Drug and Alcohol Dependence 59 (2000) 309–318

www.elsevier.com/locate/drugalcdep

One year follow-up of cannabis dependence among long-term users in Sydney, Australia

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Received 25 May 1999; received in revised form 19 October 1999; accepted 19 October 1999

Abstract

Eighty one percent of a sample of long-term cannabis users was followed up at 1 year (162/200). Half (51%) were daily smokers, while 20% had substantially decreased or ceased use. More than half received a dependence diagnosis on each of three measures in the last year, with 44% dependent on all three. Remission was much more common than incidence of dependence. Nevertheless, use and dependence patterns were strongly related over time. Longitudinal analyses revealed that quantity of use and severity of dependence at baseline were the primary predictors of those same variables at follow-up. These data suggest that cannabis use and dependence are fairly stable among long-term users.

Keywords: Cannabis; Dependence; Follow-up; Australia

1. Introduction

Cannabis use is typically initiated in late adolescence, used experimentally or intermittently, and often discontinued by the mid to late 20s (Chen and Kandel, 1995; Hall et al., 1999). A minority proceed to regular, long-term use. Approximately one tenth to one third of those who use on a monthly or more frequent basis at around 20 years of age report doing so in their early thirties (Bachman et al., 1997; Kandel and Davies, 1992). Compared to the rich longitudinal literature on the natural history of regular alcohol use, there is little research on the natural history of regular cannabis use.

Kandel and colleagues' landmark prospective research on the consequences of adolescent drug use has contributed important information on the initiation, escalation and cessation of cannabis and other drug use in the general population. An early age of cannabis use onset, for example, was the major predictor of near-daily cannabis use at age 29 (Kandel and Davies, 1992). While the prevalence of daily use declined into the thirties, cannabis showed the highest persistence of the illicit drugs. Predictors of continued use included being male, frequent use, using to enhance positive and reduce negative feelings, early onset of use, and consumption of other illicit drugs (Chen and Kandel, 1998).

The Monitoring the Future Project (Bachman et al., 1997), studied successive, nationally representative cohorts comprising more than 33 000 young American adults over two decades. It found remarkable individual stability in cannabis use from late adolescence to early adulthood (correlations of approximately 0.9). As with alcohol, there was a modest age-related decline in use from the mid-twenties. Increases in cannabis and alcohol use after high school were attributed to the new freedoms associated with leaving home, while the subsequent decrease reflected new responsibilities such as marriage and parenthood. Because of the low overall prevalence and frequency of cannabis use in these studies, these findings were of little relevance to patterns of dependence.

Longitudinal research on cannabis dependence is rare. One of the few population studies to prospectively address dependence followed 1000 school children on five occasions over 12 years (Newcomb, 1992). Longitudinal analyses of a subset of this group investigated

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predictors of cannabis abuse, a term incorporating DSM-III-R dependence symptoms and items tapping other problem domains. Although cannabis consumption in late adolescence significantly predicted consumption in adulthood, it did not explain abuse, which was predicted by measures of psychosocial vulnerability, risk and protection (e.g. education, religiosity, availability, adult and peer use patterns). However, because this study was conducted on an adolescent population it does not necessarily relate to the experiences of older, more chronic users.

Consumption in adolescence (age 15) was also a strong predictor of consumption in early adulthood (age 21) in a recent prospective study (Poulton et al., 1997). Initiation and escalation of use was more common than remission or decrease in this age group. Almost half of those with a DSM-III-R cannabis dependence diagnosis at 18 were still dependent at 21. Finally, Kandel et al. (1997) calculated estimates of persistence of cannabis dependence from North American epidemiological research. They concluded that nicotine was the most addictive substance with the highest rate of persistence (0.45), followed by alcohol (0.32) and cannabis (0.25). Thus, one in four people with a lifetime diagnosis met criteria for cannabis dependence in the past year.

Unfortunately, the small body of prospective research on regular marijuana users (e.g. Weller and Halikas (1982), Halikas et al. (1983, 1984), Weller and Halikas (1985), Haas (1987), Hendin et al. (1987)) has not addressed the issue of dependence, although it has provided valuable insight into the patterns and experiences of cannabis use over time.

For example, a group of 100 regular users and 50 non-using friends were followed over a 6–8 year period, and changes in cannabis and other drug use patterns, and psychological functioning, were examined (Weller and Halikas, 1982; Halikas et al., 1983; Weller and Halikas, 1985). Users displayed general stability in the reported effects of cannabis, although there was a small decrease in the frequency of desirable effects of use. Use patterns had polarised to either daily or occasional use, although they were significantly correlated with original frequency. There was a general decline in the use of other drugs with the exception of alcohol, and their use was also correlated with that reported initially.

