

# Early Reactions to Cannabis Predict Later Dependence

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**Context:** While there is a growing literature on the linkages between early subjective responses to nicotine and alcohol and later risks of nicotine or alcohol dependence, to date there has been no study of this issue in relation to cannabis.

**Objective:** To examine the extent to which subjective responses to early (prior to the age of 16 years) cannabis use were associated with subsequent cannabis dependence in a birth cohort studied to the age of 21 years.

**Design:** Data on early (prior to the age of 16 years) subjective reactions to cannabis use and subsequent cannabis dependence were gathered over the course of the Christchurch Health and Development Study, a 21-year longitudinal study of a birth cohort of children born in Christchurch, New Zealand.

**Setting:** General community sample.

**Participants:** Members of a population-based birth cohort (86.5% white, 11.3% New Zealand Maori, and 2.2% Pacific Island).

**Main Outcome Measure:** *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* cannabis dependence (for those aged 16-21 years).

**Results:** Of the cohort, 198 (20%) had used cannabis prior to the age of 16 years. Among this high-risk group, rates of dependence were high with 21.7% meeting DSM-IV criteria for cannabis dependence by the age of 21 years. There were clear tendencies for rates of cannabis dependence to increase with increasing reports of positive responses to early cannabis use: those reporting 5 positive responses had odds of cannabis dependence that were 28.5 (95% confidence interval, 6.3-133.8) times higher than those not reporting positive reactions to cannabis. The association held (odds ratio, 23.4; 95% confidence interval, 4.0-135.9) after control for potentially confounding factors including the extent of use of cannabis prior to age 16 years. The extent of early negative reactions to cannabis was unrelated to later cannabis dependence.

**Conclusions:** Early subjective responses to cannabis are prognostic of later cannabis dependence. These findings may suggest the presence of genetically mediated individual differences in early responsiveness to cannabis. Clinicians should be aware that young people who report positive reactions to early use of cannabis are at increased risks of later cannabis dependence.

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**D**URING THE LAST 3 decades there has been growing interest and research into the use of tobacco, alcohol, and cannabis among young people. This research has focused on the prevalence of use and abuse of these substances, the risk and protective factors associated with patterns of use, and the consequences of use for other aspects of health and personal adjustment. One component of this research has focused on the issue of the extent to which subjective and physiological reactions to substances are prognostic of longer-term, heavy problem, or dependent use (for reviews see references 1 through 3).

Most research has focused on responses to nicotine or alcohol. In particular, several studies have examined the extent to which heavy users of tobacco report either no negative reaction to tobacco on initial use or report positive reactions. This evidence has recently been reviewed by Eisenberg and Balster<sup>1</sup> who concluded that adolescent smokers who eventually became regular users reported fewer negative effects (eg, "feeling sick"), with some studies suggesting that this group more often reported positive reactions (eg, "felt high"). Clearly this evidence suggests that early nonnegative and/or pleasurable responses to nicotine may be precursors of later regular cigarette smoking and nicotine dependence.

Parallel to research into the associations between subjective responses and the development of nicotine dependence, there has been research into early responses to alcohol. This research has focused on the offspring of alcoholic and nonalcoholic parents and has examined both physiological and subjective responses to early alcohol exposures.<sup>2-11</sup> Accumulating evidence from these studies suggests that young people predisposed to alcohol dependence are characterized by increased cardiac rates following alcohol administration<sup>4,6,11</sup> with these increases being associated with positive subjective responses that include increases in energy, confidence, and a decrease in anxiety.<sup>11</sup> However, other research has suggested that those prone to alcohol dependence are characterized by a reduced sensitivity to alcohol.<sup>3,8-10</sup> The paradox between these findings has recently been addressed by Conrod et al<sup>11</sup> who suggest that those prone to dependence are characterized by both a heightened sensitivity to the positive effects of alcohol and a reduced sensitivity to the negative (sedative) effects of alcohol.

Although there has been growing evidence of the linkages between early responses to tobacco and alcohol and later dependence, there seems to have been no research that has examined these linkages for other substances. Given the growing evidence to suggest the presence of common, correlated, or overlapping neural pathways in the development of dependence,<sup>11</sup> it is reasonable to conjecture that it is likely that the nature of early subjective responses to a substance will be prognostic of later dependence.

