Objective To document the prevalence of cannabis use in a large sample of British women studied during pregnancy, to determine the association between cannabis use and social and lifestyle factors and assess any independent effects on pregnancy outcome.

Design Self-completed questionnaire on use of cannabis before and during pregnancy.

Sample Over 12,000 women expecting singletons at 18 to 20 weeks of gestation who were enrolled in the Avon Longitudinal Study of Pregnancy and Childhood.

Methods Any association with the use of cannabis before and during pregnancy with pregnancy outcome was examined, taking into account potentially confounding factors including maternal social background and other substance use during pregnancy.

Main outcome measures Late fetal and perinatal death, special care admission of the newborn infant, birthweight, birth length and head circumference.

Results Five percent of mothers reported smoking cannabis before and/or during pregnancy; they were younger, of lower parity, better educated and more likely to use alcohol, cigarettes, coffee, tea and hard drugs. Cannabis use during pregnancy was unrelated to risk of perinatal death or need for special care, but, the babies of women who used cannabis at least once per week before and throughout pregnancy were 216g lighter than those of non-users, had significantly shorter birth lengths and smaller head circumferences. After adjustment for confounding factors, the association between cannabis use and birthweight failed to be statistically significant (P = 0.056) and was clearly non-linear: the adjusted mean birthweights for babies of women using cannabis at least once per week before and throughout pregnancy were 90g lighter than the offspring of other women. No significant adjusted effects were seen for birth length and head circumference.

Conclusions The results of this study suggest that the use of cannabis during pregnancy was not associated with increased risk of perinatal mortality or morbidity in this sample. However, frequent and regular use of cannabis throughout pregnancy may be associated with small but statistically detectable decrements in birthweight.

INTRODUCTION

Over the last 30 years there has been a marked increase in cannabis use in developed countries including Europe, Great Britain, the USA and Australasia. The increase in cannabis use has, in turn, raised questions about the extent to which cannabis may have harmful physical or psychological effects. One aspect of this concern has focused on the extent to which cannabis use during pregnancy may lead to adverse outcomes including miscarriage, perinatal death, congenital abnormality, preterm delivery, intrauterine growth retardation, reduced gestational age or other neonatal problems.

There is a growing literature on the fetal and neonatal consequences of maternal cannabis use in pregnancy. The findings of this literature have been somewhat inconsistent. There is some evidence that the offspring of cannabis users may have slightly lower birthweight and/or increased risk of preterm birth, but studies are conflicting. For example, Gibson et al. found that the offspring of relatively heavy cannabis users had a higher incidence of low birthweight and were also more prone to preterm delivery. They showed that the low birthweight relationship was entirely due to excess preterm delivery; nevertheless, they found no relationship between lower consumption of cannabis (≤1/wk) and adverse outcome, and the numbers in the heavy user group were small (n = 36). In contrast, in a study of 1226 mothers from an American prenatal clinic, Zuckerman et al. found that the offspring of relatively heavy cannabis users (i.e. positive urine screen) had lower mean birthweight (79g), and were shorter at birth (0.52cm) than the offspring of non-users when allowance was made for a number of confounding factors including cigarette smoking and gestation, thus implying some growth retardation. A large study comprising 12,424 singleton deliveries in Boston identified 880 mothers who occasionally smoked cannabis in pregnancy, 229 who did so at least weekly and 137 who smoked daily. Unadjusted data indicated increased rates of low birth-
weight (<2500g) and preterm delivery (<37 weeks), but adjusted analyses gave odds ratios (95% confidence interval) for any cannabis use of 1.07 (0.87, 1.31) and 1.02 (0.82, 1.27) for low birthweight and preterm delivery, respectively. No analysis was carried out to see if there was any reduction in mean birthweight among cannabis users. A study of 3857 pregnancies in Connecticut found the adjusted risk of giving birth to a low birthweight baby (<2500g) to be 2.6 (1.1, 6.2) among white women who were regular users of cannabis. They also reported an almost twofold risk of preterm delivery in the same women. In a group of adolescent mothers marijuana use during the first trimester resulted in a seven day reduction in gestation after adjusting for various confounders (including smoking) and use in the second trimester gave an odds ratio of 3.8 (1.2–14.0) of having a baby that was small for gestational age. Fried et al. also reported a reduction in gestation of 0.8 weeks in the offspring of mothers who used cannabis at least six times a week during pregnancy.

