Adverse Mental Health Effects of Cannabis Use: A Literature Review and a Prevalence Study in Local Cannabis Abusers

Submitted to

Beat Drug Fund Association

Submitted by

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Content

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Abbreviations

ASI: Addiction Severity Index

BDI: Beck Depression Inventory

BPRS: Brief Psychiatric Rating Scale

CBT: Cognitive Behavioural Therapy

CCPSA: Counseling Centres for Psychotropic Substance Abusers

CIADs: Cannabis induced anxiety disorders

CIMDs: Cannabis induced mood disorders

CIP: Cannabis induced psychosis

CSD: The Hong Kong Correctional Services Department

CUD: Cannabis Use Disorder

DSM-V: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

HADSA: Hospital Anxiety Depression Scale

ICE: Methamphetamine

MET: Motivational Enhancement Therapy

MWC: Marijuana Withdrawal Checklist

NPS: No psychotic symptoms

OR = Odds ratio

PANSS: Positive and Negative Symptoms Scale

PPS: Persistent psychotic symptoms

RAs: Research assistants

SCID: Structured Clinical Interview for DSM-IV

SDS: Severity of Dependence Scale

THC: Tetrahydrocannabinol

TPS: Transient psychotic symptoms

Executive summary

The objective of this study was to determine the prevalence of cannabis-induced psychosis and psychotic symptoms, mood, and anxiety disorders in a sample of Hong Kong residents who abused cannabis. Our sample comprised 194 participants who were recruited from the Counselling Centres for Psychotropic Substance Abusers (CCPSAs), the Correctional Services Department (CSD), residential rehabilitation centres, and a local university from August 2019 to October 2023. All participants were interviewed face-to-face for 40–90 minutes each to diagnose their psychiatric condition and to collect their demographic, clinical, and drug use data.

Most of the participants were male and unemployed, with a mean age of 26 and a mean of 11 years of education; 89% were single, and 68% were current smokers. The participants' mean age at first cannabis use was 18, and their mean duration of using cannabis was 5 years. The lifetime mean number of days using cannabis was 877. The lifetime mean total cannabis consumption was 2,568 joints, and the lifetime mean consumption per day was 2.5 joints. Approximately three-quarters of the participants had lifetime cannabis dependence.

Sixty-nine percent of the participants were poly-drug users, with the five most commonly used drugs being cocaine (54%), ketamine (39%), ecstasy (32%), ice (methamphetamine, 29%), and hypnotics (21%). The age at first use of these other drugs ranged from 17 to 20 years, and the duration of use ranged from 2 to 4 years. The mean number of days of other-drug use per month in the participants' regular-use period ranged from 12 to 23. Current dependence on these drugs was rare (range: 1%–14%).

Approximately 87% of the participants reported experiencing withdrawal symptoms, suggesting that these symptoms are very common. The average number of symptoms was five, and the five most common symptoms were, in order, a craving to smoke cannabis, strange dreams, depressed mood, sweating, and restlessness.

Approximately 70% of the participants had lifetime substance-induced psychosis, and a minority (14%) of the participants had a lifetime diagnosis of cannabis-induced psychosis (CIP). The mean duration of CIP was 2 days. A small proportion of the participants had other psychoses such as delusional disorder or schizophrenia. CIP was related to a higher level of education (13 vs 11 years), being non-smoker (15% vs 4%), recruited from non-residential detoxification services (41% vs 22%), and being less likely to have a religion (19% vs 41%). CIP was also related to a higher amount of cannabis consumption and current dependence of cannabis (30% vs. 6%, $p<0.001$). A logistic regression revealed that education (odds ratio OR = 1.3) and current dependence on cannabis (OR = 11.7) predicted the occurrence of CIP. Amongst the cannabis-only users, 35% had CIP, and the mean duration of CIP was 3 days. A small proportion of the participants had other psychoses such as delusional disorder or schizophrenia. Those with CIP and those without CIP did not differ in terms of demographics and pattern of cannabis use.

Seventy-six percent of the entire sample had lifetime psychotic symptoms, and 27% had transient psychotic symptoms (TPS) that lasted for 6 days (range: 1–28 days) after their most recent cannabis use. Four percent had persistent psychotic symptoms (PPS), with the time between their most recent use of cannabis and the day of assessment being a mean of 103 days (range: 24–182 days). In terms of subtypes of psychotic symptoms, more than half of the entire sample reported lifetime delusions (67%) or hallucinations (58%). Delusions of reference (60%) were the most common type of delusion, followed by persecutory delusions (26%) and

grandiose delusions (12%). Auditory hallucinations were the most common type of hallucination (45%), followed by visual hallucinations (35%). Thirteen percent of the entire sample reported thought broadcasting.

Amongst the cannabis-only users, 48% had lifetime psychotic symptoms, and 23% had TPS that lasted for a mean of 1.6 days (range: 1–4 days) after their most recent use of cannabis. Five percent of these participants had PPS, with a mean interval of 80 days (range: 31–152 days) between their most recent use of cannabis and the day of assessment. In terms of subtypes of psychotic symptoms, a third of these participants reported lifetime delusions (33%) or hallucinations (33%). Delusions of reference (32%) were the most common type of delusion, followed by persecutory delusions (12%) and grandiose delusions (5%). Auditory hallucinations were the most common type of hallucination (27%), followed by visual hallucinations (12%). Three percent of these participants reported thought broadcasting.

In the entire sample, the participants with psychotic symptoms had a higher mean age (27 vs 24) and were more likely to be unemployed (75% vs 47%), to have religious beliefs (42% vs 26%), and to have a history of smoking (33% vs 6%) than those without psychotic symptoms. In terms of drug use, the participants with psychotic symptoms had a shorter duration of cannabis use in the past month (2 days vs 6 days) and higher rates of lifetime use of other substances (2.3 vs 0.7 type of drugs) than those without psychotic symptoms. Specifically, the participants with psychotic symptoms were more likely to have used cocaine (61% vs 28%,), ketamine (48% vs 13%), ecstasy (40% vs 9%), ice (35% vs 11%), or hypnotics (26% vs 4%) than those without psychotic symptoms. A logistic regression analysis revealed that age (OR = 1.08), unemployment (OR = 2.69), and the number of other drugs used (OR = 1.69) independently predicted the presence of psychotic symptoms. Amongst the cannabis-only users,

those with psychotic symptoms were more likely to be unemployed (66% vs 32%) than those without psychotic symptoms, and a logistic regression analysis revealed that unemployment (OR = 4.0) independently predicted the presence of psychotic symptoms.

In the entire sample, those with PPS had a lower educational level (9 vs 12 years) and were more likely to reside in public housing (43% vs 30%, p = 0.001) than those without PPS. A logistic regression analysis revealed no independent predictor of PPS. Amongst the cannabis-only users, those with PPS were older (28 vs 22 years), had a lower level of education (10 vs 14 years), were more likely to be recruited from non-residential settings (100% vs 36%), and were less likely to reside in public housing (33% vs 43%) than those without PPS. In terms of cannabis-use patterns, those with PPS had a higher level of cannabis consumption per day in the past year (7 vs 2 joints) than those without PPS. A logistic regression analysis revealed no independent predictor of PPS.

Lifetime substance-induced mood disorders were also common, as they were exhibited by 39% of the entire sample; the most common presentation was depressive episodes, which were experienced by 25% of the entire sample. In addition, cannabis-induced mood disorders (CIMDs) were exhibited by 9% of the entire sample. The prevalence rates of lifetime diagnoses of major depressive disorder and bipolar disorder were 18% and 3%, respectively. Those with CIMDs were more likely to have current dependence on cannabis (41% vs 6%) and higher cannabis consumption in the past one year than those without CIMDs. A logistic regression found that higher daily average use of cannabis (OR = 1.4) and current dependence on cannabis (OR = 6.6) predicted the occurrence of CIMDs.

Amongst the cannabis-only users, 50% had a lifetime diagnosis of mood disorders, with 25% having cannabis-induced anxiety disorders (CIADs). The prevalence rates of lifetime diagnoses of major depressive disorder and bipolar disorder were 25% and 2%, respectively. Individuals with CIMDs did not differ from those without CIMDs in terms of demographics characteristics. Those with CIMDs were more likely to exhibit current dependence on cannabis (46% vs 14%, $p = 0.020$).

Eight percent of the entire sample had a lifetime substance-induced anxiety disorder, with the most common presentation being substance-induced obsessive-compulsive features (8%). The prevalence of CIADs was 1%, and those with CIADs used cannabis more frequently in the past month (21 vs 3 days), and had a higher total consumption (63 vs 5 joints) and consumption per day (2.3 vs 0.3 joints) in the past month, than those without CIADs. A logistic regression found that total consumption of cannabis in the past month predicted the occurrence of CIADs (OR = 1.03). Amongst cannabis-only users, 5% had a lifetime diagnosis of an anxiety disorder, with 3% having CIADs.

In terms of the level of psychopathology of the entire sample, the mean scores on the Beck Depression Inventory (BDI), Hospital Anxiety Depression Scale (HADSA), Severity of Dependence Scale (SDS), and Marijuana Withdrawal Checklist (MWC) were 12.6 ± 10.6, 4.6 ± 4.6, 6.4 ± 3.8, and 7.3 ± 7.1, respectively. In addition, the mean score on the Brief Psychiatric Rating Scale (BPRS) was 18.1 ± 0.4, and all scores were below the respective cut-off point of the scale. Moreover, on the Positive and Negative Symptoms Scale (PANSS), the mean total score was 33.1 ± 0.4; the mean scores on the positive, negative, and general psychopathology (GP) items of the PANSS were 7.0 ± 0.0, 7.0 ± 0.0, and 16.1 ± 0.4, respectively; and no scores were greater than the cut-off points of the scales. Overall, female

sex and cannabis use per day in the past month predicted scores on the BDI; female sex predicted scores on the HADSA; education level predicted scores on the BPRS and PANSS GP; and unemployment and lifetime dependence on cannabis predicted MWC score

In terms of the level of psychopathology of the participants who were cannabis-only users, their mean scores on the BDI, HADSA, SDS, and MWC were 12.0 ± 10.3, 4.6 ± 4.4, 4.3 ± 3.2, and 5.8 ± 6.4, respectively. In addition, their mean score on the BPRS was 18.0 ± 0.0, and all scores were below the respective cut-off points. Moreover, on the PANSS, their mean total score was 33.0 ± 0.0; their mean scores on the positive, negative, and GP items of the PANSS were 7.0 ± 0.0, 7.0 ± 0.0, and 16.0 ± 0.0, respectively, and none of the participants scored higher than the cut-off points (Leucht et al., 2005). Overall, female sex predicted scores on the BDI and HADSA, and lifetime dependence on cannabis predicted scores on the MWC.

In conclusion, in our sample of cannabis users, psychotic symptoms such as delusions and hallucinations were very common. In the majority of users, these psychotic symptoms are short-lasting. On the other hand, a small fraction of users experienced PPS. One in seven individuals in our sample had CIP, the risk of which was increased by cannabis use. One in eleven individuals in our sample had CIMDs, with the predominant presentations being depressive episodes, and total cannabis consumption in the past 2 years predicted the presence of CIMDs. Nevertheless, cannabis-induced anxiety disorders were rare.

本研究的目標是確定濫用大麻者中大麻誘發的精神病，精神病症狀、情緒和焦慮障礙的病發率。從 2019 年 8 月至 2023 年 10 月，我們招募了一百九十四名大麻使用者。所有的大麻使用者都接受了持續 40 至 90 分鐘面對面的訪談，以診斷其精神狀態，並搜集了相關的人口統計、臨床和藥物使用數據。

參與本研究的人士大多數為男性，平均年齡為 26 歲且失業，受教育年限平均為 11 年。其中 89%為單身，68%是目前吸煙者。使用者來自濫用精神藥物者輔導中心（CCPSA）、懲教署（CSD）、居住式康復中心和一所本地大學。本研究中的大麻使用者的首次使用大麻的平均年齡為 18 歲，使用大麻的平均持續時間為 5 年。終身使用大麻的平均天數為 877 天。使用者終身總使用大麻量為 2,568 支卷煙，每天平均使用 2.5 支卷煙。大約四分之三的使用者存在大麻依賴問題。

百分之六十九的使用者是多種藥物使用者。其中使用最常見的五種藥物分別是可卡因（54%）、氯胺酮（39%）、搖頭丸（32%）、冰毒（甲基安非他明，29%）和安眠藥（21%）。其他藥物的首次使用年齡介於 17 至 20 歲之間，使用時間從 2 至 4 年不等。使用者在定期使用多種藥物期間，每月平均使用天數在 12 至 23 天之間。參與本研究的人士目前對這些藥物的依賴現象並不常見（1%–14%）。

在所有使用者中， 大約 87%的使用者報告出現戒斷症狀，表明這些症狀非常普遍。平均症狀數量為五個。最常見的五個症狀依次是渴望吸食大麻、奇怪的夢境、抑鬱情緒、出汗和焦躁不安。

約 70%的使用者在生命周期內曾經出現毒品誘發的精神病，而部份使用者（14%）曾被診斷為大麻誘發的精神病（CIP）。CIP 的平均持續時間為 2 天。少數使用者有其他精神病，如妄想性障礙或精神分裂症。CIP 與更高的教育水平（13 年對比 11 年）、非吸菸人士（15%對比 4%）、來自非居住式康復中心（41%對比 22%），以及沒有宗教信仰（19%對比 41%）有關。CIP 亦與較高的大麻使用量以及目前對大麻的依賴程度（30%對比 6%，p<0.001）有關。邏輯回歸分析發現教育程度（OR=1.3）和目前對大麻的依賴程度（OR=11.7）能預測 CIP 的出現。在僅使用大麻的使用者中，35%出現了 CIP。CIP 的平均持續時間為 3 天。少數使用者有其他精神病，如妄想性障礙或精神分裂症。CIP 組和非 CIP 組在人口統計學特徵和大麻使用模式方面沒有顯著差異。

在所有使用者中，76%的大麻使用者曾經有精神症狀。在精神症狀的模式方面，27%的人出現了短暫性精神症狀（TPS），其精神症狀在最後一次使用大麻後持續了 6 天（範圍為 1 至 28 天）。4%的使用者出現了持續性精神症狀（PPS），這些症狀發生在最後一次使用大麻和評估當天之間的時間，平均為 103 天（範圍為 24 至 182 天）。在精神症狀的亞型方面，超過一半的使用者報告曾經出現妄想 （67%）或幻覺（58%）。參照妄想（60%）是最常見的妄想類型，其次是被害妄想（26%）和自大妄想（12%）。幻聽是最常見的幻覺類型（45%），其次是視覺幻覺（35%）。樣本中有 13%的人報告思想播放症狀。

在僅使用大麻的使用者中，48%的大麻使用者曾經有精神症狀。在精神症狀的模式方面，23%的人出現了短暫性精神症狀（TPS），其精神症狀在最後一次使用大麻後持續了 1.6 天（範圍為 1 至 4 天）。5%的使用者出現了持續性精神症狀（PPS），這些症

狀發生在最後一次使用大麻和評估當天之間的時間，平均為 80 天（範圍為 31 至 152 天）。在精神症狀的亞型方面，三分之一的使用者報告曾經出現妄想（33%）或幻覺（33%）。參照妄想（32%）是最常見的妄想類型，其次是被害妄想（12%）和自大妄想（5%）。幻聽是最常見的幻覺類型（27%），其次是視覺幻覺（12%）。樣本中有 3%的人報告思想播放症狀。

在所有使用者中，具有精神症狀的使用者平均年齡較高（27 歲對比 24 歲）、失業比例較高（75%對比 47%）、較高可能有宗教信仰（42%對比 26%）和吸煙史（33%對比 6%）。在藥物使用方面，具有精神症狀的群體在當前一個月內使用大麻的持續時間較短（2 天對比 6 天），但終身使用其他毒品的比例較高（2.3 種對比 0.7 種）。具體而言，具有精神症狀的使用者有較高可能使用可卡因 （61%對比 28%）、氯胺酮 （48%對比 13%）、搖頭丸（40%對比 9%）、冰毒（35%對比 11%）和安眠藥（26%對比 4%）。邏輯回歸分析顯示，年齡（OR=1.08）、失業（OR=2.69）和使用其他藥物的數量（OR=1.69）獨立預測了精神症狀的存在。在僅使用大麻的使用者中，具有精神症狀的群體有較高可能失業（66%對比 32%）。邏輯回歸分析顯示，職業（失業）（OR=4.0）獨立預測了精神症狀的存在。

在所有使用者中，具有持續性精神症狀（PPS）的使用者教育水平較低（9 年對比 12 年），更有可能居住在公共住房（43%對比 30%，p = 0.001）。邏輯回歸分析顯示，沒有持續性精神症狀（PPS）的獨立預測因素。在僅使用大麻的使用者中，具有持續性精神症狀（PPS）的使用者較年長（28 對比 22 歲），教育水平較低（10 年對比 14 年），較多招募自非住宿背景（100%對比 36%）及較少居住在公共住房（33%對比 43%）。在大麻使用模式方面，具有持續性精神症狀（PPS）的使用者，對比沒有 PPS 的使用者，

在過去一年的每日大麻使用量較高（7 支對比 2 支）。邏輯回歸分析顯示，沒有持續性精神症狀（PPS）的獨立預測因素。

終身毒品誘發的情緒障礙也很常見，佔使用者的 39%。主要表現為抑鬱發作（25%）。在使用者中，發現了 9%的人患有大麻誘發的情緒障礙（CIMDs）。終身抑鬱症和雙相情感障礙的診斷患病率分別為 18%和 3%。患有 CIMDs 的人士更可能目前對大麻產生依賴性 （41%對比 6%），並且在過去一年內有更高的大麻使用量。邏輯回歸發現，較高的每日平均大麻使用量（OR=1.4）和目前對大麻的依賴程度（OR=6.6）預測了 CIMDs 的發生。

在僅使用大麻的使用者中，50%的使用者有終身情緒障礙的診斷，25%的使用者有 CIADs 的診斷。終身抑鬱症和雙相情感障礙的診斷患病率分別為 25%和 2%。

在人口特徵方面，患有 CIMDs 的人士與沒有 CIMDs 的人士沒有差異。CIMDs 組更有可能表現出目前對大麻的依賴性（46%對比 14%，p=0.020）。

在所有使用者中，有 8%的使用者患有終身毒品誘發的焦慮障礙。其中，最常見的表現是毒品誘發的強迫症狀（8%）。百分之一的使用者被診斷為 CIADs。與沒有 CIADs 的人士相比，患有 CIADs 的人士在過去一個月內更頻繁地使用大麻（21 天對比 3 天），並且在過去一個月內的大麻總使用量（63 根對比 5 根）和每天大麻使用量都較高（2.3 根對比 0.3 根）。 邏輯回歸發現，過去一個月內的大麻總使用量預測了 CIADs 的發生（OR=1.03）。在僅使用大麻的使用者中，5%的使用者患有終身焦慮障礙的診斷，其中 3%的使用者被診斷為 CIADs。

在心理病理水平方面，所有使用者的平均 BDI、HADSA、SDS 和 MWC 得分分別為 12.6±10.6、4.6±4.6、6.4±3.8 和 7.3±7.1。平均 BPRS 得分為 18.1±0.4，所有使用者在量表的得分都低於相應的截點。PANSS 的平均總分為 33.1±0.4。PANSS 中的陽性症狀、陰性症狀和一般病理學項目得分分別為 7.0±0.0、7.0±0.0 和 16.1±0.4。沒有使用者的得分高於截點。女性和過去一個月內的大麻使用量預測了 BDI 得分。女性也預測了 HADSA 得分。教育水平預測了 BPRS 和 PANSS 的一般病理學得分 。 失業和對大麻的終身依賴預測了 MWC 得分。在僅使用大麻的使用者中，所有使用者的平均 BDI、HADSA、SDS 和 MWC 得分分別為 12.0±10.3、4.6±4.4、4.3±3.2 和 5.8±6.4。平均 BPRS 得分為 18.0±0.0，所有使用者的得分都低於相應的截點。PANSS 的平均總分為 33.0±0.0。PANSS 中的陽性症狀、陰性症狀和一般病理學項目得分分別為 7.0±0.0、7.0±0.0 和 16.0±0.0。沒有使用者的得分高於截點。女性性別預測了 BDI 和 HADSA 得分。對大麻的終身依賴預測了 MWC 得分。

總括來說，在這一群大麻使用者中，幻覺和妄想等精神症狀非常常見。只有少數使用者有持續的精神症狀，有七分之一患有大麻誘發的精神病，而對大麻的依賴增加了患大麻誘發的精神病的風險。十一分之一的使用者患有大麻誘發的情緒障礙，主要表現為抑鬱發作。過去兩年的總大麻使用量預測了大麻誘發的情緒障礙。最後，大麻誘發的焦慮障礙並不常見。

Background

The hemp plant (*Cannabis sativa* L.) is native to Central Asia and yields the flowers, dried leaves, and extracts that comprise cannabis, which is a globally popular psychotropic drug. As such, hemp is now cultivated worldwide. Cannabis has been well known in China for centuries (Touw, 1981), and medicinal use of the hemp plant dates back nearly 5,000 years to the reign of Chinese Emperor Shen-Nung. Various preparations and extracts of cannabis are available, including loose marijuana, kilobricks, buds, Thai sticks, hashish, and hash oil. Usually, the plant is dried, cut, and rolled in tobacco papers to make a cannabis cigarette called a 'joint'. Cannabis contains more than 400 chemicals, and its main active ingredient is the cannabinoid tetrahydrocannabinol (THC). The existence of G-protein-coupled cannabinoid receptors was discovered in 1988 (Barceloux, 2012).

Cannabis is a commonly consumed illicit drug and is reportedly used by 4% of all adults worldwide (Copeland & Swift, 2009). In China, the lifetime prevalence of cannabis use is 0.3%–0.6% (Hao et al., 2002; Degenhardt et al., 2008). Cannabis users tend to be young men (Copeland & Swift, 2009), and in Hong Kong, cannabis is the most common psychotropic drug abused by people aged under 21 in 2022 (Narcotics Division, 2023). In addition, a study of club-drug users in Hong Kong found that 84% had tried cannabis and 15% reported that it was their drug of choice (Loxton et al., 2008).

The most common route of cannabis exposure is inhalation from sources such as joints, pipes, bongs, or 'buckets'. Recreational cannabis users typically smoke 0.5–1.0g joints (Barceloux, 2012), and club-drug users were found to have an average daily consumption of 1.5 joints (Loxton et al., 2008). The initial effects of cannabis range from euphoria, perceptual alterations, and relaxation at low doses to depersonalisation, pressured speech, paranoia, and

manic psychosis at high doses (Grotenhermen, 2003). The subjective effects of cannabis begin within a few minutes after inhalation, reach a maximum within 15 to 30 minutes, and resolve over 2 to 3 hours. The psychological effects of recreational cannabis use are categorised as affective (euphoria), somatic (a floating sensation), sensory (increased perception of external stimuli and the experience of vivid visual imagery) and cognitive (decreased short-term memory, distortion of time perception, and reduced concentration/attention). Smoking cannabis in a group setting may promote social interaction, friendliness, and laughter (Barceloux, 2012).

