

# Cannabis use during pregnancy in France in 2010

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**Objective** The aim was to estimate the proportion of women who reported cannabis use during pregnancy, to analyse the demographic and social characteristics of users, and the link between cannabis use and either preterm or small-for-gestational-age birth.

**Design** Data were obtained from interviews of a representative sample of women giving birth in France in 2010 in the days after delivery, and from their medical records.

**Setting** All maternity units in France.

**Sample** The analysis includes women with live singleton births in metropolitan France who responded to the question about cannabis use during pregnancy: in total, 13 545 women.

**Methods** The percentage of cannabis users during pregnancy was estimated, and variations according to social characteristics were described. Logistic regression analyses were used to investigate any associations between cannabis use and preterm birth or small-for-gestational-age status.

**Main outcome measures** Percentage of cannabis use, preterm birth rate, and small-for-gestational-age rate.

**Results** In all, 1.2% of women reported having used cannabis during pregnancy. This percentage was higher among younger women, women living alone, or women who had a low level of education or low income. It was also associated with tobacco use and drinking alcohol. Cannabis users had higher rates of spontaneous preterm births: 6.4 versus 2.8%, for an adjusted odds ratio (aOR) of 2.15 (95% CI 1.10–4.18). The corresponding aOR was 2.64 (95% CI 1.12–6.22) among tobacco smokers and 1.22 (95% CI 0.29–5.06) among non-tobacco smokers.

**Conclusions** Although the reported rate of cannabis use during pregnancy in France is low, efforts should be continued to inform women and healthcare providers about the potential consequences of its use.

**Keywords** Cannabis use, pregnancy, preterm birth, small for gestational age.

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## Introduction

Cannabis is the most frequently used illicit drug in Western countries. In 2005, 13% of young Europeans aged 15–34 years reported that they had used cannabis in the past year.<sup>1</sup> France is one of the countries where this frequency is the highest, with 17% of 15–34 year olds reporting its use in that survey.<sup>1</sup> The level of regular use (at least ten times in the past 30 days) increased between 2000 and 2005 for men (from 2.6 to 4.2%), and also for women (from 0.8 to 1.2%).<sup>2</sup> In 2010, among adults aged 26–34 years, 40% of women and 64% of men reported having consumed cannabis at least once during their lifetime.<sup>3</sup>

In contrast to the many studies on the effects of tobacco and alcohol consumption in pregnancy, data about cannabis use during pregnancy are scarce. The percentage of

pregnant women who use cannabis is unknown. A survey in a maternity unit in western France estimated that 8% of women used cannabis at the beginning of the pregnancy, and that 3% continued to use cannabis beyond the first trimester.<sup>4</sup>

In France the National Perinatal Surveys provide routine perinatal data on the main health indicators and risk factors, thus producing information helpful for decision making in public health.<sup>5</sup> In 2010, mothers were asked about cannabis use for the first time.

The aim of this article was to estimate the proportion of women who reported cannabis use during pregnancy, at the national level, to analyse the demographic and social characteristics of users, and to study the association between cannabis use and preterm or small-for-gestational-age birth.

## Methods

The survey was conducted in France among a nationally representative sample of births. Data collection covered all births during 1 week in March 2010: that is, all liveborn or stillborn children, in public and private maternity units, as well as children born outside these facilities and subsequently transferred to one, at a gestational age of at least 22 weeks or weighing at least 500 g at birth.

The information for each birth came from: (1) an interview with the mother in the postpartum ward 2 or 3 days after the delivery, to obtain data on her social and demographic characteristics, use of psychoactive substances, preventive behaviours, and prenatal care; (2) data from the medical records about complications of pregnancy and delivery, and the child's health status at birth.

Women were asked two questions about cannabis use: (1) 'During your pregnancy, did you ever use cannabis (hashish, marijuana, shit)?' yes/no; (2) 'If yes, how often?' less than once a month/more frequently. Similar questions were asked about tobacco use and alcohol consumption.