Despite the negative associations noted above, various studies have reported no significant effects of cannabis use on preterm labour, birthweight or adverse intratuterine growth. A meta-analysis of 10 studies of cannabis use concluded that the evidence of cannabis use affecting birthweight was inadequate.

Although the literature on the effects of maternal cannabis use during pregnancy has been steadily growing, it has a number of limitations which include: the use of relatively small samples; the failure to provide estimates of the extent of maternal cannabis use; lack of prospectively collected measures of cannabis use; and failure to control for factors that may potentially confound the association between cannabis use and pregnancy outcomes.

Against this general background, this paper reports on the relationship between cannabis use during pregnancy and neonatal outcomes in a large sample of British singleton pregnancies studied prospectively during pregnancy. The aims of this study were: 1. to estimate the proportion of women who reported cannabis use before and during pregnancy; 2. to document the social, individual and related factors that distinguish women who used cannabis during pregnancy from those who did not use cannabis; and 3. to examine the extent to which use of cannabis during pregnancy was associated with increased risks of late fetal death and perinatal mortality, reduced birthweight, birth length and head circumference.

METHODS

The Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC) is a survey aimed at identifying features of environmental exposure prenatally and postnatally that affect the development, health and wellbeing of children. All pregnant mothers resident in the three Bristol-based health districts of Avon with expected dates of delivery between 1 April 1991 and 31 December 1992 were eligible for enrolment. It is estimated that 85%–90% of the eligible population took part, comprising 15,541 pregnancies. Of these 13,921 were still pregnant at 18–20 weeks of gestation; 13,710 had singleton pregnancies resulting in live births and were eligible for this study. There were 130 pregnancies that resulted in perinatal death, defined as fetal death of 20 weeks or more and early neonatal death (i.e. death of a live birth within seven days) of which 113 were singleton pregnancies.

Data on cannabis use were collected by self-completion questionnaires posted to the mothers at 18–20 weeks of gestation and returned by them in reply-paid envelopes. The questions were: “How often did you smoke marijuana/grass/cannabis/ganja: (a) in the six months before you conceived, (b) in the first three months of pregnancy, (c) between three months and now”. For each of (a), (b), and (c), the options given were: “Every day, two to four times a week, once a week, less than once a week, not at all”.

Associations with cannabis use and a variety of factors were investigated, and these factors were considered as possible confounders in multivariate analyses. These were:

- Parity (number of previous pregnancies resulting in a live or stillbirth).
- Cigarette smoking just before pregnancy (0, 1–4, 5–9, 10–14, 15–19, 20–24, 25–29, 30+).
- Cigarette smoking in the first three months of pregnancy (grouped as above).
- Cigarette smoking at 18–20 weeks of pregnancy (grouped as above).
- Alcohol consumption before pregnancy (none, <1 drink/week, 1+ drinks/week, 1–2 drinks/day, 3+ drinks/day).
- Alcohol consumption during first three months of pregnancy (grouped as above).
- Alcohol consumption at the time the mother first felt the baby move (grouped as above).
- Number of cups of tea/week at 18–20 weeks.
- Number of cups of coffee/week at 18–20 weeks.
- Use of hard drugs during pregnancy (yes/no).
- Maternal ethnic origins (white, non-white).
- Maternal education level achieved (five groups).
- Maternal height and maternal weight before pregnancy.
- Sex of the child.

(In Table 2 some of these measures were dichotomised as shown; in the covariate adjustment analysis in Table 5, these variables were analysed as scored above).
In order to obtain good measures of birth length and newborn head circumference, ALSPAC staff made daily visits to the two major maternity hospitals (responsible for 95% of births) in the area, and measured the babies born in the previous 24 hours, wherever possible. Babies in Special Care were measured as soon as this was not clinically constrained. Gestation was calculated (in days) using the date of the mother’s last menstrual period when the mother was certain of this, but for uncertain last menstrual periods and conflicts with clinical assessment the ultrasound assessment was used. For the purposes of analysis, gestation was rounded down to complete weeks. Deaths were notified to the study from a variety of sources, and detailed information was then abstracted from clinical records and postmortem reports.