Most cannabis use is experimental and irregular, but the incidence and intensity of use typically increases during the middle-to-late teens and decreases from the mid-20s. However, 1 in 10 cannabis users develop dependence (Andrade, 2016), and substantially higher rates of dependence are exhibited by children and young adult users, early initiators, and daily users than older adult users, later initiators, and non-daily users (Copeland & Swift, 2009; Danovitch & Gorelick, 2012). The most effective treatment for cannabis dependence in users of all ages involves a combination of motivational enhancement therapy, cognitive behavioural therapy (CBT), and contingency management, together with family therapy for dependence in adolescent users. No pharmacological treatments are currently recommended due to a lack of evidence regarding their efficacy (Hoch et al., 2015). In particular, fewer than 20% of those who have undergone treatment in randomised trials achieved long-term abstinence. Moreover, the optimal duration of treatment is unclear, and certain populations have not been studied adequately, particularly those with co-occurring disorders (Danovitch & Gorelick, 2012).

Heavy and chronic cannabis users who cease using the drug may experience a withdrawal syndrome that manifests as affective and behavioural symptoms. These symptoms

may include aggression, anger, anxiety, jitteriness, irritability, restlessness, sleep disturbances, anorexia, nausea, abdominal pain, weight loss, sweating, salivation, and increased body temperature. Typically, withdrawal symptoms begin 1–3 days after the cessation of regular cannabis use, reach a maximum approximately 2–6 days after cessation, and resolve within 4–14 days after cessation. However, clinically significant physical symptoms of withdrawal do not usually occur after the cessation of chronic cannabis use. For example, one study found that 40% of chronic users who ceased using cannabis did not experience clinically significant withdrawal symptoms or prominent cravings (Barceloux, 2012). Few data are available on the pharmacologic treatment of these withdrawal symptoms. Nevertheless, in addition to cognitive and behavioural therapies, potential therapies include oral THC, mirtazapine, rimonabant, and buspirone (Benyamina et al., 2008), of which oral THC was found to reduce cannabis cravings and withdrawal symptoms (Barceloux, 2012).

Chronic cannabis use can also cause a wide range of psychiatric symptoms, such as psychosis, mania, depression, anxiety, and cognitive impairment (Karila et al., 2014). For example, according to our own database, 70% of 43 current cannabis users who attended a local substance-abuse clinic had experienced psychosis, and 23% had a mood disorder.

Laboratory studies have demonstrated that cannabinoid agonists produce a wide range of positive and negative cognitive symptoms and psychophysiological deficits in healthy human participants that resemble the phenomenology of schizophrenia. These transient effects correlate with the timing of drug administration and are dose-related but rarely necessitate intervention. The magnitude of these effects is similar to that of ketamine-related effects (Sherif et al., 2016). Most psychotic symptoms that develop after cannabis use resolve within 6 hours;

however, in rare cases, acute psychosis may persist for as long as 1 week after heavy habitual use (Barceloux, 2012).

After cannabis use, a self-limited acute psychosis develops with either clear consciousness or an acute state of confusion, and may present with mania-like features (e.g., grandiosity, excitement, hostility, or a lack of cooperation) (Barceloux, 2012). It was reported recently that acute psychotic symptoms had been experienced by 15% of a group of cannabis users of all ages (Shrivastava et al., 2015), but this proportion increased to 55% in a group of adolescent cannabis users admitted to a dual diagnosis unit (Bassir et al., 2016). Flashbacks, i.e., relapses of symptoms experienced during intoxication, are rare but can occur during the first 3 months after the cessation of cannabis use (Barceloux, 2012).

The association of the initiation of cannabis use during adolescence with the emergence of psychosis is dose-dependent. This association appears to be more robust for adolescents who have a high risk of developing a psychotic disorder than for other adolescents, which suggests that that the emergence of psychosis due to cannabis use is the result of an interaction with a pre-existing vulnerability (Bagot et al., 2015). Indeed, a recent review found that the heaviest cannabis users had a 3.9-fold higher risk of schizophrenia and other psychoses than non-users (Marconi et al., 2016). In addition, a national health survey in Australia found that there was a 5% prevalence of psychosis in a group of adults who used cannabis weekly (Degenhardt et al., 2001), whereas 50% of cannabis users admitted to a dual diagnosis unit in Israel had psychoses (Bassir et al., 2016). Risk factors for psychosis include a high consumption of cannabis, an early age of onset of use, and a family history of psychosis (Bagot et al., 2015). Cannabis induces the release of dopamine, and emerging evidence suggests that polymorphisms in several genes related to dopamine metabolism may moderate the effects of cannabis. The

effects of and interactions between the endocannabinoid, gamma-aminobutyric acid, and glutamate systems are a plausible mechanism for the psychotomimetic effects of cannabis (Sherif et al., 2016).

Cannabis use, particularly when heavy, may be related to an increased risk of depressive disorders (Lev-Ran et al., 2014). In a large sample of Australian adolescents, 14% and 18% of male and female cannabis users, respectively, had depression (Rey et al., 2002). Similarly, the incidences of major depression and other depressive disorders were 14% and 27%, respectively, in a group of young Italian male cannabis users (Troisi et al., 1998). Moreover, the frequency of any depressive disorder was 20% in a group of cannabis-dependent adolescent patients in a substance-abuse clinic in Boston, USA (Zaman et al., 2015). Furthermore, the prevalence rates of mood symptoms and depressive disorders were 45% and 36%, respectively, in a group of adolescent cannabis users admitted to a dual diagnosis unit in Israel (Bassir et al., 2016). Cannabis users may also experience depressive symptoms after the cessation of use, whilst chronic use can produce stressful life circumstances that may lead to depression (Conner et al., 2008). In summary, cannabis use is related to depression in a variety of ways. However, the efficacy of antidepressant agents in the treatment of cannabis-dependent individuals with comorbid depressive disorders remains uncertain (Beaulieu et al., 2012).

The lifetime cannabis usage rate was determined to be approximately 70% among a set of patients with bipolar disorder, and approximately 30% of these patients presented with comorbid cannabis abuse or dependence (Bally et al., 2014). In such populations, cannabis use has been associated with a younger age of onset of mania and with more frequent depressive or manic episodes than in other populations. Similarly, compared with not using cannabis, using cannabis appears to be related to poorer outcomes and an increased risk of rapid cycling

or mixed episodes (Bally et al., 2014). In addition, a 3% prevalence of bipolar disorder was reported in a group of cannabis-dependent adolescent patients in a substance-abuse clinic in Boston, USA (Zaman et al., 2015). Furthermore, bipolar disorder was present in 10% of adolescent cannabis users admitted to a dual diagnosis unit in Israel (Bassir et al., 2016) and 12% of cannabis users who attended a tertiary referral centre in India (Sarkar et al., 2003). Pharmacological and brain imaging investigations suggest that dopaminergic hyperactivity may underlie mania, and cannabis use may contribute to the development of manic symptoms via sensitisation of the dopaminergic system (Gibbs et al., 2015). Thus, valproate and lithium are effective treatments for bipolar disorders in cannabis-dependent individuals (Beaulieu et al., 2012).

Cannabis use is also linked to an increased risk of anxiety disorders (Kedzior & Laeber, 2014). A New Zealand population-based study reported that 22% of cannabis users had experienced acute anxiety or panic attacks after cannabis use (Thomas, 1996). Similarly, a study of cannabis-dependent adolescent patients in a substance-abuse clinic in Boston, USA, found that 47% had anxiety disorders (i.e., post-traumatic stress disorder: 7%; generalised anxiety disorder: 5%; obsessive-compulsive disorder: 4%; panic disorder: 2%; social phobia: 4%; or anxiety disorder not otherwise specified: 25%) (Zaman et al., 2015). In another group of cannabis users at a clinic in France, the prevalence of anxiety disorders was 53% (Guillem et al., 2015). Compared with those without anxiety disorders, those with such disorders may be more prone to perform false safety behaviours that may perpetuate their cannabis use, despite their having cannabis-related problems (Buckner et al., 2018). Therefore, the integration of CBT with treatment to eliminate the performance of false safety behaviours may aid patients with anxiety and cannabis use disorder (CUD; Buckner et al., 2014; Buckner et al., 2016).

There is a lack of up-to-date comprehensive data on the prevalence and clinical features of and risk factors for psychiatric disorders in cannabis users in Hong Kong. Accordingly, we examined a sample of cannabis users in a community setting in Hong Kong to assess the prevalence and characteristics of and risk factors for psychiatric disorders (i.e., CUD, psychosis, mood disorders, and anxiety disorders).

Cross-sectional study was designed to investigate the prevalence of psychosis, psychotic symptoms, and other mental illnesses among Hong Kong cannabis users. Data were collected in face-to-face structured diagnostic interviews administered by a research assistant. Each interview lasted 40–90 minutes, after which the participants were given supermarket coupons with a value of HK$350 as compensation for their time. This study was approved by the Survey and Behavioural Research Ethics Committee of the Chinese University of Hong Kong.

Participants

Participant recruitment sites

All participants were recruited from The Hong Kong Correctional Services Department (CSD), local university or residential treatment centres, or the following Counselling Centres for Psychotropic Substance Abusers (CCPSAs).

a. Hong Kong Christian Service PS33
b. Hong Kong Children and Youth Service Sane Centre
c. Caritas HUGS Centre
d. The Evangelical Lutheran Church of Hong Kong Enlighten Centre
e. Hong Kong Sheng Kung Hui Welfare Council Neo-Horizon
f. Hong Kong Lutheran Social Services Cheer Lutheran Centre
g. Barnabas Charitable Service Association
h. Caritas Hong Kong
i. Christian New Being Fellowship
j. Christian New Life Association

k. Christian Zheng Sheng Association

l. Drug Addicts Counselling and Rehabilitation Services

m. The Evangelical Lutheran Church of Hong Kong

n. Hong Kong Christian Service

o. Mission Ark

p. Operation Dawn

q. The Society for the Aid and Rehabilitation of Drug Abusers

r. The Hong Kong Federation of Youth Groups

Inclusion criteria

a. Aged 18–65 years;

b. have used cannabis use at least 20 times in the past 2 years; and

c. met the criteria for CUD given in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, American Psychiatric Association, 2013).

Psychiatric assessment

Demographic information

Each interview started with the collection of personal demographic information from the participants, namely their

a. age;

b. sex;

c. level of education;

d. marital status;

e. employment status;

f. monthly income;

g. housing property;

h. smoking history; and

i. psychosis history.

Drug-use patterns and severity

The participants' drug-use patterns were established by collecting data on their age at the initial use of a drug/drugs, their frequency of use of a drug/drugs, their duration of use of a drug/drugs, and the date of their last use of a drug/drugs. Lifetime and current cannabis use and the use of other illicit drugs, alcohol, and cigarettes were estimated using a semi-structured interview similar to the Lifetime Drinking History interview (Skinner & Sheu, 1982). Current consumption was calculated as the average use per day in the past month before recruitment.

The Marijuana Withdrawal Checklist (MWC) was administered to the participants to determine their withdrawal symptoms. The MWC is a 15-item scale that lists common and uncommon cannabis-withdrawal symptoms. The 15 items are craving for marijuana, depressed mood, decreased appetite, increased aggression, increased anger, headache, irritability, nausea, nervousness/anxiety, restlessness, shakiness, sleep difficulty, stomach pains, strange dreams, and sweating. Interviewees score each item on a scale from 0 to 3 (0 = not at all, 1 = mild, 2 = moderate, and 3 = severe) based on their experience after the most recent time they stopped using cannabis. Subsequently, the ratings of all 15 items are summed to give a severity score that is regarded as a composite 'withdrawal-discomfort' score. The internal reliability of this measure is high (Budney et al., 1999).

The Severity of Dependence Scale (SDS; Gossop et al., 1995) was also used to assess the participants. The SDS is a five-item self-report scale used to measure the degree of drug dependence in the past month or the month before abstinence. Each item is scored from 0 to 3, with a higher score indicating a greater severity of dependence.

Psychiatric comorbidity

The Structured Clinical Interview (SCID; Kam et al., 2003) was administered to the participants to screen for possible Axis-I psychiatric disorders. The SCID is a semi-structured interview that guides the making of DSM-V diagnoses and lasts approximately 30–45 minutes.

Psychotic disorders were further divided into primary and drug-induced disorders. The following criteria for a drug-induced disorder are based on the DSM-V: (a) onset of symptoms within 1 month of drug use, intoxication, or withdrawal; (b) exhibition of symptoms for no longer than 1 month after the cessation of drug use; and (c) no history of recurrence of non-drug-related episodes.

The participants were also divided based on their pattern of psychotic symptoms into those that had experienced:

(a) no psychotic symptoms (NPS);

(b) transient psychotic symptoms (TPS), i.e., those that had experienced psychotic symptoms during at least 1 month in which they were using cannabis but not during any months in which they were not using cannabis;

(c) persistent psychotic symptoms (PPS), i.e., those that had experienced psychotic symptoms during at least 1 month in which they were using cannabis and during at least 1 month in which they were not using cannabis;

(d) psychotic symptoms but were not yet in the detoxification stage;

(e) psychotic symptoms only during months of abstinence from cannabis;

(f) psychotic symptoms followed later by flashbacks, representing a spontaneous recurrence of psychosis even without further use of cannabis.

The Brief Psychiatric Rating Scale (BPRS; Hofmann et al., 2022), which measures the positive, negative, and affective symptoms of an individual with psychotic disorders (and schizophrenia in particular) was used to measure the participants' severity of currently occurring psychotic symptoms and mood conditions, if any, with 'currently occurring' regarded as 'during the interview'. The score for each item on the BPRS ranges from 0 (not assessed) to 7 (extremely severe). The Positive and Negative Syndrome Scale (PANSS; Bell et al., 1992) was used to measure the participants' severity of currently occurring positive and negative symptoms. The score for each item on the PANSS ranges from 1 (absent) to 7 (extreme).

A 21-item version of the Beck Depression Inventory (BDI: Shek, 1990) was used to measure depressive symptoms 1 week prior to each interview. The BDI was previously applied to assess a group of ecstasy users in Hong Kong. Total BDI scores range from 0 to 63 (Lee et al., 2001).

The Hospital Anxiety Depression Scale (HADSA; Leung et al., 1993) was used to measure anxiety symptoms 1 week prior to each interview. The HADSA has 7 items, each of which are scored from 0 to 3; the total score ranges from 0 to 21, and a higher total score indicates more severe symptoms (Bunevicius et al., 2007).

Statistical methods

Data analyses were performed using SPSS 17.0. The independent variables were socio-demographic and drug-use parameters, and the dependent variables were psychiatric disorders and symptoms and mood and anxiety symptoms. The frequency distributions of all variables were calculated, and descriptive statistics were used to summarise the variables. The prevalence of psychiatric disorders was calculated. We have compared the age and sex

characteristics of the sample to that of local population and applied weightings in the prevalences. We have performed three subgroup analyses, in terms of age, sex and lifetime consumption of cannabis, for the pattern of psychotic symptoms and psychiatric diagnoses.

Potential associations between independent variables and CUD were first evaluated using Pearson's chi-square test or a t-test, as appropriate. Significant associations were entered into a multivariate regression analysis to identify independent predictors of CUD. The level of statistical significance was set at 0.05 in two-sided tests. This analysis was repeated for the other psychiatric disorders.

Demographics and basic information

Our sample comprised 194 participants, all of whom were cannabis users; 79% were male, and 68% were unemployed. The mean age of the participants was 26 years (range: 15–56 years), and they had been educated for a mean of 11 years (range: 3–24 years). The majority of the participants were single (89%) and current smokers (68%). They were recruited from various places, namely residential centres (55%), CCPSAs (24%), the CSD (16%), and a local university (5%). Furthermore, 44% of the participants resided in public housing, 38% had religious beliefs, and 13% had a family history of psychiatric disorders (Table 1).

The cannabis-only users (n = 60) within our sample consisted predominantly (80%) of men, had a mean age of 24 years (range:15–52 years), and had been educated for a mean of 12 years (range: 6–18 years). In addition, the majority were single (93%) and current smokers (78%). They were recruited from various sources, namely CCPSAs (42%), residential centres (25%), a local university (22%), and the CSD. Furthermore, 47% resided in public housing, 22% had religious beliefs, and 12% had a family history of psychiatric disorders (Table 1).

Table 1. Descriptive statistics of demographic characteristics of the entire sample (n = 194).

Variables	All sample (n = 194) Mean ± SD, Median (range)	Cannabis only users (n= 60) Mean ± SD, Median (range)
Age, mean ± SD	26.1 ± 7.2	24.2 ± 6.8
Gender (male), n (%)	153 (78.9)	48 (80)
Education (year), mean ± SD	11.3 ± 3.2	12.4 ± 3.0
Marital status, n (%)		
Single	173 (89.2)	56 (93.3)
Married	18 (9.3)	4 (6.7)
Separated	3 (1.5)	0 (0)
Occupation, n (%)		
Unemployed	132 (68)	29 (48.3)
Employed	62 (32)	31 (51.7)
Source of referral, n (%)		
Residential	107 (55.2)	15 (25)
CCPSA	47 (24.2)	25 (41.7)
CSD	31 (16)	7 (11.7)
University	9 (4.6)	13 (21.7)
Family psychiatric history, n (%)	25 (12.9)	7 (11.7)
Has a religious belief, n (%)	73 (37.6)	13 (21.7)
Accommodation, n (%)		
Public housing	85 (43.8)	28 (46.7)
Private housing	77 (39.7)	22 (36.7)
Home Owner Scheme housing	27 (13.9)	7 (11.7)
Others	5 (2.6)	3 (5)
Smoking history, n (%)		
Current	132 (68)	47 (78.3)
Previous	52 (26.8)	5 (8.3)
Non-smoker	10 (5.5)	8 (13.3)
Onset age, mean ± SD	14.6 ± 3.2	15.4 ± 2.6

CSD = The Hone Kong Correctional Services Department.
SD = Standard deviation

Cannabis use pattern

The average age at which all of the participants had started using cannabis and their duration of cannabis use were 18 and 5 years, respectively. On average, the participants reported using cannabis for 877 days in their lifetime, 276 days in the past 2 years, 126 days in the past year, and 3 days in the past month. The average total consumption of cannabis reported by the participants was 2,568 joints in their lifetime, 936 joints in the past 2 years, 339 joints in the past year, and five joints in the past month (Table 2). In addition, 24 participants had used cannabis in the past month. Furthermore, the mean daily consumption of cannabis by all participants in the past year was 3.8 joints.

Among the cannabis-only users, the average age at which they had started using cannabis and the duration of use were 18 and 4 years, respectively. On average, these participants reported using cannabis for 763 days in their lifetime, 284 days in the past 2 years, 146 days in the past year, and 7 days in the past month. Their average total consumption of cannabis was 1,640 joints in their lifetime, 672 joints in the past 2 years, 331 joints in the past year, and 10 joints in the past month (Table 2). In addition, 12 of these participants had used cannabis in the past month. Furthermore, the mean daily consumption of cannabis by these participants in the past year was 2.1 joints.

Table 2. Descriptive statistics of cannabis use patterns of the entire sample (n = 194) and cannabis only users (n = 60).

Variables	All sample (n = 194) Mean ± SD, Median (range)	Cannabis only users (n= 60) Mean ± SD, Median (range)
Age of first use	17.8 ± 3.9 17 (10 – 35)	18.2 ± 3.1 18 (11 – 25)
Duration of use (year)	4.8 ± 4.7 3.1 (0.8 – 27)	3.7 ± 3.1 2.5 (0.3 – 16)
Days of use		
Lifetime	877.3 ± 1146.9 456.0 (4.3 – 9828)	762.6 ± 852.9 386.5 (8.0 – 4011.5)
Past two years	275.6 ± 226.6 208.0 (3 – 728)	283.5 ± 238.8 208.0 (12.0 – 728)
Past one year	125.8 ± 109.2 90.9 (3 – 364)	145.8 ± 125.5 90.1 (0.0 – 364)
Past month	3.3 ± 8.1 0.0 (0 – 30)	7.0 ± 11.2 0.0 (0 – 30.3)
Lifetime consumption (joint)		
Total	2568.0 ± 4716.6 728.0 (7 – 39312)	1640.1 ± 2183.2 591.3 (12.0 – 9394.4)
Consumption in one day	2.5 ± 2.5 1.8 (0.5 – 16)	2.4 ± 2.8 1.5 (0.5 – 15)
Consumption in the past two years (joint)		
Total	936.0 ± 1588.0 294.7 (3 – 9282)	672.0 ± 1097.0 260.0 (11.5 – 6188)
Consumption in one day	2.7 ± 3.6 1.9 (0.2 – 18)	2.3 ± 2.6 1.0 (0.5 – 15)
Consumption in the past one year (joint)		
Total	339.2 ± 530.4 121.3 (0 – 3094)	331.0 ± 616.4 105.1 (0.0 – 3094)
Consumption in one day	3.8 ± 18.6	2.1 ± 2.4

Variables	All sample (n = 194) Mean ± SD, Median (range)	Cannabis only users (n= 60) Mean ± SD, Median (range)
	1.5 (0.5 – 235.0)	1.5 (0.5 – 15.0)
Consumption in the previous month (joint)		
Total	5.2 ± 20.2 0 (0 – 182)	9.7 ± 24.1 0 (0.0 – 120)
Consumption in one day	0.3 ± 0.8 0 (0 – 6)	0.5 ± 0.9 0 (0.0 – 4)
Lifetime dependence, n (%)	143 (73.7)	48 (80)
Low	63 (32.5)	24 (40)
Medium	50 (25.8)	14 (23.3)
High	30 (15.5)	10 (16.7)
Lifetime abuse, n (%)	40 (20.6)	6 (10)
Current dependence, n (%)	18 (9.3)	13 (21.7)
Low	8 (4.1)	5 (8.3)
Medium	7 (3.6)	6 (10)
High	3 (1.5)	2 (3.3)
Current abuse, n (%)	24 (12.4)	13 (21.7)

SD = Standard deviation

Table 3. Daily consumption of cannabis by age and duration of use [Note to grantee: Different from daily consumption in Table 2.]

