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RESEARCH ARTICLE



## Predictors for cannabis cessation during pregnancy: a 10-year cohort study

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### ABSTRACT

The aim of this study is to determine factors associated with cannabis discontinuation, to assess the impact of mental health and addiction interventions on cannabis discontinuation during pregnancy and to investigate the neonatal impact of cannabis discontinuation. This is a 10-year cohort study in a tertiary hospital in Barcelona, Spain, including women with self-reported cannabis use during pregnancy. Main outcome was cannabis discontinuation based on biological sample testing. Secondary outcomes were neonatal intensive care unit (NICU) admission, preterm birth, birth weight and bottle-feeding. When cannabis use was detected during pregnancy, 32 out of 81 (38.3%) discontinued cannabis during pregnancy vs. four out of 61 (6.6%) when detected at birth ( $p < .001$ ). Multivariate binary logistic regression showed that null parity (OR: 6.95,  $p = .011$ ), detection of cannabis use during pregnancy (OR: 5.35,  $p = .018$ ) and early detection and referral to mental health care for counseling on cannabis cessation and interventions on the first trimester (OR: 25.46,  $p < .001$ ) increased cannabis discontinuation. Risk for preterm birth  $<37$  weeks (11.4% vs. 30.8%) and NICU admission (25.7% vs. 54.2%) were lower when discontinuation. Early detection of cannabis use during pregnancy, cessation counseling with mental health interventions, and null parity are predictors for cannabis discontinuation during pregnancy.

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Cannabis; drugs; mental health; neonatal outcomes; pregnancy complications

## Introduction

Cannabis is the illegal drug most frequently used during pregnancy and in women of reproductive age. In addition, both cannabis use and potency have been consistently increasing over time [1–3]. Widespread use is associated with the legalization of this drug in large swaths of North America and Europe, leading to a negative impact of health and wellbeing [4].

Adverse pregnancy outcomes have been linked to cannabis use during pregnancy, such as preterm birth, and neurodevelopmental abnormalities [5,6]. Although these data do not establish causality, recent long-term studies have linked cannabis use to preterm birth and giving birth to a small for gestational age neonate as

the bigger risks [7]. Therefore, there is evidence showing that cannabis use during pregnancy may have detrimental consequences. Based on this, healthcare providers should warn pregnant and reproductive age women about the risks of using cannabis during pregnancy and promote discontinuation strategies.

Discontinuation of cannabis use occurs during pregnancy [8,9] in more than half of regular cannabis users. However, little has been studied about factors predicting discontinuation of cannabis use during pregnancy. Identifying and understanding factors that may lead to discontinuation of cannabis use can be useful to promote strategies to reduce substance abuse. Social and demographic factors, use of other illegal drugs, and a perceived low risk of fetal harming have been

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identified as factors associated with continuing using cannabis during pregnancy [8,10,11]. However, maternal and obstetric factors associated with cannabis discontinuation during pregnancy have not yet been established. A better understanding of these factors may improve cannabis screening during pregnancy and counseling for discontinuation, help to assess potential negative perinatal and long-term outcomes associated with cannabis use during pregnancy, and promote better discontinuation interventions.

The main aim of the present study was to investigate maternal demographics, obstetric and mental health factors, and discontinuation interventions during pregnancy associated with cannabis discontinuation during pregnancy. As a secondary outcome, we aimed to investigate the impact of cannabis discontinuation during pregnancy on obstetric and neonatal outcomes.

## Methods

### Study design

This is a retrospective cohort study including a cohort of antenatal cannabis users, divided into two groups: discontinuation of cannabis during pregnancy and non-discontinuation of cannabis.

### Setting

The research was conducted at Hospital Universitari Vall d'Hebrón, a tertiary hospital at Barcelona, Spain, and included pregnant women from 1 January 2013 to 1 July 2023 who were cannabis users.

### Participants

Pregnant women having antenatal care and/or birth at Hospital Universitari Vall d'Hebrón, and a urinary test positive for  $\Delta$ -9-tetrahydrocannabinol (THC) or self-reported use of cannabis at any point during pregnancy were included in the cohort of cannabis users during pregnancy. Consent form was waived due to the retrospective nature of the study.

In the routine antenatal protocol, screening for drug use during pregnancy was based on self-reported use during the antenatal visits. Universal screening for drug use in urine is not supported by the local antenatal care protocol or international guidelines [12,13].