In an attempt to supplement the sparse longitudinal literature on patterns of cannabis use and dependence this paper presents data collected from a 1-year follow-up interview of a sample of long-term cannabis users recruited in Sydney, Australia, as part of an exploratory study of the characteristics, correlates and measurement of cannabis dependence (Swift et al., 1998a,b).

2. Aims

The aims of this study were to: (i) examine patterns and contexts of cannabis use and dependence in long-term users over a 1-year period, and (ii) investigate baseline factors that may be associated with these variables at follow-up.

3. Methods

3.1. Subjects

Eligible subjects were 200 long-term cannabis users who had participated in a comprehensive interview about their patterns and experiences of cannabis use and dependence in 1995–1996 and had provided permission to be contacted for a follow-up interview 12 months later. The recruitment and characteristics of this convenience sample are described elsewhere (Swift et al., 1998a,b). Briefly, participants were recruited from advertisements or by word of mouth. Inclusion in the study required at least 5 years of weekly cannabis use by men, and at least 3 years of weekly use by women. A lower threshold of regular use was allowed for women, as women are less likely than men to be regular cannabis users (Hall et al., 1999). However, 74% of women had been using on a regular basis for at least 5 years, which was the minimum entry criterion for men.

At 12 months, 90% ($n = 179$) were located and 81% ($n = 162$) were re-interviewed. The main reason for non-participation (15 of the 17 clients who were located but lost to follow-up) was a repeated failure to return phone calls or letters or keep appointments. Two clients were lost to follow-up because they returned telephone calls or letters more than 6 months after their follow-up interview was due.

3.2. The interview schedule

The follow-up interview employed a modified version of a structured questionnaire administered at baseline to gather information on the respondents' characteristics and experiences 1 year later. It assessed: demographic characteristics, past and current cannabis use patterns and experiences, other drug use, cannabis supply, cannabis dependence, perceived health effects, general health status, psychological well-being and treatment issues.

Twelve-month cannabis dependence was assessed at follow-up by three of the four instruments administered at baseline. These were a measure of ICD-10 dependence, the short version of the University of Michigan CIDI (short UM-CIDI) and the Severity of Dependence Scale (SDS). The Substance Abuse Module of the

CIDI (CIDI-SAM) (Robins et al., 1990), which had assessed lifetime DSM-III-R dependence at baseline, was not re-administered. The dependence measures and the patterns and correlates of cannabis dependence at baseline have been described elsewhere (Swift et al., 1997, 1998a).

Briefly, ICD-10 dependence was measured by a 10-item scale, which was developed for a Canadian population survey of alcohol and other drug use (Adlaf et al., 1994). It operationalised the six ICD-10 dependence criteria for the last 12 months, and required the occurrence of at least three out of the six criteria in this period for a dependence diagnosis.

The short UM-CIDI (Mroczek and Kessler, 1994; Kessler and Mroczek, 1997) was a nine item screening scale developed from the UM-CIDI, used in the US National Comorbidity Survey (Anthony et al., 1994). It estimated the probability of a DSM-III-R dependence diagnosis during the last 12 months. A score of at least 3 (maximum possible score of 7) indicated probable dependence.

The Severity of Dependence Scale (SDS) was a five item scale assessing a limited number of dependence symptoms (Gossop et al., 1992). It focussed on the degree of 'psychological' dependence, or compulsive use, as evidenced by concern over impaired control. It was included to investigate its applicability to a cannabis-using population, and because its simplicity suggests its potential clinical utility as a screening instrument. It has been found to have good psychometric properties with samples of heroin, cocaine and amphetamine users in the UK and Australia (Gossop et al., 1995, 1997). A receiver operating characteristic (ROC) analysis indicated that a score of 3 or more was the optimal indicator of dependence among long-term cannabis users (Swift et al., 1998a).

3.3. Procedure

This study received appropriate institutional ethics approval. Follow-up interviews were conducted between August 1996 and July 1997, a mean of 383.8 days (S.D. = 21.0, range: 318–485) after the initial meeting had occurred. The respondents were assured that they would not be able to be identified and only the interviewer would have access to their data.

The interview took a median of 35 min to complete (range: 20–125 min). The majority of follow-up interviews (93%) were conducted face-to-face, with the remaining 7% being self-completed and returned by mail if face-to-face interviews were not logistically possible. Participants were thanked and reimbursed up to $AUS20 for costs incurred in attending the appointment. A small number were referred for treatment.

3.4. Data analyses

The analyses compare the characteristics of the follow-up sample to those interviewed at baseline. Descriptive statistics consist of percentages for categorical variables, and means (S.D., range) and medians for normally distributed and skewed continuous variables, respectively. χ^2 Statistics are presented for univariate categorical comparisons and t-tests or Pearson's correlations for continuous variables.