	All Cannabis users (n = 194)	Male (n = 153)	Female (n = 41)	p value [a]	Cannabis only users (n = 60)	Male (n = 48)	Female (n = 12)	p value [a]
Consumption in one day (joint) in past one year, mean ± SD, median (range)	3.8 ± 18.6 1.5 (0.5 – 235.0)	4.3 ± 20.7 2.0 (0.5 – 235.0)	2.1 ± 2.1 1.0 (0.5 - 8.5)	0.162	2.1 ± 2.4 1.5 (0.5 – 15.0)	2.2 ± 2.4 1.5 (0.5 – 15.0)	2.1 ± 2.4 1.0 (0.5 - 8.5)	0.899
90th percentile	5	5	6.4		4		8	
95th percentile	7	6.5	8.2		7.1	6	-	
99th percentile	104.8	172.1	-		-	-	-	

[a] Mann-Whiney test.
SD = Standard deviation

Pattern of other drug use

Sixty-nine percent of our sample (n = 134) used cannabis and at least one other type of drug, whereas the remaining 31% (n = 60) were cannabis-only users, as mentioned (Table 4.1). Amongst the former group, the five drugs most commonly used in addition to cannabis were cocaine, ketamine, ecstasy, ice (methamphetamine), and hypnotics. The age at which the participants had first used these other drugs ranged from 17 (ketamine) to 20 years (ice). The mean duration of their regular use of these other drugs ranged from 2.3 (cocaine and ecstasy) to 3.8 years (cough medicine). The mean number of days per month that they had used these other drugs during their regular drug-use period ranged from 12 (ecstasy) to 23 (ice). Among the participants, the frequency of lifetime dependence on these other drugs ranged from 40% (ecstasy) to 95% (ice). However, only small proportions of these participants were currently dependent on these drugs (1% to 14%; Table 4.2).

Table 4.1. Other drug use in terms of number of drugs in the entire sample (n=194)

Number of other drug use (apart from cannabis)	n (%)
0	60 (30.9)
1	37 (19.1)
2	27 (13.9)
3	25 (12.9)
4	22 (11.3)
5	18 (9.3)
6	5 (2.6)
Average	1.9 ± 1.8

Table 4.2. Other drug use in the entire sample (n=134)

	Cocaine n = 103	Ketamine n = 76	Ecstasy n = 63	ICE n = 57	Hypnotics n = 40	Cough medicine n = 14
Age of first use, mean ± SD	19.1 ± 4.7[b]	17.1 ± 3.8[b]	18.6 ± 4.2[b]	20.0 ± 6.8	18.8 ± 4.9[b]	18.7 ± 5.1
Duration (years), mean ± SD	2.3 ± 2.7[b]	3.1 ± 3.7[b]	2.3 ± 3.1[b]	2.5 ± 3.3 [b]	2.8 ± 3.4[b]	3.8 ± 4.1[b]
Days of use per month [a], mean ± SD	20.8 ± 10.3[b]	22.2 ± 10.2[b]	12.3 ± 9.6 [b]	23.0 ± 9.6 [b]	16.8 ± 10.1[b]	15.1 ± 12.7 [b]
Consumption in one day [a], mean ± SD	13.2. ± 22.0¶[b]	2.5 ± 2.0¶[b]	1.8 ± 1.8†[b]	1.1 ± 0.9¶ [b]	5.0 ± 8.1†	1.6 ± 1.0†
Current dependence, n (%)	8 (7.8)	3 (11.5)	1 (1.3)	1 (1.8)	1 (2.5)	2 (14.3)
Low	6 (3.1)	2 (1)	1 (0.5)	0 (0)	1 (0.5)	0 (0.0)
Medium	1 (0.5)	1 (0.5)	0 (0)	1 (0.5)	1 (0.5)	2 (1.0)
High	1 (0.5)	0 (0.0)	0 (0)	0 (0)	0 (0.0)	0 (0.0)
Lifetime dependence, n (%)	91 (88.3)	49 (64.5)	25 (39.7)	54 (94.7)	9 (50.0)	7 (50.0)
Low	8 (4.1)	17 (8.8)	10 (5.2)	6 (3.1)	9 (4.6)	2 (1.0)
Medium	28 (14.4)	13 (6.7)	10 (5.2)	19 (9.8)	8 (4.1)	3 (1.5)
High	55 (28.4)	19 (9.8)	5 (2.5)	19 (9.8)	3 (1.5)	2 (1.0)

*During period of regular use.
Unit: tab†; bottle§; gram¶.
[a] During period of regular use.
[b] Missing data.
ICE: methamphetamine.
SD = Standard deviation

Cannabis withdrawal symptoms

Eighty-seven percent of the participants reported experiencing withdrawal symptoms after ceasing cannabis use for 12–24 hours. The mean number of symptoms was five, and the mean score on the Cannabis Withdrawal Scale (MWC) was 7.3 ± 7.1 (Table 5.1). The five most common symptoms were a craving to smoke cannabis (60%), followed by strange dreams (43%), depressed mood (38%), sweating (37%), and restlessness (34%) (Table 5.2).

Table 5.1. Number of withdrawal symptoms as measured by MWC in the entire sample (n=194)

Total score, mean ± SD	7.3 ± 7.1
No. of symptoms, mean ± SD	4.8 ± 3.9
No. of symptoms, n (%)	
0	26 (13.4)
1	18 (9.3)
2	23 (11.9)
3	23 (11.9)
4	15 (7.7)
5	16 (8.2)
6	13 (6.7)
7	14 (7.2)
8	10 (5.2)
9	8 (4.1)
10	7 (3.6)
11	5 (2.6)
12	8 (4.1)
13	4 (2.1)
14	2 (1.0)
15	2 (1.0)

SD = Standard deviation

Table 5.2. The frequency of individual withdrawal symptoms as measured by MWC in the entire sample (n=194)

Items	n (%)
Craving to smoke cannabis	117 (60.3)
Strange dreams	84 (43.3)
Depress mood	73 (37.6)
Sweating	71 (36.6)
Restlessness	66 (34.0)
Sleep difficulty	65 (33.5)
Nervousness/anxiety	65 (33.5)
Increased anger	63 (32.5)
Irritability	59 (30.4)
Shakiness/tremulousness	57 (29.4)
Decreased appetite	52 (26.8)
Headaches	50 (25.8)
Increased aggression	43 (22.2)
Nausea	40 (20.6)
Stomach Pains	27 (13.9)

Psychotic symptoms

Amongst all of the participants, 76% (n = 147), 67% (n = 130), and 18% (n = 34) reported experiencing lifetime, past, and current psychotic symptoms, respectively. Regarding the subtypes of psychotic symptoms, a significant proportion of the participants reported experiencing lifetime delusions (67%) and hallucinations (58%), with the most prevalent being delusions of reference (60%), followed by persecutory delusions (26%), and grandiose delusions (12%). Auditory hallucinations were the most common type of hallucination (45%), followed by visual hallucinations (35%). Thought broadcasting was reported by 13% of the participants, whereas only one participant reported thought withdrawal (Table 6.1 & 6.2). Regarding the specific pattern of psychotic symptoms, 27% of the participants (n = 53) exhibited TPS. Additionally, 4% (n = 7) exhibited PPS, and the mean time between their most recent use of cannabis and the day of assessment was 102.8 ± 68.3 days, with a range of 24 to 180 days. Moreover, 15 (8%) of the participants had psychotic symptoms but had not yet entered the detoxification stage. Finally, none of the participants had experienced flashbacks or psychotic symptoms solely during periods of abstinence from cannabis use. Female subjects were more likely to have tactile hallucinations. Subjects with higher age were more likely to have any delusions, delusion of reference. No difference was found between subjects with different level of consumption of cannabis.

Amongst those who were cannabis-only users, 48% reported experiencing lifetime psychotic symptoms, and 33% and 22% had previously experienced or were currently experiencing psychotic symptoms, respectively. One third (33%) of these participants reported experiencing lifetime delusions, and an equal proportion (33%) reported experiencing hallucinations. Delusions of reference (32%) were the most common type of delusion, and auditory hallucinations (27%) were the most common type of hallucination (Table 6.6).

Regarding the specific pattern of psychotic symptoms, 23% of these participants (n = 14) exhibited TPS with a mean duration of 1.6 (range: 0.5–3.5) days (Table 8.5). Additionally, 5% (n = 3) of the participants had PPS, and the mean time between their most recent use of cannabis and the day of assessment was 3 (range: 1–6) months. Five of these participants (8%) had psychotic symptoms but had not yet entered the detoxification stage. Finally, none of these participants had experienced flashbacks or psychotic symptoms solely during periods of abstinence from cannabis use.

Table 6.1. Frequency of lifetime psychotic symptom in all cannabis users (n = 194).

Variables	Lifetime	Past	Current
Psychotic symptoms, n (%)	147 (75.8)	130 (67.0)	34 (17.5)
Delusion (any type), n (%)	129 (66.5)	111 (57.2)	29 (14.9)
Delusion of reference, n (%)	116 (59.8)	92 (47.4)	24 (12.4)
Persecutory delusion, n (%)	50 (25.8)	41 (21.1)	9 (4.6)
Grandiose delusion, n (%)	24 (12.4)	21 (10.8)	4 (2.1)
Somatic delusion, n (%), n (%)	12 (6.2)	10 (5.2)	2 (1)
Delusion of being controlled, n (%)	12 (6.2)	10 (5.2)	2 (1.0)
Religious delusion, n (%)	1 (0.5)	0 (0)	1 (0.5)
Delusion of guilt, n (%)	0 (0)	0 (0)	0 (0)
Jealous delusion, n (%)	0 (0)	0 (0)	0 (0)
Erotomanic delusion, n (%)	0 (0)	0 (0)	0 (0)
Other delusion, n (%)	1 (0.5)	0 (0)	1 (0.5)
Hallucination (any type), n (%)	112 (57.7)	97 (50.0)	20 (10.3)
Auditory hallucination, n (%)	88 (45.4)	73 (37.6)	15 (7.7)
Visual hallucination, n (%)	68 (35.1)	60 (30.9)	8 (4.1)
Tactile hallucination, n (%)	17 (8.8)	13 (6.7)	5 (2.6)
Olfactory hallucination, n (%)	4 (2.1)	3 (1.5)	1 (0.5)
Gustatory hallucination, n (%)	5 (2.6)	5 (2.6)	0 (0.0)
Thought broadcasting, n (%)	26 (13.4)	24 (12.4)	2 (1.0)
Thought insertion, n (%)	0 (0)	0 (0)	0 (0)
Thought withdrawal, n (%)	1 (0.5)	1 (0.5)	0 (0)
Catatonic behavior, n (%)	0 (0)	0 (0)	0 (0)
Disorganized speech, n (%)	0 (0)	0 (0)	0 (0)
Crossly disorganized behavior, n (%)	0 (0)	0 (0)	0 (0)
Grossly inappropriate affect, n (%)	0 (0)	0 (0)	0 (0)
Avolition, n (%)	0 (0)	0 (0)	0 (0)
Alogia, n (%)	0 (0)	0 (0)	0 (0)
Affective flattening, n (%)	0 (0)	0 (0)	0 (0)
Duration of psychotic symptoms after last use of cannabis (days), mean ± SD; median (range)	6.9 ± 27.6 1 (1 – 182)	5.6 ± 24.4 1 (1 – 182)	16.8 ± 39.7 1 (1 – 152)

SD = standard deviation

Table 6.2. Frequency of lifetime psychotic symptom in all cannabis users (n = 194, adjusted for age and sex).

Variables	Lifetime		Past		Current	
Psychotic symptoms, n (%)	142	(73.0)	122	(63.1)	30	(15.4)
Delusion (any type), n (%)	129	(66.6)	111	(57.1)	21	(10.8)
Delusion of reference, n (%)	115	(59.3)	91	(47.1)	25	(12.7)
Persecutory delusion, n (%)	49	(25.5)	40	(20.6)	9	(4.8)
Grandiose delusion, n (%)	24	(12.2)	20	(10.5)	4	(2.2)
Somatic delusion, n (%), n (%)	12	(6.4)	11	(5.4)	2	(1.0)
Delusion of being controlled, n (%)	12	(6.0)	10	(5.0)	2	(1.0)
Religious delusion, n (%)	1	(0.5)	0	(0)	1	(0.5)
Delusion of guilt, n (%)	0	(0)	0	(0)	0	(0)
Jealous delusion, n (%)	0	(0)	0	(0)	0	(0)
Erotomanic delusion, n (%)	0	(0)	0	(0)	0	(0)
Other delusion, n (%)	1	(0.5)	0	(0)	1	(0.5)
Hallucination (any type), n (%)	112	(57.5)	96	(49.7)	21	(10.8)
Auditory hallucination, n (%)	87	(44.8)	72	(37.0)	16	(8.3)
Visual hallucination, n (%)	67	(34.4)	59	(30.6)	8	(4.3)
Tactile hallucination, n (%)	17	(8.7)	13	(6.6)	5	(2.6)
Olfactory hallucination, n (%)	4	(2.0)	3	(1.5)	1	(0.5)
Gustatory hallucination, n (%)	5	(2.7)	5	(2.7)	0	(0)
Thought broadcasting, n (%)	26	(13.3)	24	(12.3)	2	(1.0)
Thought insertion, n (%)	0	(0)	0	(0)	0	(0)
Thought withdrawal, n (%)	1	(0.5)	1	(0.5)	0	(0)
Catatonic behavior, n (%)	0	(0)	0	(0)	0	(0)
Disorganized speech, n (%)	0	(0)	0	(0)	0	(0)
Crossly disorganized behavior, n (%)	0	(0)	0	(0)	0	(0)
Grossly inappropriate affect, n (%)	0	(0)	0	(0)	0	(0)
Avolition, n (%)	0	(0)	0	(0)	0	(0)
Alogia, n (%)	0	(0)	0	(0)	0	(0)
Affective flattening, n (%)	0	(0)	0	(0)	0	(0)

Table 6.3. Frequency of lifetime psychotic symptom in all cannabis users, by sex (n = 194).

Variables, n (%)	Male (n=153)	Female (n=41)	P-value
Psychotic symptoms	106 (69.3)	35 (85.4)	0.040
Delusion (any type)	96 (62.7)	33 (80.5)	0.033
Delusion of reference	85 (55.6)	30 (73.2)	0.041
Persecutory delusion	40 (26.1)	10 (24.4)	0.820
Grandiose delusion	21 (13.7)	3 (7.3)	0.268
Somatic delusion	6 (3.9)	6 (14.6)	0.011
Delusion of being controlled	10 (6.5)	2 (4.9)	0.696
Religious delusion	0 (0)	1 (2.4)	0.053
Delusion of guilt	0 (0)	0 (0)	-
Jealous delusion	0 (0)	0 (0)	-
Erotomanic delusion	0 (0)	0 (0)	-
Other delusion	1 (0.7)	0 (0)	0.604
Hallucination (any type)	83 (54.2)	13 (31.7)	0.106
Auditory hallucination	67 (43.8)	19 (46.3)	0.770
Visual hallucination	51 (33.3)	16 (39.0)	0.496
Tactile hallucination	8 (5.2)	9 (22.0)	0.001
Olfactory hallucination	4 (2.6)	0 (0)	0.295
Gustatory hallucination	4 (2.6)	1 (2.4)	0.950
Thought broadcasting	19 (12.4)	7 (17.1)	0.437
Thought insertion	0 (0)	0 (0)	-
Thought withdrawal	1 (0.7)	0 (0)	0.604
Catatonic behavior	0 (0)	0 (0)	-
Disorganized speech	0 (0)	0 (0)	-
Crossly disorganized behavior	0 (0)	0 (0)	-
Grossly inappropriate affect	0 (0)	0 (0)	-
Avolition	0 (0)	0 (0)	-
Alogia	0 (0)	0 (0)	-
Affective flattening	0 (0)	0 (0)	-
Duration of psychotic symptoms after last use of cannabis (days), mean ± SD; median (range)	7.8 ± 30.4 1 (1 – 182)	4.0 ± 16.3 1 (1 – 91)	0.356

SD = standard deviation
Bonferroni alpha level correction= 0.0029

Table 6.4. Frequency of lifetime psychotic symptom in all cannabis users, by age (n = 194).

Variables, n (%)	Age </=24 (n=100)	Age>24 (n=94)	P-value
Psychotic symptoms	65 (65)	76 (80.9)	0.013
Delusion (any type)	56 (56)	73 (77.7)	0.001
Delusion of reference	49 (49)	66 (70.2)	0.003
Persecutory delusion	20 (20)	30 (31.9)	0.058
Grandiose delusion	10 (10)	14 (14.9)	0.301
Somatic delusion	5 (5)	7 (7.4)	0.480
Delusion of being controlled	4 (4)	8 (8.5)	0.192
Religious delusion	0 (0)	0 (0)	-
Delusion of guilt	0 (0)	0 (0)	-
Jealous delusion	0 (0)	0 (0)	-
Erotomanic delusion	0 (0)	0 (0)	-
Other delusion	0 (0)	1 (1.1)	0.301
Hallucination (any type)	51 (51)	60 (63.8)	0.071
Auditory hallucination	44 (44)	42 (44.7)	0.924
Visual hallucination	27 (27)	40 (42.6)	0.023
Tactile hallucination	7 (7)	10 (10.6)	0.370
Olfactory hallucination	2 (2)	2 (2.1)	0.950
Gustatory hallucination	4 (4)	1 (1.1)	0.197
Thought broadcasting	9 (9)	17 (18.1)	0.063
Thought insertion	0 (0)	0 (0)	-
Thought withdrawal	1 (1)	0 (0)	0.331
Catatonic behavior	0 (0)	0 (0)	-
Disorganized speech	0 (0)	0 (0)	-
Crossly disorganized behavior	0 (0)	0 (0)	-
Grossly inappropriate affect	0 (0)	0 (0)	-
Avolition	0 (0)	0 (0)	-
Alogia	0 (0)	0 (0)	-
Affective flattening	0 (0)	0 (0)	-
Duration of psychotic symptoms after last use of cannabis (days), mean ± SD; median (range)	11.5 ± 38.9 0 (0 – 182)	2.73 ± 9.14 0 (0 – 61)	0.085

SD = standard deviation

Bonferroni alpha level correction=0.0031

Table 6.5. Frequency of lifetime psychotic symptom in all cannabis users, by level of consumption (n = 194).

Variables, n (%)	Lifetime total consumption of cannabis </=728 (n=75) *	Lifetime total consumption of cannabis >728 (n=73) *	P-value
Psychotic symptoms	54 (72)	59 (80.8)	0.207
Delusion (any type)	48 (64)	51 (69.9)	0.449
Delusion of reference	43 (57.3)	48 (65.8)	0.293
Persecutory delusion	17 (22.7)	24 (32.9)	0.165
Grandiose delusion	7 (9.3)	9 (12.3)	0.557
Somatic delusion	6 (8)	4 (5.5)	0.541
Delusion of being controlled	3 (4.0)	5 (6.8)	0.443
Religious delusion	0 (0)	0 (0)	-
Delusion of guilt	0 (0)	0 (0)	-
Jealous delusion	0 (0)	0 (0)	-
Erotomanic delusion	0 (0)	0 (0)	-
Other delusion	1 (1.3)	0 (0)	0.322
Hallucination (any type)	42 (56.0)	47 (64.4)	0.298
Auditory hallucination	34 (45.3)	36 (49.3)	0.628
Visual hallucination	24 (32.0)	29 (39.7)	0.327
Tactile hallucination	7 (9.3)	9 (12.3)	0.557
Olfactory hallucination	2 (2.7)	2 (2.7)	0.978
Gustatory hallucination	3 (4)	2 (2.7)	0.671
Thought broadcasting	9 (12)	13 (17.8)	0.321
Thought insertion	0 (0)	0 (0)	-
Thought withdrawal	0 (0)	1 (1.4)	0.309
Catatonic behavior	0 (0)	0 (0)	-
Disorganized speech	0 (0)	0 (0)	-
Crossly disorganized behavior	0 (0)	0 (0)	-
Grossly inappropriate affect	0 (0)	0 (0)	-
Avolition	0 (0)	0 (0)	-
Alogia	0 (0)	0 (0)	-
Affective flattening	0 (0)	0 (0)	-
Duration of psychotic symptoms after last use of cannabis (days), mean ± SD; median (range)	4.73 ± 21.9 0 (0 – 152)	12.0 ± 37.1 0.5 (0 – 182)	0.234

SD = standard deviation

Bonferroni alpha level correction= 0.0031

* Missing data (n=46) were due to participants being unable to recall the details of their cannabis use consumption.

Table 6.6. Frequency of lifetime psychotic symptoms in cannabis only users (n = 60).

Variables	Lifetime	Past	Current
Psychotic symptoms, n (%)	29 (48.3)	20 (33.3)	13 (21.7)
Delusion (any type), n (%)	20 (33.3)	12 (20)	11 (18.3)
Delusion of reference, n (%)	19 (31.7)	10 (16.7)	9 (15)
Persecutory delusion, n (%)	7 (11.7)	4 (6.7)	3 (5)
Grandiose delusion, n (%)	3 (5.0)	2 (3.3)	1 (1.7)
Delusion of being controlled, n (%)	1 (1.7)	0 (0)	1 (1.7)
Somatic delusion, n (%), n (%)	0 (0)	0 (0)	0 (0)
Other delusion, n (%)	0 (0)	0 (0)	0 (0)
Religious delusion, n (%)	0 (0)	0 (0)	0 (0)
Delusion of guilt, n (%)	0 (0)	0 (0)	0 (0)
Jealous delusion, n (%)	0 (0)	0 (0)	0 (0)
Erotomanic delusion, n (%)	0 (0)	0 (0)	0 (0)
Hallucination (any type), n (%)	20 (33.3)	14 (23.3)	7 (11.7)
Auditory hallucination, n (%)	16 (26.7)	10 (16.7)	6 (10)
Visual hallucination, n (%)	7 (11.7)	4 (6.7)	3 (5)
Tactile hallucination, n (%)	2 (3.3)	1 (1.7)	1 (1.7)
Gustatory hallucination, n (%)	1 (1.7)	1 (1.7)	0 (0)
Olfactory hallucination, n (%)	0 (0)	0 (0)	0 (0)
Thought broadcasting, n (%)	2 (3.3)	1 (1.7)	1 (1.7)
Thought insertion, n (%)	0 (0)	0 (0)	0 (0)
Thought withdrawal, n (%)	0 (0)	0 (0)	0 (0)
Catatonic behavior, n (%)	0 (0)	0 (0)	0 (0)
Disorganized speech, n (%)	0 (0)	0 (0)	0 (0)
Crossly disorganized behavior, n (%)	0 (0)	0 (0)	0 (0)
Grossly inappropriate affect, n (%)	0 (0)	0 (0)	0 (0)
Avolition, n (%)	0 (0)	0 (0)	0 (0)
Alogia, n (%)	0 (0)	0 (0)	0 (0)
Affective flattening, n (%)	0 (0)	0 (0)	0 (0)
Duration of psychotic symptoms after last use of cannabis (days), mean ± SD; median (range)	6.66 ± 27.2 0 (0 - 182)	5.5 ± 25.1 0 (0 - 182)	13.0 ± 35.3 1 (0 - 152)

SD = Standard deviation

Correlates of presence of psychotic symptoms

Participants with psychotic symptoms were older than those without psychotic symptoms (mean age: 27 vs 24 years, p = 0.004), and a higher proportion of the former than the latter were unemployed (75% vs 47%, p = 0.001). Additionally, participants with psychotic symptoms were more likely to have religious beliefs (42% vs 26%) and a history of smoking than those without psychotic symptoms (33% vs 6%, p = 0.001). However, the difference in sex was of borderline significance (Table 7.1). In terms of cannabis-use patterns, participants with psychotic symptoms had a shorter mean duration of cannabis use in the past month than those without psychotic symptoms (2 vs 6 days, p = 0.034) (Table 7.2). In terms of other-drug use patterns, participants exhibiting psychotic symptoms had higher mean rates of lifetime use of other drugs than those without psychotic symptoms (2.3 vs 0.7 type of drugs, p < 0.001). Specifically, those with psychotic symptoms were more likely than those without psychotic symptoms to have used cocaine (61% vs 28%, p < 0.001), ketamine (48% vs 13%, p < 0.001), ecstasy (40% vs 9%, p < 0.001), ice (35% vs 11%, p = 0.001), or hypnotics (26% vs 4%, p = 0.001) (Table 7.3). Furthermore, a logistic regression analysis revealed that age (odds ratio (OR) = 1.08, 95% confidence interval (CI) 1.004–1.16, p = 0.038), unemployment (OR = 2.69, 95% CI 1.25–5.83, p = 0.012), and the number of other drugs used (OR = 1.69, 95% CI 1.27–2.26, p < 0.001) independently predicted the presence of psychotic symptoms (Table 7.4).