Antenatal care for women using cannabis was provided on a monthly basis, at the high-risk clinic of the Obstetrics Department at Hospital Vall d'Hebrón. They were referred to the perinatal mental health unit,

receiving counseling for cannabis cessation and information leaflets about the effects of cannabis on the fetus and the long-term effects on the infant [14]. These women had regular appointments during the whole pregnancy and one year postpartum in the unit. A social risk assessment was offered in many cases by a specialized health social worker.

Urine samples were taken for THC detection in the first and third trimester, and birth, for those women who consent for testing at their follow-up appointment. Qualitative detection of 11-nor-9-carboxi- $\Delta$ <sup>9</sup>-tetrahydrocannabinol, the main secondary metabolite of THC, was performed using a homogeneous enzyme immunoassay analysis. Cutoff for detection was set at 50 ng/ml.

Negative antenatal cannabis use was considered when women did not self-report cannabis use during pregnancy, and therefore no THC urine-analysis was performed during pregnancy and/or admission for birth.

Exclusion criteria were late pregnancy loss (termination of pregnancy, miscarriage, ectopic pregnancy), lost to follow-up and pregnancy ongoing when retrieving data.

## Variables

### Primary outcome variable

The primary outcome was cannabis discontinuation during pregnancy, as established by a negative urinary THC test during pregnancy or peripartum in women with a previously positive urinary THC test during pregnancy.

### Psychosocial and demographic variables

Demographic variables included in the analysis were maternal age, ethnicity and low average household income. Maternal variables included were body mass index (BMI, in kg/m<sup>2</sup>) and weight before pregnancy, parity, height, previous termination of pregnancy, self-reported use of other illicit drugs, self-reported use of tobacco, and mental health disorders.

Clinical variables during pregnancy included perinatal mental health assessment during pregnancy, detection of cannabis use for the first time during pregnancy vs. at birth and poor antenatal care.

Average household income, a major social factor, was measured based on the postcode and the *per capita* income associated with that postcode [15]. Barcelona districts were categorized according to *per capita* income as low or high, using the median as a cutoff point.

Poor antenatal care was defined as women missing the first-trimester trisomy 21 combined screening test. This test was performed routinely at 11 to 13 + 6 weeks of gestation according to the Fetal Medicine Foundation criteria.

### Secondary outcomes

Secondary outcomes were obstetric outcomes (pre-eclampsia, type of delivery and preterm birth before 37 weeks of gestation) and neonatal outcomes (birth weight, admission to the special care baby unit (SCBU), neonatal intensive care unit (NICU), bottle-feeding and neonatal death). In addition, other variables studied were positive urinary cannabis test for the neonate and withdrawal syndrome.

Pregnancies were dated based on the last menstrual period (LMP), and modified according to the crown rump length (CRL) if there was a discrepancy on dates greater than seven days. In the cases of late pregnancy detection, pregnancy was dated using either the LMP if dates were consistent or the ultrasound head circumference.

Breastfeeding outcome was recorded at hospital discharge. According to the local protocol, when the mother's urine test is positive for THC at birth, breastfeeding is not recommended.

### Data sources and measurements

Data were obtained from the electronic medical records (SAP®) and cross-matched with Viewpoint software (GE®) for obstetrics ultrasound. Data were saved in an Excel file located at the Q- of the hospital IT (Information Technology) system. The participant's name was codified, and only study researchers (CC, JT, MB) had access to the file.

For birth weight, neonatal growth percentiles were calculated using curves adapted to the Spanish population [16], and adjusted for gender and gestational age at birth.

### Risk assessment bias

We have planned to avoid selection bias by including women who engage early and late to antenatal assessment, and early and late in pregnancy, cannabis detection. Nevertheless, in this study, cannabis users that do not self-report during pregnancy, and those who discontinue very early in pregnancy (just when they know they were pregnant) were not included. However, in the study, there are cases where cannabis use was just detected at birth and for research purposes, are equivalent to those who do not self-report during pregnancy.

The study protocol was approved by the local Review Board of Vall d'Hebron Research Institute (VHIR)

with the code PR(AMI)204/2021, on 30 April 2021. Informed consent was waived since this is a retrospective study, evaluating a large amount of routinely collected data, where no extra procedures/tests were undertaken for study purposes.

### Statistical methods

SPSS software, IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY), was used for the statistical calculations. Continuous variables were expressed as the mean, standard deviation and interquartile range (IQR). Categorical variables were expressed as the frequency, percentage and 95% confidence interval.