Multivariate linear regression analyses assessed the relationship between cannabis use and dependence at follow-up, and a limited set of variables measuring sociodemographic characteristics, patterns of cannabis use and other drug use collected at baseline. Those variables whose relationship with the outcome variable was significant at $P < 0.1$ in the univariate analyses were included in the regression modelling. While these analyses were exploratory, the choice of variables was based on the available literature. The value of the outcome variable (total score if continuous and proportion if categorical) was used rather than the change score representing the difference between the variables' value at the two interviews (see Streiner and Norman (1995)).

The effect of sample attrition on parameter estimates was assessed by calculating a sample selection hazard, expressing the probability that someone was lost to follow-up as the solution to a logistic regression equation (Berk, 1983). This solution created a continuous score, which represented the probability that an individual would be lost to follow-up and thus not included in the longitudinal analyses. This score was entered as a covariate in the multivariate models to assess the effect of attrition on the model parameters, which are those that would have been observed if there had been no differential sample attrition. The addition of the hazard function was not significant in any model; the β and S.E. parameters changed by only 0.001–0.01 with the addition of the function.

4. Results

4.1. Predictors of participation in follow-up

The baseline ($n = 200$) and follow-up ($n = 162$) samples were compared to investigate characteristics which predicted participation in the 1-year follow-up interview. Univariate analyses revealed a trend towards older participants remaining in the sample (χ^2_{MH}, 1 d.f. = 3.4, $P = 0.07$). Those who were re-interviewed were also more likely to be female (89 versus 75% of males; χ^2, 1 d.f. = 6.5, $P = 0.01$), employed (86 versus 75% who were unemployed; χ^2, 1 d.f. = 3.4, $P = 0.06$), in a relationship (86 versus 75% of those not in a

relationship; χ^2, 1 d.f. = 3.7, $P = 0.06$) and to have used fewer drug classes in the month prior to interview (mean of 2.0 versus 2.7; $t_{50} = 3.3$, $P = 0.002$) than those who were lost to follow-up.

A logistic regression analysis revealed gender and polydrug use remained independently associated with follow-up status (χ^2, 2 d.f. = 20.0, $P < 0.001$). Males remained significantly less likely than females to have participated (adjusted OR = 0.3, 95% CI: 0.1, 0.8; χ^2_{WALD}, 1 d.f. = 6.6, $P = 0.01$), while for every extra drug class consumed, the odds of participating decreased by approximately half (adjusted OR = 0.5, 95% CI: 0.4, 0.8; χ^2_{WALD}, 1 d.f. = 12.4, $P = 0.0004$).

4.2. Demographics

A comparison of the demographic characteristics of the follow-up and baseline samples is presented in Table 1. The increased likelihood of females participating in the follow-up interview is reflected in the decreased proportion of men in this sample (54 versus 58% at the initial interview). The mean age at follow-up was 30.0 years (S.D. = 7.5, range: 18–58) (approximately 1 year older than at baseline); men remained significantly older than women (mean of 32.2 versus 27.4 years; $t_{160} = -4.3$, $P < 0.0001$).

Table 1
Demographic characteristics and cannabis use frequency at follow-up ($n = 162$) and baseline ($n = 200$) interviews

Variable	Follow-up sample			Baseline sample
	Total	Male	Female	
Gender (%)	100.0	53.7	46.3	58.0% Male
Age (years)				
Mean	30.0	32.2	27.4	28.4
Range	18–58	21–58	18-46	17–57
Employment status (%)				
Student	19.1	11.5	28.0	18.5
Employed	70.4	78.2	61.3	56.0
Unemployed	16.0	14.9	17.3	30.0
Pension/benefits	9.3	8.0	10.7	9.5
Lived alone (%)	12.3	18.4	5.3	11.5
In relationship (%)	63.0	55.2	72.0	58.5
Live with dependent children (%)	17.9	12.6	24.0	15.5
Average frequency of use				
Daily	51.2	46.0	57.3	56.1
4–6 Days/week	11.1	13.5	8.0	17.7
2–3 Days/week	13.0	16.1	9.3	19.7
Weekly	6.2	4.6	8.0	6.6
<Weekly	9.9	9.2	10.7	–
–monthly				
<Monthly	0.6	1.1	0	–
No use	8.0	9.2	6.7	–

Less than half (45%) the sample had moved residence in the intervening 12 months (median number of moves: 0; range: 0–6). Seventy percent of this group was currently in full-time, part-time or casual employment, compared to 56% of the initial sample. Living arrangements, and the likelihood of being in a relationship or living with dependent children, remained similar across the two samples.