Amongst the cannabis-only users, those with psychotic symptoms were more likely than those without psychotic symptoms to be unemployed (66% vs 32%, p = 0.034), whereas smoking status was of borderline significance (p = 0.077) (Table 7.5). Additionally, there were no significant differences between those with or without psychotic symptoms in terms of cannabis-use patterns (Table 7.6). Furthermore, a logistic regression analysis revealed that

occupation (unemployed) (OR = 4.0, 95% CI 1.4–11.7, p = 0.012) independently predicted the presence of psychotic symptoms (Table 7.7).

Table 7.1. Demographic characteristics of subjects with or without lifetime psychotic symptoms in the entire sample (n=194).

	With psychotic symptoms n =147	Without psychotic symptoms n = 47	p value
Age, mean ± SD	26.7 ± 7.2	24.0 ± 7.1	0.004[a]
Gender (male), n (%)	111 (75.5)	42 (89.4)	0.063[b]
Education (year), mean ± SD	11.2 ± 3.3	11.57 ± 2.9	0.299[a]
Marital status, n (%)			
Single	131 (89.1)	42 (89.4)	0.582[c]
Married	13 (8.8)	5 (10.6)	
Separated	3 (2.0)	0 (0)	
Other	0 (0)	0 (0)	
Occupation, n (%)			
Employed	37 (25.2)	25 (53.2)	0.001[b]
Unemployed	110 (74.8)	22 (46.8)	
Source of referral, n (%)			
Non-residential	33 (22.4)	14 (29.8)	0.132[c]
Residential	87 (59.2)	19 (40.4)	
University	6 (4.1)	3 (6.4)	
CSD	20 (13.6)	11 (23.4	
Family psychiatric history, n (%)	16 (10.9)	9 (19.1)	0.136[c]
Has a religious belief, n (%)[*]	61 (41.5)	12 (25.5)	0.017[c]
Accommodation, n (%)			
Public housing	62 (42.2)	23 (48.9)	0.180[c]
Private housing	56 (38.1)	21 (44.7)	
Home Owner Scheme housing	24 (16.3)	3 (6.4)	
Other	5 (3.4)	0 (0)	
Smoking history, n (%)			
Current	92 (62.6)	40 (85.1)	0.001[c]
Previous	49 (33.3)	3 (6.4)	
Non-smoker	6 (4.1)	4 (8.5)	
Onset age, mean ± SD	14.7 ± 3.3	14.1 ± 3.2	0.533 [a]

[a] Mann-Whitney test; [b] Fisher Exact test; [c] Chi-square test.
CSD = The Hone Kong Correctional Services Department
SD = Standard deviation

Table 7.2. Cannabis use patterns in subjects with or without lifetime psychotic symptoms in the entire sample (n=194).

Variables	With psychotic symptoms n = 147 Mean ± SD, Median (range)	Without psychotic symptoms n = 47 Mean ± SD, Median (range)	p value [a]
Age of first use	18.0 ± 4.0 17 (12 – 35)	17.3 ± 3.6 17.0 (10 – 25)	0.437
Duration of use (year)	5.1 ± 5.1 3.5 (0 – 27)	3.7 ± 2.8 3 (0.3 – 11)	0.310
Days of use			
Lifetime	912.4 ± 1226.3 420.0 (4.33 – 9828)	768.3 ± 856.9 486.4 (7 – 3276)	0.521
Past two years	268.3 ± 222.5 204.8 (4.3 – 728.0)	297.9 ± 239.8 270.8 (3 – 728)	0.580
Past one year	120.1 ± 104.5 78 (0 – 364.0)	143.2 ± 121.9 100 (3 – 364)	0.398
Past month	2.3 ± 6.5 0 (0 – 30)	6.2 ± 11.3 0 (0 – 30)	0.034
Lifetime Consumption (joint)			
Total	2796.8 ± 5104.0 832 (12 – 39312)	1864.8 ± 2954.7 568.5 (7 – 10908)	0.188
Consumption in one day	2.6 ± 2.7 2 (0.5 – 16)	2.2 ± 2.1 1.5 (0.5 – 11)	0.441
Consumption in past two years (joint)			
Total	967.6 ± 1609.8 294.7 (12 – 9282)	825.5 ± 1527.5 260 (3 – 2954.3)	0.209
Consumption in one day	2.8 ± 3.2 2 (0.5 – 18)	2.6 ± 4.6 1 (0.2 – 9)	0.204
Consumption in the past one year (joint)			
Total	365.7 ± 577.9 130 (0 – 3094)	247.6 ± 304.4 90.9 (3 – 1274)	0.427
Consumption in one day	2.5 ± 2.7 2 (0 – 18)	1.9 ± 1.5 1 (0.5 – 6.5)	0.278

Variables	With psychotic symptoms n = 147 Mean ± SD, Median (range)	Without psychotic symptoms n = 47 Mean ± SD, Median (range)	p value [a]
Consumption in the previous month (joint)			
Total	4.7 ± 20.1 0 (0 – 182)	7.1 ± 20.3 0 (0 – 106)	0.269
Consumption in one day	0.3 ± 0.8 0 (0 – 6)	0.3 ± 0.8 0 (0 – 3.5)	0.321
Current dependence, n (%)	12 (8.2)	6 (12.3)	0.850 [b]
Current abuse, n (%)	15 (10.2)	4 (66.7)	0.127[b]
Lifetime dependence, n (%)	109 (74.1)	34 (72.3)	0.387 [b]
Lifetime abuse, n (%)	31 (21.1)	9 (19.1)	0.839[b]

[a] Mann-Whitney; [b] Fisher's exact test, [c] Chi-square test.
SD = Standard deviation

Table 7.3. Other drug use in subjects with and without lifetime psychotic symptoms in the entire sample (n=194)

Lifetime use of other drugs	With psychotic symptoms n=147	Without psychotic symptoms n=47	p value [a]
Cocaine	90 (61.2)	13 (27.7)	<0.001
Ketamine	70 (47.6)	6 (12.8)	<0.001
Ecstasy	59 (40.1)	4 (8.5)	<0.001
ICE	52 (35.4)	5 (10.6)	0.001
Hypnotics	38 (25.9)	2 (4.3)	0.001
Cough medicine	12 (8.2)	2 (4.3)	0.524
Number of other drugs use	n (%)	n (%)	
0	29 (19.7)	31 (66)	
1	30 (20.4)	7 (14.9)	
2	24 (16.3)	3 (6.4)	
3	21 (14.3)	4 (8.5)	
4	22 (15)	0 (0)	
5	16 (10.9)	2 (4.3)	
6	5 (3.4)	0 (0)	
Average, mean ± SD	2.3 ± 1.8	0.74 ± 1.3	<0.001

[a] Fisher's exact test.
ICE: methamphetamine.
SD = Standard deviation

Table 7.4. Logistic regression model predictors of lifetime psychotic symptoms for all subjects in the entire sample (n=194)

		95% Cl for OR		
Variable	OR	Lower	Upper	p value
Age	1.08	1.004	1.16	0.038
Gender (male)	-	-	-	-
Unemployed	2.69	1.25.	5.83	0.012
Has a religious belief	-	-	-	-
Smoke history	-	-	-	-
Days of use of cannabis in the previous month	-	-	-	-
Lifetime use of ICE	-	-	-	-
Lifetime use of ecstasy	-	-	-	-
Lifetime use of cocaine	-	-	-	-
Lifetime use of hypnotics	-	-	-	-
Lifetime use of ketamine	-	-	-	-
Number of other drugs use	1.69	1.27	2.26	<0.001

Table 7.5. Demographic characteristics of subjects with or without lifetime psychotic symptoms amongst cannabis only users (n = 60).

Variables	With psychotic symptoms n =29	Without psychotic symptoms n = 31	p value
Age, mean ± SD	24.1 ± 5.6	24.4 ± 8.0	0.778[a]
Gender (male), n (%)	22 (75.9)	26 (83.9)	0.518[b]
Education (year), mean ± SD	12.6 ± 2.8	12.3 ± 3.2	0.790[a]
Marital status, n (%)			
Single	27 (93.1)	29 (93.5)	1.000[b]
Married	2 (6.9)	2 (6.5)	
Occupation, n (%)			
Employed	10 (34.5)	21 (67.7)	0.034[b]
Unemployed	19 (65.5)	10 (32.3)	
Source of referral, n (%)			
Non-residential	12 (41.4)	13 (41.9)	0.878[c]
Residential	7 (24.1)	8 (25.8)	
University	4 (13.8)	3 (9.7)	
Others	6 (20.7)	7 (22.6)	
Family psychiatric history, n (%)	1 (3.4)	6 (19.4)	0.103[c]
Has a religious belief, n (%)[*]	5 (17.2)	8 (25.8)	0.582[c]
Accommodation, n (%)			
Public housing	14 (48.3)	14 (45.2)	0.119[c]
Private housing	7 (24.1)	15 (48.4)	
Home Owner Scheme housing	5 (17.2)	2 (6.5)	
Other	3 (10.3)	0 (0.0)	
Smoking history, n (%)			
Current	20 (69)	27 (87.1)	0.077[c]
Previous	5 (17.2)	0 (0)	
Non-smoker	4 (13.8)	4 (12.9)	
Onset age, mean ± SD	15.6 ± 2.1	15.3 ± 3.0	0.883[a]

[a] Mann-Whitney test; [b] Fisher Exact test; [c] Chi-square test.
SD = Standard deviation

Table 7.6. Cannabis use patterns in subjects with or without lifetime psychotic symptoms amongst cannabis only users (n = 60).

Variables	With psychotic symptoms n = 29 Mean ± SD, Median (range)	Without psychotic symptoms n = 31 Mean ± SD, Median (range)	p value [a]
Age of first use	18.5 ± 2.5 18 (13 – 24)	17.9 ± 3.6 18 (11 – 25)	0.372
Duration of use (year)	3.6 ± 3.6 2 (0.3 – 16)	3.7 ± 2.6 3 (0.3 – 9)	0.386
Days of use			
Lifetime	777.6 ± 945.6 364 (8 – 4011.5)	748.0 ± 768.8 548 (25 – 3068)	0.649
Past two years	273.7 ± 231.2 208 (12 – 728)	293.1 ± 249.4 215.6 (12 – 728)	0.791
Past one year	131.8 ± 115.5 75.8 (0 – 364)	159.0 ± 134.8 119.2 (6 – 364)	0.594
Past month	4.6 ± 8.7 0 (0 – 30)	9.3 ± 12.9 0 (0 – 30)	0.254
Lifetime Consumption (joint)			
Total	1644.8 ± 2087.9 667.3 (12 – 7280)	1634.9 ± 2338.1 572.3 (12.5 – 9394.4)	0.950
Consumption in one day	2.7 ± 3.2 1.9 (0.5 – 15)	2.0 ± 2.2 1.5 (0.5 – 10.9)	0.610
Consumption in past two years (joint)			
Total	760.4 ± 1316.4 515.7 (1 – 6188)	566.8 ± 778.9 156 (11.5 – 2579)	0.612
Consumption in one day	2.6 ± 3.2 1.5 (0.5 – 15)	1.9 ± 1.82 1 (0.5 – 9)	0.338
Consumption in the past one year (joint)			
Total	412.8 ± 798.7 121.3 (0 – 3094)	241.8 ± 315.6 90 (8.7 – 1274)	0.708
Consumption in one day	2.6 ± 3.2 1.5 (0.5 – 15)	1.6 ± 0.9 1.5 (0.5 – 3.5)	0.442

Variables	With psychotic symptoms n = 29 Mean ± SD, Median (range)	Without psychotic symptoms n = 31 Mean ± SD, Median (range)	p value [a]
Consumption in the previous month (joint)			
Total	8.3 ± 23.6 0 (0 – 120)	11.1 ± 24.9 0 (0 – 106)	0.869
Consumption in one day	0.4 ± 0.9 0 (0 – 4)	0.5 ± 0.9 0 (0 – 3.5)	0.953
Current dependence, n (%)	6 (22.2)	6 (19.4)	0.758 [c]
Current abuse, n (%)	5 (18.5)	8 (25.8)	0.536 [c]
Lifetime dependence, n (%)	22 (81.5)	24 (77.4)	0.750 [c]
Lifetime abuse, n (%)	2 (7.4)	4 (12.9)	0.672 [c]

[a] Mann-Whitney; [b] Pearson Chi-Square; [c] Fisher's exact
SD = Standard deviation

Table 7.7. Logistic regression model predictors of lifetime psychotic symptoms for cannabis only users (n=60)

		95% Cl for OR		
Variable	OR	Lower	Upper	p value
Unemployed	4.0	1.4	11.7	0.012
Smoking history	-	-	-	-

Correlates of PPS

In the entire sample, the participants exhibiting PPS had a lower mean level of education than those with TPS (9 vs 12 years, p = 0.025). Furthermore, a greater proportion of those with PPS than those with TPS resided in public housing (43% vs 30%, p = 0.001) (Table 8.1). However, there were no significant differences between those with PPS and TPS in terms of cannabis-use patterns and the use of other drugs (Tables 8.2 and 8.3). Furthermore, a logistic regression analysis revealed that no factors predicted the occurrence of PPS and TPS (Table 8.4).

Amongst the cannabis-only participants, those with PPS were older and had fewer mean years of education than those with TPS (28 vs 22 years, p = 0.047 and 10 vs 14 years, p = 0.021, respectively). Furthermore, a greater proportion of those with PPS than those with TPS were recruited from non-residential settings (100% vs 36%, p = 0.033), but those with PPS were less likely than those with TPS to reside in public housing (33% vs 43%, p = 0.011) (Table 8.5). In terms of cannabis-use patterns, those with PPS had a higher mean cannabis consumption per day in the past year than those with TPS (7 vs 1.6 joints, p = 0.048). (Table 8.6). However, a logistic regression analysis found that no factors predicted the occurrence of PPS or TPS (Table 8.7).

Table 8.1. Demographic characteristics of subjects with TPS and PPS in the entire sample (n=60).

	PPS n=7	TPS n=53	TPS vs PPS (p value)
Age, mean ± SD	24.7 ± 4.8	25.7 ± 5.6	0.752[a]
Gender (male), n (%)	6 (85.7)	42 (79.2)	1.000[b]
Education (year), mean ± SD	9.4 ± 1.9	12.2 ± 3.4	0.025[a]
Marital status, n (%)			
Single	7 (100)	50 (94.3)	0.812[c]
Married	0 (0)	2 (3.8)	
Separated	0 (0)	1 (1.9)	
Others	0 (0)	0 (0)	
Occupation, n (%)			
Employed,	2 (28.6)	9 (17.0)	0.602[b]
Unemployed	5 (71.4)	44 (83.0)	
Source of referral, n (%)			
Non-residential	1 (14.3)	9 (17.0)	0.606[b]
Residential	6 (85.7)	33 (62.3)	
University	0 (0)	4 (7.5)	
CSD	0 (0)	6 (11.3)	
Family psychiatric history, n (%)	2 (28.6)	6 (11.3)	0.319[c]
Has a religious belief, n (%)	4 (57.1)	16 (30.2)	0.459[c]
Accommodation, n (%)			
Public housing	3 (42.9)	16 (30.2)	0.001[c]
Private housing	2 (50.0)	24 (45.3)	
Home Owner Scheme housing	0 (0)	13 (24.5)	
CSD	2 (28.6)	0 (0)	
Smoking history, n (%)			
Current	5 (71.4)	30 (56.6)	0.680[c]
Previous	2 (28.6)	20 (37.7)	
Non-smoker	0 (0)	3 (5.7)	
Onset age, mean ± SD	15.3 ± 3.0	15.7± 4.1	0.934[a]
Duration of psychosis after last use of cocaine (day)	102.8 ± 68.3 90.9 (24 – 182)	5.8 ± 6.0 1.0 (1 – 28)	<0.001
75th percentile	180	1	
90th percentile	-	7	

[a] Mann-Whitney; [b] Fisher's Exact Test; [c] Chi-square test.
TPS: Transient psychotic symptoms; PPS: Persistent psychotic symptoms.
CSD = The Hone Kong Correctional Services Department
SD = Standard deviation

Table 8.2. Descriptive statistics of cannabis use patterns with PPS and TPS in the entire sample (n=60).

Variables	PPS n=7 Mean ± SD, Median (range)	TPS n=53 Mean ± SD, Median (range)	TPS vs PPS p value [a]
Age of first use	17.5 ± 4.1 18 (12 – 22)	18.8 ± 4.4 18 (12 – 35)	0.702
Duration of use (year)	5.1 ± 3.9 6 (1 – 12)	4.1 ± 3.5 3 (0.3 – 16)	0.557
Days of use			
Lifetime	3374.7 ± 6580.4 936 (145 – 18200)	700.6 ± 630.7 468 (24 – 2678)	0.296
Past two year	218.5 ± 104.3 234 (15 – 319)	285.9 ± 227.7 223.2 (24 – 728)	0.828
Past one year	110.2 ± 80.8 104 (15 – 234)	126.5 ± 108.4 91 (0 – 364)	0.839
Lifetime consumption (joint)			
Total	10921.1 ± 22413.0 3861 (117 – 61516)	2249.3 ± 3561.6 1076.8 (12 – 17407)	0.230
Consumption in one day	3.7 ± 5.1 2 (0.5 – 15)	2.5 ± 2.1 2 (0.5 – 11.6)	1.000
Consumption in the past two years (joint)			
Total	814.1 ± 938.6 546 (60 – 2730)	813.9 ± 1218.0 515.7 (12 – 5460)	0.834
Consumption in one day	4.1 ± 5.0 3 (0.5 – 15)	2.4 ± 2.1 2 (0.5 – 12)	0.316
Consumption in the past one year (joint)			
Total	545.4 ± 976.5 117 (43 – 2730)	838.3 ± 3360.7 121.3 (0 – 22403)	0.820
Consumption in one day	4.1 ± 5.0 3 (0.5 – 15)	7.5 ± 34.8 2 (0 – 235)	0.316

Variables	PPS n=7 Mean ± SD, Median (range)	TPS n=53 Mean ± SD, Median (range)	TPS vs PPS p value [a]
Lifetime dependence, n (%)	6 (85.7)	43 (81.1)	0.768 [b]
Lifetime abuse, n (%)	1 (14.3)	7 (13.2)	0.973 [b]

[a] Mann-Whitney; [b] Pearson Chi-Square.
TPS: Transient psychotic symptoms; PPS: Persistent psychotic symptoms
SD = Standard deviation

Table 8.3. Other drug use in the TPS and PPS group in the entire sample.

Lifetime use	PPS n=7	TPS n=53	p value [a]
Ketamine	4 (57.1)	24 (45.3)	0.695
Cocaine	4 (57.1)	24 (45.3)	0.695
Ecstasy	3 (42.9)	21 (39.6)	1.000
ICE	3 (42.9)	15 (28.3)	0.419
Hypnotics	1 (14.3)	11 (20.8)	1.000
Cough medicine	0 (0)	6 (11.3)	1.000
Number of other drug use n (%)			
0	3 (42.9)	12 (22.6)	
1	0 (0)	14 (26.4)	
2	0 (0)	10 (18.9)	
3	1 (14.3)	5 (9.4)	
4	3 (42.9)	3 (5.7)	
5	0 (0)	8 (15.1)	
6	0 (0)	1 (1.9)	
Average, mean ± SD	2.1 ± 2.0	2.0 ± 1.8	0.882 [b]

[a] Fisher's Exact test; [b] T-test.
ICE: methamphetamine.
SD = Standard deviation

Table 8.4. Logistic regression model of predictors of PPS in the entire sample.

		95% Cl for OR		
Variable	OR	Lower	Upper	p value
Education	-	-	-	-
Accommodation	-	-	-	-

Table 8.5. Demographic characteristics of subjects with TPS and PPS in cannabis only users (n=17).

Variables	PPS n=3	TPS n=14	TPS vs PPS (p value)
Age, mean ± SD	28.0 ± 5.3	22.2 ± 3.7	0.047[a]
Gender (male), n (%)	3 (100)	11 (78.6)	1.000[b]
Education (year), mean ± SD	10.0 ± 0.0	13.8 ± 2.5	0.021[a]
Marital status, n (%)			
Single	3 (100)	14 (100)	-
Occupation, n (%)			
Employed,	0 (0)	5 (35.7)	0.515[c]
Unemployed	3 (100)	9 (64.3)	
Source of referral, n (%)			
Non-residential	3 (100)	5 (35.7)	0.033[b]
Residential	0 (0)	2 (14.3)	
University	0 (0)	3 (21.4)	
CSD	0 (0)	4 (28.6)	
Family psychiatric history, n (%)	0 (0)	14 (100)	-
Has a religious belief, n (%)	2 (66.7)	14 (100)	0.022[c]
Accommodation, n (%)			
Public housing	1 (33.3)	6 (42.9)	0.011[c]
Private housing	0 (0)	4 (28.6)	
Home Owner Scheme housing	0 (0)	4 (28.6)	
Others	2 (66.7)	0 (0)	
Smoking history, n (%)			
Current	2 (66.7)	9 (64.3)	0.748[c]
Previous	1 (33.3)	3 (21.4)	
Non-smoker	0 (0)	2 (14.3)	
Onset age, mean ± SD	16.3 ± 3.1	15.7± 1.9	0.536[a]
Duration of psychosis after last use of cannabis (day)	80.8 ± 63.1 61 (31 – 152)	1.6 ± 0.9 1.5 (0.5 – 3.5)	0.003
75th percentile	-	2.0	
90th percentile	-	3.2	

[a] Mann-Whitney; [b] Fisher's Exact Test; [c] Pearson Chi-Square.
TPS: Transient psychotic symptoms; PPS: Persistent psychotic symptoms.
CSD = The Hone Kong Correctional Services Department.
SD = Standard deviation

Table 8.6. Descriptive statistics of cannabis use patterns for cannabis only users (n=17).

