Drug and Alcohol Dependence 143 (2014) 239–243

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Cannabis use in adolescence and risk of future disability pension: A 39-year longitudinal cohort study

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ARTICLE INFO

Article history:
Received 19 May 2014
Received in revised form 28 July 2014
Accepted 29 July 2014
Available online 12 August 2014

Keywords:
Cannabis
Adolescence
Disability pension
Cohort study

ABSTRACT

Aims: This study aimed at examining a possible association between cannabis use in adolescence and future disability pension (DP). DP can be granted to any person in Sweden aged 16–65 years if working capacity is judged to be permanently reduced due to long-standing illness or injury.
Methods: Data were obtained from a longitudinal cohort study comprising 49,321 Swedish men born in 1949–1951 who were conscripted to compulsory military service aged 18–20 years. Data on DP was collected from national registers.
Results: Results showed that individuals who used cannabis in adolescence had considerably higher rates of disability pension throughout the follow-up until 59 years of age. In Cox proportional-hazards regression analyses, adjustment for covariates (social background, mental health, physical fitness, risky alcohol use, tobacco smoking and illicit drug use) attenuated the associations. However, when all covariates where entered simultaneously, about a 30% increased hazard ratio of DP from 40 to 59 years of age still remained in the group reporting cannabis use more than 50 times.
Conclusions: This study shows that heavy cannabis use in late adolescence was associated with an increased relative risk of labor market exclusion through disability pension.

1. Introduction

Worldwide, marijuana is among the most widely used illicit drugs (UNODC, 2012). According to the European Drug Report 2013, 85 million adults, a quarter of the European population, have used drugs, and 77 million have used cannabis (EMCDDA, 2013). Increasing number of studies show that cannabis is associated with a variety of psychiatric and somatic diseases, such as anxiety (Degenhardt et al., 2012), schizophrenia (Andréasson et al., 1987; Zammit et al., 2002), depression (Lev-Ran et al., 2013), dependence (Cox et al., 2007), lung cancer (Callaghan et al., 2013), and myocardial infarction (Thomas et al., 2014). Still, much of the relationship between cannabis use and health effects remains unclear.

Furthermore, cannabis use seems to be associated with a range of social and socioeconomic consequences, such as impaired cognitive functioning (Harvey et al., 2007), low educational attainment (Horwood et al., 2010; Legley et al., 2010), and educational problems (Degenhardt et al., 2010). Also, cannabis use has been found to be systematically higher in individuals with a low socioeconomic position (Redonnet et al., 2012). One recent study related cannabis use with lower work commitment (Hyggen, 2012) and another showed that frequent cannabis users tend to be at increased risk for receiving social welfare assistance (Pedersen, 2011). However, the number of studies in this area is few, and there is to our knowledge no previous study investigating the possible impact of cannabis use on future disability pension (DP).

DP can be granted to any person in Sweden aged 16–65 years if working capacity is judged to be permanently reduced due to long-standing illness or injury (Statistics Sweden, 2009). In most cases, it provides full-time compensation and implies a permanent exclusion from the labor market. Sweden is among the countries with the highest prevalence and largest public spending on DP (OECD, 2009). In 2010 approximately 8% of the Swedish population received DP with psychiatric and musculoskeletal disorders as the most common diagnoses (Mulder, 2011). Previous studies have reported an

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http://dx.doi.org/10.1016/j.drugalcdep.2014.07.038

association between lower cognitive ability and DP (Sörberg et al., 2013), and lower level of education and DP (Johansson et al., 2012). Also, mild psychological distress, personality characteristics (e.g., low emotional control), low frequency of physical activity, tobacco use and alcohol use in adolescence, especially "risk use", have been associated with increased risk of obtaining DP (Rai et al., 2012; Ropponen and Svedberg, 2013; Sidorchuk et al., 2012; Upmark et al., 1999).

Considering the association between cannabis use and psychiatric disorders (e.g. Degenhardt et al., 2012; Lev-Ran et al., 2013; Zammit et al., 2002), there are reasons to believe that cannabis use would be associated with DP. In this study, we will therefor make use of a cohort study spanning over nearly 40 years to investigate (1) if there is an association between cannabis use in adolescence and future DP and (2) if possible associations persist after adjustment for a number of potential covariates.

2. Methods

2.1. Study population

The study cohort, comprising 49,321 Swedish men has been described in detail elsewhere (Andréasson et al., 1987).