The sample included 14 681 women. This analysis concerned women in metropolitan France who had liveborn singletons and who answered the question about cannabis use during pregnancy: in total, 13 545 women.

We estimated the percentage of women who used cannabis during pregnancy, and the frequency of consumption. We compared the percentage of cannabis use by social and demographic characteristics, such as age, parity, nationality, partner status (whether they lived with a partner, married or not), level of education, employment during pregnancy, and household income. Chi-square tests were used for these comparisons. A multivariate analysis, by logistic regression, was performed to assess the specific role of each characteristic. Tobacco use both before pregnancy and in the third trimester, and consumption of alcohol, were described according to cannabis use.

The percentages of preterm birth (delivery before 37 completed weeks of gestation), spontaneous preterm birth, medically indicated preterm birth (i.e. caesarean section before labour or induction), and small-for-gestational-age birth (defined as the tenth percentile of birthweight by week of gestation and sex, according to French growth curves; [www.audipog.net](http://www.audipog.net)) were estimated according to cannabis use, and adjusted odds ratios were calculated after taking into account demographic and social risk factors, as well as body mass index, and tobacco and alcohol consumption. Mean birthweight adjusted for gestational age (in weeks) was also analysed as an indicator of pregnancy outcome, with generalised linear regression.

## Results

Overall, 1.2% of women ( $n = 156$ ) reported cannabis use during pregnancy (95% confidence interval, 95% CI, 0.01–3.0%): 19% did not answer the question about frequency of use, 40% reported using cannabis less than once a month, 26% reported using cannabis between one and nine times a month, and 15% reported using cannabis at least ten times a month.

Cannabis use was more common among younger women (<25 years old), women with low parity, French women, single women, those with a low level of education, and those with a low monthly income (Table 1). It was not significantly related to employment status during pregnancy. When we took these maternal characteristics into account together, parity, nationality, not living with a partner, level of education, and household income remained significantly related to cannabis use.

Cannabis users were more frequently tobacco smokers than were non-users, and the highest proportion of women who smoked at least ten cigarettes a day or more was found among those who used cannabis at least once a month (Table 2). Cannabis users were also consumers of alcohol more often than non-users.

The preterm birth (before 37 completed weeks of gestation) rate was higher among cannabis users, 10.9%, than among non-users, 5.3%. The trend was similar for the percentage of births before 32 weeks of gestation: 1.3 and 0.5%, respectively. The spontaneous preterm birth rate was significantly higher among cannabis users: 6.4 versus 2.8%. The preterm birth rate was 9.9% among women using cannabis less than once a month, 12.3% among more frequent users, and 5.3% among non-users ( $P < 0.01$ ; Table 3). After adjustment for confounding factors, the odds ratios of preterm birth and of spontaneous preterm birth were significantly higher than 1 for women using cannabis once a month or more often.

After adjustment for confounding factors, the risk of small-for-gestational-age birth differed significantly according to cannabis use, and the average weight adjusted for gestational age was lower in cannabis users.

These figures also differed according to whether or not women smoked cigarettes. Among non-tobacco smokers there was only one significant association: gestational age, with a higher percentage of babies born before 32 weeks among cannabis users. Among tobacco smokers, the risks of preterm and of spontaneous preterm birth were significantly higher among cannabis users who reported use once a month or more often. The tobacco–cannabis interaction, which we have tested in the logistic regression models, was not significant for any indicator of pregnancy outcome.