4.3. Patterns and contexts of cannabis use

One in five (19%) the respondents were now using cannabis less than weekly or not at all (see Table 1). Nevertheless, half the sample (51%) was using cannabis daily, and approximately one third (30%) was using between 1 and 6 days a week. There were no gender differences in frequency of use (χ^2, 6 d.f. = 5.7, $P = 0.5$). The majority of respondents (91%) had used cannabis in the previous month, smoking the equivalent of a mean of 6.7 cones (in waterpipes) per day (S.D. = 6.3, range: 0.1–30). There were no gender differences in the amount smoked (mean of 6.9 for women versus 6.5 for men; $t_{145} = 0.4$, $P = 0.7$).

On the whole, use patterns remained fairly stable, with two thirds (66%) reporting current use levels had persisted for at least 1 year. Of the 13 people no longer using, one had been abstinent since the initial interview, four for between 6 months and a year, and eight for between 1 and 6 months. One third (32%) believed their level of use was the same as at the initial interview. Half believed they had decreased their use (either by smoking less frequently or by smoking less on each use occasion), and 18% claimed they had increased. The participants cited the major reasons for increased use to be stress (29% of those who had escalated use), availability (25%), and enjoyment (18%). The most commonly cited reasons for decreased use were boredom with smoking (35% of those who used less frequently), lack of money (23%), and change of life circumstances (20%).

The most common route of administration in the last year remained smoking in a waterpipe or 'bong' (83%), followed by smoking joints (51%). Not surprisingly, the sample continued to prefer the 'heads' of the cannabis plant (91%), with one in five (22%) using leaf. The majority of respondents (80%) also continued to combine cannabis with tobacco in their 'bongs' or joints (mean = 35.6%, S.D. = 14.4, range: 4–75%). The locations and times of use, and the people with whom they smoked, remained largely unchanged.

4.4. Other drug use

The majority of participants had continued to use drugs other than cannabis in the period to follow-up (99% had used at least once and 93% had used at least

Table 2
Prevalence (%) of 12-month ICD-10 diagnoses, and prevalence and rank ordering of ICD-10 symptoms among follow-up ($n = 162$) and baseline ($n = 200$) samples

Rank ordered symptoms (most–least common)	Follow-up sample			Baseline sample (rank order)
	Total	Male	Female	
1 Strong urge to use	82.7	83.9	81.3	86.5 (1)
2 Difficulties in controlling use	57.4	52.9	62.7	60.5 (3)
3 Neglect of activities/interests	53.1	49.4	57.3	60.8 (3)
4 Tolerance #	50.6	50.6	50.7	62.1 (2)
5 Kept using despite physical/psychological problems	45.7	42.5	49.3	52.3 (5)
6 Withdrawal/withdrawal relief	30.9	32.2	29.3	32.0 (6)
Dependent #				
Three or more criteria*	61.7	58.6	65.3	71.7
Mean criteria	3.2	3.1	3.3	3.6
Range	0–6	0–6	0–6	0–6

Significant difference in prevalence between baseline and follow-up.
* ROC analyses indicated that this was the most appropriate cut-off in this sample (Swift et al., 1998a).

monthly). Alcohol (97% had used and 75% had used at least monthly) and tobacco (79% had used and 70% had used at least monthly) were the most commonly used drugs, as they were at baseline. In addition, hallucinogens (44%), amphetamine (34%), cocaine (27%) and benzodiazepines (24%) had been used by between one quarter and almost one half of the sample. However, less than 10% of the participants had used drugs other than alcohol and tobacco on a greater than monthly basis during this time. One quarter of the sample (24%) claimed to have experienced a problem or to have sought professional help for a drug other than cannabis since the initial interview.

4.5. Cannabis dependence

The majority of participants (92%) had received a lifetime DSM-III-R cannabis dependence diagnosis at baseline, according to the CIDI-SAM, and 40% were assessed to be severely dependent. In addition, 72, 77 and 62% of participants met 12-month cannabis dependence diagnoses according to the ICD-10 measure, the short UM-CIDI and the Severity of Dependence Scale, respectively (Swift et al., 1997, 1998a).

Nearly half (44%) of the participants received a dependence diagnosis according to all three operationalisations of dependence during the intervening 12-month period. Fourteen percent of participants were classified as dependent on only one measure, while 23% were dependent on two. Two people (both males) with a lifetime diagnosis of cannabis abuse at baseline (but no lifetime or current dependence diagnosis on any of the four dependence measures) were subsequently diagnosed as dependent on at least one of the instruments at follow-up. Conversely, 24 people (14 men and 10 women) who had an active dependence diagnosis at baseline (i.e. in the last year) were not diagnosed as dependent using any of the instruments at follow-up.

