The association between cannabis use and motivation and intentions to quit tobacco within a sample of Australian socioeconomically disadvantaged smokers

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Abstract

This study aimed to (i) describe concurrent and simultaneous tobacco and cannabis use and (ii) investigate the association between cannabis use and motivation and intentions to quit tobacco in a sample of socioeconomically disadvantaged smokers. A cross-sectional survey was conducted in 2013 and 2014 with current tobacco smokers receiving aid from two community service organizations in New South Wales, Australia. At least weekly cannabis use for the month prior to survey, motivation to quit tobacco and intentions to quit tobacco were measured in 369 participants (77% consent rate). Regressions were carried out to investigate associations between weekly cannabis use and motivation and intentions to quit tobacco.

Concurrent tobacco and cannabis use was reported by 19% ($n = 71$) of the sample and of these users, 100% reported simultaneous use. Although regular cannabis use was significantly associated with lower motivation to quit tobacco, it was not significantly associated with intentions to quit tobacco in the next 30 days. Concurrent cannabis use is common in disadvantaged smokers and may play a role in decreased motivation to quit tobacco; however, it does not appear to be associated with intentions to quit in a sample of disadvantaged smokers.

Introduction

Tobacco smoking is the leading cause of avoidable morbidity and mortality globally and is associated with increased likelihood of cancer, cardiovascular and respiratory disease [1]. Cannabis users are four to nine times more likely to be regular tobacco users, compared with non-cannabis users [2]. The potential for cannabis to act as a 'gateway' to tobacco use [3], as well as the role of cannabis in supporting and reinforcing ongoing tobacco smoking [4], have been identified as issues of concern. Cannabis and tobacco use can occur either concurrently (use of cannabis and tobacco but not necessarily in the same instance) or simultaneously (use at the same time in the same instance) [5]. Rates of concurrent use in the general population have been estimated between 25 and 58%, with younger people more likely to report concurrent use [6–8]. Simultaneous use is an increasingly common occurrence [9, 10]. Cannabis and tobacco can be used simultaneously through spliffs (adding tobacco to cannabis wrapped in cigarette paper), blunts (removal of majority of tobacco from cigar, then filling with cannabis) or

through chasing (smoking tobacco immediately after smoking cannabis) [5].

Increased levels of socioeconomic disadvantage are associated with increased likelihood of cannabis or tobacco use [11–14] and concurrent use of both substances [15]. Socioeconomically disadvantaged tobacco smokers who use cannabis tend to be at higher risk of poorer health outcomes [16, 17], find it harder to quit compared with those who do not use cannabis [18] and are a group who are more likely to be underrepresented in research studies [19].

Studies linking cannabis use to tobacco cessation have found mixed results with some studies suggesting cannabis use inhibits tobacco cessation [18, 20–23] and others finding no association [24, 25]. In one qualitative study conducted with socioeconomically disadvantaged tobacco smokers, simultaneous use of cannabis and tobacco was identified as a barrier to quitting tobacco smoking [10]. These results suggest that the effect of cannabis on tobacco cessation may be complex and depend on a number of variables such as context [22], age and type of tobacco dependence treatment received [25].

The mechanisms that underlie any association between cannabis use and poorer tobacco cessation outcomes are unclear. Some researchers have suggested that weekly or daily cannabis use may result in diminished motivation to make attempts to quit tobacco smoking as well as maintain long-term abstinence [25, 26]. Cannabis use may reduce a tobacco smoker's motivation to quit tobacco through simultaneous use, the shared route of administration (inhalation) [6], increased strength or frequency of nicotine withdrawal symptoms [27], increased urges to use tobacco [28] and environmental factors including increased acceptability and availability of both substances [5, 6]. Furthermore, preliminary neuropsychological evidence suggests regular cannabis users may also experience decreased motivation through lower levels of dopamine synthesis capacity [29], which may affect motivation to change current behaviours generally, and tobacco use in particular.

Although there remain questions around the impact of cannabis use on motivation in general

[30], it is plausible that recent, frequent cannabis use has detrimental impacts on motivation to quit tobacco smoking and intention to quit which compromises the ability to remain abstinent from tobacco. Although the two concepts of intention and motivation are closely related, intentions (related to planning to quit) have been referred to as 'motivation related' variables, rather than 'pure' measures of motivation (related to a desire to quit). Intention to quit is typically seen as a consequence of motivation [31]. Lower levels of motivation may mediate the association between current cannabis use and smokers' intention to quit tobacco.

Therefore, this study aimed to (i) describe concurrent and simultaneous tobacco and cannabis use and (ii) investigate the association between cannabis use and motivation and intentions to quit tobacco in a sample of socioeconomically disadvantaged smokers.

Methods

Study design

A cross-sectional survey was conducted at two non-government community service organizations (CSO) in New South Wales, Australia, from October 2013 to July 2014.

Setting

In Australia, clients of CSOs represent a social group who are more likely to experience multiple forms of disadvantage including unemployment, homelessness and financial stress [32]. Rates of tobacco and heavy alcohol use (including concurrent use of both substances) are high in clients of CSOs [33].