This article reports on the results of a longitudinal study of the linkages between early subjective responses to the use of cannabis and the later development of cannabis dependence in a birth cohort of New Zealand young people studied to the age of 21 years. The aims of the study were (1) to document the range of subjective responses to the early use of cannabis; (2) to examine the extent to which positive and negative reactions to early cannabis use were related to the development of subsequent dependence by age 21 years; and (3) to adjust any association between subjective reactions and later cannabis dependence for potentially confounding factors.

## METHODS

### PARTICIPANTS

Data were gathered during the course of the Christchurch Health and Development Study. The Christchurch Health and Development Study is a longitudinal study of a birth cohort of 1265 children who were born in the Christchurch, New Zealand, urban region in mid-1977. This cohort has been assessed at birth, 4 months, 1 year, annually to the age of 16 years, and at ages 18 and 21 years using information from a combination of sources including parental interview, teacher report, psychometric testing, self-report, and medical and police records.<sup>12,13</sup> All study information has been collected on the basis of signed and informed consent of study participants. Throughout the study, rates of sample retention have remained high and at the age of 21 years, 1011 sample members were assessed. This sample represented 80% of the initial cohort and 90% of the sample alive and resident in New Zealand. The present analysis is based on the subsample of 198 (101 females and 97 males) young people who reported using cannabis prior to the age of 16 years and

for whom information on cannabis use subsequent to the age of 16 years was available.

### SUBJECTIVE REACTIONS TO CANNABIS USE

At the age of 15 and 16 years, sample members were interviewed personally by trained survey interviewers about their use of cannabis in the previous 12 months. Those who reported using cannabis were asked a series of questions relating to the frequency of use, the context in which use occurred, and reactions to use. At each age cannabis users were asked to report their subjective reactions on the last or most recent occasion they used cannabis, based on a series of 8 symptoms that covered both positive and negative experiences. These symptoms included getting really high, feeling happy, feeling relaxed, doing silly things, laughing a lot, feeling ill or dizzy, feeling frightened, and passing out. These items were originally collected as part of a descriptive study of early cannabis use.<sup>14</sup> For this current analysis, the symptom reports at the ages of 15 and 16 years were combined so that an individual was classified as having the symptom if he or she reported the symptom at either 15 or 16 years.

### CANNABIS DEPENDENCE

At ages 18 and 21 years, sample members were again interviewed about their use of cannabis since the previous assessment, including their frequency of use and problems associated with cannabis use. As part of this questioning, items from the *Composite International Diagnostic Interview*<sup>15</sup> were used to assess standardized symptom criteria for cannabis dependence. Using this information, it was possible to classify sample members according to *DSM-IV* diagnostic criteria for cannabis dependence over the period when they were 16 through 21 years old. (No participant was classified as cannabis dependent prior to age 16 years.) Specifically, individuals were classified as cannabis dependent if they reported regular (at least weekly) use of cannabis and at least 3 of the following: increased tolerance for cannabis, withdrawal symptoms when use was ceased or attempts were made to cut down on cannabis use, prolonged use or overuse of cannabis, unsuccessful attempts to quit or cut down on cannabis use, spending large amounts of time in cannabis-related activities, restriction of social or other activities as a result of cannabis use, or consequent physical or psychological problems from heavy or prolonged cannabis use. Overall, 9% of the total sample were classified as cannabis dependent by the age of 21 years. However, within the reduced sample of early users the rate of subsequent dependence was 21.7%. Almost all (95%) of those classified as cannabis dependent reported using cannabis more than once a week for a period of at least 1 year. On average, sample members classified as cannabis dependent reported using cannabis on 320 (SD, 136) occasions from the age of 16 through 21 years. The overall rate of dependence in this sample (9%) is almost identical to the rate reported in another New Zealand cohort study, the Dunedin Multidisciplinary Health and Development Study, which reported a prevalence of cannabis dependence to the age of 21 years of 9.6%.<sup>16</sup>

### CONFOUNDING FACTORS

Data gathered over the course of the study provided information on a wealth of factors that might confound the relationships between symptom reports among early cannabis users and later cannabis use/dependence. The following factors were selected as potential confounders on the basis of previous research examining cannabis dependence in this cohort<sup>17</sup> and from analyses showing that they were associated with early reactions to cannabis.