Variables	PPS n=3 Mean ± SD, Median (range)	TPS n=14 Mean ± SD, Median (range)	TPS vs PPS p value [a]
Age of first use	19.3 ± 2.5 19 (17 – 22)	18.7 ± 2.2 18 (14 – 24)	0.591
Duration of use (year)	3.2 ± 2.6 2.5 (1 – 6)	2.9 ± 3.1 1.7 (0.3 – 16)	0.591
Days of use			
Lifetime	897.7 ± 1119.4 364 (145 – 2184)	466.5 ± 533.5 333.7 (24 – 1820)	0.676
Past two year	156.7 ± 130.9 182 (15 – 273)	265.2 ± 213.8 195 (24 – 698)	0.591
Past one year	72.9 ± 94.6 21.6 (15 – 182)	116.6 ± 102.2 69.9 (0 – 334)	0.362
Lifetime consumption (joint)			
Total	3339.3 ± 2781.5 4368 (190 – 5460)	984.7 ± 1165.9 521.1 (12 – 3428)	0.180
Consumption in one day	6.1 ± 7.7 2 (1.3 – 15)	2.0 ± 1.6 1.9 (0.5 – 7)	0.365
Consumption in the past two years (joint)			
Total	1112.0 ± 1422.1 546 (60 – 2730)	421.8 ± 353.0 515.7 (12 – 1040)	0.800
Consumption in one day	7.0 ± 7.0 4 (2 – 15)	1.7 ± 1.0 1.5 (0.5 – 4.5)	0.057
Consumption in the past one year (joint)			
Total	944.4 ± 1546.4 60 (43 – 2730)	174.4 ± 178.2 121.3 (0 – 531)	0.945
Consumption in one day	7.0 ± 7.0 4 (2 – 15)	1.6 ± 0.9 1.5 (0.5 – 3.5)	0.048

Variables	PPS n=3 Mean ± SD, Median (range)	TPS n=14 Mean ± SD, Median (range)	TPS vs PPS p value [a]
Lifetime dependence, n (%)	3 (100)	11 (78.6)	0.377[b]
Lifetime abuse, n (%)	0 (0)	1 (7.1)	0.633[b]

[a] Mann-Whitney; [b] Pearson Chi-Square.
SD = Standard deviation

Table 8.7. Logistic regression model of predictors of PPS for cannabis only users (n=17).

		95% Cl for OR		
Variable	OR	Lower	Upper	p value
Age	-	-	-	-
Education	-	-	-	-
Accommodation	-	-	-	-
Sources of referral	-	-	-	-
Has a religious belief	-	-	-	-
Cannabis consumption per day in the past two years	-	-	-	-
Cannabis consumption per day in the past one years	-	-	-	-

Psychiatric diagnoses

The distribution of psychiatric disorders in the entire sample is presented in Table 9.1 & 9.2. As can be seen, 143 participants (74% of the sample) had lifetime substance-induced psychosis, and 27 participants (14% of the sample) had a lifetime diagnosis of cannabis-induced psychosis (CIP). The mean duration of CIP was 2 days. A small proportion of the participants (2%) had been diagnosed with schizophrenia. Fifty-seven percent of the entire sample had lifetime mood disorders. Lifetime substance-induced mood disorders were exhibited by 39% of the participants, with depressive episodes (25%) being the most prevalent presentation, and cannabis-induced mood disorders (CIMDs) were exhibited by 9% of the participants. The prevalence rates of lifetime diagnoses of major depressive disorder and bipolar disorder were 18% and 3%, respectively. Lifetime anxiety disorders were exhibited by 10% of the participants, with substance-induced anxiety disorders with obsessive-compulsive features being the most common (8%). CIADs were exhibited by 1% of the participants. Female subjects were more likely to have mood disorders. No difference was found between subjects with different age group or level consumption of cannabis (Table 9.3, 9.4, 9.5).

The distribution of psychiatric disorders among the cannabis-only users is presented in Table 9.5. As can be seen, 21 (35%) of these participants had a lifetime diagnosis of CIP, with a mean duration of 3 days. A small proportion of these participants (2%) had been diagnosed with schizophrenia. Lifetime cannabis-induced mood disorders (CIMDs) were exhibited by 25% of these participants, with depressive episodes (15%) being the most common. The prevalence rates of lifetime diagnoses of major depressive disorder and bipolar disorder were 25% and 2%, respectively. Approximately 5% of these participants had a lifetime diagnosis of an anxiety disorder, with the most common being substance-induced obsessive-compulsive features (2%). CIADs were exhibited by 3% of these participants.

Table 9.1. Pattern of psychiatric diagnoses for the entire sample (n=194)

Variables, n (%)	Lifetime	Past	Current
Any psychotic disorders	143 (73.7)	118 (60.8)	28 (14.4)
Substance-induced psychotic disorder	135 (69.6)	116 (59.8)	21 (10.8)
Cannabis-induced psychotic disorder	27 (13.9)	18 (9.3)	9 (4.6)
Other substance-induced psychotic disorder	108 (55.7)	97 (50.0)	12 (6.2)
Delusional disorder	3 (1.5)	0 (0)	3 (1.5)
Schizophrenia / schizophreniform disorder	4 (2.1)	1 (0.5)	3 (1.5)
Psychotic not otherwise specified	2 (1.0)	1 (0.5)	1 (0.5)
Any mood disorders	111 (57.2)	96 (49.5)	23 (11.9)
Substance-induced mood disorder	76 (39.2)	68 (35.1)	11 (5.7)
Depressive episodes	49 (25.3)	42 (21.6)	9 (4.6)
Manic / hypomanic episodes	11 (5.7)	11 (5.7)	1 (0.5)
Mixed episodes	20 (10.3)	19 (9.8)	1 (0.5)
Cannabis-induced mood disorder	17 (8.8)	12 (6.2)	6 (3.1)
Major depressive disorder	34 (17.5)	26 (13.4)	13 (6.7)
Bipolar I or II disorder	6 (3.1)	6 (3.1)	0 (0.0)
Any anxiety disorders	19 (9.8)	-	-
Substance-induced anxiety disorder (any type)	16 (8.2)	-	-
With obsessive compulsive symptoms	15 (7.7)	-	-
With phobic features	1 (0.5)	-	-
With panic attacks	2 (1.0)	-	-
With generalized anxiety symptoms	1 (0.5)	-	-
Cannabis-induced anxiety disorder	2 (1.0)		
Specific phobia	2 (1.0)	-	-
Panic disorder	4 (2.1)	-	-
Generalized Anxiety Disorder	0 (0)	-	-
Obsessive Compulsive Disorder	2 (1.0)	-	-
Agoraphobia without history of panic disorder	0 (0)		
Social Phobia	2 (1.0)		
Duration of CIP; mean ± SD, median (range)	2.3 ± 6.0 1.0 (1 – 30)	2.9 ± 7.1 1.0 (0 – 30)	0.9 ± 0.2 1 (1 – 1)
75th percentile	1.	1	1
90th percentile	4.0	11.6	-

CIP: Cannabis induced psychotic disorders.
SD = Standard deviation

Table 9.2 Pattern of psychiatric diagnoses for the entire sample (n=194, adjusted for age and sex)

Variables, n (%)	Lifetime		Past		Current	
Any psychotic disorders	144	(74.0)	118	(60.6)	29	(14.9)
Substance-induced psychotic disorder	135	(69.6)	116	(59.6)	21	(11.1)
Cannabis-induced psychotic disorder	27	(14.1)	18	(9.2)	10	(5.0)
Other substance-induced psychotic disorder	108	(55.5)	97	(49.9)	12	(6.1)
Delusional disorder	3	(1.7)	0	(0)	3	(1.7)
Schizophrenia / schizophreniform disorder	4	(2.2)	1	(0.5)	3	(1.7)
Psychotic not otherwise specified	2	(1.0)	1	(0.5)	1	(0.5)
Any mood disorders	113	(58.1)	98	(50.3)	23	(12.0)
Substance-induced mood disorder	76	(39.0)	68	(35.0)	11	(5.6)
Depressive episodes	49	(25.4)	43	(21.9)	9	(4.5)
Manic / hypomanic episodes	11	(5.7)	11	(5.7)	1	(0.5)
Mixed episodes	20	(10.3)	19	(9.6)	1	(0.7)
Cannabis-induced mood disorder	17	(8.7)	12	(6.2)	6	(3.0)
Major depressive disorder	36	(18.4)	28	(14.3)	13	(6.9)
Bipolar I or II disorder	6	(3.0)	6	(3.0)	0	(0)
Any anxiety disorders	20	(10.3)		-		-
Substance-induced anxiety disorder (any type)	17	(8.6)		-		-
With obsessive compulsive symptoms	19	(9.6)		-		-
With phobic features	1	(0.5)		-		-
With panic attacks	2	(1.2)		-		-
With generalized anxiety symptoms	1	(0.5)		-		-
Cannabis-induced anxiety disorder	2	(1.0)		-		-
Specific phobia	2	(1.1)		-		-
Panic disorder	4	(2.0)		-		-
Generalized Anxiety Disorder	0	(0)		-		-
Obsessive Compulsive Disorder	2	(1.2)		-		-
Agoraphobia without history of panic disorder	0	(0)		-		-
Social Phobia	2	(1.00)		-		-

CIP: Cannabis induced psychotic disorders.

Table 9.3. Pattern of psychiatric diagnoses for the entire sample, by sex (n=194)

Variables, n (%)	Male (n=153)	Female (n=41)	P-value
Any psychotic disorders	108 (70.6)	35 (85.4)	0.056
Substance-induced psychotic disorder	102 (66.7)	33 (80.5)	0.088
Cannabis-induced psychotic disorder	20 (13.1)	7 (17.1)	0.511
Other substance-induced psychotic disorder	82 (53.6)	26 (63.4)	0.261
Delusional disorder	2 (1.3)	1 (2.4)	0.602
Schizophrenia / schizophreniform disorder	3 (2.0)	1 (2.4)	0.848
Psychotic not otherwise specified	2 (1.3)	0 (0)	0.462
Any mood disorders	77 (50.3)	34 (82.9)	<0.001
Substance-induced mood disorder	56 (36.6)	20 (48.8)	0.156
Depressive episodes	35 (22.9)	14 (34.1)	0.140
Manic / hypomanic episodes	9 (5.9)	2 (4.9)	0.805
Mixed episodes	14 (9.2)	6 (14.6)	0.305
Cannabis-induced mood disorder	14 (9.2)	3 (7.3)	0.712
Major depressive disorder	20 (13.1)	14 (34.1)	0.002
Bipolar I or II disorder	5 (3.3)	1 (2.4)	0.785
Any anxiety disorders	11 (7.2)	8 (19.5)	0.018
Substance-induced anxiety disorder (any type)	9 (5.9)	7 (17.1)	0.021
With obsessive compulsive symptoms	9 (5.8)	9 (22.0)	0.002
With phobic features	1 (0.7)	0 (0)	0.604
With panic attacks	1(0.7)	1 (2.4)	0.315
With generalized anxiety symptoms	0 (0)	1 (0.5)	0.053
Cannabis-induced anxiety disorder	2 (1.3)	0 (0)	0.462
Specific phobia	0 (0)	2 (4.9)	0.006
Panic disorder	4 (2.6)	0 (0)	0.295
Generalized Anxiety Disorder	0 (0)	0 (0)	-
Obsessive Compulsive Disorder	1 (0.7)	1 (2.4)	0.315
Agoraphobia without history of panic disorder	0 (0)	0 (0)	-
Social Phobia	2 (1.3)	0 (0)	0.462
Duration of CIP; mean ± SD, median (range)	2.9 ± 6.9 1.0 (1 – 30)	0.7 ± 0.5 1.0 (0 – 1)	0.194
75th percentile	1.0	1.0	
90th percentile	9.3	-	

CIP: Cannabis induced psychotic disorders.
Bonferroni alpha level correction = 0.0019
SD = Standard deviation

Table 9.4. Pattern of psychiatric diagnoses for the entire sample, by age (n= 194).

Variables, n (%)	Age </=24 (n=100)	Age>24 (n=94)	P-value
Any psychotic disorders	65 (65)	78 (83)	0.004
Substance-induced psychotic disorder	60 (60)	75 (79.8)	0.003
Cannabis-induced psychotic disorder	13 (13)	14 (14.9)	0.703
Other substance-induced psychotic disorder	47 (47)	61 (64.9)	0.012
Delusional disorder	2 (2)	1 (1.1)	0.597
Schizophrenia / schizophreniform disorder	3 (3)	1 (1.1)	0.343
Psychotic not otherwise specified	1 (1)	1 (1.1)	0.965
Any mood disorders	54 (54)	57 (60.6)	0.350
Substance-induced mood disorder	34 (34)	42 (44.7)	0.128
Depressive episodes	23 (23)	26 (27.7)	0.455
Manic / hypomanic episodes	6 (6)	5 (5.3)	0.838
Mixed episodes	7 (7)	13 (13.8)	0.118
Cannabis-induced mood disorder	7 (7)	10 (10.6)	0.370
Major depressive disorder	21 (21)	13 (13.8)	0.189
Bipolar I or II disorder	2 (2)	4 (4.3)	0.365
Any anxiety disorders	11 (11)	8 (8.5)	0.560
Substance-induced anxiety disorder (any type)	8 (8)	8 (8.5)	0.897
With obsessive compulsive symptoms	8 (8)	10 (10.6)	0.527
With phobic features	0 (0)	1 (1.1)	0.301
With panic attacks	1 (1)	1 (1.1)	0.965
With generalized anxiety symptoms	0 (0)	1 (1.1)	0.301
Cannabis-induced anxiety disorder	1 (1)	1 (1.1)	0.965
Specific phobia	1 (1)	1 (1.1)	0.965
Panic disorder	3 (3)	0 (0)	0.343
Generalized Anxiety Disorder	0 (0)	0 (0)	-
Obsessive Compulsive Disorder	2 (2)	0 (0)	0.168
Agoraphobia without history of panic disorder	0 (0)	0 (0)	-
Social Phobia	2 (2)	0 (0)	0.168
Duration of CIP; mean ± SD, median (range)	0.91 ± 0.20 1 (1 – 1)	3.54 ± 8.14 0 (0 – 30)	0.297
75th percentile	1	1	
90th percentile	1	20.8	

CIP: Cannabis induced psychotic disorders.
Bonferroni alpha level correction= 0.0019
SD = Standard deviation

Table 9.5. Pattern of psychiatric diagnoses for the entire sample, by level of consumption (n= 194)

Variables, n (%)	Lifetime total consumption of cannabis </=728 (n=75)	Lifetime total consumption of cannabis >728 (n=73)	P-value
Any psychotic disorders	55 (73.3)	57 (78.1)	0.501
Substance-induced psychotic disorder	54 (72)	53 (72.6)	0.935
Cannabis-induced psychotic disorder	11 (14.7)	8 (11.0)	0.500
Other substance-induced psychotic disorder	43 (57.3)	45 (61.6)	0.593
Delusional disorder	1 (1.3)	0 (0)	0.322
Schizophrenia / schizophreniform disorder	0 (0)	3 (4.1)	0.076
Psychotic not otherwise specified	0 (0)	2 (2.7)	0.149
Any mood disorders	39 (52)	44 (60.3)	0.311
Substance-induced mood disorder	28 (37.3)	29 (39.7)	0.765
Depressive episodes	22 (29.3)	14 (19.2)	0.150
Manic / hypomanic episodes	4 (5.3)	4 (5.5)	0.969
Mixed episodes	7 (9.3)	10 (13.7)	0.405
Cannabis-induced mood disorder	5 (6.7)	5 (6.8)	0.965
Major depressive disorder	13 (17.3)	13 (17.8)	0.939
Bipolar I or II disorder	0 (0)	5 (6.8)	0.021
Any anxiety disorders	8 (10.7)	9 (12.3)	0.751
Substance-induced anxiety disorder (any type)	6 (8)	9 (12.3)	0.383
With obsessive compulsive symptoms	5 (6.7)	10 (13.7)	0.156
With phobic features	0 (0)	1 (1.4)	0.309
With panic attacks	2 (2.7)	0 (0)	0.160
With generalized anxiety symptoms	0 (0)	0 (0)	-
Cannabis-induced anxiety disorder	1 (1.3)	1 (1.4)	0.985
Specific phobia	2 (2.7)	0 (0)	0.160
Panic disorder	3 (4)	0 (0)	0.084
Generalized Anxiety Disorder	0 (0)	0 (0)	-
Obsessive Compulsive Disorder	2 (2.7)	0 (0)	0.160
Agoraphobia without history of panic disorder	0 (0)	0 (0)	-
Social Phobia	1 (1.3)	0 (0)	0.322
Duration of CIP; mean ± SD, median (range)	1.5 ± 1.9 1 (1 – 7)	5.8 ± 11.9 1 (1 – 30)	0.428
75th percentile	1	1	
90th percentile	6.4	-	

CIP: Cannabis induced psychotic disorders.
Bonferroni alpha level correction= 0.002
SD = Standard deviation

Table 9.5. Pattern of psychiatric diagnoses for cannabis only users (n=60).

Variables, n (%)	Lifetime	Past	Current
Any psychotic disorders	27 (45)	15 (25)	12 (20)
Cannabis-induced psychotic disorder	21 (35)	13 (21.7)	8 (13.3)
Delusional disorder	3 (5)	0 (0)	3 (5)
Schizophrenia / schizophreniform disorder	1 (1.7)	0 (0)	31 (1.7)
Psychotic not otherwise specified	1 (1.7)	1 (1.7)	0 (0)
Any mood disorders	30 (50)	25 (41.7)	7 (11.7)
Cannabis-induced mood disorder	15 (25)	11 (18.3)	4 (6.7)
Depressive episodes	9 (15)	6 (10)	3 (5)
Manic / hypomanic episodes	4 (6.7)	3 (5)	1 (1.7)
Mixed episodes	2 (3.3)	2 (3.3)	0 (0)
Major depressive disorder	15 (25)	13 (21.7)	3 (5.0)
Bipolar I or II disorder	1 (1.7)	1 (1.7)	0 (0)
Any anxiety disorders	3 (5)	-	-
Cannabis-induced anxiety disorder (any type)	2 (3.3)	-	-
With obsessive compulsive symptoms	1 (1.7)	-	-
With phobic features	0 (0)	-	-
With panic attacks	1 (1.7)	-	-
With generalized anxiety symptoms	0 (0)	-	-
Specific phobia	0 (0)	-	-
Panic disorder	1 (1.7)	-	-
Generalized Anxiety Disorder	0 (0)	-	-
Obsessive Compulsive Disorder	0 (0)	-	-
Agoraphobia without history of panic disorder	0 (0)		
Social Phobia	1 (1.7)		
Duration of CIP (days); mean ± SD, median (range)	10.7 ± 32.9 1 (0 – 31)	5.1 ± 24.7 0 (0 – 31)	0.8 ± 4.4 0 (1 – 1)
75th percentile	1	0	1
90th percentile	4	22	-

CIP: Cannabis induced psychotic disorders.
SD = Standard deviation

Correlates of lifetime CIP

In the entire sample, the majority of individuals with cannabis-induced psychosis (CIP) were more likely recruited from non-residential detoxification services (41% vs 22%, p=0.002), being non-smokers (15% vs. 4%, p=0.019), had a higher level of education (13 years vs. 11 years, p<0.001), and were less likely to have a religion (19% vs. 41%, p=0.027), compared to individuals without CIP (see Table 10.1).

Regarding cannabis use patterns, individuals with CIP consumed a higher amount of cannabis in terms of both total consumption and daily average use over the previous month (9 joints vs. 5 joints, p=0.029; and 0.5 joints vs. 0.3 joints, p=0.027, respectively). Additionally, there was a trend indicating that subjects with CIP were more likely to have used cannabis on more days in the past year (161 days vs. 119 days, p=0.078). Current dependence of cannabis was more common in the CIP group (30% vs. 6%, p < 0.001) (Table 10.2).

In terms of other drug use, subjects in the CIP group were less likely to report lifetime use of ecstasy (11% vs. 36%, p=0.011), ICE (11% vs. 32%, p=0.025), cocaine (7% vs. 61%, p<0.001), ketamine (7% vs. 44%, p<0.001) and hypnotics (0% vs. 24%, p=0.004) (Table 10.3).

A logistic regression revealed that education (OR = 1.3, 95% CI 1.1–1.6, p=0.005), current dependence on cannabis (OR = 11.7, 95% CI 2.4–57.3, p = 0.002), and lifetime use of cocaine (OR=0.1, 95% CI 0.02–0.6, p= 0.009) predicted the occurrence of CIP (Table 10.4).

Among cannabis-only users, there were no differences in demographic characteristics or cannabis use patterns between those with CIP and those without (Table 10.5-10.6).

Table 10.1. Demographic characteristics of subject with or without lifetime CIP for the entire sample (n=194).

Variables	With CIP n = 27	Without CIP n = 167	p-value
Age, mean ± SD	25.2 ± 5.8	26.2 ± 7.5	0.661[a]
Gender (male), n (%)	20 (74.1)	133 (79.6)	0.511[b]
Education (year), mean ± SD	13.4 ± 2.4	11.0 ± 3.2	<0.001[a]
Marital status (single), n (%)			
Single	25 (92.6)	148 (88.6)	0.361[c]
Married	1 (3.7)	17 (10.2)	
Separated	1 (3.7)	2 (1.2)	
Occupation, n (%)			
Employed	9 (33.3)	53 (31.7)	0.869[b]
Unemployed	18 (66.7)	114 (68.3)	
Source of referral, n (%)			
Non-residential	11 (40.7)	36 (21.6)	0.002[c]
Residential	7 (25.9)	99 (53.3)	
University	4 (14.8)	5 (3.0)	
CSD	5 (18.5)	27 (16.2)	
Family psychiatric history, n (%)	2 (7.4)	23 (13.8)	0.360[b]
Has a religious belief, n (%)[*]	5 (18.5)	68 (40.7)	0.027[c]
Accommodation, *n (%)*			
Public housing	9 (33.3)	76 (45.5)	0.078[c]
Private housing	9 (33.3)	68 (40.7)	
Home Owner Scheme housing	8 (29.6)	19 (11.4)	
Others	1 (3.7)	4 (2.4)	
Smoking history, n (%)			
Current	19 (70.4)	113 (67.7)	0.025[c]
Previous	4 (14.8)	48 (28.7)	
Non-smoker	4 (14.8)	6 (3.6)	
Onset age, mean ± SD	15.4 ± 2.6	14.5 ± 3.3	0.067[a]

[a] Mann-Whitney; [b] Fisher's exact test; [c] Pearson Chi-Square test.
CSD = The Hone Kong Correctional Services Department.
[*]Post hoc analysis revealed a significant difference between non-smokers with CIP (15%) and non-smokers without CIP (4%), p = 0.019.
SD = Standard deviation.