Outcome measures for all live births surviving the early neonatal period were: (a) birthweight (measured in g); (b) birth length (cm); (c) head circumference at birth (cm); (d) preterm delivery (<37 weeks); (e) admission to special care baby unit. Additionally, the perinatal death rate was considered. In all analyses sample sizes were based on the number with data on all variables in the analysis.

All analyses were performed using SPSS for Windows Version 10.0. Associations between cannabis users and other categorical factors were examined using $\chi^2$ tests for independence; t tests were used to examine mean differences in continuous variables. Similarly, univariate associations between cannabis use and categorical outcome variables used $\chi^2$ tests for independence, while differences in continuous outcomes were examined using ANOVA. Multivariate analysis was performed using general linear modelling.

**RESULTS**

12,129 of the participating mothers returned the questionnaire sent to them which was concerned with cannabis smoking. Ninety percent of these had been completed by 25 weeks of gestation. Of the 113 singleton pregnancies resulting in late fetal or neonatal death, 79 mothers had given information on their use of cannabis.

Table 1 shows the number reporting cannabis use: 1. before pregnancy; 2. within the first trimester of pregnancy; 3. in the second trimester of pregnancy. The table shows that before pregnancy just under 5% of the sample reported cannabis use, while during pregnancy 2%–3% reported cannabis use. At each time the level of daily use was less than 1%.

Table 2 shows the sample classified into those who reported using cannabis before or during pregnancy and those who were non-users and the associations with a variety of social and other characteristics. The table shows that cannabis users were significantly younger than non-users, of lower parity, had a higher level of education, were more likely to smoke during pregnancy, and to consume more alcohol, tea and coffee and more likely to use other illicit drugs. In addition, women who used cannabis were slightly taller but significantly lighter than non-users. These results suggest that those mothers using cannabis were more likely to have some characteristics that put them at higher risk of adverse pregnancy outcomes than non-users.

### Table 1. Cannabis use prior to and during pregnancy. Values are given as $n$ (%).

<table>
<thead>
<tr>
<th>Frequency of use</th>
<th>6 months before pregnancy</th>
<th>1st Trimester</th>
<th>Mid-pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>109 (0.9)</td>
<td>61 (0.5)</td>
<td>53 (0.4)</td>
</tr>
<tr>
<td>2–4 times/week</td>
<td>149 (1.2)</td>
<td>84 (0.7)</td>
<td>59 (0.5)</td>
</tr>
<tr>
<td>Once/week</td>
<td>49 (0.4)</td>
<td>34 (0.3)</td>
<td>39 (0.3)</td>
</tr>
<tr>
<td>&lt; Once/week</td>
<td>278 (2.3)</td>
<td>132 (1.1)</td>
<td>99 (0.8)</td>
</tr>
<tr>
<td>Not at all</td>
<td>11544 (95.2)</td>
<td>11827 (97.4)</td>
<td>11890 (97.9)</td>
</tr>
<tr>
<td>All known</td>
<td>12129 (100)</td>
<td>12138 (100)</td>
<td>12140 (100)</td>
</tr>
</tbody>
</table>


### Table 2. Comparison of social and other characteristics of cannabis users and non-users prior and during pregnancy.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Users</th>
<th>Non-users</th>
<th>$P^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean maternal age (years)</td>
<td>25.5</td>
<td>27.8</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Primiparous (%)</td>
<td>58.3</td>
<td>44.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mothers with A level or higher educational qualification (%)</td>
<td>43.4</td>
<td>35.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Non-white ethnicity (%)</td>
<td>2.9</td>
<td>1.9</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Smoking during pregnancy (%)</td>
<td>68.6</td>
<td>23.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Drinking alcohol at least once per week during pregnancy (%)</td>
<td>34.6</td>
<td>19.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean tea consumption during pregnancy (cups per week)</td>
<td>22.2</td>
<td>19.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean coffee consumption (cups per week) during pregnancy (%)</td>
<td>10.8</td>
<td>9.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Use of illicit drugs during pregnancy (%)</td>
<td>6.8</td>
<td>0.2</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean pre-pregnant weight (kg)</td>
<td>58.5</td>
<td>61.9</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean pre-pregnant height (cm)</td>
<td>164.7</td>
<td>164.0</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

$^*$ P for dichotomous outcomes are based on the chi-squared tests of independence; p values for mean differences are based on the t-test.

