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# Cannabis use and psychosis among patients hospitalized in psychiatric wards in Lebanon: a retrospective chart review

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## Abstract

**Background** Trends in cannabis use suggest a global increase in the past decade. Current evidence associates cannabis use with an increased risk of psychosis. This association has prompted a growing research interest in the association between cannabis use and psychiatric disorders, especially psychotic disorders. This study aims to gain a better understanding of the effect of cannabis on psychosis and its clinical progression.

**Results** We conducted a retrospective chart review of cannabis use in patients hospitalized for a psychosis episode over five years at the American University of Beirut Medical Center (AUBMC). Cannabis users were more likely to be young single males using other substances compared to non-cannabis users. Frequent cannabis use was associated with a higher likelihood of paranoia and legal problems. Other psychotic symptoms did not significantly differ between frequent cannabis users and non-users. The length of hospital stay and the duration of the psychotic episode did not significantly differ between cannabis users and non-users. Family stressors and family history of a psychotic disorder were associated with a higher likelihood of personal history of violence.

**Conclusions** This study is the first in Lebanon to reproduce findings supporting the association between cannabis and psychosis previously highlighted in other populations. Further prospective research is needed to better understand the effect of cannabis use on psychosis and to accordingly revise policies on cannabis legalization to reduce the global burden of psychotic disorders.

**Keywords** Cannabis, Delusions, Hallucinations, Psychotic disorders, Schizophrenia

## Background

With the global increase in cannabis use and its legalization in multiple countries [1, 2], there is growing interest in exploring the relationship between its misuse and psychiatric disorders, specifically psychosis. Increasing epidemiologic evidence correlates the chronic use of cannabis with the likelihood of developing symptoms of psychosis [3].

The current literature shows that cannabis can induce transient psychotic symptoms which may occur in the lifetime of about 1 in 200 of people who use cannabis [4, 5]. Moreover, studies suggest a dose–response correlation between cannabis use and the risk of psychosis

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with a significant increase for weekly or more frequent cannabis use [6]. In addition, there is an ongoing debate around whether the relationship between cannabis use and psychosis is of causal nature with much of the available evidence supporting the biological basis and temporal sequence for cannabis causing psychosis [5]. This is significant when the use of cannabis starts in adolescence, when the central nervous system is still developing and maturing [7]. A recent meta-analysis found cannabis use in adolescence to be associated with a long-lasting structural changes in the brain, particularly greater gray matter volume. These changes in gray matter of the cerebellar network were found to be associated with lower volume in a schizophrenia-related network compromising the insula and parts of the frontal gyrus. Results suggested that early use of cannabis in adolescence can impact the developmental trajectory of certain structural brain networks, subsequently increasing the risk for psychosis [8]. Along the same lines, the cumulative dose and frequency of cannabis consumption, specifically the tetrahydrocannabinol (Delta-9-THC) component, has been linked to an earlier age of onset for psychosis [9]. Conversely, cannabis use in early adolescence has been correlated with a highest risk of adult psychosis [10]. Evidence also links cannabis to an increased duration of psychotic episodes [9].

In Lebanon, data on cannabis and psychosis is scarce. In 2010, Karam et al. showed that cannabis is the most used illicit drug by high school and university students [11]. However, the effects of cannabis use on the evolution of psychotic disorders among the Lebanese population and the Arab region in general has not been extensively investigated. In one retrospective analysis of 222 patients admitted to the psychiatry inpatient unit at the St. Georges Hospital in Beirut between 1979 and 1992, a significantly higher cannabis use history was reported in patients diagnosed with schizophrenia when compared to other psychiatric disorders [12]. Another prospective study on 95 patients diagnosed with schizophrenia and admitted for psychosis in Morocco suggested a dose–effect of cannabis use on the onset of psychotic symptoms and the age of onset of cannabis use as a strong predictor for the development of schizophrenia [13]. Finally, another study on 75 patients in Tunisia suggested four predictors of cannabis-induced psychosis: having a family history of psychiatric disorders, and being single or separated, below 25 years old, or having been exposed to cannabis before age of 25 years old [14]. To further investigate the relationship between cannabis and psychosis in our population, we conducted a retrospective chart review of patients with cannabis use who were hospitalized for a psychotic episode at the American University of Beirut Medical Center (AUBMC). To the best of our knowledge, this is the first study in Lebanon and the region to examine the symptomatology of psychosis, its onset, recurrence, and duration in cannabis users compared to non-users.