Table 10.2. Cannabis use patterns in subjects' with or without lifetime CIP for the entire sample (n=194).

Variables	With CIP n = 27 Mean ± SD, Median (range)	Without CIP n = 167 Mean ± SD, Median (range)	p-value [a]
Age of first use	18.7 ± 3.0 18 (13 – 25)	17.7 ± 4.0 17 (10 – 35)	0.046
Duration of use (year)	3.9 ± 3.7 2 (0.3 – 16)	4.9 ± 4.8 4 (0 – 27)	0.123
Days of use			
Lifetime	789.0 ± 1004.3 364 (24 – 4012)	990.9 ± 1792.2 492 (4 – 18200)	0.385
Past two year	326.3 ± 244.0 221 (24 – 728)	267.4 ± 223.3 205 (3 – 728)	0.223
Past one year	161.4 ± 117.4 151 (0 – 364)	119.3 ± 107.3 78 (3 – 364)	0.078
Previous month	4.7 ± 9.0 0 (0 – 30)	3.0 ± 7.9 0 (0 – 30)	0.103
Lifetime consumption (joint)			
Total	1970.5 ± 4004.6 607 (12 – 17407)	3090.5 ± 7074.4 832 (7 – 61516)	0.343
Consumption in one day	2.9 ± 3.4 2 (1 – 15)	2.4 ± 2.4 2 (1 – 16)	0.617
Consumption in the past two years (joint)			
Total	1168.8 ± 1755.2 520 (12 – 6188)	896.9 ± 1562.1 260 (3 – 9282)	0.337
Consumption in one day	3.3 ± 3.5 2 (1 – 15)	2.6 ± 3.6 2 (0.2 – 28)	0.227
Consumption in the past one year(joint)			
Total	638.2 ± 960.9 156 (0 – 3094)	292.7 ± 414.0 106 (3 – 2730)	0.228

Variables	With CIP n = 27 Mean ± SD, Median (range)	Without CIP n = 167 Mean ± SD, Median (range)	p-value [a]
Consumption in one day [l]	3.1 ± 3.5 2 (0 – 15)	2.2 ± 2.3 2 (11 – 18)	0.359
Consumption in the previous month (joint)			
Total	8.9 ± 24.4 0 (0 – 120)	4.6 ± 19.4 0 (0 – 182)	0.029
Consumption in one day	0.5 ± 0.9 0 (0 – 4)	0.3 ± 0.8 0 (0 – 6)	0.027
Current dependence, n (%)	8 (29.6)	10 (6.0)	<0.001[b]
Current abuse, n (%)	3 (11.1)	21 (12.6)	0.830[b]
Lifetime dependence, n (%)	21 (77.8)	122 (73.1)	0.605[b]
Lifetime abuse, n (%)	2 (7.4)	38 (22.8)	0.067[b]

[a] Mann-Whitney; [b] Fisher's exact test.
SD = Standard deviation.

Table 10.3. Other drug use in subjects with and without lifetime CIP for the entire sample (n=194).

Lifetime use	With CIP n = 27	Without CIP n = 167	p value [a]
Ecstasy	3 (11.1)	60 (35.9)	0.011
ICE	3 (11.1)	54 (32.3)	0.025
Cocaine	2 (7.4)	101 (60.5)	<0.001
Ketamine	2 (7.4)	74 (44.3)	<0.001
Cough medicine	0 (0.0)	14 (8.4)	0.118
Hypnotics	0 (0.0)	40 (24.0)	0.004

[a] Fisher's exact test.
ICE: methamphetamine

Table 10.4. Logistic regression model of predictors of lifetime CIP for the entire sample

		95% Cl for OR		
Variable	OR	Lower	Upper	p value*
Education	1.3	1.1	1.6	0.005
Source of referral	-	-	-	-
Has a religious belief	0.2	0.05	1.04	0.056
Days of cannabis use in the past one year	-	-	-	-
Consumption of cannabis use in the current month	-	-	-	-
Consumption of cannabis use per days in the current month	-	-	-	-
Current dependence of cannabis	11.7	2.4	57.3	0.002
Lifetime use of ecstasy	-	-	-	-
Lifetime use of cocaine	0.1	0.02	0.6	0.009
Lifetime use of ketamine	-	-	-	-
Lifetime use of ICE	-	-	-	-
Lifetime use of hypnotics	0.000	0.000	-	0.997

Reference group = no psychotic disorder

Table 10.5. Demographic characteristics of subject with or without lifetime CIP in cannabis only users (n=60).

	With CIP n = 19	Without CIP n = 41	p-value
Age, mean ± SD	23.7 ± 5.8	24.0 ± 7.3	0.756[a]
Gender (male), n (%)	13 (68.4)	35 (85.4)	0.127[b]
Education (year), mean ± SD	13.2 ± 2.7	11.9 ± 3.2	0.093[a]
Marital status (single), n (%)			
Single	18 (94.7)	36 (87.8)	0.405[b]
Married	1 (5.3)	5 (12.2)	
Occupation, n (%)			
Employed	8 (42.1)	23 (56.1)	0.313[b]
Unemployed	11 (57.9)	18 (43.9)	
Source of referral, n (%)			
Non-residential	10 (52.6)	15 (36.6)	0.121[c]
Residential	1 (5.3)	14 (34.1)	
University	3 (15.8)	4 (9.8)	
CSD	5 (26.3)	8 (19.5)	
Family psychiatric history, n (%)	1 (5.3)	6 (14.6)	0.293[b]
Has a religious belief, n (%)[*]	3 (15.8)	11 (26.8)	0.347[c]
Accommodation, *n (%)*			
Public housing	9 (47.4)	20 (48.8)	0.533[b]
Private housing	6 (31.6)	17 (41.5)	
Home Owner Scheme housing	3 (15.8)	2 (4.9)	
Others	1 (5.3)	2 (4.9)	
Smoking history, n (%)			
Current	14 (73.7)	33 (80.5)	0.834[b]
Previous	2 (10.5)	3 (7.3)	
Non-smoker	3 (15.8)	5 (12.2)	
Onset age [d], mean ± SD	15.3 ± 1.9	15.3 ± 3.1	0.841[a]

[a] Mann-Whitney; [b] Fisher's Exact Test; [c] Pearson Chi-Square.
[d] Missing data: With CIP n=3; Without CIP n=5.
CIP = cannabis-induced psychosis.
CSD = The Hone Kong Correctional Services Department.
SD = Standard deviation.

Table 10.6. Cannabis use patterns in subjects' with or without lifetime CIP in cannabis users. (n=60).

Variables	With CIP n = 19 Mean ± SD, Median (range)	Without CIP n = 41 Mean ± SD, Median (range)	p-value [a]
Age of first use	18.4 ± 2.5 18 (14 – 24)	17.8 ± 3.6 18 (10 – 25)	0.492
Duration of use (year)	3.5 ± 4.0 2 (0.3 – 16)	3.7 ± 2.5 3 (0.3 – 9)	0.208
Days of use			
Lifetime	824.6 ± 1053.8 364 (24 – 4012)	805.9 ± 850.5 548 (8 – 3276)	0.808
Past two year	301.9 ± 230.6 208.0 (24 – 728)	271.4 ± 241.5 182.0 (12 – 728)	0.455
Past one year	163.7 ± 114.5 156 (0 – 364)	138.7 ± 128.4 61 (6 – 364)	0.286
Previous month	6.6 ± 10.2 0 (0 – 30)	7.2 ± 11.8 0 (0 – 30)	0.935
Lifetime consumption (joint)			
Total	1093.1.5 ± 1457.4 606 (12 – 5460)	1903.6 ± 2454.3 576 (13 – 9394)	0.618
Consumption in one day	2.5 ± 3.6 2 (1 – 15)	2.2 ± 2.1 1.5 (1 – 11)	0.905
Consumption in the past two years (joint)			
Total	889.0 ± 1508.4 520 (12 – 6188)	775.4 ± 1593.9 113 (12 – 8196)	0.206
Consumption in one day	2.9 ± 3.7 2 (1 – 15)	2.7 ± 5.0 1 (1 – 28)	0.472
Consumption in the past one year(joint)			
Total	568.5 ± 943.7 182 (0 – 3094)	231.0 ± 312.8 60 (8.7 – 1274)	0.134

Variables	With CIP n = 19 Mean ± SD, Median (range)	Without CIP n = 41 Mean ± SD, Median (range)	p-value [a]
Consumption in one day	2.9 ± 3.8 2 (1 – 15)	1.8 ± 1.3 2 (1 – 6)	0.570
Consumption in the previous month (joint)			
Total	12.4 ± 28.6 0 (0 – 120)	8.2 ± 21.7 0 (0 – 106)	0.361
Consumption in one day	0.6 ± 1.0 0 (0 – 4)	0.5 ± 0.8 0 (0 – 4)	0.353
Current dependence, n (%)	6 (31.6)	6 (14.6)	0.127[b]
Current abuse, n (%)	3 (15.8)	10 (24.4)	0.452[b]
Lifetime dependence, n (%)	15 (78.8)	33 (80.5)	0.890[b]
Lifetime abuse, n (%)	1 (5.3)	5 (12.2)	0.405[b]

[a] Kruskal-Wallis H; [b] Fisher's Exact Test.
SD = Standard deviation.

Correlates of lifetime CIMDs.

In the entire sample, only the age at which participants began smoking was significantly different between those with CIMDs and those without (16 vs. 15, p=0.028) (Table 11.1). Moreover, subjects with CIMDs consumed significantly more cannabis per day over their lifetime (5 vs. 2 joints, p=0.049). There was a trend that subjects with CIMDs consumed more cannabis over the past year, both in total consumption (862 vs. 300 joints, p=0.056) and in daily average use (5 vs. 2 joints, p=0.058). Subjects with CIMDs were more likely to currently be dependent (41% vs 6%, p<0.001) on cannabis but less likely to reported a history of abuse during their lifetime (0% vs 23%, p=0.028) (Table 11.2). In terms of other drug use, subjects with CIMDs were less likely to consume cocaine (6% vs. 58%, p<0.001), ketamine (6% vs. 42%, p=0.003), and hypnotics (0% vs. 23%, p=0.028) (Table 11.3).

The logistic regression analysis indicated that the lifetime daily average use of cannabis (OR=1.4, 95% CI 1.1–1.8, p=0.002), current dependence on cannabis (OR=6.6, 95% CI 1.1–40.5, p=0.042), and lifetime use of cocaine (OR=0.07, 95% CI 0.005–0.9, p=0.037) are significant predictors of the occurrence of CIMDs (Table 11.4).

Among cannabis-only users, those with CIMDs did not differ from those without CIMDs in terms of demographic characteristics (Table 11.5) or cannabis use patterns (Table 11.6). However, individuals with CIMDs were more likely to exhibit current dependence on cannabis (46% vs. 14%, p=0.020).

Table 11.1. Demographic characteristics of subject with and without lifetime CIMDs for the entire sample (n=194).

Variables	With CIMDs n = 17	Without CIMDs n = 177	p-value
Age, mean ± SD	26.7 ± 8.1	26.0 ± 7.2	0.763[a]
Gender (male), n (%)	14 (82.4)	139 (78.5)	0.712[b]
Education (year), mean ± SD	12.2 ± 3.1	11.2 ± 3.2	0.113[a]
Marital status (single), n (%)			
Single	16 (94.1)	157 (88.7)	0.752[b]
Married	1 (5.9)	17 (9.6)	
Separated	0 (0.0)	3 (1.7)	
Occupation, n (%)			
Employed	5 (29.4)	57 (32.2)	0.814[b]
Unemployed	12 (70.6)	120 (67.8)	
Source of referral, n (%)			
Non-residential	7 (41.2)	41 (23.2)	0.651[b]
Residential	6 (35.3)	99 (55.9)	
CSD	3 (17.6)	29 (16.4)	
University	1 (5.9)	8 (4.5)	
Family psychiatric history, n (%)	3 (17.6)	22 (12.4)	0.540[b]
Has a religious belief, n (%)	5 (29.4)	68 (38.4)	0.464[b]
Accommodation, *n (%)*			
Public housing	6 (35.3)	79 (44.6)	0.730[b]
Private housing	7 (41.2)	70 (39.5)	
Home Owner Scheme housing	3 (17.6)	24 (13.6)	
Others	1 (5.9)	4 (2.3)	
Smoking history, n (%)			
Current	15 (88.2)	117 (66.1)	0.124[b]
Previous	1 (5.9)	51 (28.8)	
Non-smoker	1 (5.9)	9 (5.1)	
Onset age, mean ± SD	15.8 ± 3.7	14.5 ± 3.2	0.028[a]

[a] Mann-Whitney; [b] Fisher's Exact Test; [c] Pearson Chi-Square.
CIMDs = cannabis-induced mood disorders
CSD = The Hone Kong Correctional Services Department
SD = Standard deviation.

Table 11.2. Cannabis use patterns in subjects with and without lifetime CIMDs for the entire sample (n=194).

Variables	With CIMDs n = 17 Mean ± SD, Median (range)	Without CIMDs n = 177 Mean ± SD, Median (range)	p-values [a]
Age of first use	18.6 ± 3.5 18 (12 – 27)	17.7 ± 4.0 17 (10 – 35)	0.201
Duration of use (year)	4.3 ± 4.3 3 (1 – 16)	4.8 ± 4.7 3 (0 – 27)	0.537
Days of use			
Lifetime	862.5 ± 1062.4 364 (45 – 4012)	971.9 ± 1754.0 468 (4 – 18200)	0.829
Past two year	319.2 ± 215.8 216.7 (45 – 728)	271.2 ± 227.8 199.3 (3 – 728)	0.227
Past one year	163.4 ± 120.1 182 (30 – 364)	122.2 ± 107.7 90.0 (0 – 364)	0.127
Previous month	4.4 ± 10.1 0 (0 – 30)	3.1 ± 7.9 0 (0 – 30)	0.744
Lifetime consumption (Joint)			
Total	2566.6 ± 4105.1 780 (113 – 13149)	2974.3 ± 6920.9 728 (7 – 61516)	0.843
Consumption in one day	5.0 ± 4.8 3 (1 – 15)	2.3 ± 2.2 2 (1 – 16)	0.049
Consumption in the past two years (Joint)			
Total	1645.0 ± 2207.0 832 (52 – 6188)	881.1 ± 1526.7 276 (3 – 9282)	0.216
Consumption in one day	4.8 ± 4.9 3 (1 – 15)	2.6 ± 3.4 2 (0.2 –28)	0.076
Consumption in the past one year (Joint)			
Total	861.6 ± 1095.9 208 (26 – 3094)	299.6 ± 443.8 117 (0 – 2730)	0.056

Variables	With CIMDs n = 17 Mean ± SD, Median (range)	Without CIMDs n = 177 Mean ± SD, Median (range)	p-values [a]
Consumption in one day	4.9 ± 4.9 3 (1 – 15)	2.2 ± 2.1 2 (0 – 18)	0.058
Cannabis consumption in the previous month (Joint)			
Total	8.1 ± 29.9 0 (0 – 120)	5.0 ± 19.1 0 (0 – 182)	0.926
Consumption in one day	0.5 ± 1.1 0 (0 – 4)	0.3 ± 0.8 0 (0 – 6)	0.889
Current dependence, n (%)	7 (41.2)	11 (6.2)	<0.001[b]
Current abuse, n (%)	2 (11.8)	22 (12.4)	0.937[b]
Lifetime dependence, n (%)	14 (82.4)	129 (72.9)	0.397[b]
Lifetime abuse, n (%)	0 (0)	40 (22.6)	0.028[b]

[a] Mann-Whitney Test; [b] Fisher's Exact Test.
CIMDs= cannabis-induced mood disorders
SD = Standard deviation.

Table 11.3. Other drug use in subjects' with and without CIMDs for the entire sample.

Lifetime use	With CIMDs n = 17	Without CIMDs n = 177	p value [a]
Ecstasy	4 (23.5)	59 (33.3)	0.410
ICE	2 (11.8)	55 (31.1)	0.095
Cough medicine	1 (5.9)	13 (7.3)	0.824
Cocaine	1 (5.9)	102 (57.6)	<0.001
Ketamine	1 (5.9)	75 (42.4)	0.003
Hypnotics	0 (0.0)	40 (22.6)	0.028

[a] Fisher's Exact Test.
CIMDs: cannabis-induced mood disorders
ICE: methamphetamine.

Table 11.4. Logistic regression model of predictors of CIMDs for the entire sample.

Variable	OR	95% Cl for OR Lower	Upper	p value
Smoke onset age	-	-	-	-
Lifetime cannabis use per day	1.4	1.1	1.8	0.002
Total cannabis use in the past one year	-	-	-	-
Cannabis use per day in the past one year	-	-	-	-
Current dependence of cannabis	6.6	1.1	40.5	0.042
Lifetime abuse of cannabis	-	-	-	-
Lifetime use of hypnotics	-	-	-	-
Lifetime use of cocaine	0.07	0.005	0.9	0.037
Lifetime use of ketamine	-	-	-	-

1= Cannabis induced mood disorders; 0= No mood disorders.
CIMDs: cannabis-induced mood disorders.

Table 11.5. Demographic characteristics of subject with and without lifetime CIMDs in cannabis only users (n=60).

Variables	With CIMDs n = 11	Without CIMDs n = 49	p-value
Age, mean ± SD	27.0 ± 9.9	23.2 ± 5.8	0.296[a]
Gender (male), n (%)	8 (72.7)	40 (81.6)	0.505[b]
Education (year) , mean ± SD	11.9 ± 3.4	12.4 ± 3.0	0.701[a]
Marital status (single), n (%)			
Single	10 (90.9)	44 (89.8)	0.911[b]
Married	1 (9.1)	5 (10.2)	
Occupation, n (%)			
Employed	4 (36.4)	27 (55.1)	0.261[b]
Unemployed	7 (63.6)	22 (44.9)	
Source of referral, n (%)			
Non-residential	6 (54.5)	19 (38.8)	0.466[c]
Residential	2 (18.2)	13 (26.5)	
CSD	3 (27.3)	10 (20.4)	
University	0 (0)	7 (14.3)	
Family psychiatric history, n (%)	2 (18.2)	5 (10.2)	0.456[b]
Has a religious belief, n (%)[*]	3 (27.3)	11 (22.4)	0.732[b]
Accommodation, *n (%)*			
Public housing	6 (54.5)	23 (46.9)	0.802[b]
Private housing	3 (27.3)	20 (40.8)	
Home Owner Scheme housing	1 (9.1)	4 (8.2)	
Others	1 (9.1)	2 (4.1)	
Smoking history, n (%)			
Current	10 (90.9)	37 (75.5)	0.455[b]
Non-smoker	1 (9.1)	7 (14.3)	
Previous	0 (0.0)	5 (10.2)	
Onset age, mean ± SD	15.3 ± 3.9	15.2 ± 2.5	0.716[a]

[a] Mann-Whitney; [b] Fisher's Exact Test; [c] Pearson Chi-Square.
CIMDs = cannabis induced mood disorders.
CSD = The Hone Kong Correctional Services Department.
SD = Standard deviation.

Table 11.6. Cannabis use patterns in subjects with and without lifetime CIMDs in cannabis only users (n=60).

Variables	With CIMDs n = 11 Mean ± SD, Median (range)	Without CIMDs n = 49 Mean ± SD, Median (range)	p-values [a]
Age of first use	17.9 ± 3.2 18 (12 – 23)	18.0 ± 3.3 18 (10 – 25)	0.923
Duration of use (year)	4.7 ± 4.7 3 (1 – 16)	3.4 ± 2.5 3 (0.3 – 9)	0.626
Days of use			
Lifetime	1084.0 ± 1258.8 364 (163 – 4012)	749.6 ± 816.9 489 (8 – 3276)	0.340
Past two year	306.8 ± 217.6 208 (64 – 728)	275.4 ± 242.4 182 (12 – 728)	0.375
Past one year	183.3 ± 119.7 182 (30 – 364)	138.4 ± 124.3 89 (0 – 364)	0.157
Previous month	6.5 ± 12.1 0 (0 – 30)	7.1 ± 11.2 0 (0 – 30)	0.505
Lifetime consumption (Joint)			
Total	1279.4 ± 2067.2 510 (156 – 5460)	1669.9 ± 2207.3 591.3 (12 – 9394)	0.986
Consumption in one day	4.0 ± 5.5 2 (1 – 15)	2.0 ± 1.9 2 (1 – 11)	0.560
Consumption in the past two years (Joint)			
Total	1512.8 ± 2263.2 515 (52 – 6188)	692.6 ± 1385.6 156 (12 – 8196)	0.328
Consumption in one day	4.6 ± 5.4 2 (1 – 15)	2.4 ± 4.3 1 (1 – 28)	0.371
Consumption in the past one year (Joint)			
Total	1015.1 ± 1327.7 208 (26 – 3094)	228.7 ± 287.3 91 (0 – 1274)	0.115

Variables	With CIMDs n = 11 Mean ± SD, Median (range)	Without CIMDs n = 49 Mean ± SD, Median (range)	p-values [a]
Consumption in one day	4.6 ± 5.4 2 (1 – 15)	1.8 ± 1.2 1 (1 – 6)	0.347
Cannabis consumption in the previous month (Joint)			
Total	12.6 ± 37.8 0 (0 – 120)	9.0 ± 20.5 0 (0 – 106)	0.403
Consumption in one day	0.5 ± 1.3 0 (0 – 4)	0.5 ± 0.8 0 (0 – 4)	0.333
Current dependence, n (%)	5 (45.5)	7 (14.3)	0.020[b]
Current abuse, n (%)	2 (18.2)	11 (22.4)	0.756[b]
Lifetime dependence, n (%)	9 (81.8)	39 (79.6)	0.868[b]
Lifetime abuse, n (%)	0 (0)	6 (12.2)	0.221[b]

[a] Mann-Whitney Test; [b] Fisher's Exact Test.
CIMDs = cannabis induced mood disorder
SD = Standard deviation.