In short, our study is a register follow-up to the cohort study including all Swedish men born in 1949–1951 who were conscripted to compulsory military service in 1969–1970 (aged 18–20 years). The cohort covers approximately 97.7% of the Swedish male population at that time. Those not participating were exempted due to severe handicaps or congenital disorders. At time for conscription all men answered two questionnaires, one focused on alcohol consumption, tobacco and illicit drug use, and the other was based on questions on family and social background, school performance, psychological factors, behavior and adjustment and self-rated health. In addition to this, they went through physical and psychological tests and a physician diagnosed physical and mental disorders according to the Swedish version of the International Classification of Disease (ICD) 8th revision (ICD-8). Those with a psychiatric disorder were also examined by a psychiatrist.

2.2. Study exposure

The study exposure is self-reported cannabis use at time for conscription. Questions were asked whether subjects had ever used drugs (including cannabis), which drugs had ever been used, first drug used, drug most commonly used, frequency of use and questions regarding use of specific drugs from a list with alternatives. The question about frequency of use had fixed response alternatives; never, 1–2 times, 3–10 times (those two categories were collapsed into one; 1–10 times), 11–50 times and >50 times, that were used in our analyses.

2.3. Study outcome

The study outcome is first time of being granted DP between 20 and 59 years of age. Data on DP was collected from the National Social Insurance Agency for the years 1971 to 1989 and from Longitudinal Register of Education and Labor Market Statistics from 1990 to 2008.

DP was categorized into three groups, i.e., overall (aged 20–59), early DP (aged 20–39) and late DP (aged 40–59). A majority of all disability pensions occur during the second part of working life, i.e. after the age of 40.

2.4. Study covariates

Based on previous studies on DP, we accounted for the following covariates:

2.4.1. Social background. Social background including childhood socioeconomic position (SEP), i.e., at the age of 9 years, which was based on the father's occupational position, from the National Population and Housing Census 1960 and categorized as unskilled workers, skilled workers, non-manual worker at low, intermediate or high level, farmers and no occupation, divorced parents (yes or no), and short education (studying at time for conscription vs not studying).

2.4.2. Mental functions. Mental functions were measured by emotional stability (in general being calm vs being nervous/anxious/aggressive on a five level scale), social maturity (levels of extraversion, initiative, independence, and responsibility, on a five level scale) (Sörberg et al., 2013) and intelligence, measured on a Stanine scale, which is based on scores from multiple tests (Sörberg et al., 2013). Primarily, low scores on these measures aimed to identify individuals with vulnerability to stress and difficulties with social adjustment. We also included having been diagnosed with a psychiatric disease (according to ICD-8) at conscription in our analyses.

2.4.3. Health behavioral factors. Health behavioral factors included alcohol consumption, measured by risk use, defined as having at least one of the following; ever been apprehended by the police for drunkenness, ever taken an eye-opener, been drunk often/quite often, drinking ≥250 g of alcohol per week. Moreover, tobacco smoking, categorized into 0, 1–5, 6–10, 11–20, and >20 cigarettes/day, body mass index (weight/height (m)^2, and physical fitness measured by performance on a bicycle ergometer test (Åberg et al., 2014), were included. In addition, we adjusted for having ever used other illicit drugs, e.g., amphetamine, morphine, LSD and Opium (ever vs. never).

2.5. Follow-up

Using unique Swedish personal identification numbers, the conscript cohort was linked to National Social Insurance Agency register data and to the Longitudinal Register of Education and Labor Market Statistics (DP status and DP granting); see Fig. 1 for detailed time line.

2.6. Statistical analysis

To assess the possible association between cannabis use at ~18 years of age and future DP, Cox proportional-hazards regression was used to estimate hazard ratios (HRs) with 95% confidence intervals (CIs).

First, crude associations were examined, and thereafter blocks of potential covariates, such as social background, mental function and health behavior factors were included (model a, b and c in Table 2) in the regression model, and finally all potential covariates were included simultaneously (models a–c in Table 2). All covariates were dichotomised (present/absent) for descriptive purpose (Table 1) but were used in full in the regression analysis (Table 2).

In the cohort 43,587 men had full information on all variables and were included in the analytical sample.