### Frequency of Cannabis Use (14-16 Years)

Parallel to questioning on subjective symptoms, at ages 15 and 16 years sample members were also asked about their frequency of cannabis use over the previous 12 months. The information gathered when members were 15 and 16 years old was then summed to provide an estimate of the number of occasions on which the young person had used cannabis over the period from 14 through 16 years old. For most early users the reported frequency of cannabis use was low. The median reported frequency of use was 3 occasions, and more than 70% of users had used on fewer than 10 occasions. However, a minority (13%) reported using on more than 50 occasions from the ages of 14 through 16 years.

### Socioeconomic Status

Family socioeconomic status was assessed at the time of the survey child's birth using the Elley and Irving<sup>18</sup> scale of occupational status for New Zealand. This scale classifies families into 6 occupational groups on the basis of paternal occupation ranging from professional-executive to unskilled-unemployed.

### Changes of Parents (Newborns-15 Years)

As part of the annual assessments to age 15 years, detailed information was obtained on the child's family placement and changes in family composition during the year. This information was used to construct a measure of family instability during childhood based on a count of the number of changes parents experienced during the birth of the child through his or her reaching the age of 15 years. Changes of parents included all changes resulting from parental separation or divorce, reconciliation, remarriage, death, fostering and their related changes.

### Interparental Violence

At the age of 18 years sample members were questioned using items from the Conflict Tactics Scale<sup>19</sup> to assess the extent to which they had witnessed incidents of physical violence or serious threats of physical violence between their parents prior to the age of 16 years. This information was used to derive scale measures of the extent of father-initiated and mother-initiated interparental violence.<sup>20</sup> The reliabilities of these scales, assessed using coefficient  $\alpha$ , ranged from 0.77 to 0.86. For our current analysis the 2 scale scores were combined to provide an overall measure of the extent of interparental violence experienced during childhood.

### Parental Attachment (15 Years)

The quality of attachment to parents was assessed at the age of 15 years using the Armsden and Greenberg parental attachment scale.<sup>21</sup> The full-scale score was used in the present analysis. The reliability of this scale was ( $\alpha=0.87$ ).

### Childhood Sexual Abuse

At the age of 18 years, sample members were questioned about their exposure to childhood sexual abuse (CSA) prior to the age of 16 years. This questioning involved specific probes concerning exposure to a series of 15 unwanted sexual experiences during childhood. These experiences ranged from episodes of noncontact abuse (eg, indecent exposure) to incidents involving sexual fondling or other forms of sexual contact, to incidents involving attempted or completed oral, anal, or vaginal intercourse. Respondents who reported exposure to CSA

were asked a further series of questions relating to the extent and nature of the abuse experience and the characteristics of the perpetrator.<sup>22</sup> The same questioning was repeated at age 21 years. The report data at age 18 and 21 years were combined to derive a 4-level classification of the extent/severity of CSA experienced by the young person. This classification constituted the following: participants reporting no CSA (85.9% of the sample); participants reporting episodes of noncontact CSA (2.7%); participants reporting episodes of contact CSA not involving attempted or completed intercourse (5.1%); and participants reporting CSA involving attempted or completed oral, anal, or vaginal intercourse (6.3%).<sup>22,23</sup>

### Novelty Seeking (16 Years)

This was assessed at the age of 16 years using the novelty-seeking scale of the Tridimensional Personality Inventory.<sup>24</sup> Scale items were summed to produce an overall measure of novelty seeking. This scale was of moderate reliability ( $\alpha=0.76$ ).

### Conduct Problems (15 Years)

The extent of adolescent conduct problems was assessed at the age of 15 years on the basis of parental and self-report measures of conduct disorder and oppositional behaviors. Parental reports were assessed using items relating to conduct disorder behaviors from the Revised Behavior Problem Checklist,<sup>25</sup> whereas self-report behaviors were assessed using items relating to conduct/oppositional defiant disorder from the *Diagnostic Interview Schedule for Children*.<sup>26</sup> For our analysis parent and self-reports were combined into a unidimensional scale reflecting the level of adolescent conduct problems. The combined scale was of high reliability ( $\alpha=0.94$ ).

### Other Substance Use (15 Years)

At the age of 15 years sample members were questioned about their frequency of use of other substances including tobacco and alcohol. The frequency of tobacco use was assessed on a 5-point scale: nonsmoker, smoked less than monthly, smoked at least monthly, smoked at least weekly, or daily smoker. The frequency of alcohol use was based on a count of the number of occasions the young person reported consuming alcohol in the previous 3 months.