In relation to cannabis cessation, the Mann–Whitney test was used for continuous variables, and the Chi-square test was used for categorical variables.

A multivariate binary logistic regression analysis was conducted to determine several predictive factors of cannabis discontinuation. The odds ratio and 95% confidence interval were calculated.

All reported probability values were two-tailed, and significance was set at  $p = .05$ .

## Results

### Descriptive data

A total of 167 women with a urine test positive for THC during pregnancy were considered. Of those, 25 were excluded according to exclusion criteria so 142 were included in the analysis population of the study (Figure 1). During pregnancy, a total of 35 out of 142 (24.6%) women discontinued cannabis: 11 (31.4%), 10 (28.5%) and 14 (40%) at the first, second and third trimesters, respectively. Figure 2 shows the cannabis discontinuation percentage according to trimester of pregnancy.

In those cases where cannabis use was detected during pregnancy, 32 out of 81 (38.3%) women discontinued cannabis during pregnancy, as compared to four out of 61 (6.6%) women when cannabis use was detected at birth ( $p < .001$ ).

Maternal characteristics and pregnancy follow-up factors, according to cannabis discontinuation during pregnancy are described in Table 1.

### Predictive factors of cannabis discontinuation during pregnancy

Multivariate binary logistic regression showed the factors associated with an increased rate of cannabis discontinuation during pregnancy: null parity (OR: 6.95,

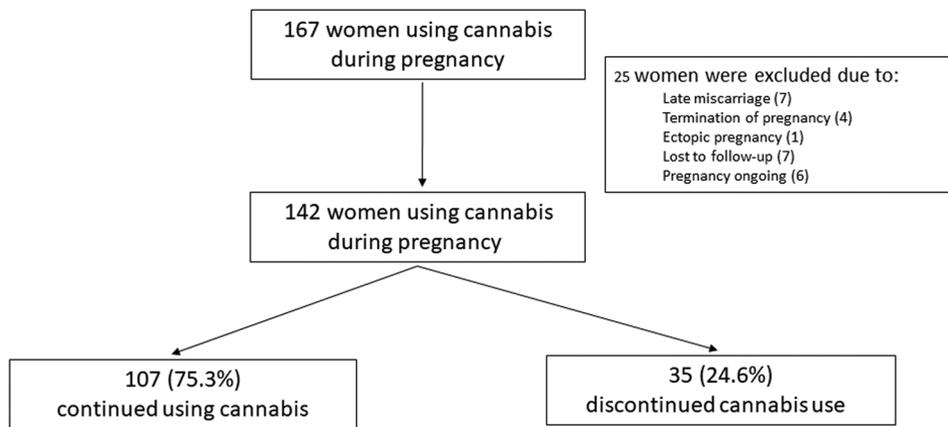


Figure 1. Flow diagram.

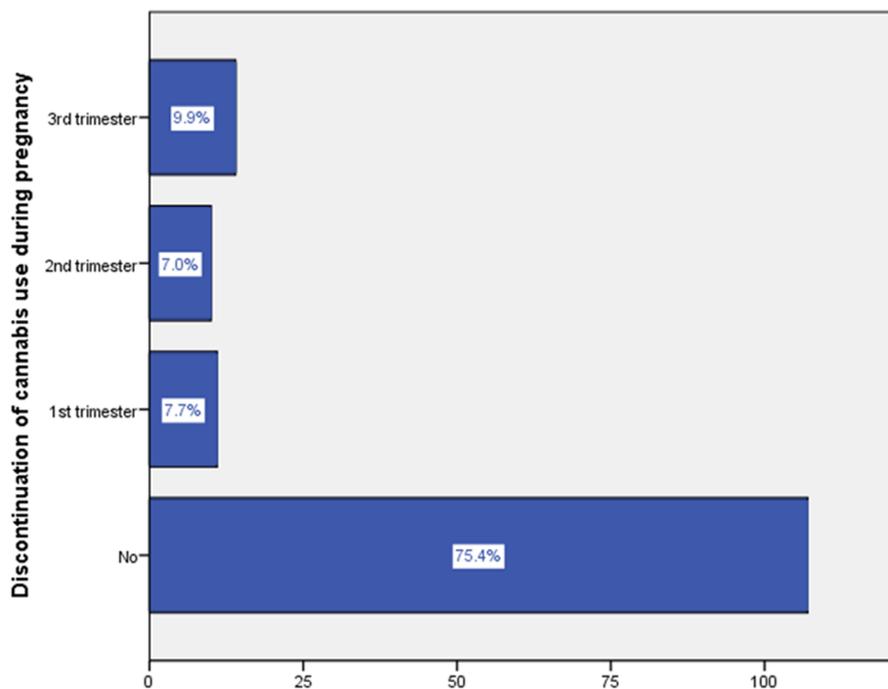


Figure 2. Discontinuation of antenatal cannabis use by trimester.