4.5.1. ICD-10 dependence

Almost two thirds of the respondents (62%) qualified for an ICD-10 diagnosis of dependence in the intervening year, experiencing an average of 3.2 criteria (S.D. = 1.9; range: 0–6) (see Table 2). There were no gender differences in the likelihood of receiving a diagnosis (59% of men versus 65% of women; χ^2, 1 d.f. = 0.8, $P = 0.4$) or in the number of criteria met at follow-up (mean of 3.3 for women and 3.1 for men; $t_{160} = 0.7$, $P = 0.5$). Significantly fewer follow-up respondents were dependent on this instrument at follow-up than at baseline (62 versus 72% of the baseline sample; $\chi^2_{\text{McNEMAR}} = 4.9$, $P = 0.03$). Thirty-one respondents were dependent at baseline but not at follow-up, while 15 people received an ICD-10 diagnosis at follow-up but not at initial contact. The rank ordering of dependence symptoms was largely unchanged from baseline, with the exception of tolerance, which dropped from the second to the fourth most frequently reported symptom (51 versus 62% at baseline; $\chi^2_{\text{McNEMAR}} = 9.5$, $P = 0.002$).

4.5.2. DSM-III-R (short UM-CIDI) dependence

The short UM-CIDI diagnosed 70% of the sample with DSM-III-R cannabis dependence in the last year (see Table 3); the mean score was 3.7 (S.D. = 2.1, range: 0–7). There were no gender differences in total UM-CIDI scores (a mean of 3.8 for women and 3.5 for men; $t_{159} = 0.7$, $P = 0.5$) or in the likelihood of receiving a dependence diagnosis at follow-up (69% of women versus 70% of men; χ^2, 1 d.f. = 0.03, $P = 0.9$). Twenty-five respondents were dependent according to this instrument at baseline but not at the follow-up interview, while 14 were dependent at follow-up that had not been dependent at baseline.

Although a smaller proportion of the follow-up group were diagnosed as dependent (70 versus 77% of

the initial sample), this difference was not significant ($\chi^2_{McNEMAR} = 2.6$, $P = 0.1$). The following items were significantly less frequently endorsed at the follow-up than the baseline interview: intoxication while at work, school or with children (53 versus 63% of baseline: $\chi^2_{McNEMAR} = 3.7$, $P = 0.05$), spending a lot of time using and recovering from cannabis (51 versus 66%; $\chi^2_{McNEMAR} = 8.5$, $P = 0.004$) and tolerance (56 versus 66%; $\chi^2_{McNEMAR} = 5.4$, $P = 0.02$). Subsequently, the rank ordering of symptoms reflected the changes in individual symptom prevalence.

4.5.3. SDS dependence

The mean SDS score was 4.1 (S.D. = 3.4; range: 0–14) and 61% of the sample met cannabis dependence criteria in the last year (Table 4). There were no significant differences between the proportions diagnosed at follow-up or baseline (62%) ($\chi^2_{McNEMAR} = 0.0$, $P = 1.0$). Seventeen respondents were dependent on the SDS at baseline but not at follow-up, while another 17 qualified for a diagnosis at follow-up after receiving no diagnosis at baseline. There were no gender differences in SDS score (mean of 4.6 for women versus 3.7 for men; $t_{137} = 1.8$, $P = 0.1$), and women were no more likely to be dependent than men at follow-up (63 versus 60% of men; χ^2, 1 d.f. = 0.1, $P = 0.7$).

4.6. Cannabis use as a problem

One third of the baseline and follow-up groups believed they had a problem with their cannabis use at least sometimes. Compared to baseline, where women and men were equally likely to believe they had a cannabis problem (43% of women versus 35% of men), women were more likely than men to hold this belief at follow-up (43 versus 26%; $\chi^2 = 5.0$, $P = 0.03$).

Almost half the sample (44%) reported cannabis-related social or legal problems in the last year. These were problems with family (19%), friends (16%), work (12%), study (17%) or the law (4%). Although women were more concerned about their cannabis use as a whole than men (as reported above), there were no gender differences in the likelihood of reporting any of these specific problems (both 44%; χ^2, 1 d.f. = 0.002, $P = 0.97$).

4.7. Treatment issues

Nearly two thirds of this sample (62%) had attempted to moderate their use in the period between baseline and follow-up, with the majority doing so unassisted (92% of those who had decreased/stopped). The most commonly reported reasons for moderating use were: physical or psychological health concerns (43% of those who had moderated), boredom with cannabis use or concerns they were using too much (27%), lack of money (26%), and life circumstances (12%). Relapse was most commonly due to stress or negative moods (27%), availability (25%) and enjoyment of smoking (18%).

