-designed with inputs from persons with lived experience.

Lastly, it is important to note that the data used in this study was collected prior to the legalization of cannabis. Research has shown that there has been an increase in self-reporting of cannabis use post legalization (Steinberg & et al., 2021). Thus, data collected post legalization would likely reveal different reporting and usage patterns than what we found in our study, limiting the internal and external validity of our findings.

Potential research implications

Studying substance use among FEP patients is crucial for future research if one hopes to improve psychosis treatment and outcomes. The proportion of participants who continue to use substances even after receiving early intervention services, as highlighted by our study and prior research, is a concern. Early intervention services may need to integrate more effective substance use management practices, as ongoing substance use and substance use disorders have an impact on overall treatment course and long-term outcomes in psychosis. As we learn more about substance use on a continuum, we will be able to better understand the types and patterns of substance use in this population, and identify and understand the factors that lead to continued substance use in this population. Such information has significant implications for improving early intervention services for psychosis.

Tables:

Table 1. Demographic Characteristics of the Study Sample

Total sample (*N=56)*	
Male (*N, %*)	47 (83.9)
Female (*N, %*)	9 (16.1%)
Age at FEP onset [*years, M(SD)]*	22.35 (4.44)
Age at consent signing [*years, M(SD)]*	25.24 (4.39)

Note. FEP= First-episode psychosis

Table 2. Outcome measures: Alcohol consumption in first-episode psychosis patients following two years of early intervention services

Frequency (*N=51)*	
Days per week, M(SD, range)]	1.61 (1.88, 0.25-7.00)
Frequent drinkers (*N, %*)	14 (27.5)
Infrequent drinkers (*N, %*)	37 (72.5)
Quantity (*N= 49)*	
Whole sample [*SDU per day, M(SD, range)*]	0.59 (0.69, 0.071-2.500)
Frequent drinker [*SDU per day, M(SD, range)*]	1.2 (0.56, 0.428-2.450)
Infrequent drinker [*SDU per day, M(SD, range)*]	0.34 (0.55, 0.017-2.500)

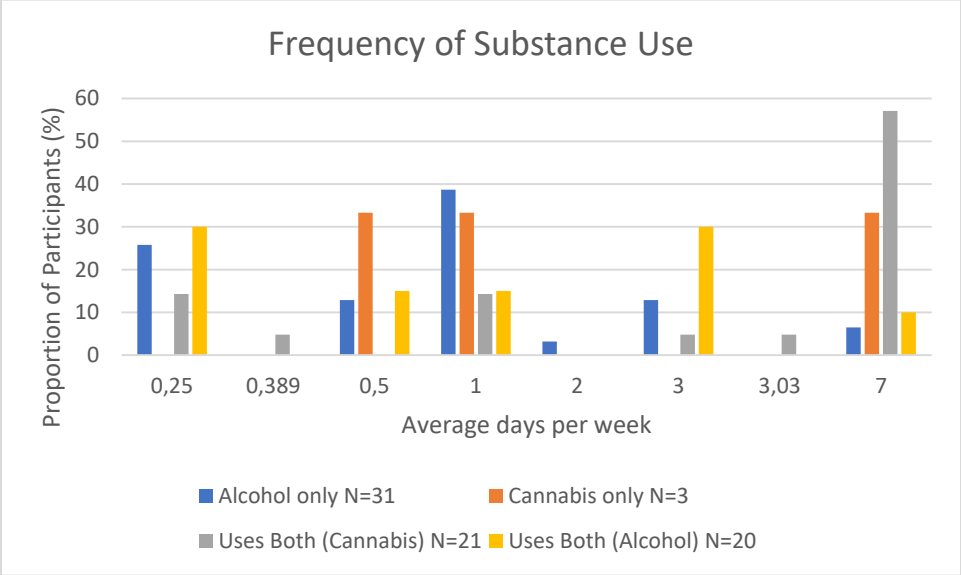
Note. Frequency is measured as the average number of days alcohol is drank per week. Quantity is measured as the average number of SDU consumed per day. SDU= standard drink unit. Frequent drinkers= drink 3 or more times per week. Infrequent drinkers= drink less than 3 days a week.

Table 3. Outcome measures: Cannabis consumption in first-episode psychosis patients following two years of early intervention services

Frequency (*N=25)*	
Days per week, M(SD, range)]	4.27 (3.10, 0.25-7.00)
Frequent users (*N, %*)	14 (60.9)
Infrequent users (*N, %*)	9 (39.1)
Quantity (*N= 24)*	
Grams (g) per day, M(SD, range)	1.28 (1.38, 0.018- 4.000)
Frequent users [*Grams (g) per day, M(SD, range)*]	1.68 (1.40, 0.710-5.000)
Infrequent users [*Grams (g) per day, M(SD, range)*]	0.73 (1.18, 0.028-3.500)

Note. Frequency is measured as the average number of days cannabis is consumed per week. Quantity is measured as the average number grams consumed per day. Frequent users= consume 3 or more times per week. Infrequent users= consume less than 3 days a week.