### Deviant Peer Affiliations (15 Years)

At the age of 15 years sample members were questioned on a series of custom-written survey items concerning the extent to which their friends used tobacco, alcohol, cannabis, or other drugs; truanted; or broke the law. These self-report items were combined to provide an overall measure of the extent to which the young person affiliated with delinquent or substance using peers.<sup>27</sup> The scale was of moderate reliability ( $\alpha=0.76$ ).

## STATISTICAL METHODS

The strength of association between subjective symptom reports and cannabis dependence (**Table 1**) was assessed by the odds ratio (OR) and the associated 95% confidence interval (CI). The statistical significance of each association was assessed using the  $\chi^2$  test of independence.

The significance of the associations between positive and negative symptom counts and risks of cannabis dependence (**Table 2**) was assessed using the Mantel-Haenszel  $\chi^2$  test of linearity. Estimates of the unadjusted ORs were obtained from logistic regression models. The association between the number of positive symptom reports and risks of cannabis depen-

**Table 1. Rates of Cannabis Dependence (at Age 16-21 Years) by Subjective Responses to Cannabis (at Age 14-16 Years)**

Symptom	Total No. of Subjects	Subjects Who Were Cannabis Dependent (at Age 16-21 y), %	OR (95% CI)	P Value
Positive symptoms				
Got really high				
No	113	12.4	1.0	
Yes	85	34.1	2.8 (1.6-4.9)	<.001
Felt happy				
No	57	5.3	1.0	
Yes	141	28.4	7.1 (2.1-24.1)	<.001
Felt relaxed				
No	52	7.7	1.0	
Yes	146	26.7	4.4 (1.5-12.9)	.004
Did silly things				
No	138	16.7	1.0	
Yes	60	33.3	2.5 (1.2-5.0)	.009
Laughed a lot				
No	62	8.1	1.0	
Yes	136	27.9	4.4 (1.6-11.9)	.002
Negative symptoms				
Felt ill, dizzy				
No	150	19.3	1.0	
Yes	48	29.2	1.7 (0.8-3.6)	.15
Felt frightened				
No	170	21.2	1.0	
Yes	28	25.0	1.2 (0.5-3.1)	.65
Passed out				
No	190	21.1	1.0	
Yes	8	37.5	2.3 (0.5-9.8)	.27

Abbreviations: CI, confidence interval; OR, odds ratio.

**Table 2. Rates of Cannabis Dependence (at Age 16-21 Years) by the Number of Positive and Negative Symptoms (at Age 14-16 Years)**

Measure	Total No. of Subjects	Subjects Who Were Cannabis Dependent, %	OR (95% CI)*
No. of positive symptoms			
0	26	3.9	1.0
1	14	0.0	1.9 (1.4-2.7)
2	33	12.1	3.8 (2.1-7.1)
3	42	19.1	7.5 (3.0-18.9)
4	53	30.2	14.6 (4.4-50.3)
5	30	46.7	28.5 (6.3-133.8)
			<i>P</i> <.001
No. of negative symptoms			
0	141	19.2	1.0
1	35	31.3	1.3 (0.9-2.0)
2+	22	22.7	1.7 (0.8-4.0)
			<i>P</i> =.19

Abbreviations: CI, confidence interval; OR, odds ratio.

\*Odds ratio estimates derived from a linear logistic model in which the log odds of dependence was regressed on the continuous symptom score.

dependence was adjusted for confounding factors using logistic regression methods. The results of the logistic regression analysis were used to derive estimates of the adjusted rate of cannabis dependence and the adjusted OR of dependence for

**Table 3. Associations Between Cannabis Dependence (at Age 16 to 21 Years) and Number of Positive Symptoms (at Age 14 to 16 Years) After Adjustment for Confounding Factors\***

No. of Positive Symptoms	Adjusted % of Subjects Who Were Cannabis Dependent†	Adjusted OR (95% CI)
0	5.2	1.0
1	8.5	1.9 (1.3-2.7)
2	13.3	2.5 (1.7-7.1)
3	19.9	6.6 (2.3-19.0)
4	28.7	12.4 (3.0-50.9)
5	39.1	23.4 (4.0-135.9)

Abbreviations: CI, confidence interval; OR, odds ratio.