$p = .011$ ), detection of cannabis use during pregnancy (OR: 5.35,  $p = .018$ ) and early detection and referral to the mental health specialist for cannabis cessation, on the first trimester (OR: 25.46,  $p < .001$ ). Table 2 shows the results of the logistic regression analysis to identify predictive factors of cannabis discontinuation during pregnancy.

#### Impact of cannabis cessation on pregnancy and neonatal outcomes

When comparing women who discontinued with those who continued cannabis use during pregnancy, those who discontinued had a lower risk of preterm

birth at 37 weeks of gestation (11.3% vs. 30.8%), NICU admissions (8.6% vs. 26.2%), SCBU admission (25.7 vs. 54.2,  $p = .006$ ) and bottle feeding (24.2% vs. 83%). In addition, birth weight was lower in the group who continued cannabis use during pregnancy (2624g vs. 3035g,  $p = .001$ ). However, when adjusting birth-weight for birth gestational age and neonatal gender, those who discontinued cannabis had higher birth-weight centiles compared to those who continued (42 vs. 29,  $p = .023$ ). Table 3 shows pregnancy and neonatal outcomes according to study group.

Urine analysis for THC detection was performed in 107 neonates, with 35 out of 90 (38.9%) being positive in those who continued using cannabis during pregnancy

**Table 1.** Descriptive maternal demographics, obstetric and mental health factors, according to the study group.

	Antenatal THC discontinuation (N = 35)	Antenatal THC continuation (N = 107)	p Value
	Mean ± SD (IQR)		
Maternal age	27.6 ± 7.3 (9.8)	28.2 ± 5.4 (6.8)	.325
BMI before pregnancy	21.8 ± 3.8 (5.5)	22.2 ± 5.0 (4.1)	.904
Height	162.0 ± 7.5 (12.0)	161.8 ± 6.6 (9.0)	.698
Weight before pregnancy	57.6 ± 10.7 (15.2)	58.5 ± 1.3 (13.0)	.872
	Number frequency % (95%CI)		p Value
Caucasian	28 (66–93)	95 (82–94)	.187
Nulliparous	26 (50–90)	43 (31–50)	<.001
Previous TOP	15 (26–60)	39 (27–46)	.499
Mental health disorder (excluding substance use)	17 (31–66)	30 (19–37)	.026
Mental health disorder (including substance use)	19 (37–72)	41 (29–48)	.098
Tobacco smoking self-reported	21 (43–77)	79 (65–82)	.121
Alcohol 1st trimester self-reported	3 (–1 to 18)	12 (5–17)	.644
Cocaine	4 (0–23)	20 (11–26)	.321
Illicit drugs self-reported	6 (4–30)	26 (16–32)	.831
THC detection during pregnancy	31 (77–100)	50 (37–56)	<.001
THC detection and MH follow-up from the 1st trimester	18 (34–69)	3 (0–6)	<.001
MH specialist visit during pregnancy	18 (34–69)	20 (11–26)	<.001
Poor antenatal care from the first trimester	3 (–1 to 18)	33 (22–40)	.009
Group of low average income	15 (26–60)	57 (44–63)	.286

THC: tetrahydrocannabinol; MH: mental health. Mean ± standard deviation (IQR). Number frequency (95% confidence interval).

and 0 out of 17 (0%) being positive in those who discontinued cannabis during pregnancy ( $p < .001$ ).

## Discussion

### Main findings

First, in women who used cannabis during pregnancy, several factors increased the rate of cannabis discontinuation during pregnancy: null parity, early

**Table 2.** Multivariate binary logistic regression analysis for demographics, obstetric and mental health factors, in the prediction of discontinuation of THC use during pregnancy.