**Table 1.** Cannabis use by maternal characteristics

Maternal characteristics	N	Cannabis use				
		%	P*	aOR**	95% CI	P
<b>All sample</b>	13 545	1.2				
<b>Age</b>						
<25 years	2264	2.0		0.93	0.60–1.44	
25–34 years	8620	1.0	<0.001	1		>0.05
35 years or older	2526	1.0		1.25	0.78–2.01	
<b>Parity</b>						
Zero	5883	1.5		1		
One	4673	1.0	<0.01	0.61	0.41–0.90	<0.01
Two	1890	0.9		0.53	0.30–0.94	
Three or more	1001	0.5		0.24	0.09–0.63	
<b>French nationality</b>						
No	1720	0.3	<0.001	0.19	0.08–0.48	<0.001
Yes	11816	1.3		1		
<b>Cohabiting</b>						
No	975	3.0	<0.001	1.69	1.01–2.82	<0.05
Yes	12549	1.0		1		
<b>Educational level</b>						
None–primary	290	0.7		1.77	0.38–8.15	
High school, low	3483	2.0		2.65	1.49–4.71	
High school, high	2691	1.0	<0.001	1.59	0.86–2.92	<0.05
College	2896	1.1		1.72	0.99–3.00	
Postgraduate	4118	0.6		1		
<b>Employment</b>						
Yes	9501	1.1		1		
Unemployed	1066	1.6	>0.05	0.85	0.48–1.50	>0.05
Inactive	2858	1.3		1.00	0.62–1.60	
<b>Monthly income of household</b>						
<1000€	1327	2.5		2.68	1.24–5.82	
1000–1499€	1355	1.8		2.52	1.25–5.08	
1500–1999€	1941	1.3	<0.001	1.86	0.97–3.58	<0.05
2000–2999€	4020	0.9		1.11	0.62–2.01	
3000–4000€	2742	0.7		1		
>4000€	1803	1.0		1.84	0.94–3.60	

\*P value derived from chi-square tests.

\*\*Obtained from multivariate logistic regression including all variables shown in the table.

## Discussion

### Main findings

The results of this study show that cannabis use during pregnancy is more frequent for women who are French, single, primiparous, or have a low level of education and a low income. It is associated with tobacco use and alcohol consumption. The rate of preterm birth and of spontaneous preterm birth is higher for cannabis users, and for

**Table 2.** Cannabis use and tobacco and alcohol consumption during pregnancy

	Cannabis use			
	No (13 531) %	Yes (158) %	Less than once a month* (93) %	Once a month or more often (65) %
<b>Tobacco smoking before pregnancy</b>				
Yes	30.4	76.9	67.0	90.8
	<0.001			
<b>Tobacco use in the third trimester of pregnancy</b>				
No	83.2	39.4	54.4	18.5
1–9 cigarettes/day	12.1	45.8	35.6	60.0
10 or more cigarettes/day	4.7	14.8	10.0	21.5
	<0.001			
<b>Alcohol drinking</b>				
Never	77.4	53.2	53.8	52.3
Only before being aware of the pregnancy	3.1	7.0	6.6	7.7
Once a month or less	17.1	30.8	30.8	30.8
More than once a month	2.4	9.0	8.8	9.2
	<0.001			
<b>Three drinks or more on one occasion</b>				
Never	97.5	91.2	89.7	93.3
Less than once a month	2.2	8.2	10.3	5.0
Once a month or more	0.3	0.7	0.0	1.7
	<0.001			

\*Including unknown frequency of consumption.

users once a month or more often, especially among those who also smoke tobacco.

### Strengths and limitations

The 2010 survey was the first time that the National Perinatal Survey collected data on cannabis use. The size of the sample, and its representativeness at the national level, constitute the main strength of this study. We have no laboratory tests to validate the women's self-reports. It is likely that cannabis consumption was under-reported, as its harmfulness is widely suspected by the women. Such under-reporting would mean that some cannabis users are included in the group considered to be non-users, so that the associations with preterm or small-for-gestational-age births are probably underestimated, compared with the true associations.