This study aims to expand our understanding of the relationship between cannabis use and psychosis, in a culturally understudied population in the Arab World. We postulate that the use of cannabis accelerates not only the onset of psychosis, but also the progression of the disease, particularly in patients with a family history of psychotic disorders. We also postulate that cannabis use predisposes to more psychosis-related hospitalizations and worse clinical outcomes.

## Methods

### Study design and setting

We conducted a retrospective chart review of all patients admitted to the psychiatry unit at AUBMC for management of psychosis over a five-year duration (July 2012 until July 2017). The psychiatry unit at AUBMC is a specialized multi-disciplinary closed inpatient unit where patients with various psychiatric presentations are admitted. We collected data from the charts of patients using the electronic medical records system at AUBMC. All patient files were de-identified prior to data collection.

### Participants

We included patients admitted for psychotic symptoms or episode, regardless their primary psychiatric diagnosis (i.e., psychosis in the setting of schizophrenia, bipolar disorder, major depressive disorder, or substance-induced psychosis). We excluded patients under the age of 18 and those admitted for delirium or psychosis secondary to a general medical condition. Sampling was not done in our study as the expected population size was not large and, therefore, it was feasible to include the whole population in the analysis. The study was approved by the Institutional Review Board at AUB (IRB ID: IM.FT.02).

### Variables of interest

We collected the following data from included participants: demographic factors, information about cannabis use (based on patients' self-report and results of urine drug testing), including time of last cannabis use before the first episode of psychosis and the duration and frequency of cannabis use, history of all other substance use, onset presentation and frequency of psychotic episodes, and hospital course and outcomes (such as length of stay, agitation, and use of physical restraints). Patients were divided into three groups based on their cannabis use: no current cannabis use which included both never users and ex-users, frequent cannabis use, and infrequent cannabis use. Although there is no consensus on how to

characterize the frequency of cannabis use, frequent cannabis use was defined as weekly or more frequent use over months or years, while infrequent cannabis use was defined as less than four times per month [15, 16]. We excluded infrequent (non-habitual) cannabis users in our analysis.

### Statistical methods

We used IBM SPSS version 26.0 for statistical analysis. We tested for correlations between cannabis use and various demographics, psychosis symptomatology, and clinical progression. Associations between different clinical and demographic characteristics and cannabis use were assessed using Pearson's Chi-Square or Fisher's exact, as indicated for categorical variables. Mean differences of continuous variables were assessed using T-tests. Statistical significance was determined at $P<0.05$.

## Results

We initially screened a total of 1595 patients. We excluded 847 participants by analysis of patient logs, due to their age being below 18 or the absence of psychotic symptoms during admission. We included the remaining 748 participants in a detailed chart evaluation, based on the preset inclusion and exclusion criteria. We included 295 patients hospitalized with psychosis in the final analysis (Fig. 1).