\*The covariates (and age of respondent) are frequency of cannabis use (at age 14-16 years); sex; socioeconomic status; childhood sexual abuse; change of parents (at age 0-15 years); interparental violence (at age 0-16 years); parental attachment (at age 15 years); frequency of cigarette smoking (at age 15 years); frequency of alcohol use (at age 15 years); conduct problems (at age 15 years); deviant peer affiliations (at age 15 years); and novelty seeking (at age 16 years).

†*P*=.003.

each level of the number of positive symptom reports (**Table 3**). The adjusted rates were computed using the method described by Lee.<sup>28</sup>

## RESULTS

### ASSOCIATIONS BETWEEN REACTIONS TO EARLY (AGE 14-16 YEARS) CANNABIS USE AND LATER RISKS OF CANNABIS DEPENDENCE BY AGE 21 YEARS

Table 1 lists the associations between a series of measures of early (by the age of 16 years) reactions to cannabis use and risks of later cannabis dependence among the 198 cohort members who reported using cannabis by the age of 16 years. Each association is tested for significance using the  $\chi^2$  test of independence and the strength of association is described by the OR.

The findings in Table 1 indicate a pervasive tendency for early positive reactions to cannabis to be related to significantly increased risks of later cannabis dependence. Odds ratios between positive reactions and cannabis dependence varied from 2.5 to 7.1. However, risks of later cannabis dependence were unrelated to early negative reaction to cannabis.

To explore the linkages among positive reactions to early cannabis use, negative reactions to early cannabis use, and risks of later dependence, 2 simple scale measures were constructed. The first scale was a count of the number of positive reactions to cannabis reported by the age of 16 years, whereas the second was a count of the number of negative responses. Table 2 summarizes the associations between these scale measures and risks of later cannabis dependence. The findings in Table 2 indicate the following: (1) For the positive response scale, there was clear evidence that increasing numbers of positive reactions were associated with increasing rates

of cannabis dependence. This trend is reflected in the ORs associated with each level of the scales. Those reporting 5 positive reactions to cannabis had odds of later cannabis dependence that were 28.5 (95% CI, 6.3-133.8) times higher than those reporting no positive reaction to cannabis. (2) Increasing negative reactions to early cannabis use were unrelated to later cannabis dependence.

#### ADJUSTMENT FOR CONFOUNDING FACTORS

The findings in Tables 1 and 2 do not consider confounding factors that may have been correlated with both early reactions and later dependence. To address this issue, the association between early positive reactions and later cannabis dependence was adjusted for confounding factors using logistic regression (see "Methods" section). The results of this analysis are summarized in Table 3 which reports on the association between the extent of early positive responses and later cannabis dependence after adjustment for a series of confounding factors including the following: the frequency of cannabis use (for 14- to 16-year-olds), sex, socioeconomic status, childhood sexual abuse, parental change and interparental violence, parental attachment, adolescent tobacco and alcohol use, adolescent conduct problems, deviant peer affiliations, and novelty-seeking behaviors. Table 3 provides estimates of (1) the risks of cannabis dependence after adjustment for confounders and (2) ORs after adjustment for confounders. It is evident from both sets of statistics that adjustment for confounding factors had virtually no effect on the associations between early positive reactions to cannabis and later cannabis dependence. After adjustment for confounding factors, young people reporting 5 positive responses to cannabis had odds of later cannabis dependence that were 23.4 (95% CI, 4.0-135.9) times higher than young people who reported no positive response to cannabis.

#### SUPPLEMENTARY ANALYSIS

To examine issues relating to the results in Tables 1 through 3, supplementary analyses were conducted and included the following:

##### Replication of Results Using Data Gathered at Age 15 Years

To determine whether the conclusions drawn depended on the age at which reactions to cannabis were assessed, the results were replicated using data on the early reactions of the 89 young people who had used cannabis prior to the age of 15 years. The findings of this analysis led to almost identical conclusions to those drawn in Table 3: young people reporting 5 early positive responses to cannabis had odds of later cannabis dependence that were 14.4 (95% CI 2.8-82.5) times higher than for those who reported no pleasurable response, even after adjustment for potentially confounding factors. This result suggests that the conclusions drawn were un-

likely to depend on the age at which reactions to cannabis were assessed.

#### Analysis of Frequency of Cannabis Use

The analysis was extended to examine whether early reactions were related to the frequency of later cannabis use in the same way as with the relationship with dependence. This analysis showed the presence of a clear association between early reactions and the frequency of later cannabis use. However, this relationship became non-significant following control for confounding factors. This analysis suggested that early pleasurable reactions to cannabis were more strongly related to the development of dependence than they were to the subsequent frequency of cannabis use.