**Table 3.** Cannabis use and pregnancy outcomes

	Cannabis use					
	No	Less than once a month	Once a month or more	Trend test	Less than once a month	Once a month or more
	%	%	%		aOR* (95% CI)	
<b>All sample</b>	(13 348)	(91)	(65)			
<i>Gestational age</i>						
<32 weeks	0.5	1.1	1.5	<0.05		
32–36 weeks	4.8	8.8	10.8			
≥37 weeks	94.7	90.1	87.7			
Preterm birth (<37 weeks)	5.3	9.9	12.3	<0.002	1.62 (0.78–3.40)	2.22 (1.04–4.74)
Spontaneous preterm birth	2.8	5.5	7.7	<0.004	1.85 (0.74–4.64)	2.57 (1.01–6.59)
Medically indicated preterm birth	2.5	4.4	4.6	ns	1.28 (0.40–4.12)	1.62 (0.50–5.27)
SGA (<10 <sup>th</sup> percentile)	8.4	16.7	23.1	<0.001	1.51 (0.84–2.71)	1.98 (1.07–3.68)
Birthweight (mean)**	3302.9 g	3157.2 g	3053.9 g	<0.001		
<b>Among tobacco smokers</b>	(2233)	(41)	(53)			
<i>Gestational age</i>						
<32 weeks	0.8	0.0	0.0			
32–36 weeks	5.5	9.7	13.2	<0.10		
≥37 weeks	93.7	90.2	86.8			
Preterm birth (<37 weeks)	6.3	9.8	13.2	<0.03	1.86 (0.64–5.44)	2.68 (1.16–6.20)
Spontaneous preterm birth	3.4	4.9	9.4	<0.02	1.63 (0.37–7.23)	3.50 (1.28–9.53)
Medically indicated preterm birth	2.8	4.9	3.8	ns	2.06 (0.47–9.08)	1.49 (0.34–6.41)
SGA (<10 <sup>th</sup> percentile)	15.9	24.4	24.6	<0.04	1.29 (0.61–2.72)	1.30 (0.66–2.56)
Birthweight (mean)**	3151.4 g	3016.4 g	3010.2 g	<0.01		
<b>Among non-tobacco smokers</b>	(11025)	(61)***				
<i>Gestational age</i>						
<32 weeks	0.4	3.3				
32–36 weeks	4.6	4.9		<0.01		
≥37 weeks	95.0	91.8				
Preterm birth (<37 weeks)	5.0	8.2		ns	1.24 (0.44–3.49)	
Spontaneous preterm birth	2.6	3.3		ns	1.22 (0.29–5.06)	
Medically indicated preterm birth	2.4	4.9		ns	1.22 (0.29–5.11)	
SGA (<10 <sup>th</sup> percentile)	6.8	11.7		ns	1.24 (0.52–2.94)	
Birthweight (mean)**	3334.7 g	3244.1 g		ns		

SGA, small for gestational age.

Medically indicated preterm birth: caesarean section before labour or induction.

\*For all sample and non-tobacco smokers: adjusted for mother's age, parity, nationality, cohabiting, level of education, employment status, income of the household, body mass index, and alcohol consumption. For tobacco smokers: adjusted for all the above variables plus the number of cigarettes per day in the third trimester.

\*\*Adjusted for gestational age in weeks.

\*\*\*Only 12 women did not smoke tobacco and used cannabis once a month or more often. It was not possible to stratify non-smokers for frequency of cannabis use.

## Interpretation

Compared with the results of the 2005 survey of women aged 18–44 years in the general population in France, in which 11% reported that they had used cannabis at least once in the previous year,<sup>2</sup> our estimate among pregnant women is lower: 1.2%. It is certain that most women stop cannabis use when they are pregnant, or beforehand, in the context of planned pregnancies. This percentage seems slightly lower than those described in other countries.