Correlates of lifetime CIADs

In the entire sample, participants with Cannabis-Induced Anxiety Disorders (CIADs) were less likely to be current smokers compared to those without CIADs (50% vs. 68%, p=0.014) (Table 12.1). Those with CIADs reported using cannabis more frequently in the past month (21 vs. 3 days, p=0.026), with higher total (63 vs. 5 joints, p=0.014); and daily consumption (2 vs. 0.3 joints, p=0.031) than those without CIADs (Table 12.2). There were no significant differences between the two groups regarding their use of other drugs (Table 12.3). A logistic regression analysis indicated that total cannabis consumption in the past month predicted the occurrence of CIADs (OR=1.03, 95% CI 1.0 – 1.1, p=0.015) (Table 12.4).

Among cannabis-only users, those with and without CIADs did not differ in demographic characteristics (Table 12.5). However, there was a trend suggesting that subjects with CIADs consumed more cannabis in the previous month (63 vs. 8 joints, p=0.055) (Table 12.6).

Table 12.1. Demographic characteristics of subject with and without lifetime CIADs for the entire sample (n=194).

Variables	With CIADs n = 2	Without CIADs n = 192	p-values
Age, mean ± SD	23.0 ± 5.7	26.1 ± 7.3	0.585[a]
Gender (male), n (%)	2 (100.0)	151 (78.6)	0.462[b]
Education (year) , mean ± SD	13.5 ± 6.4	11.3 ± 3.1	0.609[a]
Marital status, n (%)			
Single	2 (100.0)	171 (89.1)	0.885[c]
Married	0 (0.0)	18 (9.4)	
Separated	0 (0.0)	3 (1.6)	
Occupation, n (%)			
Unemployed	2 (100.0)	130 (67.7)	0.330[b]
Employed	0 (0.0)	62 (32.3)	
Source of referral, n (%)			
Non-residential	1 (50.0)	46 (24.0)	0.372[c]
Residential	0 (0.0)	106 (55.2)	
University	0 (0.0)	9 (4.7)	
CSD	1 (50.0)	31 (16.1)	
Family psychiatric history, n (%)	1 (50.0)	24 (12.5)	0.115[b]
Has a religious belief, n (%)	1 (50.0)	72 (37.5)	0.717[c]
Accommodation, n (%)			
Public housing	1 (50.0)	84 (43.8)	0.939[b]
Private housing	1 (50.0)	76 (39.6)	
Home Owner Scheme housing	0 (0.0)	27 (14.1)	
Others	0 (0.0)	5 (2.6)	
Smoking history, n (%)			
Current	1 (50.0)	131 (68.2)	0.014[c]
Previous	0 (0.0)	52 (27.1)	
Non-smoker	1 (50.0)	9 (4.7)	
Onset age, mean ± SD	12.0 ± N/A	14.6 ± 3.2	0.304[a]

[a] Mann-Whitney Test; [b] Fisher's Exact Test; c Pearson Chi-Square
CIADs = cannabis induced anxiety disorder
CSD = The Hone Kong Correctional Services Department
SD = Standard deviation.

Table 12.2. Cannabis use pattern in subject with and without lifetime CIADs for the entire sample (n=194).

Variables	With CIADs n = 2 Mean ± SD, Median (range)	Without CIADs n = 192 Mean ± SD, Median (range)	p-values [a]
Age of first use	16.5 ± 3.5 16.5 (14 – 19)	17.8 ± 3.9 17.0 (10 – 35)	0.727
Duration of use (year)	3.7 ± 3.3 4 (1.3 – 6)	4.7 ± 4.7 3 (0 – 27)	0.836
Days of use			
Lifetime	260.0 ± 73.5 260 (208 – 312)	969.5 ± 1709.1 468 (4 – 18200)	0.454
Past two year	156.0 ± 73.5 156 (104 – 208)	276.9 ± 227.4 208 (3 – 728)	0.654
Past one year	130.0 ± 110.3 130 (52 – 208)	125.8 ± 109.24 90 (0 – 364)	0.806
Previous month	21.0 ± 12.7 21 (12 – 30)	3.1 ± 7.9 0 (0 – 30)	0.026
Lifetime consumption (joint)			
Total	494.0 ± 478.0 494 (156 – 832)	2980.3 ± 6799.1 728 (7 – 61516)	0.526
Consumption in one day	2.3 ± 2.5 2 (1 – 4)	2.5 ± 2.5 2 (1 – 16)	0.777
Consumption in the past two years (joint)			
Total	442.0 ± 551.5 442 (52 – 832)	942.6 ± 1596.9 295 (3 – 9282)	0.716
Consumption in one day	2.3 ± 2.5 2 (1 – 4)	2.7 ± 3.6 2 (0.2 – 28)	0.799
Consumption in the past one year (joint)			
Total	429.0 ± 569.9	338.0 ± 531.8	0.968

Variables	With CIADs n = 2 Mean ± SD, Median (range)	Without CIADs n = 192 Mean ± SD, Median (range)	p-values [a]
	429 (26 – 832)	121.3 (0 – 3094)	
Consumption in one day (gram)	2.3 ± 2.5 2 (1 – 4)	2.4 ± 2.5 1.5 (0 – 18)	0.848
Consumption in the previous month (joint)			
Total	63.0 ± 80.6 63 (6 – 120)	4.6 ± 18.4 0 (0 – 182)	0.014
Consumption in one day	2.3 ± 2.5 2.3 (0.5 – 4)	0.3 ± 0.8 0 (0 – 6)	0.031
Current dependence, n (%)	1 (50)	17 (80.9)	0.046[b]
Current abuse, n (%)	1 (50)	23 (12.0)	0.104[b]
Lifetime dependence, n (%)	2 (100)	141 (73.4)	0.396[b]
Lifetime abuse, n (%)	0 (0)	40 (20.8)	0.469[b]

[a] Mann-Whitney Test; [b] Fisher's Exact Test.
CIADs = cannabis induced anxiety disorder
SD = Standard deviation.

Table 12.3 Other drug use in subject with and without lifetime CIADs for the entire sample. (n=194)

Lifetime use	With CIADs n = 2	Without CIADs n = 168	p value [a]
Cocaine	0 (0.0)	103 (53.6)	0.130
Ketamine	0 (0.0)	76 (39.6)	0.254
Ecstasy	0 (0.0)	63 (32.8)	0.324
ICE	0 (0.0)	57 (29.7)	0.359
Hypnotics	0 (0.0)	40 (20.8)	0.469
Cough medicine	0 (0.0)	14 (7.3)	0.692

[a] Pearson Chi-square.
CIADs = cannabis induced anxiety disorder
ICE: methamphetamine

Table 12.4. Logistic regression model of predictors of CIADs for the entire sample.

		95% Cl for OR		
Variable	OR	Lower	Upper	p value
Smoking history	-	-	-	-
Days of cannabis use in the previous month	-	-	-	-
Total cannabis used in the previous month	1.03	1.0	1.1	0.015
Cannabis use per day in the previous month	-	-	-	-

Reference group = No anxiety disorders.
CIADs = cannabis induced anxiety disorder

Table 12.5. Demographic characteristics of subject with and without CIADs in cannabis only users (n=60).

	With CIADs n = 2	Without CIADs n = 58	p-values
Age, mean ± SD	23.0 ± 5.7	24.0 ± 6.9	0.918[a]
Gender (male), n (%)	2 (100.0)	46 (79.3)	0.472[b]
Education (year) , mean ± SD	13.5 ± 6.4	12.3 ± 3.0	0.793[a]
Marital status, n (%)			
Single	2 (100.0)	52 (89.7)	0.632[c]
Married	0 (0.0)	6 (10.3)	
Occupation, n (%)			
Unemployed	2 (100.0)	27 (46.6)	0.137[b]
Employed	0 (0.0)	31 (53.4)	
Source of referral, n (%)			
Non-residential	1 (50.0)	24 (41.4)	0.669[c]
Residential	0 (0.0)	15 (25.9)	
CSD	1 (50.0)	12 (20.7)	
University	0 (0.0)	7 (12.1)	
Family psychiatric history, n (%)	1 (50.0)	6 (10.3)	0.086[b]
Has a religious belief, n (%)	1 (50.0)	13 (22.4)	0.364[c]
Accommodation, n (%)			
Public housing	1 (50.0)	28 (48.3)	0.950[b]
Private housing	1 (50.0)	22 (37.9)	
Home Owner Scheme housing	0 (0.0)	5 (8.6)	
Others	0 (0.0)	3 (5.2)	
Smoking history, n (%)			
Current	1 (50.0)	46 (79.3)	0.291[c]
Previous	0 (0.0)	5 (8.6)	
Non-smoker	1 (50.0)	7 (12.1)	
Onset age, mean ± SD	12.0 ± N/A	15.3 ± 2.8	0.192[a]

[a] Mann-Whitney Test; [b] Pearson Chi-Square.
CIADs = cannabis induced anxiety disorder
CSD = The Hone Kong Correctional Services Department
SD = Standard deviation.

Table 12.6. Cannabis use pattern in subject with and without CIA in cannabis only users (n=60).

Variables	With CIADs n = 2 Mean ± SD, Median (range)	Without CIADs n = 58 Mean ± SD, Median (range)	p-values [a]
Age of first use	16.5 ± 3.5 16.5 (14 – 19)	18.1 ± 3.3 18 (10 – 25)	0.572
Duration of use (year)	3.7 ± 3.3 4 (1 – 6)	3.6 ± 3.1 3 (0.3 – 16)	1.000
Days of use			
Lifetime	260 ± 73.5 260 (208 – 312)	831.3 ± 921.7 510 (8 – 4011)	0.540
Past two year	156 ± 73.5 156 (104 – 208)	285.6 ± 239.63 208 (12 – 728)	0.673
Past one year	130 ± 110.3 130 (52 – 208)	147.2 ± 125.0 98 (0 – 364)	0.983
Previous month	21 ± 12.7 21 (12 – 30)	6.6 ± 11.0 0 (0 – 30)	0.137
Lifetime consumption (joint)			
Total	494 ± 478.0 494 (156 – 832)	1670.2 ± 2206.2 591 (12 – 9394)	0.671
Consumption in one day	2.3 ± 2.5 2 (1 – 4)	2.3 ± 2.7 3 (1 – 15)	0.929
Consumption in the past two years (joint)			
Total	442 ± 551.5 442 (52 – 832)	834.4 ± 1578.0 260 (12 – 8196)	0.852
Consumption in one day	2.3 ± 2.5 2 (1 – 4)	2.8 ± 4.6 1 (1 – 28)	0.855
Consumption in the past one year (joint)			
Total	429 ± 569.9 429 (26 – 832)	344.7 ± 629.6 105 (0 – 3094)	0.893

Variables	With CIADs n = 2 Mean ± SD, Median (range)	Without CIADs n = 58 Mean ± SD, Median (range)	p-values [a]
Consumption in one day (gram)	2.3 ± 2.5 2 (1 – 4)	2.2 ± 2.5 2 (1 – 15)	0.895
Consumption in the previous month (joint)			
Total	63 ± 80.6 63 (6 – 120)	7.7 ± 19.2 0 (0 – 106)	0.055
Consumption in one day	2.3 ± 2.5 2 (1 – 4)	0.4 ± 0.7 0 (0 – 4)	0.105
Current dependence, n (%)	1 (50)	11 (19.0)	0.281[b]
Current abuse, n (%)	1 (50)	12 (20.7)	0.323[c]
Lifetime dependence, n (%)	2 (100)	46 (79.3)	0.472[b]
Lifetime abuse, n (%)	0 (0)	6 (10.3)	0.632[b]

[a] Mann-Whitney Test; [b] Pearson Chi-square; [c] Fisher's Exact Test.
CIADs = cannabis induced anxiety disorder
SD = Standard deviation.

Severity and correlates of psychiatric symptoms

The mean BDI, HADSA, SDS, and MWC scores of the entire sample were 12.6 ± 10.6, 4.6 ± 4.6, 6.4 ± 3.8, and 7.3 ± 7.1, respectively. The mean BPRS score of the entire sample was 18.1 ± 0.4, and all participants scored below the respective cut-off points. The mean total PANSS score of the entire sample was 33.1 ± 0.4, and the mean positive, negative, and GP item scores in the PANSS were 7.0 ± 0.0, 7.0 ± 0.0, and 16.1 ± 0.4, respectively. None of the participants scored higher than the cut-off points (Leucht et al., 2005). The correlations between psychiatric symptoms, demographic characteristics, and the patterns of cannabis and other drug use are shown in Tables 13.1–13.3, and the corresponding linear regression models are shown in Tables 13.4–13.8. Female sex (beta = 5.9, p = 0.002) and cannabis use per day in the past month (beta = 2.1, p = 0.030) predicted the BDI score, and female sex (beta = 2.3, p = 0.004) predicted the HADSA score. Education predicted the BPRS score (beta = -0.03, p = 0.010) and PANSS GP score (beta = -0.03, p = 0.010). Unemployment (beta = 2.5, p = 0.033) and lifetime dependence on cannabis (beta = 2.3, p < 0.001) predicted the MWC score.

Amongst the cannabis-only users, the mean BDI, HADSA, SDS, and MWC scores were 12.0 ± 10.3, 4.6 ± 4.4, 4.3 ± 3.2, and 5.8 ± 6.4, respectively. The mean BPRS score was 18.0 ± 0.0, and all of these participants scored below the respective cut-off points. The mean total score of these participants on the PANSS was 33.0 ± 0.0, and their mean scores on the positive, negative, and GP items in the PANSS were 7.0 ± 0.0, 7.0 ± 0.0, and 16.0 ± 0.0, respectively. None of the participants scored higher than the cut-off points (Leucht et al., 2005). The correlations between psychiatric symptoms, demographic characteristics, and the patterns of cannabis and other drug use are shown in Table 13.9 and 13.10, and the corresponding linear regression models are shown in Tables 13.11–13.13. Female sex

predicted the BDI score (beta = 5.3, p = 0.004) and HADSA score (beta = 2.3, p = 0.004) scores, and lifetime dependence on cannabis (beta = 2.3 p < 0.001) predicted the MWC score (Table 13.4-13.5, 13.8).

Table 13.1. Correlations between psychiatric symptoms and demographic characteristics in the entire sample (n=194).

Variables [a]	BDI	HADSA	BPRS	PANSS	PANSS positive	PANSS negative	PANSS GP	MWC
Age [b]	-0.036	-0.089	0.049	0.049	-	-	0.049	0.059
Female	0.151*	0.156*	0.145*	0.145*	-	-	0.145*	0.022
Education [b]	-0.040	0.059	-0.177*	-0.177*	-	-	-0.177*	0.077
Married	0.018	-0.031	-0.108	-0.108	-	-	-0.108	0.040
Occupation (unemployed)	0.066	-.160*	-0.108	-0.108	-	-	-0.108	0.167*
Sources of referral	-0.076	-0.058	-0.183*	-0.183*	-	-	-0.183*	-0.050
Smoking history	0.055	0.103	0.038	0.038	-	-	0.038	-0.011
Smoke onset	0.066	0.045	-0.106	-0.106	-	-	-0.106	0.102
Family psychiatry history	0.107	0.098	-0.008	-0.008	-	-	-0.008	-0.079
Has a Religious belief	-0.100	-0.024	-0.026	-0.026	-	-	-0.026	-0.118
Accommodation	0.032	0.087	0.118	0.118	-	-	0.118	0.114

** $p < 0.01$

*$p < 0.05$;

+$p < 0.1$

[a] Spearman correlation; [b] Pearson correlation.

BDI: Beck Depression Inventory; HADSA: Hospital Anxiety Depression Scale; PBRS: Brief Psychiatric Rating Scale; PANSS: Positive and Negative Syndrome Scale; GP: General psychopathology; SDS: Severity of Dependence Scale; MWC: Marijuana Withdrawal Checklist

Table 13.2. Correlations between psychiatric symptoms and cannabis use pattern in the entire sample (n=194).

Variables [a]	BDI	HADSA	BPRS	PANSS	PANSS positive	PANSS negative	PANSS GP	MWC
Onset Age	-0.028	-0.031	0.028	0.028	-	-	0.028	0.029
Duration	-0.069	-0.077	0.047	0.047	-	-	0.047	-0.034
Days of cannabis use								
Lifetime	0.027	0.061	-0.034	-0.034	-	-	-0.034	0.111
Past two years	-0.041	-0.060	-0.132^{+}	-0.132^{+}	-	-	-0.132^{+}	-0.018
Past one year	-0.014	-0.064	-0.063	-0.063	-	-	-0.063	-0.048
Previous month	0.094	0.060	0.002	0.002	-	-	0.002	-0.085
Lifetime consumption								
Total	0.035	0.046	-0.056	-0.056	-	-	-0.056	0.156^{+}
Consumption in one day	-0.010	-0.028	-0.095	-0.095	-	-	-0.095	-0.193*
Consumption in the **Past two years**								
Total	0.084	0.018	-0.093	-0.093	-	-	-0.093	-0.177*
Consumption in one day	0.042	-0.002	-0.065	-0.065	-	-	-0.065	0.144^{+}
Consumption in the **Past one year**								
Total	-0.017	-0.026	-0.040	-0.040	-	-	-0.040	0.051
Consumption in one day	-0.030	-0.027	-0.023	-0.023	-	-	-0.023	0.024
Previous month								
Total	0.097	0.019	-0.024	-0.024	-	-	-0.024	0.060
Consumption in one day	0.132^{+}	0.056	0.072	0.072	-	-	0.072	0.012
Current dependence [b]	0.111	0.111	0.023	0.023	-	-	0.023	0.025
Current abuse [b]	-0.038	-0.025	0.002	0.002	-	-	0.002	-0.280**
Lifetime dependence [b]	0.216*	0.219*	-0.038	-0.038	-	-	-0.038	0.321**
Lifetime abuse [b]	-0.159*	-0.157*	0.020	0.020	-	-	0.020	-0.140^{+}

$^{**}p < 0.01$.
$^{*}p < 0.05$.
$^{+}p < 0.1$.
[a] Pearson correlation; [b] Spearman correlation.
BDI = Beck Depression Inventory
GP = General psychopathology
HADSA = Hospital Anxiety Depression Scale
MWC = Marijuana Withdrawal Checklist
PANS = Positive and Negative Syndrome Scale
PBRS = Brief Psychiatric Rating Scale
SDS: Severity of Dependence Scale

Table 13.3. Correlations between psychiatric symptoms and other drug use in the entire sample (n=194).

Variables [a]	BDI	HADSA	BPRS	PANSS	PANSS positive	PANSS negative	PANSS GP	MWC
Lifetime use								
Hypnotics	-0.427*	-0.365+	-0.075	-0.075	-	-	-0.075	0.010
Cocaine	0.095	0.212	0.240	0.240	-	-	0.240	-0.206
ICE	-0.122	-0.026	0.285	0.285	-	-	0.285	0.058
Cough medicine	-0.174	0.039	-0.104	-0.104	-	-	-0.104	0.309
Ecstasy	-0.248	0.093	0.158	0.158	-	-	0.158	0.036
Ketamine	-0.175	-0.057	0.389*	0.389*	-	-	0.389*	0.010

**p < 0.01.
*p < 0.05.
+p <0.1.
ICE: methamphetamine
[a] Pearson correlation; [b] Spearman correlation
BDI = Beck Depression Inventory
GP = General psychopathology
HADSA = Hospital Anxiety Depression Scale
MWC = Marijuana Withdrawal Checklist
PANS = Positive and Negative Syndrome Scale
PBRS = Brief Psychiatric Rating Scale
SDS: Severity of Dependence Scale

Table 13.4. Linear regression of BDI scores in the entire sample.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	p value
Female sex	5.9	2.2	9.5	0.002
Cannabis use per day in the previous month	2.1	0.2	3.9	0.030
Lifetime dependence of cannabis	-	-	-	-
Lifetime use of hypnotics	-	-	-	-

Table 13.5. Linear regression of HADSA scores in the entire sample.
.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Female sex	2.3	0.8	3.9	0.004
Lifetime dependence of cannabis	-	-	-	-
Lifetime use of hypnotics	-	-	-	-

Table 13.6. Linear regression of BPRS scores in the entire sample.
.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Female sex	-	-	-	-
Education	-0.03	-0.05	-0.006	0.010
Occupation (unemployed)	-	-	-	-
Source of referral	-	-	-	-
Total days of cannabis use in the past 2 years	-	-	-	-
Lifetime use of ketamine	-	-	-	-

Table 13.7. Linear regression of PANSS GP in the entire sample.
.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Male sex	-	-	-	-
Education	-0.03	-0.05	-0.006	0.010
Occupation (unemployed)	-	-	-	-
Source of referral	-	-	-	-
Total days of cannabis use in the past 2 years	-	-	-	-
Lifetime use of ketamine	-	-	-	-

Table 13.8. Linear regression of MWC scores in the entire sample.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Occupation (unemployed)	2.5	0.2	4.8	0.033
Lifetime total consumption of cannabis	-	-	-	-
Lifetime cannabis consumption per day	-	-	-	-
Total cannabis consumption in the past 2 years	-	-	-	-
Cannabis consumption per day in the past 2 years	-	-	-	-
Current abuse of cannabis	-	-	-	-
Lifetime dependence of cannabis	2.3	1.4	3.2	<0.001
Lifetime abuse of cannabis	-	-	-	-

Table 13.9. Correlations between psychiatric symptoms and demographic characteristics in cannabis only users (n=60)

Variables [a]	BDI	HADSA	BPRS*	PANSS	PANSS positive	PANSS negative	PANSS* GP	MWC
Age [b]	0.068	0.006	.[c]	.[c]	.[c]	.[c]	.[c]	-0.003
Male	0.284*	0.330*	.[c]	.[c]	.[c]	.[c]	.[c]	0.099
Education [b]	-0.025	0.086	.[c]	.[c]	.[c]	.[c]	.[c]	0.026
Married	-0.237	-0.217	.[c]	.[c]	.[c]	.[c]	.[c]	-0.021
Occupation	-0.164	-0.032	.[c]	.[c]	.[c]	.[c]	.[c]	-0.139
Sources of referral	-0.095	0.067	.[c]	.[c]	.[c]	.[c]	.[c]	-0.028
Smoking history	0.034	0.009	.[c]	.[c]	.[c]	.[c]	.[c]	0.052
Smoke onset	0.113	0.052	.[c]	.[c]	.[c]	.[c]	.[c]	0.047
Family psychiatry history	0.015	0.042	.[c]	.[c]	.[c]	.[c]	.[c]	-0.082
Has a Religious belief	-0.255*	-0.238+	.[c]	.[c]	.[c]	.[c]	.[c]	-0.177
Accommodation	-0.076	0.013	.[c]	.[c]	.[c]	.[c]	.[c]	0.016

** $p < 0.01$

*$p < 0.05$;

+$p < 0.1$

[a] Spearman correlation; [b] Pearson correlation.

.c Cannot be computed because at least one of the variables is constant.