3. Results

Nine percent reported cannabis use at 18 years of age. Table 1 presents the frequency distribution of all covariates. About 654 persons (1.5%) reported having used cannabis more than 50 times. In this group, many of the examined risk factors were present to a considerably greater extent than in the other groups, with for example 55% having a psychiatric diagnosis, 74% having low emotional stability, 65% having low social maturity, 47% reporting risky alcohol use, and 80% also reporting having used other drugs.

Unadjusted, cannabis use in adolescence was associated with increased hazard ratios of future DP in all groups (Table 2). The hazard ratios increased in a graded manner, i.e., the more frequent cannabis use in adolescence, the higher was also the hazard ratio of future DP. When adjusted for covariates, the associations were attenuated; especially when adjusting for health behavioral factors in the groups reporting cannabis use 50 times or less. However, when all covariates where entered simultaneously, the increased hazard ratio of DP remained statistically significant only in the group receiving late DP and reporting cannabis use more than 50 times.

4. Discussion

We found that having used cannabis more than 50 times in adolescence increased the risk for future DP. The increased risks remained to some extent when adjusted for social background, mental function and health behaviors, although they were substantially attenuated. The associations were only statistically significant for individuals receiving late DP. Among those receiving DP in Sweden the great majority is 40 years or older and in our cohort they comprised 84%. This is to the best of our knowledge, the first study reporting the association between cannabis use in adolescence and risk of future DP.

Our results are partially in line with previous research, reporting cannabis use to be associated with exclusion from the labor market. Cannabis users have been found less likely to be in work (Davstad et al., 2013). It has been reported that frequent cannabis users are at increased risk for receiving social welfare assistance; they have been observed to have longer periods of receiving social

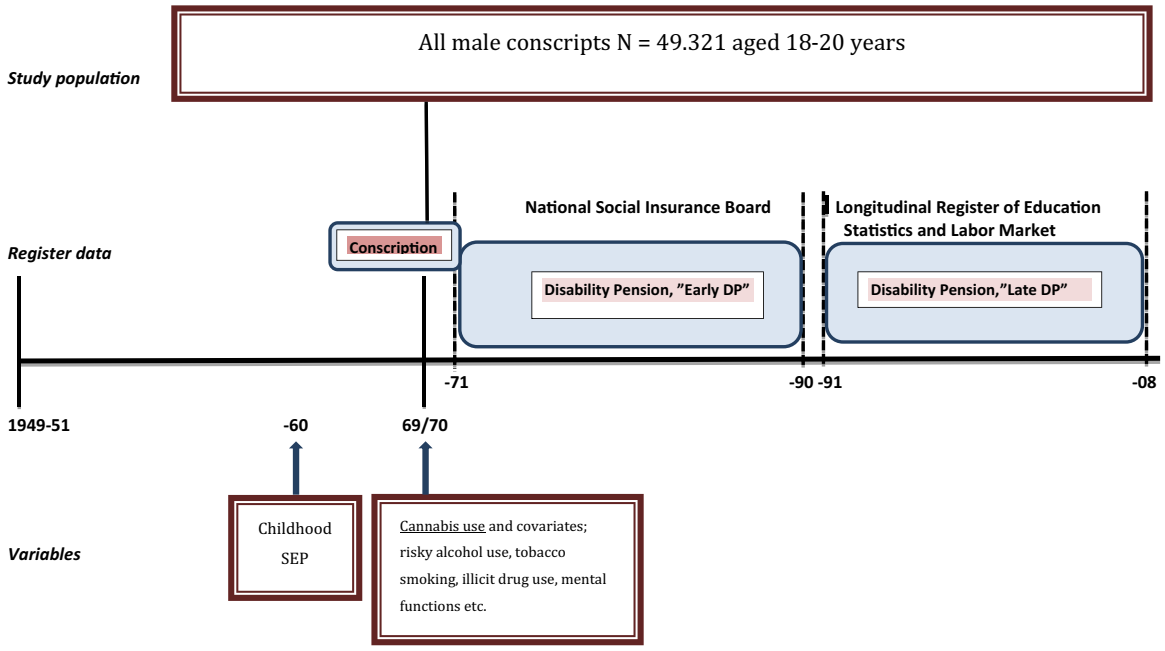

Fig. 1. Timeline showing conscript cohort, record linkages and timing of surveys. The cohort consisted of all 49,321 Swedish males presenting for mandatory conscription at ages 18–20 years.

Table 1
Distribution of covariate frequencies (%) across categories of cannabis consumption at ~18 years of age.