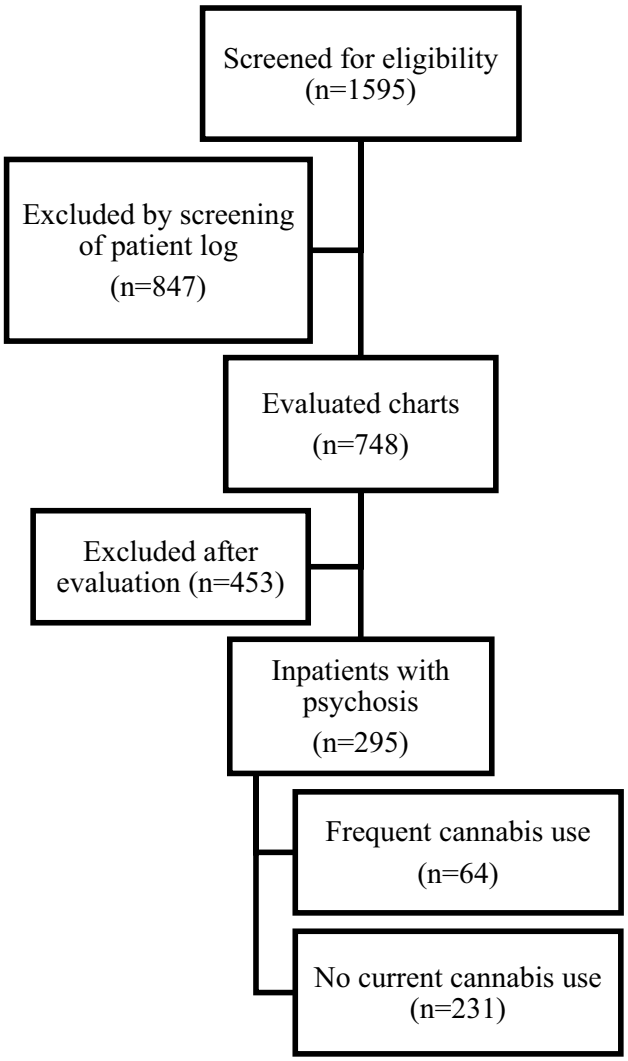


**Fig. 1** Recruitment process flowchart

### Demographic differences between frequent cannabis users and non-users

The prevalence of frequent cannabis use among patients admitted with a diagnosis of psychosis was 22.3%. Compared to non-users, frequent cannabis users were more likely to be younger (mean age of 27 years versus 38 years, $P=0.000$), males ($P=0.000$), single ($P=0.001$), or had recent academic stressors ($P=0.004$) (Table 1). They were also more likely to engage in other substance use, including nicotine, alcohol, amphetamines, cocaine, and opioids ($P=0.000$ for all) (Table 1). When examining urine drug testing for patients, testing was only performed in 20% of cases only.

### Psychotic symptoms in frequent cannabis users compared to non-users

Paranoia, the persistent irrational suspicion of others [17], was reported in 86.3% of frequent cannabis users versus 68.9% of non-users ($P=0.013$) (Table 2). Other psychotic symptoms, including all types of delusions, auditory hallucinations, visual hallucinations, disorganized thoughts or behaviors, and negative symptoms did not significantly differ between frequent cannabis users and non-users.

### Hospital course of frequent cannabis users compared to non-users

The average age at the first psychotic episode was 24 years among frequent cannabis users and 29 years for non-users ($P=0.006$) (Table 3). There was no significant difference in all other assessed variables across the two groups, including duration of psychotic episode or inpatient stay, agitation, need for restraints, recurrence of psychosis, medication adherence, or use of psychotropic medications (Table 3).

Among frequent cannabis users, 70% of patients had a 24 to 48-h window between last cannabis use and the onset of current psychotic episode, while 30% had onset later than 48 h after last cannabis use.