BDI: Beck Depression Inventory; HADSA: Hospital Anxiety Depression Scale; PBRS: Brief Psychiatric Rating Scale; PANSS: Positive and Negative Syndrome Scale; GP: General psychopathology; SDS: Severity of Dependence Scale; MWC: Marijuana Withdrawal Checklist

Table 13.10. Correlations between psychiatric symptoms and cannabis use pattern for cannabis only users. (n=60)

Variables [a]	BDI	HADSA	BPRS	PANSS	PANSS positive	PANSS negative	PANSS GP	MWC
Onset Age	-0.053	-0.063	.[c]	.[c]	.[c]	.[c]	.[c]	-0.028
Duration	-0.011	0.031	.[c]	.[c]	.[c]	.[c]	.[c]	0.104
Days of cannabis use			.[c]	.[c]	.[c]	.[c]	.[c]	
Lifetime	0.022	0.042	.[c]	.[c]	.[c]	.[c]	.[c]	0.145
Past two years	-0.012	0.076	.[c]	.[c]	.[c]	.[c]	.[c]	0.026
Past one year	0.009	0.133	.[c]	.[c]	.[c]	.[c]	.[c]	0.139
Previous month	0.072	0.017	.[c]	.[c]	.[c]	.[c]	.[c]	-0.156
Lifetime consumption			.[c]	.[c]	.[c]	.[c]	.[c]	
Total	0.052	-0.018	.[c]	.[c]	.[c]	.[c]	.[c]	0.070
Consumption in one day	0.061	0.057	.[c]	.[c]	.[c]	.[c]	.[c]	0.185
Consumption in the **Past two years**			.[c]	.[c]	.[c]	.[c]	.[c]	
Total	0.186	0.164	.[c]	.[c]	.[c]	.[c]	.[c]	0.076
Consumption in one day	0.167	0.102	.[c]	.[c]	.[c]	.[c]	.[c]	0.039
Consumption in the **Past one year**			.[c]	.[c]	.[c]	.[c]	.[c]	
Total	-0.001	0.095	.[c]	.[c]	.[c]	.[c]	.[c]	0.185
Consumption in one day	0.008	0.020	.[c]	.[c]	.[c]	.[c]	.[c]	0.160
Previous month			.[c]	.[c]	.[c]	.[c]	.[c]	
Total	-0.034	-0.050	.[c]	.[c]	.[c]	.[c]	.[c]	0.073
Consumption in one day	-0.037	-0.074	.[c]	.[c]	.[c]	.[c]	.[c]	-0.011
			.[c]	.[c]	.[c]	.[c]	.[c]	
Current dependence [b]	0.151	0.097	.[c]	.[c]	.[c]	.[c]	.[c]	0.103
Current abuse [b]	-0.049	-0.113	.[c]	.[c]	.[c]	.[c]	.[c]	-.294*
			.[c]	.[c]	.[c]	.[c]	.[c]	
Lifetime dependence [b]	0.177	0.293*	.[c]	.[c]	.[c]	.[c]	.[c]	.275*
Lifetime abuse [b]	-0.111	0.024	.[c]	.[c]	.[c]	.[c]	.[c]	-0.152

**p < 0.01.
*p < 0.05.
+p <0.1.
[a] Pearson correlation; [b] Spearman correlation.
.[c] Cannot be computed because at least one of the variables is constant.
BDI: Beck Depression Inventory; HADSA: Hospital Anxiety Depression Scale; PBRS: Brief Psychiatric Rating Scale; PANSS: Positive and Negative Syndrome Scale; GP: General psychopathology; SDS: Severity of Dependence Scale; MWC: Marijuana Withdrawal Checklist

Table 13.11. Linear regression of BDI scores for cannabis only users.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	p value
Female sex	5.3	1.7	8.9	0.004
Had a religious belief	-	-	-	-

Table 13.12. Linear regression of HADSA scores for cannabis only users.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Female sex	2.3	0.8	3.9	0.004
Had a religious belief	-	-	-	-
Lifetime dependent of cannabis	-	-	-	-

Table 13.13. Linear regression of MWC scores for cannabis only users.

Variable	Unstandardized beta	95% Cl for OR Lower	Upper	P value
Current abuse of cannabis	-	-	-	-
Lifetime dependence of cannabis	2.0	1.4	3.6	0.014

Characteristics of the sample

The participants were either young or middle-aged adults who had received a mean of 11 years of education. Moreover, approximately two-thirds of the participants were unemployed, and the majority were single, living in public housing, and current smokers. The participants in the current study had begun to use cannabis in adolescence or early adulthood and had used it for a mean duration of 5 years. More than 70% of the participants had lifetime cannabis dependence, approximately one fifth were currently dependent on or abusing cannabis, and all participants had used cannabis for a mean of 126 days per year and consumed a mean of approximately 2 joints per day. Hence, the sample consisted of chronic regular users with cannabis dependence. Sixty-nine percent of the participants reported lifetime use of other drugs, which were most commonly cocaine, ketamine, ecstasy, ice, and hypnotics.

Cannabis withdrawal symptoms

Approximately 87% of the participants reported experiencing withdrawal symptoms, indicating that these symptoms are very common. The average number of withdrawal symptoms was five, and the five most common symptoms were, in order, a craving to smoke cannabis, strange dreams, depressed mood, sweating, and restlessness. A previous study of 384 non-treatment-seeking lifetime cannabis smokers found that 57% of participants had reported at least two withdrawal symptoms (Gorelick et al., 2012). Typically, withdrawal symptoms begin 1–3 days after the cessation of regular cannabis use, reach a maximum at approximately 2–6 days after cessation, and resolve within 4–14 days. However, 40% of chronic users did not

experience clinically significant withdrawal symptoms after the cessation of use (Barceloux, 2012).

Few data are available regarding the pharmacologic treatment of these withdrawal symptoms. Nevertheless, it is known that in addition to cognitive and behavioural therapies, potential therapies include oral THC, mirtazapine, rimonabant, and buspirone (Benyamina et al., 2008). Moreover, oral THC reduces both cannabis cravings and withdrawal symptoms (Barceloux, 2012).

CIP

13.9% had lifetime and current CIP psychosis and 4.6% had current CIP. A logistic regression revealed that current dependence on cannabis predicted the presence of CIP. Amongst cannabis-only users, 35% had CIP, but no predictor of CIP was found.

In our previous literature review on psychosis in cannabis users, it was found that the prevalence of psychosis amongst cannabis users ranges from 5% to 22%. Cannabis abuse / dependence is a risk factor for psychosis. Other risk factors for psychosis include characteristics of cannabis use, other drug use, environmental factors and individual vulnerability. In terms of characteristics of cannabis use, early onset of use, more frequent use, longer duration of use, and potency of cannabis. environmental factors include childhood maltreatment (sexual abuse, traumatic experiences) and living in urban areas. Finally, the risk of psychosis is higher amongst vulnerable cannabis users with high degree of psychosis-proneness, which refers to a family history of psychosis, schizotypy or prodromal psychotic symptoms (Tang et al., in press).

In three prospective studies, the prevalence of psychosis among cannabis users ranged from 1.5% (Manrique-Garcia et al., 2012) to 12% (Van Os et al., 2002), with a median of

4.8% (Mustonen et al., 2018). In addition, two population/community-based cross-sectional studies reported a prevalence of psychosis of 1.3% to 2.4% among cannabis users (Degenhardt et al., 2001a; Houston et al., 2008). Moreover, the prevalence of psychosis amongst those using cannabis at a level equivalent to abuse or dependence has been found to range from 2.6% to 6.8% (Degenhardt et al., 2001a; Khan et al., 2013). Furthermore, in two prospective studies of participants with an ultrahigh risk of psychosis, the frequencies of psychosis were 12.7% among cannabis users (Valmaggia et al., 2014) and 41.5% among those exhibiting cannabis abuse or dependence (Auther et al., 2015). In the current study, the prevalence of psychosis was higher than in the above-described studies, which may be because our sample comprises participants with more severe dependence on cannabis and/or other substances than the above-mentioned samples.

The prevalence of CIP in the Hong Kong population is unknown. A study by the Danish Psychiatric Central Research Register reported that the incidence rate of CIP in Denmark increased steadily from 2.8 per 100,000 person-years in 2006 to 6.1 per 100,000 person-years in 2016. Moreover, this increase in CIP followed increases in the concentration of THC in cannabis and in cannabis use in the country (Hjorthøj et al., 2021).

Patients with CIP may experience further psychotic episodes and develop severe psychosis. In a Danish study, 535 patients with CIP were followed for at least 3 years, during which period new psychotic episodes of any type were diagnosed in 77% of the patients, and schizophrenia-spectrum disorders were diagnosed in 45% of the patients. Male sex and young age were associated with an increased risk of the aforementioned disorders. In addition, the development of schizophrenia-spectrum disorders was often delayed, and 47% of the sample received a diagnosis more than a year after seeking treatment for a CIP (Arendt et al., 2005).

The biological mechanism underlying CIP is not clear. It has been established that the administration of THC interferes with processes regulating synaptic plasticity, and it is

hypothesised that this may induce developmental brain alterations that ultimately lead to psychosis. In addition, it is hypothesised that exposure to THC in adolescence disrupts the normal fine-tuning of glutamate- and gamma-amino butyric acid-release processes in the endocannabinoid system, thereby adversely impacting brain maturation processes, especially in the prefrontal neural circuitries. Dopamine, adenosine, and the endocannabinoid system also collaborate to gate input from the cortex to the striatum, thus regulating implicit learning. Therefore, given the essential role of striatal endocannabinoid signalling in habit formation and implicit learning, it is also hypothesised that excessive stimulation of the endocannabinoid system by THC facilitates the connection of logically unrelated ideas, ultimately resulting in the formation of delusions (Morrison & Murray 2009).

The pharmacological treatment of acute CIP may include the use of antipsychotic medications. For example, 30 patients with CIP were randomly allocated to receive either olanzapine or haloperidol in a 4-week, double-blind clinical trial. The results showed that olanzapine is as effective as haloperidol in the treatment of CIP but is associated with a lower rate of extrapyramidal side-effects (Berk et al., 1999). More recently, Rolland et al. (2013) reported the case of a 22-year-old male patient with an ultra-high risk of psychosis and who reported cannabis addiction and recurrent CIP. Treatment of this patient with aripiprazole totally and durably suppressed his CIP.

Pattern of psychotic symptoms

Lifetime psychotic symptoms were exhibited by more than 70% of the participants in the current study, compared with 91% and 86% of methamphetamine and cocaine users, respectively, in Hong Kong in recent studies (Tang et al., 2020; Tang et al., 2022). In terms of subtypes of psychotic symptoms, more than 60% of the participants in the current study reported lifetime delusions, and more than 50% reported hallucinations. Delusions of reference

were the most common type of delusion, followed by persecutory delusions. Auditory hallucinations were the most common type of hallucination, followed by visual hallucinations. Thought broadcasting was uncommon and negative symptoms were not found. The aforementioned pattern of psychotic symptoms is similar to those reportedly exhibited by methamphetamine or cocaine users in Hong Kong (Tang et al., 2020; Tang et al., 2022).

PPS

Only 4% of all participants and 5% of cannabis-only users reported PPS. These proportions of PPS are much lower than those that have been reported for methamphetamine and cocaine users, respectively, in Hong Kong, i.e., 18% and 15%, respectively (Tang et al., 2020; Tang et al., 2022). Cannabis-use patterns and the use of other drugs did not predict PPS. However, this negative finding should be treated with caution, as the number of participants with PPS was small and thus reduced the statistical power of our effort to identify possible predictors. For instance, a post-hoc power calculation revealed that current sample size only had 10% power in detecting the differences in lifetime consumption of cannabis between PPS and TPS group, due to the large standard deviations. In addition, there is evidence that continuous use of cannabis may increase the risk of PPS. in a prospective study of a population sample of 1923 subjects, continued use of cannabis increased the risk of persistent psychotic symptoms (OR = 2.2), 95% CI = 1.2–4.4.2). (Kuepper et al., 2011). Similarly, in ice users, consumption per day in the past 2 years and lifetime cannabis use were independent predictors of PPS (Tang et al., 2020). In cocaine users, education level, family history of psychiatric disorders, and lifetime ice use were predictors of PPS (Tang et al., 2022).

Mood disorders

Fifty-seven percent of the entire sample had lifetime mood disorders; 37% had lifetime substance-induced mood disorders, with the predominant presentation being depressive episodes (25%), followed by mixed episodes (10%) and manic/hypomanic episodes (6%). Approximately 9% of the entire sample and 35% of cannabis-only users had lifetime CIMDs, and lifetime daily consumption of cannabis consumption predicted the occurrence of CIMDs.

In our previous literature review on mood disorders in cannabis users, it was found that the prevalence of depression and bipolar disorder amongst cannabis users ranges from 8% to 46% and 6% to 20%, respectively. Higher level of cannabis use was a risk factor for both depression and bipolar disorder. Other risk factors for depression include age at onset of cannabis use, age, female sex and medical use of cannabis (Tang et al., in press).

In prospective studies, the prevalence of depression in cannabis users ranged from 2% to 9% (median = 5%). In some prospective studies, cannabis use predicted later depression (OR = 1.1–9; median = 2). In cross-sectional studies, the prevalence of depression in all users and dependent users has ranged from 8% to 28% and from 12% to 40% (median = 25%), respectively. Most cross-sectional studies have reported an association between cannabis use and depression (all users, OR = 1–3; dependent users, OR = 2–6). Overall, there is evidence of an association between cannabis use and a modest increase in the risk of depressive disorders. Possible risk factors for depression include frequent use of cannabis, and the age at onset of cannabis use, age, female sex and medical use of cannabis. Frequent users have double the risk of depression of infrequent users (Tang et al., in press).

There are three possible explanations for the association between cannabis use and depression. The first possibility is that there is a neurobiological link between the effects of cannabinoids and the symptoms of depression. The primary psychoactive ingredient of cannabis, THC, acts upon the cannabinoid system in the brain, which appears to be related to the regulation of emotional experiences, including depression. The second possibility is that

cannabis use is associated with life events or circumstances that increase the likelihood of depression, which means that the perceived association between cannabis use and increased risk of depression is socially mediated. For example, cannabis use is associated with reduced educational attainment, unemployment, and crime, each of which may increase the risk of depression (Lev-Ran et al., 2004). Cannabis use during adolescence may also serve as a marker for an unconventional lifestyle and social processes, such as the nature of peer affiliations, that may increase the risk of mood disorders and related disorders (Lynskey, 2007). The third possibility is the self-medication hypothesis, which is not supported by longitudinal studies (Degenhardt et al., 2003). High rates of comorbidity between substance-use disorders (SUDs) and depression in adolescents may be attributable to a significant overlap of environmental factors, such as family disruption, poor parental monitoring, early childhood loss, and personal trauma. Multiple shared neurophysiological changes have been also identified, including serotonin concentrations, monoamine oxidase activity, dopamine-2 receptor expression, and hypothalamic–pituitary–adrenal axis-mediated neuroendocrine responses to stress (Hinckley & Riggs, 2019).

The clinical course of depression in cannabis users is unknown, and data on treatment are very limited. Cornelius et al. (2010) completed a randomised controlled trial of fluoxetine in 70 adolescents and young adults with co-occurring major depressive disorder and cannabis-use disorder (CUD). They found a significant decrease in depressive symptoms in the fluoxetine and placebo treatment arms, indicating that fluoxetine was not superior to placebo in reducing the symptoms of depression in this population.

Previous studies have indicated that the treatment of depression alone does not significantly reduce substance use (Riggs et al., 1995), and that SUD treatment alone does not result in remission of depression (Schmitz et al., 2001). Taken together, these findings suggest that the treatment of co-occurring major depressive disorders and SUDs should be

integrated; that is, adolescents with severe SUDs should receive evidence-based treatment and concurrent management of depression. For example, motivational enhancement therapy and cognitive behavioural therapy are evidence-based treatments for co-occurring depression and SUDs. Moreover, fluoxetine is well tolerated in substance-using adolescents with depression and should be considered if no improvement in depression symptoms is seen with psychotherapy (Hinckley & Riggs, 2019).

Anxiety disorders

In this study, lifetime anxiety disorders were exhibited by 10% of the sample. The most common presentations were substance-induced anxiety disorders with obsessive-compulsive features, which were exhibited by 8% of the sample, whereas CIADs were exhibited by only 1% of the sample. Risk factors for CIADs were higher level of cannabis consumption in past one month.

In our previous literature review on anxiety disorders in cannabis users, it was found that the prevalence of anxiety disorder amongst cannabis users ranges from 7% to 25%. A higher level of cannabis use increased the risk of anxiety disorder. Other possible risk factors include the age at onset of cannabis use, persistent use and dependence on cannabis (Tang et al., in press).

In prospective studies, the prevalence of anxiety disorders in cannabis users has ranged from 7% to 25% (median = 21%). In some prospective studies, cannabis use predicted later anxiety disorders (OR = 1.5–2.5; median = 2). In cross-sectional studies, the prevalence of anxiety disorders has ranged from 4% in non-dependent users to 36% in dependent users. Most cross-sectional studies have found an association between cannabis use and anxiety disorders (all users, OR = 2; dependent users, OR = 4). Moreover, meta-analyses have

concluded that cannabis use is associated with an increased risk of anxiety symptoms, although the ORs were small (1.2–1.3), indicating that cannabis use is a relatively minor risk factor for later anxiety in the general population (Tang et al., In press).

Possible risk factors for anxiety disorders in cannabis users include a young age at onset of use, a high level of use, persistent use, and a dependence on use. Population and community studies have reported that anxiety disorders are more common in participants with cannabis dependence than in those without cannabis dependence (ORs = 2–4), whereas small studies have found no such association. The evidence for the other three risk factors is conflicting. It was suggested that early cannabis use may affect adolescent neuromaturation and cognitive functioning and thus predispose users to subsequent development of anxiety problems (Kedzior & Laeber, 2014).

It has been suggested that cannabis has a bidirectional effect on anxiety, such that those with anxiety experience some acute relief from their symptoms after low-frequency and low-dose cannabis use. Therefore, individuals with high levels of anxiety and those with anxiety disorders may use cannabis as a form of 'self-medication'. In support of this idea, many people have reported using cannabis to relax, to cope with stress, and to reduce anxiety. However, regular and heavy use could lead to the development of CUD, which may be associated with a worsening of anxiety symptoms. These bidirectional relationships could result from a dose-dependent interaction between the active ingredient of cannabis (THC) and (dysregulation of) the endocannabinoid and neurotransmitter systems, such as the dopamine, gamma-aminobutyric acid, glutamate, serotonin, and noradrenaline systems (Kedzior & Laeber, 2014). Acute cannabis intoxication can also lead to anxiety secondary to impaired cognitive functioning and a clouding of consciousness (Crippa et al., 2009). Thus, cannabis use could cause persistent anxiety disorders by chronically dysregulating the endocannabinoid system, particularly in genetically vulnerable individuals. Emerging data

from human and animal perinatal exposure studies also suggest that cannabis has neurodevelopmental or hormonal effects on subsequent anxiety and mood states, especially in adolescents (Sundram, 2006).

Other indirect relationships could exist between CUD and anxiety disorders. For instance, chronic cannabis use beginning at a young age could increase the possibility of lower educational attainment due to dropout or failure. This could, in turn, limit users' employment prospects, and the resulting unemployment could increase stress and cause anxiety symptoms or disorders (Lynskey et al., 2002). Other psychosocial mechanisms, such as the adoption of a countercultural lifestyle, may also underlie the association (Lynskey et al., 2002).

A third possibility is that CUD and anxiety disorders have a common aetiopathology, which may encompass biological, neurodevelopmental, environmental, and social influences, personality traits, or a combination thereof (Crippa et al., 2009). For instance, peer influence may play a role in problematic cannabis use among individuals with social anxiety disorder (Buckner et al., 2006).

The precise neural and receptor bases of cannabis-related anxiety disorders have not been well established. The results of a neuroimaging study suggest that the acute effects of cannabis on anxiety are mediated by the modulation of amygdalar function, and that the extent of these effects is related to the local availability of cannabinoid type 1 receptors. The results of the only genetics study that has been performed suggest that the serotonin transporter genotype may play a role in the development of anxiety disorders in cannabis users. In terms of psychological mechanisms, chronic cannabis use is associated with impaired fear extinction, which is involved in the pathogenesis and maintenance of anxiety disorders (Tang et al., in press).

The clinical course of anxiety disorders in cannabis users remains unknown, and no clinical trial of a pharmacological treatment has been published. With regard to psychological treatment, a regimen that integrates cannabis- and anxiety-reduction treatment may prove effective. Various treatment guidelines recommend integrated treatment, which can be implemented in various ways. First, it can take the form of a unified treatment programme, in which staff members are cross-trained and mental health and substance-abuse treatment providers share the same treatment chart and plan. Second, mental health and substance-abuse services can be co-located or both provided at a primary treatment site. Third, services can be broadly integrated at a system level via inter-organisational links and referrals (Watkins et al., 2005).

Limitations

Regarding limitations, first, most participants in our sample had abused or were dependent on illicit substances in addition to cannabis, and these substances might have contributed to the development of psychiatric symptoms. Second, we aimed to quantify the participants' lifetime consumption of cannabis, and our reliance on their ability to recall cannabis-use patterns of a long duration may have reduced the reporting accuracy due to memory deficits or impairment among users. Third, some potential confounders were not assessed, such as childhood adversity, schizotypal personality, or antisocial personality. Fourth, our sample was recruited from various treatment facilities, and hence our findings may not be applicable to non-treatment-seeking cannabis users. Fifth, no urine testing was performed to confirm recent use of cannabis.

Future research directions

In terms of study design, a long-term prospective study may provide additional insights into the complex inter-play between cannabis use and psychiatric disorders. Moreover, a large population-based sample enriched with equal proportions of men and women with minimal concurrent use of other illicit substances would generate more generalisable findings than those in the current study. Healthy controls should also be recruited, and recent cannabis use confirmed by means of urine tests. Detailed measurements of possible confounders, such as childhood and adolescent adversity, premorbid intelligence, learning disabilities, personality disorders, or a family history of psychosis, would also strengthen any future studies.

Messages for preventive education and publicity.

- Psychotic symptoms, such as hallucinations and delusions are common in local cannabis users. Three quarter of users had experienced psychotic symptoms.
- These psychotics symptoms can persistent even after quitting cannabis.
- Psychotic disorders, mood disorders and anxiety disorders are common in local cannabis users.
- Cannabis can cause psychosis. One in seven users has psychosis caused by cannabis.
- Cannabis can cause mood disorders. One in eleven users has mood disorders caused by cannabis.

Conclusion

Psychotic symptoms, such as delusions and hallucinations, were very common in our sample of young cannabis users in Hong Kong, but only a small proportion had PPS. One in seven participants in our sample exhibited CIP, the risk of which was increased by cannabis dependence. One in eleven participants in our sample had CIMDs, which were most

commonly depressive episodes, and total cannabis consumption in the past 2 years predicted the occurrence of CIMDs. However, CIADs were rare.

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