According to studies based on women's responses, 2–3% of women in the Avon Longitudinal Study of Parents and Children (ALSPAC) in 1991–92 reported cannabis use in the UK,<sup>6</sup> 2.6% of women surveyed in Australia between 2000 and 2006 used cannabis,<sup>7</sup> 3.2% used cannabis in the USA from 1997 to 2004,<sup>8</sup> 9.5% reported cannabis use at Yale–New Haven Hospital in 1980–82,<sup>9</sup> and 13% reported cannabis use in the first trimester of pregnancy, and 10% reported cannabis use in the third trimester, in Ontario.<sup>10</sup>

A study based on either interviews or urine assays concluded that 27% of pregnant women at Boston City Hospital were cannabis users between 1984 and 1987.<sup>11</sup> Finally, in the USA during 1996–1998, 2.8% of pregnant women reported that they used illicit drugs, and marijuana accounted for three-quarters of that use.<sup>12</sup>

The social and demographic factors related to cannabis use are similar to those reported among users in the general population: people with a low level of education or who are unemployed are more frequent consumers,<sup>13</sup> which is consistent with the higher rate of users among the lower income group in our survey. Other studies have shown more frequent use during pregnancy among less educated or single women.<sup>5,7,9,12</sup> In contrast, the British ALSPAC study showed that cannabis users had a higher level of education.<sup>6</sup>

All studies report a strong link between using cannabis and smoking tobacco or drinking alcohol.<sup>6–9,11,14,15</sup> The characteristics of women using cannabis during pregnancy are similar to those who smoked cigarettes: young, single, of French nationality, with a low level of education.<sup>16</sup> Because cannabis is almost always used with tobacco, it is difficult to separate these two habits, in terms of their frequency and of their effect on pregnancy.

The findings of this study are consistent with previous research suggesting that smoking cannabis during pregnancy might increase the rate of preterm birth or lead to lower birthweights. In Ottawa, Canada, Fried et al.<sup>10</sup> reported that the adjusted mean length of gestation was 39.6 weeks among non-users, compared with 38.8 weeks among heavy users: this difference was significant. From a study in Australia between 2000 and 2006, Hayatbakhsh et al.<sup>7</sup> estimated an adjusted odds ratio for preterm birth of 1.5 (95% CI 1.1–1.9) related to cannabis use. Another study from Australia showed that 18.8% of cannabis users had preterm births, compared with 5.8% of the non-drug exposed group.<sup>14</sup> A prospective study of 3857 pregnancies in Connecticut (USA) reported an odds ratio for preterm birth related to marijuana use of 1.9 (95% CI 1.0–3.9) among white women and no significant difference from 1 for non-white women.<sup>9</sup> Some surveys, however, have not found any effect on gestational length or preterm birth.<sup>6,8</sup> Our results for small-for-gestational-age birth are inconclusive; nevertheless, we observed a lower mean birthweight for cannabis users among tobacco smokers. Several authors have reported that cannabis use affects fetal growth,<sup>6,7,9,11,14–17</sup> but others, less numerous, have not found this effect.<sup>8,10</sup>

It is difficult to explain the differences in results for those who do and do not use tobacco. To our knowledge, no previous study reports such findings. Our data suggest that the quantity of cannabis used in pregnancy was small among non-tobacco smokers, and it is possible that this

low level has no discernible effect on the pregnancy outcome. It is also possible that it is the combined effect of the two substances—tobacco and cannabis—that is detrimental to pregnancy outcome.

It is possible that our significant results can be explained by other factors that we could not consider, such as other toxins or especially hard living conditions, although we have adjusted for many social factors: level of education, employment status, and household income. These results should be confirmed in other populations, and we must ask questions about cannabis use in future national surveys.

The mechanism of the effect of cannabis remains to be elucidated. The results of El Marroun et al.<sup>18</sup> suggest that intrauterine cannabis exposure is associated with changes in the haemodynamic programming of the vascular system in late pregnancy. Animal work has indicated that tetrahydrocannabinol, the main psychoactive component of marijuana, can alter a wide range of pituitary–ovarian and adrenal hormones, and can affect steroid production by the placenta.<sup>10</sup> To our knowledge, few studies are available on the long term effects of *in utero* exposure to cannabis on neurodevelopment and the cognitive abilities of the children exposed *in utero*;<sup>19,20</sup> this research should be developed.