Among patients admitted for psychosis with frequent cannabis use, diagnoses on discharge were as

**Table 1** Demographic differences between frequent cannabis users and non-users ($N=295$)

| | Frequent cannabis users (%) | Cannabis non-users (%) | *P*-value |
|---|---|---|---|
| **Sex** | | | |
| Male | 90.20 | 48.20 | **0.000** |
| **Age** | | | |
| *years (SD)* | 27.37 (8.97) | 37.78 (14.45) | **0.000** |
| **Relationship Status** | | | |
| Married | 7.80 | 29.40 | **0.001** |
| **Employment Status** | | | |
| Employed | 57.10 | 43.70 | 0.09 |
| *values of variables below represent participants who endorsed them* | | | |
| **Comorbid chronic medical condition** | 30.00 | 30.10 | 0.99 |
| **History of legal problems** | 9.80 | 1.80 | **0.013** |
| **History of violence** | 35.30 | 24.00 | 0.097 |
| **Financial stressors** | 5.90 | 8.10 | 0.774 |
| **Familial stressors** | 42.00 | 31.80 | 0.169 |
| **Interpersonal stressors** | 33.30 | 31.70 | 0.819 |
| **Academic stressors** | 19.60 | 5.90 | **0.004** |
| **Family history of psychiatric disorders** | 48.60 | 39.10 | 0.297 |
| **Family history of psychotic disorders** | 52.60 | 32.70 | 0.097 |
| **Nicotine use** | 84.00 | 47.50 | **0.000** |
| **Alcohol use** | 68.60 | 21.90 | **0.000** |
| **Amphetamine use** | 15.70 | 0.90 | **0.000** |
| **Cocaine use** | 35.30 | 3.60 | **0.000** |
| **Opioid use** | 17.60 | 1.40 | **0.000** |

**Table 2** Psychotic symptoms in frequent cannabis users compared to non-users ($N=295$)

| | Frequent cannabis users (%) | Cannabis non-users (%) | *P*-value |
|---|---|---|---|
| Paranoia | 86.30 | 68.90 | **0.013** |
| All types of delusions | 86.30 | 80.60 | 0.347 |
| Auditory hallucinations | 35.30 | 41.00 | 0.454 |
| Visual hallucinations | 15.70 | 16.70 | 0.865 |
| Disorganized thoughts or behaviors | 35.30 | 28.80 | 0.364 |
| Negative symptoms | 17.60 | 18.90 | 0.834 |
| Catatonia | 2.00 | 3.60 | 1 |

follows: substance-induced psychosis (36%); psychosis not otherwise specified (NOS) (22%); schizophrenia spectrum disorder (22%); bipolar disorder (18%); and major depressive disorder (2%). Among patients with no cannabis use, diagnoses on discharge were as follows: schizophrenia spectrum disorder (40%); bipolar disorder (34%); psychosis NOS (18%); major depressive disorder (3%); and substance-induced psychosis (2%). Among frequent cannabis users 23.8% received substance use treatment; while 76.2% never received substance use treatment.

### Predictors of clinical course of psychotic symptoms and other outcomes

Patients with a family history of a psychotic disorder were almost 9 times more likely to have a personal history of violence (adjusted OR: 8.86, 95% CI [2.54–25.25], $P=0.001$) (Table 4). Patients with a family history of a psychotic disorder were also approximately three times more likely to have paranoia (adjusted OR: 3.05, 95% CI [0.97–9.55], $P=0.056$) as compared to patients with no family history of a psychotic disorder (Table 4). Patients who were compliant with their medications were less likely to have delusions (adjusted OR: 0.42, 95% CI [0.19–0.94], $P=0.035$) when compared to patients not compliant with their medications (Table 4). Patients experiencing psychosis who reported interpersonal stressors were more likely to have negative symptoms (adjusted OR: 2.29, 95% CI [1.18–4.42], $P=0.014$) as compared to patients with no interpersonal stressors (Table 4). Patients who frequently used cannabis were almost three times more likely to have paranoia (adjusted OR: 2.87, 95% CI [0.99–8.31], $P=0.052$) as compared to those who did not use cannabis (Table 4).