Participants

Eligible participants were (i) clients of the CSO, (ii) aged 18 years or older, (iii) not under the influence of alcohol or other drugs at time of recruitment, (iv) not too distressed to complete the survey and (v) current daily or occasional tobacco smokers. Self-reported tobacco status was assessed using the following two items: (i) 'do you currently smoke

tobacco products?' [categorized into: (a) Yes, daily; (b) Yes, at least once a week; (c) Yes, but less often than once a week and (d) No, not at all] and (ii) 'have you smoked at least 100 cigarettes or a similar amount of smoking in your life?' (Yes/No/Not sure). Current tobacco smokers were defined as self-reported daily or occasional tobacco smokers who had smoked at least 100 cigarettes in their lifetime.

Procedure

CSO staff informed all clients about a health survey being conducted at the organization and clients were asked to approach the research assistant (RA) for more information. RAs assessed client eligibility and provided clients with a written information statement. Survey completion was taken as consent. The survey was administered via a touchscreen computer. The RA provided assistance in completing the survey where necessary. Participants received a $10 grocery gift voucher as reimbursement for completing the survey. Ethics approval was granted by the University of Newcastle's Human Research Ethics Committee (Approval #: HREC2010-1002).

Measures

The survey included 40 questions and the mean completion time was 16.2 min (range = 9.2–21.3 min). All survey items were written assuming a fifth grade reading level. The structure of the survey was such that participants were assessed on their tobacco use and cannabis use separately and questions concerning tobacco or cannabis use were clearly delineated in the survey structure.

Sociodemographic variables

Age, gender, highest level of education, marital status, housing status, income amount, income source and Aboriginal and/or Torres Strait Islander status were assessed.

Cannabis use

Self-reported cannabis use was assessed using a modified item from the Opiate Treatment Index-Cannabis scale [34]. Participants were first asked if they had ever used cannabis (marijuana, dope, grass, hash, pot). All participants who responded 'yes' were asked how often they had used cannabis within the past 4 weeks. Response options included (i) 6–7 days each week, (ii) 4–5 days each week, (iii) 2–3 days each week, (iv) 1 day each week, (v) 1 day each fortnight, (vi) once in the last month and (vii) not at all in the last month. Participants who reported using cannabis at least once a week in the past 4 weeks were distinguished from those who had not and defined as current cannabis users. The 'at least once per week for the past 4 weeks' criteria was set as use at that frequency is sufficient to have an impact on functioning and to warrant intervention [35, 36]. Participants who reported ever using cannabis were also asked 'do you mix tobacco with cannabis (marijuana, dope, grass, hash, pot)?' (response: Yes/No). Participants who responded yes were classified as being simultaneous users.

Motivation to quit tobacco

Current motivation to quit smoking tobacco was assessed with the following item 'on a scale of 1–10, where 1 is very low motivation and 10 is very high motivation, please rate your current motivation to give up smoking' [37].

Intentions to quit tobacco

Intentions to quit were assessed using the following item derived from the stage of change theory 'what are your intentions regarding quitting smoking. Do you plan to: (i) quit in the next 30 days, (ii) quit in the next 6 months, (iii) quit, but not in the next 6 months, (iv) never quit and (v) don't know'. These categories were divided into two groups; respondents who reported intending to quit in the next 30 days and others.

Smoking-related variables (tobacco)

The Heaviness of Smoking Index (HSI) [38] was used to assess participants' level of nicotine dependence. The HSI is calculated using two components: the number of cigarettes smoked per day and the time to first cigarette of the day. Scores ranged

from zero to six, with higher scores indicating higher levels of dependence. Age of tobacco smoking initiation and self-efficacy for quitting tobacco were also assessed [39]. Participants were also asked to indicate which of the following types of tobacco they normally used (only one choice was allowed): (i) cigarettes (pre-rolled); (ii) cigarettes (roll your own); (iii) 'chop-chop' (loose leaf, unbranded, illicit tobacco); (iv) chewing tobacco or (v) snuff or powder tobacco.

Data analysis

Descriptive statistics for sociodemographic and tobacco characteristics were calculated as counts and percentages for categorical variables and means (standard deviation) or median (interquartile range; IQR) for continuous variables, depending on distribution. The prevalence of current cannabis use (at least once per week during the last 4 weeks) was estimated with 95% confidence intervals (CIs). Characteristics were compared among cannabis use status groups using χ^2 (categorical characteristics), analysis of variance (ANOVA) or Kruskal–Wallis (continuous; parametric and non-parametric) tests for association.

Linear regression was used to examine whether frequency of cannabis use was associated with motivation to quit smoking. Logistic regression was used to examine whether frequency of cannabis use was associated with intentions to quit tobacco within the next 30 days. In the regression analyses, the cannabis variable was dichotomized as current cannabis users (use at least once per week within the past 4 weeks) versus non-current cannabis users. Covariates included in modelling were determined *a priori* based on review of current literature and included demographics (age, gender, education and indigenous status), HSI and mixing of cannabis and tobacco. For all regression modelling, collinearity of variables was checked using variance inflation factor (VIFs) and linearity assumption for continuous variables and the (log or linear) outcome were examined. Adjusted regression coefficients or odds ratios are presented with 95% CIs and Wald test *P*-values. SAS 9.4 was used for all analyses [40].