Only eight people had sought assistance to moderate their use in this time. Seven had been to a drug counsellor, residential or detoxification service, and one person had seen a psychiatrist. One third (32%) of the sample had been questioned about their cannabis use by, or discussed their use with, a health professional such as a general practitioner, in the last year.

4.8. Stability of use and dependence

Stability of use and dependence was assessed for the 162 people who participated in both interviews. As

Table 3
Prevalence (%) of 12-month short UM-CIDI diagnoses, and prevalence and rank ordering of short UM-CIDI symptoms among follow-up ($n = 162$) and baseline ($n = 200$) samples

Rank ordered items (most–least common)	Follow-up sample			Baseline sample (rank order)
	Total	Male	Female	
1 Intoxicated in a situation where could be hurt	60.5	64.4	56.0	64.0 (3)
2 Tolerance #	56.2	52.9	60.0	66.0 (1)
3 Intoxicated at work, school, while caring for children #	53.1	54.0	52.0	62.5 (4)
4 Often used larger amounts/for longer ($n = 161$)	50.9	49.4	52.7	54.0 (5)
5 Spent a lot of time on cannabis #	50.6	48.3	53.3	66.0 (1)
6 Irresistible urge to use	48.8	47.1	50.7	46.2 (6)
7 Cannabis use caused psychological problems	44.4	37.9	52.0	44.5 (7)
Dependent ($n = 161$)				
At least three symptoms*	69.6	70.1	68.9	76.9
Mean symptoms	3.7	3.5	3.8	4.0
Range	0–7	0–7	0–7	0–7

Significant difference in prevalence between baseline and follow-up.

* ROC analyses indicated that this was the most appropriate cut-off in this sample (Swift et al., 1998a).

Table 4
Prevalence (%) of 12-month SDS diagnoses and symptoms among follow-up ($n = 162$) and baseline ($n = 200$) samples

Symptoms	Follow-up sample			Baseline sample
	Total	Male	Female	
Out of control				
Never/almost never	45.1	48.3	41.3	46.5
Sometimes	37.7	42.5	32.0	39.5
Often	12.3	6.9	18.7	8.5
Always/nearly always	4.9	2.3	8.0	5.5
Anxious without use				
Never/almost never	39.5	37.9	41.3	32.5
Sometimes	41.4	51.7	29.3	51.0
Often	14.2	6.9	22.7	10.0
Always/nearly always	4.9	3.4	6.7	6.5
Worry about use				
Not at all	29.6	31.0	28.0	28.0
A little	51.2	54.0	48.0	57.0
Quite a lot	14.8	12.6	17.3	10.0
A great deal	4.3	2.3	6.7	5.0
Wish to stop				
Never/almost never	48.1	49.4	46.7	48.5
Sometimes	32.1	35.6	28.0	37.0
Often	13.6	11.5	16.0	10.0
Always/nearly always	6.2	3.4	9.3	4.5
Difficulty stopping				
Not difficult	46.3	46.0	46.7	44.0
Quite difficult	32.7	36.8	28.0	35.0
Very difficult	16.7	14.9	18.7	15.5
Impossible	4.3	2.3	6.7	5.5
Dependent				
Score 3 or more*	61.1	59.8	62.7	61.5
Mean	4.1	3.7	4.6	4.0

* ROC analyses indicated that this was the most appropriate cut-off in this sample (Swift et al., 1998a).

Table 5 shows, patterns of frequency and quantity of use were relatively stable over the year.

A similar pattern was evident for dependence, when stability was assessed as the correlation between total dependence scores on both occasions, or as the unadjusted odds of being dependent on each of the three measures at follow-up if a respondent was dependent on that measure at baseline. Dependence was most stable when measured by the SDS, followed by the short UM-CIDI and the ICD-10 measure of dependence. Furthermore, a respondent was approximately 19 times more likely to believe they had a cannabis problem at follow-up if they also believed this initially.

4.9. Longitudinal multivariate analyses

Longitudinal multivariate analyses investigated the relationship between the respondents' demographic and cannabis use patterns at the baseline and follow-up interviews. The outcomes evaluated at follow-up were quantity of cannabis use and severity of cannabis dependence.

4.9.1. Quantity

Univariate analyses showed quantity of cannabis used at follow-up had a small negative correlation with age of first use ($r = -0.19$), small positive correlations with baseline severity of ICD-10 ($r = 0.14$) and DSM-III-R (short UM-CIDI) ($r = 0.21$) dependence, and a moderate positive correlation with baseline frequency of use ($r = 0.44$). It was most strongly related to the quantity of cannabis used at the initial interview ($r = 0.62$).