### Cannabis use before and during pregnancy

Table 1 shows the number reporting cannabis use: 1. before pregnancy; 2. within the first trimester of pregnancy; 3. in the second trimester of pregnancy. The table shows that before pregnancy just under 5% of the sample reported cannabis use, while during pregnancy 2%–3% reported cannabis use. At each time the level of daily use was less than 1%.

Table 2 shows the sample classified into those who reported using cannabis before or during pregnancy and those who were non-users and the associations with a variety of social and other characteristics. The table shows that cannabis users were significantly younger than non-users, of lower parity, had a higher level of education, were more likely to smoke during pregnancy, and to consume more alcohol, tea and coffee and more likely to use other illicit drugs. In addition, women who used cannabis were slightly taller but significantly lighter than non-users. These results suggest that those mothers using cannabis were more likely to have some characteristics that put them at higher risk of adverse pregnancy outcomes than non-users.

### Cannabis use in pregnancy and pregnancy outcomes

Table 3 reports on the relationship of the extent of cannabis use before and during pregnancy and each measure of pregnancy outcome. For all measures of cannabis use there was a consistent absence ($P>0.10$) of association between cannabis use and perinatal death, preterm delivery and admission to special care. However, in all comparisons there was evidence to suggest a dose–response relationship between birthweight, birth length and head circumference and the extent of cannabis use before and during preg-
Children whose mothers used cannabis at least once per week had a mean birthweight that was approximately 200g lower than the mean birthweight of children whose mothers did not use cannabis and a mean birth length almost 1cm shorter. In all cases these associations were highly statistically significant ($P < 0.0001$). The smaller head circumference observed with weekly use of cannabis was most significant with use before pregnancy ($P = 0.009$).

To further examine the relationship between cannabis use and birthweight, the sample was classified using the fourfold classification (Table 4). This method classified the sample into four mutually exclusive dose groups, from those who used cannabis at least once per week before and throughout pregnancy to those who had never used cannabis. The table demonstrates a consistent dose–response relationship between the extent of maternal cannabis use during pregnancy and mean birthweight, birth length and head circumference. Children whose mothers smoked cannabis at least weekly before and during pregnancy had mean birthweights that were nearly 250g lower than non-users and birth lengths of 1cm shorter and head circumferences reduced by an average of 0.3cm. Between these extremes all measurements increased with decreasing cannabis use.

### Table 4. Mean measurements at birth by cannabis use before and during pregnancy. Values are given as [n], mean (SD).

<table>
<thead>
<tr>
<th>Cannabis use</th>
<th>Birthweight (g)</th>
<th>Birth length (cm)</th>
<th>Head circumference (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least once per week before and throughout pregnancy</td>
<td>[129] 3214 (517.7)</td>
<td>[84] 49.6 (2.01)</td>
<td>[86] 34.5 (1.31)</td>
</tr>
<tr>
<td>Once per week before or during pregnancy but not throughout pregnancy</td>
<td>[183] 3296 (588.9)</td>
<td>[117] 50.2 (2.32)</td>
<td>[119] 34.6 (1.56)</td>
</tr>
<tr>
<td>$&lt; $ Once per week both before or throughout pregnancy</td>
<td>[294] 3348 (547.1)</td>
<td>[184] 50.2 (2.30)</td>
<td>[185] 34.8 (1.39)</td>
</tr>
<tr>
<td>Non-user</td>
<td>[11464] 3430 (536.1)</td>
<td>[7102] 50.6 (2.12)</td>
<td>[7230] 34.8 (1.41)</td>
</tr>
<tr>
<td>$P^*$</td>
<td>$&lt; 0.0001$</td>
<td>$&lt; 0.0001$</td>
<td>0.026</td>
</tr>
</tbody>
</table>