**Table 3** Hospital course of frequent cannabis users compared to non-users ($N = 295$)

| | Frequent cannabis users (%) | Cannabis non-users (%) | *P*-value |
|---|---|---|---|
| **Age at first psychotic episode** *years (SD)* | 24.11 (7.36) | 29.17 (13.35) | **0.006** |
| **Duration of psychotic episode** *days (SD)* | 40.2 (43.8) | 29.42 (39.47) | 0.147 |
| **Duration of inpatient stay** *days (SD)* | 6.86 (6.77) | 8.22 (6.93) | 0.206 |
| *values of variables below represent participants who endorsed them* | | | |
| **Agitation** | 64.70 | 50.90 | 0.075 |
| **Need for restraints** | 11.80 | 13.50 | 0.739 |
| **Psychosis recurrence status (≥ 2 episodes)** | 46.50 | 53.50 | 0.369 |
| **Medication adherence** | 57.10 | 59.90 | 0.741 |
| **Antipsychotic medications** | 82.40 | 90.50 | 0.092 |
| **Mood stabilizing medications** | 31.40 | 27.00 | 0.532 |
| **Antidepressant medications** | 19.60 | 22.10 | 0.7 |
| **Anxiolytic medications** | 35.30 | 34.20 | 0.886 |

**Table 4** Predictors of clinical course of psychotic symptoms

| **Variable** | **Violence** | | | | | |
|---|---|---|---|---|---|---|
| | **Crude OR** | **95% CI** | ***P*-value** | **Adjusted OR** | **95% CI** | ***P*-value** |
| **Family history of psychotic disorder** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 4.08 | 1.61–10.37 | **0.003** | 8.86 | 2.54–25.25 | **0.001** |
| **Familial stressors** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 1.90 | 1.10–3.27 | **0.021** | 1.76 | 0.96–3.23 | 0.067 |
| | **Paranoia** | | | | | |
| | **Crude OR** | **95% CI** | ***P*-value** | **Adjusted OR** | **95% CI** | ***P*-value** |
| **Cannabis use** | | | | | | |
| Non-user | 1.00 | | | 1.00 | | |
| Frequent user | 2.84 | 1.22–6.61 | **0.016** | 2.87 | 0.99–8.31 | 0.052 |
| **Family history of psychotic disorder** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 2.83 | 1.10–7.55 | **0.038** | 3.05 | 0.97–9.55 | 0.056 |
| | **Delusions** | | | | | |
| | **Crude OR** | **95% CI** | ***P*-value** | **Adjusted OR** | **95% CI** | ***P*-value** |
| **Medication adherence** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 0.38 | 0.18–0.81 | **0.012** | 0.42 | 0.19–0.94 | **0.035** |
| **Financial stressors** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 0.27 | 0.12–0.63 | **0.003** | 0.26 | 0.10–0.62 | **0.003** |
| | **Negative symptoms** | | | | | |
| | **Crude OR** | **95% CI** | ***P*-value** | **Adjusted OR** | **95% CI** | ***P*-value** |
| **Interpersonal stressors** | | | | | | |
| No | 1.00 | | | 1.00 | | |
| Yes | 1.98 | 1.07–3.66 | **0.03** | 2.29 | 1.18–4.42 | **0.014** |

## Discussion

The prevalence of cannabis use among our sample was found to be 22.3%. These results were similar to results from recent studies; a study on 201 patients admitted with psychosis found that 21.4% tested positive for cannabis [18]. Another study that collected data from 53 studies of treatment samples and 5 epidemiological studies found that the estimated prevalence of current cannabis use among patients with psychosis was 23% [19]. This is in contrast to the study done by Johnson et al. in 2016 which found that bipolar disorder was the most common diagnosis for patients admitted with psychosis and found to be cannabis users [18].