Two multiple regression analyses were conducted, containing the age of first use, initial quantity and frequency of use and the two measures of dependence severity. In both cases, the final model ($F_{1,158} = 98.2$, $P < 0.001$) revealed that only the transformed value of the quantity of cannabis used at baseline ($\beta = 0.49$, S.E. $= 0.05$, $t = 9.9$, $P < 0.001$; $R^2 = 0.38$) predicted the transformed value of the quantity used a year later.

4.9.2. Severity of dependence

For each dependence measure, the strongest univariate predictor was the score on that same measure 1 year previously (ICD-10: $r = 0.57$; short UM-CIDI: $r = 0.60$; SDS: $r = 0.71$). Age (range: $r = -0.17$– -0.29), years of cannabis use (range: $r = -0.19$– -0.30), and quantity (range: $r = 0.28$–0.37) and frequency of use (range: $r = 0.19$–0.25) at baseline, also predicted severity of

Table 5
Stability of use and dependence measures defined by (a) correlations between frequency and quantity of use and severity of dependence at baseline and follow-up (column 2), and (b) the unadjusted odds of being diagnosed as dependent or reporting a cannabis problem at follow-up if reported at baseline (column 3) ($n = 162$).

Variable	Correlation*	Unadjusted OR (95% CI)
Frequency of use	$\theta = 0.58$	N/A
Quantity used #	$r = 0.62$	N/A
Short UM-CIDI	$r = 0.61$	6.7 (3.0, 14.7)
ICD-10 measure	$r = 0.57$	5.4 (2.6, 11.4)
SDS	$r = 0.71$	13.1 (6.1, 28.0)†
Problematic use	N/A	18.6 (7.8, 44.3)

Measured as the log (ln) of standard cones consumed per day at baseline, and as the log (ln) of 1 plus number of standard cones consumed per day in the month prior to follow-up.

† OR calculated using cut-offs estimated in ROC analysis (i.e. dependent if scored 3 or more) (Swift et al., 1998a).

* All $P < 0.0005$.

dependence 1 year later. Gender and the number of drug classes a respondent had used was related only to the SDS score.

Multiple linear regressions revealed that after adjusting for age, quantity and frequency of cannabis use, severity of ICD-10 ($F_{1,158} = 75.7$, $P < 0.001$; $R^2 = 0.32$) and short UM-CIDI ($F_{1,158} = 89.7$, $P < 0.001$; $R^2 = 0.36$) dependence at follow-up was predicted solely by severity of dependence on each instrument at the initial interview (ICD-10: $\beta = 0.65$, S.E. $= 0.07$, $t = 8.7$, $P < 0.001$; short UM-CIDI: $\beta = 0.68$, S.E. $= 0.07$, $t = 9.5$, $P < 0.001$).

Finally, after adjusting for age, gender, quantity and frequency of cannabis use, the SDS score at follow-up ($F_{2,159} = 87.9$, $P < 0.001$; $R^2 = 0.53$) was predicted by the SDS score 1 year prior ($\beta = 0.78$, S.E. $= 0.06$, $t = 13.0$, $P < 0.001$) and the number of drug classes the respondent had ever tried at the initial interview ($\beta = -0.25$, S.E. $= 0.10$, $t = -2.6$, $P = 0.01$). There was a negative relationship between polydrug use and SDS score, such that those who had used fewer drugs at the initial interview were more concerned about their cannabis use at follow-up.

5. Discussion

A respectable 81% of the baseline sample was re-interviewed at 1 year. While younger, polydrug using males were significantly less likely to be interviewed at follow-up differential attrition had no effect on the predictors of the follow-up variables.

Consistent with other research (e.g. Halikas et al., 1984), cannabis use patterns remained fairly stable, with at least moderate correlations between frequency and quantity of use at the two interviews. Longitudinal multivariate analyses revealed that after adjusting for confounders, only quantity of cannabis used at the initial interview predicted the quantity used at follow-up. Bachman et al. (1997) claimed their findings of substantial stability in cigarette, alcohol and marijuana use in late adolescence and early adulthood reflected relatively stable individual differences in personality and social environments (see also Stein et al. (1987)). Likewise, within the relatively short period assessed here there was little change in many of the demographic characteristics and drug using contexts of the participants.

Despite this general stability, one in five follow-up participants had markedly decreased their use, typically without professional intervention. Halikas et al. (1984) noted a polarisation in cannabis use frequency at their 6-year follow-up. It is possible that the data reported here reflects the beginning of this process in this group — with half remaining daily users, and an increasing proportion using less than weekly. However, the 1-year time period may be insufficient to reveal such a trend, particularly given the limited range of changes in behaviour. Further follow-up data are required to assess the longevity and nature of these changes.