#### COMMENT

In recent years there has been growing interest in the extent to which early physiological and subjective responses to substances are prognostic of later substance dependence.<sup>1-3</sup> This research has suggested that individuals prone to dependence tend to show different physiological and subjective responses to early substance use than those not prone to dependence. However, this research has been limited to the early effects of nicotine and alcohol and there appears to have been no research into the effects of cannabis.

This study adds to this knowledge by suggesting an association between early subjective responses to cannabis and later risks of dependence with those reporting 5 positive reactions having odds of later dependence that were over 20 times higher than those not experiencing positive reactions. These associations persisted after control for a series of potentially confounding factors. However, there was no association between early negative experiences with cannabis and later dependence. This may, in part, be owing to the fact that negative reactions to cannabis were relatively uncommon. Further analysis suggested that the associations were specific to cannabis dependence rather than reflecting an association between early reactions and later frequency of cannabis use.

These findings add to a growing body of evidence that has suggested that the early subjective and physiological reactions to substances are prognostic of later dependence. It seems likely that these differences in physiological and subjective responses to the early use of substances reflect the presence of underlying genetic differences in susceptibility to substance dependence,<sup>29-31</sup> with this susceptibility being reflected in individual differences in the responsiveness of the mesolimbic dopamine system to substance administration.<sup>11,32,33</sup>

The present study has a number of strengths to the extent that it was derived from a representative birth cohort and has used a prospective design in which reactions to cannabis were assessed prior to the development of cannabis dependence. The latter feature eliminates the possibility of the study results being contaminated by recall bias. There are, however, a

number of limitations of the study that should be kept in mind. First, the study is confined to the reactions of 15- and 16-year-old users of cannabis. It has been clearly documented that this group is an at-risk group for later cannabis dependence<sup>34</sup> with this increase in risk being reflected in the fact that more than 20% had met *DSM-IV* criteria for cannabis dependence by the age of 21 years. However, the research did not examine the linkages between early reactions and later cannabis dependence in those who began their cannabis use after the age of 16 years.

Second, a possible limitation of the study is that individuals varied in their early experience of cannabis from those who had used cannabis on one occasion to those who used cannabis on many occasions. It could be suggested that the association between positive responses to cannabis and later dependence was owing to the fact that those who had used cannabis on many occasions were both more likely to both report positive responses and develop later dependence. However, this explanation is inconsistent with the fact that even after control for the frequency of use of cannabis prior to the age of 16 years, early reactions to cannabis remained related to dependence.

A third possible limitation of the study is that the assessment of cannabis dependence was based on interview data rather than being derived from clinical assessment. It could be proposed that such assessments may have led to false-positive diagnoses that inflated the prevalence of cannabis dependence. The extent of such bias is unknown, but even if such bias were present, it is unlikely that errors in the ascertainment of dependence would be correlated with the reporting of early reactions to cannabis. Under these circumstances, errors in the ascertainment of dependence would lead to the association between early reactions to cannabis and later dependence being underestimated rather than overestimated.<sup>23,35</sup>

A fourth limitation of the study was that reactions to cannabis use were based on reports of reactions to the last use of cannabis and this mode of questioning may have led to an underestimation of the overall rates of positive and negative reactions. Again, the extent of bias created by this is unknown, but it seems likely that underascertainment of reactions to cannabis is likely to have led to an underestimation of the associations between early reactions and later dependence.

Despite these potential limitations, the findings of this study clearly suggest that early positive subjective responses to cannabis were prognostic of later dependence. It will be important for these results to be replicated in other samples to confirm the association. Also, it would be of interest to extend research to use laboratory-based challenge studies to examine the extent to which differences in subjective reactions are paralleled by differences in physiological responses to cannabis administration.

In recent years there has been growing evidence to suggest that the heavy and dependent use of cannabis may have harmful effects in many areas including crime, mental health, susceptibility to other substance use, respiratory function, and low birth weight in pregnant wom-

en.<sup>36-40</sup> Given the high experimental use of cannabis in many societies it is clearly important that those who are susceptible to cannabis dependence are identified at an early stage in the development of dependence. Clinicians should be aware that among their cannabis using patients, those who report early pleasurable reactions to cannabis are likely to be an at-risk group for later cannabis dependence and the other adverse outcomes that have been found to be associated with the heavy use of cannabis.

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