* $P$ value based on one-way analysis of variance.
use before and during pregnancy and mean birthweight, birth length and head circumference adjusted for the effects of maternal education, parity, maternal ethnicity, cigarette smoking during pregnancy, gender of the child, alcohol, tea and coffee consumption during pregnancy, maternal height and weight and the use of hard drugs during pregnancy. The table shows that after adjustment for confounding factors there was an almost significant \( P = 0.030 \) but non-linear association between the extent of cannabis use during pregnancy and mean birthweight. The offspring of women who smoked cannabis at least once per week before and throughout pregnancy had mean birthweights that were approximately 102g lower than the offspring of other women who had never used cannabis. The clear implication of this finding is that while occasional use of cannabis before or during pregnancy does not have detectable adverse effects on birthweight, indeed it appears to increase mean birthweight, although not statistically significantly, there is evidence that regular use of cannabis during pregnancy may result in a reduction in birthweight that is statistically independent of maternal and social background, maternal characteristics or other substance use behaviours during pregnancy. After adjusting for the various confounding factors the association found with the extent of cannabis use and mean birth length and head circumference were no longer significant \( P = 0.225 \) and \( P = 0.845 \), respectively.

Table 6 repeats this analysis but also adjusts for the effects of gestation on the three measures of birth size.

Although reducing the size of the effect in those who used cannabis during and throughout pregnancy, the effect in women who used cannabis before or during pregnancy, but not throughout the whole pregnancy, was significantly increased for both mean birthweight and birth length. The effects of cannabis use on head circumference were still not significant after adjusting for gestation.

## DISCUSSION

In this paper we have used prospectively collected data on cannabis use before and during pregnancy to examine the extent to which cannabis use was associated with adverse pregnancy outcomes when due allowance was made for confounding factors. The major findings of this analysis are reviewed below.

On the basis of self-reported data, around 5% of the women in this study admitted using cannabis before pregnancy and a slightly smaller proportion reported using cannabis during pregnancy. These findings are generally consistent with the results of other self-reported studies that have suggested that around 5% of women admit to using cannabis in pregnancy. However, likely that these figures may underestimate the true prevalence of cannabis smoking in pregnancy. In particular, Zuckerman et al. noted that in Boston the proportion of pregnant women who smoked cannabis would be increased by 20% if the results of urine screening were

### Table 5. Estimates of effect sizes in mean measurements at birth by cannabis use before and during pregnancy after adjustment for all covariates, using non-users as the baseline.

<table>
<thead>
<tr>
<th>Cannabis use</th>
<th>( (n = 9552) ) Birthweight (g) (95% CI)</th>
<th>( (n = 6127) ) Birth length (cm) (95% CI)</th>
<th>( (n = 6233) ) Head circumference (cm) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least once per week before and throughout pregnancy</td>
<td>-101.90 (-207.60, 3.81)</td>
<td>-0.43 (-0.95, 0.09)</td>
<td>-0.12 (-0.47, 0.23)</td>
</tr>
<tr>
<td>Once per week before or during pregnancy but not throughout pregnancy</td>
<td>65.72 (-23.21, 154.60)</td>
<td>0.28 (-0.16, 0.71)</td>
<td>0.058 (-0.23, 0.35)</td>
</tr>
<tr>
<td>&lt; Once per week both before and throughout pregnancy</td>
<td>57.95 (-9.60, 125.50)</td>
<td>-0.02 (-0.35, 0.31)</td>
<td>0.043 (-0.18, 0.26)</td>
</tr>
<tr>
<td>Non-user</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>( P )</td>
<td>0.030</td>
<td>0.225</td>
<td>0.845</td>
</tr>
</tbody>
</table>

included. If this is also true of Avon, this would increase the proportion of mothers estimated to use cannabis in this population to approximately 6%. A urine screen carried out by the ALSPAC study in one clinic in an inner city area of Avon thought to be likely to have among the highest prevalences of drug abuse showed 8% of 200 antenatal and postnatal samples to be positive; thus extrapolating to the rest of the area where drug misuse is less likely, a prevalence of 5% to 6% seems a reasonable estimate. Similarly, the only study found to report prevalence rates for cannabis use among pregnant women in England showed that although only 0.75% of pregnant women who attended the Homerton hospital in London in 1994 were known to have a drug problem, 8.2% of a consecutive sample of 1000 women tested positive for cannabis through urine screening. This suggests that self-reporting alone is not an adequate measure of drug use in a pregnant population, and the results presented here should be interpreted with caution as it is likely that any underreporting of cannabis use would underestimate the true effect size.