There is growing evidence suggesting that adults who frequently use cannabis are at increased risk of being diagnosed with psychotic disorders as compared to non-users, and it has been suggested that this risk increases following a dose–effect model [3, 13]. A study conducted in European cities revealed a correlation between incident psychosis and the local rate of regular and heavy cannabis use [20]. Some reports found a two-fold increase in the risk of psychotic disorders in cannabis users and almost a four-fold increase among heavy users [21]. The potency and frequency of cannabis use are considerably correlated with the development of psychosis, with daily use of high-potency cannabis causing a 4.8-fold increase in the risk of psychotic disorders [22]. Evidence suggests that if high-potency cannabis were not available, the incidence of first-episode psychosis could be reduced by 12% to 50% [22]. Age-of-use onset, frequency, and high potency use were found to moderate the causal relationship between cannabis use and psychosis [6, 14]. In fact, research on cannabis and its relation to psychosis showed that cannabis users with psychosis were significantly more likely to be young, male, and single in comparison to non-users. Our findings are consistent with international data on the demographics of the users: being more likely to be male and unmarried. We detected earlier onset of psychotic symptoms in our frequent cannabis users, which is consistent with findings in the literature [23]. It is also important to take into consideration family history because a family history of psychosis combined with frequent cannabis use can result in a multiplicative 20-fold risk of psychosis [6].

It has been suggested that cannabis and schizophrenia can be associated in several ways with cannabis either triggering schizophrenia, being used by patients with new-onset schizophrenia for symptoms alleviation, or having a bidirectional relationship with schizophrenia [22]. Studies based on genetic data found evidence suggesting a possibly shared genetic etiology between the risk of psychosis and the likelihood to use cannabis [24]. Some neurobiological markers associated with chronic cannabis exposure (e.g., synaptic vesicle density) have also been observed in psychotic disorders, supporting biological evidence of the causality of the cannabis-psychosis relationship [5]. In line with the biopsychosocial model, several theories were proposed explaining the link between the two components [25], one of them being that some individuals are genetically susceptible to developing psychosis after consumption of cannabis due to a mutation or polymorphism in genes related to the dopaminergic pathways, such as the Catechol-O-methyltransferase (COMT) gene [26]. Some studies attempted to investigate the causality between the use of cannabis and the onset of psychotic disorders and found that the reason for self-medication fails to explain the relationship [25]. Another proposed mechanism is that individuals who are predisposed to develop a psychotic disorder have a preference for cannabis due to the cannabidiol component of cannabis that may reduce the negative symptoms of the prodrome phase [27].

The specificity of the association between cannabis and psychosis is potentially confounded by many factors. Frequent cannabis users in our sample were more likely to be using other substances such as nicotine, benzodiazepines, hallucinogens, opioids, and alcohol when compared to non-users of cannabis. This observation goes in line with research showing that cannabis users have significantly higher odds of using other substances [18, 28]. Moreover, the association between the use of cannabis and other drugs in the setting of psychosis can be explained by the shared vulnerability model, relating certain psychopathological diseases, like schizophrenia or mood disorders, to increased creativity and cognitive disinhibition [29]. Many substances are known to trigger psychosis, but psychosis induced by cannabis has the highest risk of converting to schizophrenia [5].

As for symptomatology, cannabis use in patients with psychotic disorders can aggravate symptoms and strongly predict relapse and/or chronicity of psychosis [30, 31]. Patients with psychosis who regularly use cannabis tend to have worse psychotic symptoms and cognitive dysfunction, as well as a higher risk of re-hospitalization, as compared to non-users [20, 32]. Some studies showed that earlier onset cannabis use in adolescence correlates with more severe positive symptoms, especially hallucinations and delusions, while others did not find any differences when comparing with the age of onset of cannabis use and with non-users [33]. A key finding in our results is the fact that the only psychotic symptom that was found to be more significantly present in frequent cannabis users versus non-users is paranoia. This finding is consistent with the established relationship between cannabis use and paranoia; predictors seem to be negative affect and anomalous cognitive experiences [34].