	Cannabis consumers				
	Overall	Never	1–10 times	11–50 times	>50 times
N	43,587	39,701	2612	620	654
Covariates[a]					
Social background					
Low childhood SEP	33.3	33.6	30.7	28.2	29.7
Divorced parents	10.3	9.4	17.7	21.6	26.2
Short education	49.1	49.1	45.4	53.1	60.4
Mental functions					
Low general cognitive ability	33.3	34.1	23.8	25.0	31.5
Low emotional stability	29.3	27.4	40.4	55.2	74.2
Low social maturity	21.9	20.6	25.8	43.7	65.1
Psychiatric diagnosis	11.60	10.11	18.07	33.06	55.35
Health behavioral factors					
BMI ≥ 25	6.7	7.0	3.8	4.0	3.4
Poor physical fitness	19.84	19.42	21.59	27.10	31.65
Smoking > 5 cigarettes/day	46.7	43.7	74.7	81.8	84.9
Risk use of alcohol	12.8	11.0	27.0	37.7	46.8
Having tried other drugs	3.1	0.3	14.2	50.0	80.1

[a] All covariates are measured at conscription by ~18 years of age, with the exception of low childhood socioeconomic position (SEP). Low childhood SEP, defined as the head of the household reporting either an unskilled manual occupation or no occupation, is measured at ~11 years of age.

welfare assistance than others and are also less likely to leave the welfare assistance system (Pedersen, 2011). Furthermore, cannabis use and problematic cannabis use have been found to be strongly associated with low occupational grade and unstable employment, as well as low work achievement and unemployment (Brook et al., 2011; Fergusson and Boden, 2008; Redonnet et al., 2012).

There is one possibility that the associations we observed between high cannabis consumption and DP are actually non-causal, and exist due to factors associated with both the use of drugs and DP. Although we were able to control for a large number of factors previously associated with cannabis use and DP, there is always the possibility that the associations found are explained by other factors. It may also be the case that adolescent cannabis use may lead to a series of negative life events, such as for example subsequent illicit drug use, illness (e.g., dependence) and associated DPs.

Prior studies have shown that frequent cannabis use increases the risk of illicit drug use uptake (Smith et al., 2011; Swift et al., 2011). Among those who develop dependence on an illicit drug by age 25, in most cases this dependence involved cannabis (Boden et al., 2006). There remains uncertainty, however, to what extent the association between cannabis and subsequent illicit drug use is an effect of the drug itself, reflects characteristics of the users, or is a consequence of other uncontrolled confounders (Greydanus et al., 2013). Numerous studies have shown that underlying early drug use is a general, highly heritable predisposition to externalizing behaviors (Agrawal and Lynskey, 2006). At the same time, it has been suggested that although illicit drug use and dependence is associated with a range of early life circumstances that put individuals at greater risk, the use of cannabis in late adolescence emerge as the strongest risk factor for later illicit drug use (Fergusson et al., 2008). This is supported by twin studies, reporting early-onset cannabis users to be at two to four times greater risk of use of drugs such as cocaine, hallucinogens, sedatives and opioids and twice as likely as their co-twins to meet criteria for dependence

Table 2
Cannabis consumption at ~18 years of age and HR for disability pension from 20 to 59 years of age.

	Follow-up period					
	All ages (20–59)		Age 20–39		Age 40–59	
	5447 DPs		851 DPs		4596 DPs	
	HR	95% CI	HR	95% CI	HR	95% CI
No adjustment						
Never	1.0		1.0		1.0	
1–10	1.15	1.03–1.28	1.32	1.02–1.71	1.12	0.99–1.26
11–50 times	1.57	1.30–1.89	2.12	1.41–3.18	1.47	1.19–1.81
>50 times	2.58	2.23–3.00	4.22	3.16–5.63	2.26	1.89–2.69
Adjustments						
Social background[a]						
Never	1.0		1.0		1.0	
1–10	1.14	1.02–1.27	1.27	0.98–1.65	1.12	0.99–1.26
11–50 times	1.48	1.23–1.78	1.88	1.25–2.83	1.40	1.13–1.72
>50 times	2.30	1.98–2.67	3.42	2.55–4.58	2.04	1.71–2.43
Mental functions[b]						
Never	1.0		1.0		1.0	
1–10	1.14	1.02–1.27	1.22	0.94–1.58	1.12	1.00–1.27
11–50 times	1.23	1.02–1.49	1.20	0.78–1.85	1.24	1.00–1.53
>50 times	1.59	1.36–1.86	1.73	1.27–2.36	1.53	1.27–1.83
Health behavioral factors[c]						
Never	1.0		1.0		1.0	
1–10	0.90	0.80–1.00	0.99	0.76–1.31	0.88	0.78–1.00
11–50 times	1.04	0.84–1.28	1.11	0.68–1.80	1.03	0.81–1.30
>50 times	1.54	1.24–1.91	1.96	1.24–3.09	1.43	1.12–1.83
All covariates[a–c]						
Never	1.0		1.0		1.0	
1–10	0.98	0.88–1.10	1.03	0.78–1.36	0.97	0.86–1.10
11–50 times	1.02	0.83–1.26	0.94	0.58–1.52	1.04	0.83–1.32
>50 times	1.30	1.05–1.61	1.28	0.82–2.01	1.29	1.00–1.65