## Conclusion

We report for the first time an estimate of the percentage of women using cannabis during pregnancy at the national level in France: at least 9900 newborns are exposed to cannabis *in utero* each year. Efforts should continue to inform women and healthcare providers about the potential consequences of cannabis use. It is important to encourage women to stop cannabis use before becoming pregnant.

## Disclosure of interests

The authors declare that there are no conflicts of interest.

## Contribution to authorship

MJSC contributed to the design of the study. MJSC, CP, and BB participated in the analysis of the data, and all of the authors interpreted the results. MJSC wrote the article, and all authors reviewed the drafts and approved the final version.

## Details of ethics approval

The National Council for Statistical Information (Comité du label) (ref. 2010X716SA) and the French Commission for Information Technology and Liberties (Commission Nationale Informatique et Libertés; ref. 909003; 12 June 2009) approved this survey.

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## How much do we really know about marijuana use during pregnancy?

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#### *Mini commentary on 'Cannabis use during pregnancy in France in 2010'*

Marijuana is the most commonly used illicit recreational drug internationally (Copeland et al. *Int Rev Psychiatry* 2009;21:96–103). The Youth Risk Behavior Survey conducted by the US Centers for Disease Control and Prevention reported that 23.1% of high school students in the USA used marijuana in the past month, and that 39.9% had used marijuana at least once. Marijuana use is also not uncommon in Western Europe (MacArthur GJ et al. *J Public Health* 2012;34:i20–i30). Despite its ubiquitous prevalence, research on marijuana use in pregnancy remains limited. Although marijuana has been associated with reduced fetal growth and an increased risk of preterm delivery in some but not all studies, the use of the drug during pregnancy has generally not been associated with adverse pregnancy outcomes (Smith LM et al. *Pediatrics* 2006;118:1149–56; Shiono PH et al. *Am J Obstet Gyn* 1995;172:19–27). Few studies evaluating these outcomes are available, however. The study by Saural-Cubizolles et al. is an important addition to the research literature on marijuana use in pregnancy. The authors analysed a national perinatal survey of women in France in 2010. Women were questioned regarding marijuana use

during pregnancy, and drug use was evaluated in relation to adverse obstetric outcomes, including preterm delivery and small for gestational age, in a multivariate model. The main findings of the study are that marijuana use was associated with: (1) an increased risk of preterm birth; and (2) a lower mean birthweight. Both of these findings remained statistically significant within a multivariate model that included covariates such as age, smoking, parity, and employment status and income. Do the risks shown in this study result from the study model being inadequately robust? Marijuana use may occur in a complex milieu of obstetric, medical, and social risk factors for adverse pregnancy outcomes. Methodological improvements that could improve the validity of future work include the following: (1) the use of biological tests to corroborate survey/interview responses; (2) a demonstration of a dose–response and/or temporal relationship between marijuana use and adverse obstetric outcomes; (3) the elucidation of mechanisms by which marijuana may cause preterm delivery and restricted fetal growth; (4) determining whether marijuana use is associated with greater smoking prevalence

and, if so, whether exposure to both marijuana and smoking confer increased risks of adverse perinatal outcomes beyond the risks conferred by these substances independently; and (5) modelling the other risk factors for spontaneous and indicated preterm delivery, including detailed obstetric and medical history. Legalised recreational marijuana use is gaining popularity and social acceptance, particularly in the USA, where taxes on the drug represent a new source of revenue. With increasing use, how harmful marijuana is in pregnancy will dictate whether it becomes an obstetrical public health concern akin to alcohol and tobacco. Although marijuana use in pregnancy should of course be discouraged, more data are needed to determine what public health resources should be used to screen for, counsel, and educate patients about the drug's potential obstetric risks. High-quality evidence is the best basis for these important forthcoming public policy decisions.

#### **Disclosure of interests**

C.A. is the Editor-in-Chief of *Paediatric and Perinatal Epidemiology*, an international journal that is also published by Wiley-Blackwell.