	Reference group: antenatal THC discontinuation			
	B	OR	OR (95%CI)	p Value
Maternal age	0.30	1.030	0.920–1.153	.607
BMI before pregnancy	–0.347	0.707	0.37–13.454	.817
Height	–0.123	0.885	0.405–1.934	.759
Weight before pregnancy	0.104	1.110	0.360–3.418	.856
Non-Caucasian	1.712	5.538	0.907–33.805	.064
Nulliparous	1.941	6.965	1.553–31.247	.011
Previous TOP	–0.486	0.626	0.194–2.021	.434
Mental health disorder (excluding other substance use)	1.181	3.258	0.236–44.994	.378
Tobacco smoking self-reported	–0.353	0.702	0.175–2.813	.618
Alcohol 1st trimester self-reported	1.029	2.791	0.083–94.108	.566
Cocaine	–1.430	0.239	0.015–3.749	.308
Illicit drugs self-reported	–0.436	0.646	0.074–5.685	.694
THC detection during pregnancy	1.678	5.352	1.328–21.578	.018
THC detection and MH specialist follow-up from the 1st trimester	3.237	25.465	4.431–146.364	<.001
Poor antenatal care from the first trimester	–1.712	0.181	0.023–1.397	.101
Group of low average household income	0.044	1.045	0.306–3.560	.945

THC: tetrahydrocannabinol; MH: mental health.

detection of cannabis use and referral to a perinatal mental health specialist on the first trimester, and cannabis use detection at any time during pregnancy. Second, women who discontinued cannabis use during pregnancy had better obstetric and neonatal outcomes as compared to those who continued using cannabis throughout the pregnancy.

### Strengths and limitations

The main limitations of this study are its retrospective nature, the limited number of women who discontinued cannabis use during pregnancy included, and the fact that it is a single center study. In addition, cannabis users that did not self-report antenatal cannabis use, and those who discontinue very early in pregnancy were not included.

However, it includes a clinical database of discontinuation cases confirmed by urine test rather than self-reported cessation.

**Table 3.** Pregnancy and neonatal outcomes according to the study group.

	Antenatal THC discontinuation (N = 35)	Antenatal THC continuation (N = 107)	p Value
<b>Obstetric outcomes</b>			
Preeclampsia	0	4 3.7 (0.01–8.5)	.236
<i>Caesarean section</i>	9 25.7 (10–51)	27 25.5 (18–36)	.977
Preterm birth <37 w	4 11.4 (–1 to 27)	33 30.8 (17–36)	.038
GA delivery (weeks)	38.54 ± 2.1 (37.7–39.2)	37.13 ± 3.0 (36.6–37.8)	.005
<b>Neonatal outcomes</b>			
Birth weight (g)	3035 ± 551 (2830–3231)	2624 ± 655 (2527–2772)	.001
Birth weight centile	42.8 ± 29 (32.0–52.9)	29.6 ± 25 (24.6–34.6)	.023
SCBU admission	9 25.7 (6–45)	58 54.2 (47–67)	.006
NICU admission	3 8.6 (–3 to 21)	28 26.2 (18–37)	.007
Bottle-feeding	8 24.2 (4–40)	88 83 (76–91)	<.001
Respiratory distress	4 11.4 (–1 to 27)	17 15.9 (9–25)	.111
Neonatal death (1 month)	0	1 1.07 (–1 to 3)	.442
Withdrawal syndrome	0	12 12.8 (5–19)	.009

Mean ± standard deviation (IQR). Number/frequency (95% confidence interval).

### Interpretation

The prevalence of cannabis use in the general Spanish population is one of the highest in Europe, around 9.1% [17]. In the pregnant population, prevalence of cannabis use in the first, second and third trimester is around 4.8%, 1.9% and 1.2%, respectively [18]. There are studies claiming that half of cannabis users during pregnancy continue using cannabis throughout the pregnancy [8,9]. Our results suggest that among those who continued using cannabis during the first trimester, the antenatal cannabis use discontinuation rate is lower than that reported in the literature [8,9]. In addition, rates of cannabis discontinuation are higher during the third trimester compared to second and first trimesters, and we believe this is due to the fear of activating child protection service protocols associated to antenatal cannabis use [19], and potential neonatal complications associated with withdrawal syndrome and long-term effects [20,21].

One of the aims of the present study was to find predictors of antenatal cannabis discontinuation. Certain sociodemographic factors may put women at greater risk for continued cannabis use during pregnancy, such as unemployment, pre-pregnancy use of tobacco, perceived low risk of prenatal cannabis use, higher frequency of pre-pregnancy cannabis use [11], being unmarried and having less than 12 years of

education [22]. Nevertheless, what are the obstetric factors that can increase the risk of cannabis continuation during pregnancy have been poorly studied. In the present study, parity was found a risk factor for antenatal cannabis continuation. In tobacco users during pregnancy, parity has been identified as a risk factor for smoking during pregnancy [23].