There had been little change in the respondents' reasons for, and experiences of, cannabis use, or in the contexts of use. Alcohol and tobacco remained the most commonly used drugs other than cannabis, with regular use of other illicit drugs infrequent. This was not surprising given the lack of persistence of illicit drug use found in general population and long-term user samples in this age group (Halikas et al., 1984; Chen and Kandel, 1995).

Despite some movement into and out of dependence, and minor changes in the rank ordering of some dependence symptoms, dependence was fairly stable over the 1-year follow-up period. This was reflected in the correlations between total dependence scores, and the odds ratios between diagnoses at both interviews. Finally, longitudinal analyses confirmed these data, showing the main predictor of dependence severity on each instrument at follow-up was the corresponding dependence score at baseline. Moderate stability has been reported for depression, anxiety and stress, measured by standardised questionnaires over a 3–8 year period (e.g. Lovibond (1998)). However, there is little comparative literature examining this issue among long-term drug users who are not seeking assistance to abstain from use.

Stability of dependence among the population-based ECA sample was assessed at a one-year follow-up (Regier et al., 1993). Unlike the ECA sample, in which there were more incident cases of substance dependence during the follow-up period than there were prevalent cases at baseline, there was a greater stability in the point prevalence of dependence in this heavy using group. Despite the dynamic nature of dependence, among a group of established users such as this, there may be less relative change in the prevalence of dependence symptoms than among general population samples, in whom the overall prevalence is much lower (see also Hasin and Paykin (1998)).

Further research is required to more fully understand the dynamics of cannabis dependence among different groups of users across time. Given the complexity of use and dependence processes, the limited predictors identified here need to be considered in the context of a broader set of biological, psychological and socio-cultural factors in order to fully understand their contribution and interaction (e.g. see Edwards and Lader (1994) and Rutter (1994)). Other interesting issues include the stability of individual symptoms versus an overall dependence diagnosis, and the factors associated with changes in dependence severity, the 'remission' of the syndrome and its recurrence. There is conflicting evidence for a natural progression of symptoms across

time (e.g. Chick and Duffy (1979), Smart (1994), Langenbucher and Chung (1995)), so the extent of flexibility in symptom expression once the 'full-blown' syndrome has become apparent is uncertain. It has been suggested that the temporal patterning of dependence symptoms may influence the persistence of a dependence syndrome (Nelson et al., 1996).

One third of the sample expressed concern over their cannabis use and almost half reported a cannabis-related legal, work, study, or social problem in the last year. Nevertheless, the importance of the positive effects of cannabis should not be under-estimated when considering the reasons for persistence of use and relapse, and the ambivalence many participants displayed between reporting dependence symptoms and believing their cannabis use to be a problem.

In summary, this group of long-term users appeared to be "both persistent and flexible" (Halikas et al., 1984) with their cannabis use. Although the time frame investigated here was only a year, it nevertheless allowed some insight into the factors associated with use patterns among a group of cannabis users rarely addressed in the literature. Further interviews are required with this group over several years in order to ascertain the nature, extent and correlates of changes versus the persistence of behaviour, which may assist in our understanding of the experience of long-term use and dependence.

Finally, some general cautions about the limitations of the study must be noted. Firstly, the recruitment of a convenience sample does not guarantee a representative sample of long-term cannabis users. Given the difficulties of estimating the total sample of long-term cannabis users, convenience samples provide a feasible method of assessing research questions, and complement the sparse population-based literature on cannabis dependence. However, these data are likely to provide estimates at the extreme end of the dependence distribution, compared to the more modest estimates generated from population-based research such as the National Comorbidity Survey (Anthony et al., 1994). Further, the present sampling technique may have recruited users with more similar characteristics and produced more stable estimates of persistence of dependence, than a representative sample of long-term users from the general population. Although costly, such comparative data would allow for a more accurate evaluation of the prevalence and dynamics of dependence.

Secondly, reliance on self-report raises the possibility of mis-reporting of use and the consequences of use. However, attempts were made to limit such problems through guarantees of anonymity and confidentiality, and most participants were genuinely interested in assisting in research on this topic. Further, the restriction of the follow-up period to 12 months may minimise the uncertainty about recall of symptoms over longer time periods.

Acknowledgements

This research was funded by a National Drug Strategy Research Scholarship, Commonwealth Department of Health and Family Services. Professors Robin Room, of The Centre for Social Research on Alcohol and Drugs, Sweden, and Ronald Kessler, of the Harvard Medical School, USA, gave permission to use the ICD-10 measure of dependence and the short UM-CIDI, respectively. Dr Michael Lynskey provided valuable advice on the longitudinal analyses. We also thank the study participants who agreed to be involved in ongoing research on their experiences of cannabis use.

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