Figure 1. Frequency: Average number of days per week substance is used



Note. Frequency of substance use can be compared between 4 different types of users. For alcohol frequency you can see the average number of days alcohol is drank per week for participants who don't co-use cannabis (blue) and for those who do (yellow). The average number of days cannabis is consumed per week can be seen for those who don't co-use alcohol (orange) and for those who do (grey). The y-axis is the proportion of participants within each group, not the total sample. The x-axis is the average number of days per week ranging from 0.25 (much less frequent than once a week) to daily use.

Figure 2. Alcohol users: Frequent vs. Infrequent users

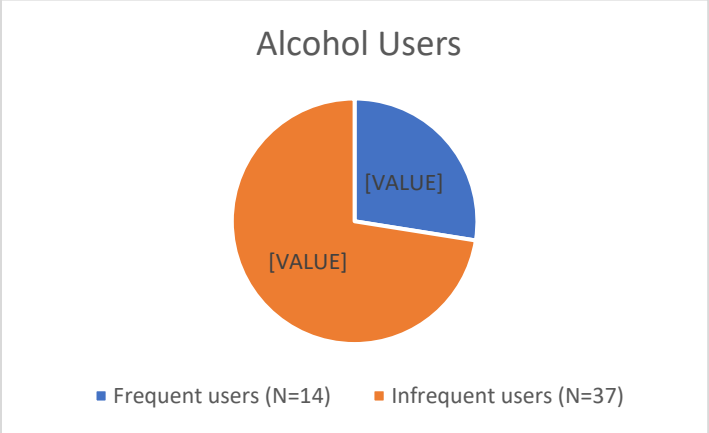


Figure 3. Cannabis users: Frequent vs. Infrequent users

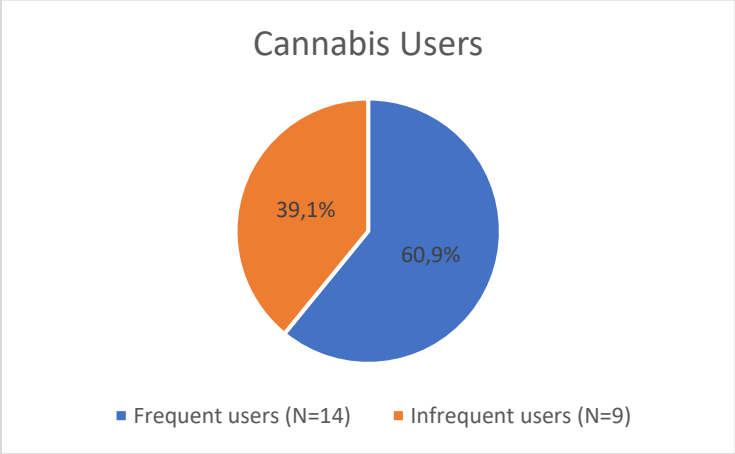
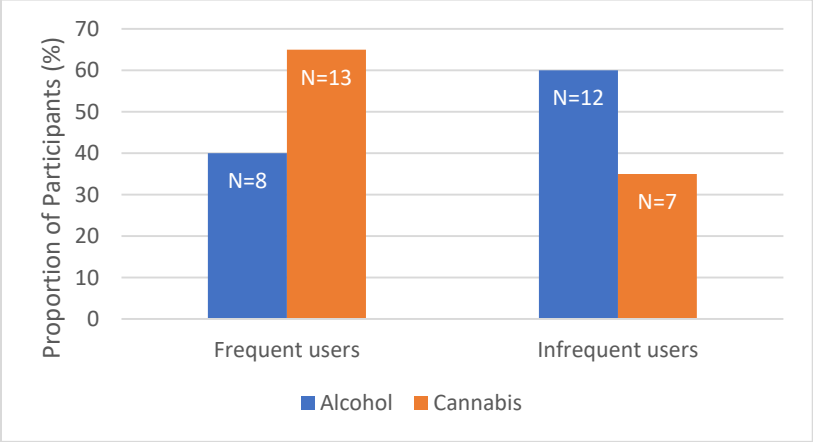


Figure 4. Participants who use both alcohol and cannabis: Frequent vs infrequent users



Note. 20 participants use both alcohol and cannabis. 8 of those (40%) are frequent alcohol users and 13 (65%) are frequent cannabis users. Frequent indicates using the substance 3 or more times per week.

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