HR = Hazard ratio; 95% CI = 95% confidence interval; DP = disability pension.
[a] Childhood socioeconomic position, divorced parents, short education.
[b] Emotional stability, social maturity, general cognitive ability, and having a psychiatric diagnosis.
[c] Cigarette smoking, body mass index, physical fitness, risky use of alcohol, and having tried other drugs.
Note: The model parameters for the fitted proportional hazard models are available upon request.

on hard drugs and alcohol (Agrawal and Lynskey, 2014; Lynskey et al., 2003).

In our study, 80% of the extensive cannabis users reported having also used other drugs, unknown to what extent. Existing research indicates that individuals with poly-substance use experience greater social consequences and higher rates of dependence, when compared to individuals who use only one drug (Midanik et al., 2007; Pacek et al., 2013; Stenbacka, 2003). Nevertheless, research on poly-substance use in relation to health and psychosocial functioning is scarce (Martin, 2008). Findings suggest psychiatric severity increases linearly with increased poly-substance use (Fischer et al., 2010) and poly-drug users to be at increased risk of unemployment (Carter et al., 2013; Quek et al., 2013). Our study did, however, focus on disability pension (i.e., a permanent exclusion from the labor market with a medical diagnosis). Also, important to highlight is the fact that when we controlled for use of other drugs the association between adolescent cannabis use and DP still remained.

We are not able to fully explain the mechanisms which underlie the observed associations between adolescent cannabis use and later DP. For example, there is reason to believe that the associations found in our study develop over a long period of time and are intertwined with problems in the both the labor market, in the social security system, and with the individual.

For one thing, we know from previous studies that drug use and dependence are associated with many psychiatric disorders (Goldstein et al., 2012), which in turn represents a large proportion of the disability pensions in Sweden. When we adjusted for mental functions (e.g., psychiatric diagnosis, cognitive ability, emotional stability and social maturity) by the age of 18, the associations weakened considerably. We have, however, no knowledge of the later diagnoses leading to DP in our population.

Also, we do not know to what extent our sample have continued or discontinued using cannabis and other illicit drugs, or alcohol and tobacco later on in life. Our sample included men only, which of course is a limitation. On the other hand, it is a representative sample comprising approximately 98% of the Swedish male population at that time. We have no information on the 2%, or 1000 individuals that did not participate at conscription. They were exempted due to severe handicaps or congenital disorders, which probably led to an increased risk of early DP.

The rate of cannabis use in our cohort was relatively low, 9%, and in other contexts where rates are higher, the impact of cannabis on welfare dependence measures is likely to be greater. The heavy using group, possibly contributing to the increased incidence of the overall DPs in the cohort, included 654 men (1.5%) only. Accordingly, DPs attributable to heavy cannabis use (i.e. the population attributable fraction, PAF) was small (0.8%). Moreover, calculating PAF assumes causal relationships and independence from other risk factors (Rockhill et al., 1998).

This study showed that heavy use of cannabis in late adolescence was associated with an increased relative risk of disability pension, with a follow-up period of almost 40 years. This finding highlights the need for further studies on cannabis and other illicit drug use in relation to possible later negative health and social consequences.

Role of funding sources

This study was supported by grants provided by the Research Council for Health, Working Life and Welfare (Fas 2009-1611), and by the Stockholm County Council (ALF project 20130025).

Contributors

Authors AKD, DF and EA designed the study. AKD wrote the protocol. Author AKD conducted literature searches and author DF did the statistical analyses. Author AKD wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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