The increase in the antenatal cannabis use prevalence in the last years may be partially due to discrepancies in the literature regarding the safety of prenatal cannabis use, healthcare providers are not appropriately counseling patients, and cannabis retailers are promoting cannabis as a safe, natural and effective method for mitigating pregnancy symptoms [24,25]. In this line, we have shown that when it is detected early (in the first trimester of pregnancy), and women are referred to a perinatal mental health specialist, for receiving cannabis discontinuation counseling and follow-up, the risk of continuing antenatal cannabis use is reduced. Since 2018, at our site we recommend using the ASSIT screening questionnaire for drug use during pregnancy [12,26]. When assessing predictive ability, an indirect screening tool predicted toxicology results [27] more accurately than direct questioning, although the clinical applicability of the indirect screening tool has not yet been established, especially in the context of false-positive results [28]. In our setting, when antenatal cannabis use is detected, women's health care is transferred to both the obstetric high-risk clinic and the perinatal mental health unit at a tertiary hospital [27,28].

Currently, there are no evidence-based interventions for cannabis discontinuation during pregnancy. A randomized controlled trial examining the acceptability and early efficacy of a computer-based, single-session, brief motivational intervention followed by a booster session also found high acceptability and significant reduction in cannabis use rates in the intervention group [29]. Our results showed that counseling for cannabis discontinuation and a motivational intervention, as well as coordination with obstetrics and health social workers, from an interdisciplinary approach, were key predictive factors of cannabis discontinuation during pregnancy. It has been described that women valued open interactions with obstetricians who acknowledged their motivations for cannabis use, and wanted information on potential risks through conversations and educational materials [30]. However, about 62% of cannabis users, indicated discomfort discussing antenatal cannabis use with their physician [31].

Women with mental health disorders showed more THC discontinuation during pregnancy compared to

women with no mental health disorders. This could be explained by the fact that patients suffering mental health disorders use cannabis as a self-medication treatment, especially during pregnancy and postpartum period. In this case, dual pathology (mental health disorders plus substance use disorders) was treated at the same time, and therefore they discontinued cannabis use as a treatment for the mental symptoms (anxiety and depression mostly) [32].

Finally, regarding poor outcomes related to cannabis use during pregnancy, our study showed that women discontinuing antenatal cannabis use had better obstetric and neonatal outcomes than those who continued. Rates of preterm birth, lower birth weight, admission to SCBU and NICU, and bottle-feeding at hospital discharge were higher in the group that continued. Several meta-analyses on cannabis and pregnancy have concluded poor neonatal outcomes related to cannabis use during pregnancy [20,33,34]. In addition, there is literature showing that self-reported cannabis use throughout the third trimester is associated with an increased risk of low birth weight and NICU admission [35]. This study shows that discontinuing cannabis during pregnancy improves obstetric and neonatal outcomes as compared to continuing cannabis use throughout the pregnancy.

As a conclusion, null parity, early detection (first trimester) of cannabis use and referral to a perinatal mental health specialist for counseling on cannabis discontinuation, and detection of cannabis use at any time during pregnancy, are predictors of cannabis discontinuation during pregnancy. Social and healthcare systems should seek screening strategies to improve early detection of cannabis use and promote access to perinatal mental health specialists for drug abuse during pregnancy. This study requires further research, including a prospective clinical validation of the screening and interventions for cannabis use during pregnancy.

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### Ethical approval

The study protocol was approved by the local Review Board of Vall d'Hebron Research Institute (VHIR) with the code PR(AMI)204/2021, on 30 April 2021. Informed consent was waived since this is a retrospective study, evaluating a large amount of routinely collected data, where no extra procedures/tests were undertaken for study purposes.

### Author contributions

MB: conception, planning, execution, analysis and drafting of the study. MS: conception, planning, drafting and reviewing of the study. CC: execution, analysis and drafting of the study. JT: execution, analysis and drafting of the study. AHF: inception, planning and execution of the study. ESE: inception, planning and reviewing of the study. EC: inception, planning and reviewing of the study.

### Disclosure statement

No potential conflict of interest was reported by the author(s).

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### Data availability statement

The data that support the findings of this study are available from the corresponding author, [MB], upon reasonable request.

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