Comparison of those using cannabis with non-users suggested that as a group, cannabis users were likely to be at increased risk of adverse pregnancy outcome. Specifically, these women tended to be younger, of lower parity and to have higher rates of cigarette smoking, alcohol, caffeine and other illicit drug use during pregnancy. These findings imply that even if there was no effect of cannabis use on pregnancy outcomes, one might expect to find a higher rate of adverse pregnancy outcomes amongst cannabis smokers as a result of their demographic background and other substance use during pregnancy.

Cannabis use during pregnancy was statistically unrelated to a series of adverse outcomes including perinatal death, preterm delivery and neonatal admission for special care. The number of cases experiencing these outcomes was small, resulting in reduced statistical power. However, these findings are generally consistent with previous studies that have found an absence of statistical association between cannabis use and antenatal or perinatal morbidity and mortality. The apparent exception to this trend was that cannabis use during pregnancy showed a consistent statistically significant unadjusted dose–response relationship with birthweight and birth length. Women who smoked cannabis at least once per week before and during pregnancy had children who weighed approximately 250g less and who were 1cm shorter than the offspring of non-users.

The unadjusted analysis suggested a generally linear relationship between cannabis use and mean birthweight with increasing cannabis use being associated with corresponding declines in mean birthweight. However, after adjusting for confounding factors, the apparently linear association between birthweight and cannabis use was lost. The results suggest that there was little difference in adjusted birthweights between the offspring of non-users and women who used cannabis less than once per week before and throughout pregnancy. However, there was a detectable decrement in birthweight for the offspring of women who used cannabis at least once per week before and throughout pregnancy. These infants were in the region of 90g lighter than offspring of other women even when due allowance was made for maternal social background, maternal characteristics and other substance use behaviours during pregnancy. These adjusted findings may suggest a threshold model in which occasional or irregular use of cannabis during pregnancy does not have detectable effects on fetal growth but in which the offspring of women who used cannabis as frequently as once a week may have reduced birthweight. To place these results in perspective, the reduction in birthweight associated with regular cannabis use before and during pregnancy was approximately equal to the reduction in birthweight for the offspring of women who smoke between 10 to 15 cigarettes per day. However, such a threshold effect can not be ascertained from the data presented here. The number of cannabis users was relatively small and so statistical power is limited. Nevertheless, further studies with sufficient statistical power to investigate any threshold effect would be warranted.

While these results suggest significant associations between cannabis use during pregnancy and mean birthweight, it should be borne in mind that there is a possibility that the apparent associations between cannabis use and birthweight are spurious and reflect the effects of uncontrolled confounding factors that are associated with both cannabis use and birthweight. While we have attempted to control a relatively comprehensive set of such factors, the possibility that the relationships could reflect uncontrolled confounders cannot be dismissed. One particularly important factor is smoking. Nearly 70% of the women in our sample who used cannabis during pregnancy also smoked. While we adjusted for smoking in the multivariate analyses we were unable to perform a stratified analysis due to limited numbers. In interpreting these results it is also important to consider the fact that cannabis is invariably smoked with tobacco and the effects seen may be a direct result of tobacco use rather than that of cannabis. It is invariably impossible to control for the inevitable confounding effect of tobacco in this study.

Nonetheless, the findings are generally consistent with a growing body of evidence that suggests that, as a group, the babies of cannabis users, and particularly heavy or regular users, are more likely to be at an increased risk of reduced birthweight. These findings suggest that it would be prudent to advise pregnant women of the evidence that cannabis use during pregnancy and particularly heavy use of cannabis may lead to reduced fetal growth. More generally, these findings add to the growing body of evidence that suggests that to produce optimal fetal growth and to minimise risks of adverse pregnancy outcomes, pregnant women should be encouraged to avoid all forms of substance use behaviour during pregnancy.
Acknowledgements

The authors would like to thank all the women who took part and the midwives for their cooperation and help in recruitment. The whole ALSPAC study team comprises interviewers, computer technicians, laboratory technicians, clerical workers, research scientists, volunteers and managers who continue to make the study possible. This study was financially supported by many organisations including the Wellcome Trust, the Department of Health, the Department of the Environment and the Medical Research Council. The ALSPAC study is part of the WHO initiated European Longitudinal Study of Pregnancy and Childhood.

References


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