Other studies showed different results when it comes to the symptomatology of psychosis influenced by cannabis; González-Pinto et al. determined no difference in positive and negative symptoms between cannabis users and non-users [28]. However, the same study showed a decrease in negative symptoms for the patients who stopped using cannabis after an episode of psychosis in comparison to the patients who did not stop using. No significant differences in the course, admission duration, or psychotropic medication administration among cannabis users and non-users were found in this study or ours. On the other hand, a study by Johnson et al. showed that cannabis users were more likely to be agitated when admitted to the psychiatric ward, needing more physical restraints and tranquilizers [18]. Interestingly, in our study, patients with cannabis use did not have higher rates of agitation or need for restraints when compared to patients without cannabis use. Medication non-adherence is the only factor that was significantly correlated with the need for restraints in our study. Positive psychotic symptoms, lack of insight, and concurrent substance use, especially cannabis use, are among a few risk factors for violent behaviors in psychotic disorders [35]. In contrast to previous findings that cannabis use, especially early-onset, is associated with increased rates of violence among those with psychiatric disorders, psychotic patients with cannabis use in our sample did not have an increased history of violence when compared to non-users [1, 36]. However, psychotic patients with cannabis use in our study had more legal issues; this could be due to cannabis use currently being illegal in Lebanon (and our region); therefore, legal involvement could be unrelated to violence but rather related to possession.

A concerning finding in our study is that urine drug testing was ordered for less than half of patients admitted with psychosis and was only performed for 20% of patients with psychosis. It is emergent to implement consistent drug screening, especially in the emergency department or acute hospitalization phase. However, patients may not cooperate with drug testing due to potential stigma and fear of legal repercussions in Lebanon, although current laws do not prosecute those testing positive in medical or treatment settings. The low rate of completed drug testing in our sample may have led to an underestimation of cannabis related psychosis in our study. Our sample size is relatively small, and the sample was taken from a tertiary academic hospital which may not be representative of other hospitals in Lebanon. The low rate of completed drug testing in our sample may have led to an underestimation of cannabis-related psychosis. Lebanon may not be representative of the broader Arab region given the easy availability and affordability of locally grown cannabis.

## Conclusion

While reducing cannabis use might have a substantial impact on psychotic disorders, this is yet to be adequately determined through prospective longitudinal studies. Around a quarter of patients with psychosis admitted at AUBMC were found to use cannabis despite the limited drug screening was conducted. Our results highlight the importance of screening and referring patients with cannabis use disorder to drug treatment/rehabilitation services, which might improve outcomes and reduce relapse rates. Given that our patients who reported cannabis use were younger than non-users on average, this confirms the need for a discussion on the increasing prevalence and normalization of cannabis use in our younger population, in the absence of a legal framework in Lebanon or updated public health regulations. This study provides a unique perspective in our country and indicates that Lebanon exhibits similar trends reported in previous studies on cannabis use and psychosis around the world. Our results are timely for Lebanon given the renewed public interest amid active governmental discussions on the legalization of cannabis use in the country. Further research is needed globally to elucidate the interaction between cannabis use and psychosis and is essential for the medical community, patients, and policymakers.

#### Abbreviations

| | |
|---|---|
| THC | Tetrahydrocannabinol |
| AUBMC | American University of Beirut Medical Center |
| NOS | Not otherwise specified |
| COMT | Catechol-O-methyltransferase |

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Not applicable.

#### Authors' contributions

PMG participated in data curation, formal analysis, writing of the original draft, and editing of the manuscript. ZB participated in project conceptualization and administration, data curation, formal analysis, and writing of the original draft. JK and GBS participated in data curation, formal analysis, and writing of the original draft. SEH and HS participated in formal analysis, writing of the original draft, and editing of the manuscript. FT performed project conceptualization, administration, supervision, and investigation, and participated in data curation, formal analysis, writing of the original draft, and editing of the manuscript. All authors read and approved the final manuscript.

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#### Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

#### Ethics approval and consent to participate

The study is a retrospective chart review that was approved by the Institutional Review Board (IRB) at the American University of Beirut (AUB) (IRB ID: IM.FT.02).

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare that they have no competing interests.

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