Results

Response rate

Of the 606 clients attending the two centres during the study period, 478 (79%) clients were eligible to take part. Reasons for ineligibility included being a non-smoker ($n = 96$), being under the influence of alcohol or other drugs ($n = 5$), distress ($n = 3$) and being aged under 18 years ($n = 5$). Of eligible clients, 369 (77%) consented and completed the survey.

Demographic and smoking characteristics of the sample

Respondents reported considerable socioeconomic disadvantage. Individuals self-reporting as Aboriginal and/or Torres Strait Islander made up 21% ($n = 60$) of the sample, compared with 2.2% of the population in New South Wales [41] and the majority (71%) of participants reported income levels below the Australian single-person 'poverty line' [42]. Most participants received government benefits as their main source of income (91%: see Table I). Table II shows that participants had high levels of nicotine dependence (mean HSI Score 3, SD 2) compared with the mean HSI scores found in a longitudinal study conducted across four countries which ranged between 1.48 (95% CI 1.42, 1.54) and 1.69 (95% CI 1.63, 1.75) depending on recruitment wave [43]. Low levels of self-efficacy for quitting tobacco smoking were also reported (55% of respondents were slightly or not at all sure they would be successful at quitting if they tried). Participants in the study were predominantly pre-rolled tobacco cigarette users (70%) or roll your own tobacco cigarette users (27%), with 3% of the sample reporting usually using chop-chop tobacco (Table II). Univariate analysis in Table II also shows that current cannabis users had higher HSI scores ($P = 0.01$), higher number of cigarettes smoked per day ($P = 0.02$), younger age at tobacco smoking initiation ($P > 0.01$) and were more likely to use roll your own cigarettes than non-current cannabis users ($P = 0.03$). Current cannabis users also had lower

Table I. *Demographic characteristics of the sample by cannabis use status*

Characteristic	No use/used < once per week in the past 4 weeks ($n = 298$; 81%)	Used ≥ once per week in the past 4 weeks ($n = 71$; 19%)	Total ($N = 369$)	P-value*
Age; mean (SD)	40 (12)	38 (10)	40 (11)	0.12
Gender				<0.01
Male	105 (35%)	45 (63%)	150 (41%)	
Female	193 (65%)	26 (37%)	219 (59%)	
Indigenous status				<0.01
Non-indigenous participants	246 (83%)	45 (63%)	291 (79%)	
Indigenous participants[a]	52 (17%)	26 (37%)	78 (21%)	
Highest level of education				0.03
Primary school	43 (14%)	18 (25%)	61 (17%)	
Secondary school	191 (64%)	45 (63%)	236 (64%)	
Tertiary qualifications	64 (21%)	8 (11%)	72 (20%)	
Weekly income amount (net)				0.04
<$200 per week	71 (24%)	29 (41%)	100 (27%)	
Between $201–$400 per week	135 (45%)	26 (37%)	161 (44%)	
More than $400 per week	67 (22%)	11 (15%)	78 (21%)	
Prefer not to answer	25 (8.4%)	5 (7.0%)	30 (8.1%)	
Source of income				0.28
Paid employment (either full or part time)	17 (5.7%)	1 (1.4%)	18 (5%)	
Government pension or benefit	269 (90%)	68 (96%)	337 (91%)	
Other	12 (4.0%)	2 (2.8%)	14 (4%)	

[a]Due to low cell numbers participants who self-reported Aboriginal, Torres Strait Islander or both Aboriginal and Torres Strait Islander status were included together in the Indigenous category. It should be noted Aboriginal and Torres Strait Islander peoples make up two distinct cultural peoples.
*P-values from χ^2 and ANOVA.

levels of motivation compared with those who were not current cannabis users ($P = 0.01$).

Motivation and intentions to quit tobacco in the sample

The mean motivation to quit tobacco score was 5.4 (SD 2.36, range 1–10), and 15% of respondents had intentions to quit using tobacco in the next 30 days ($n = 54$) (Table II). Overall, almost a third of participants (32%, $n = 117$) had high motivation to quit tobacco scores.

Cannabis use in the sample

Almost one in five (19%, $n = 71$) participants were current cannabis users (using cannabis at least once per week during the past 4 weeks; see Table III). Of those, 41% ($n = 29$) reported using cannabis on 6–7

days per week in the last 4 weeks. Simultaneous cannabis and tobacco use was reported by 81% ($n = 179$) of respondents who reported *ever* using cannabis and 100% ($n = 71$) of respondents who reported current cannabis use.

Association between current cannabis use and motivation and intentions to quit tobacco use

On average, current cannabis use was associated with a 0.7 point lower motivation to quit score, compared with non-current and never users (Table IV); current cannabis users had an least squares (LS)-mean motivation score of 4.6 (95% CI 4, 5.2) compared with 5.3 (4.9, 5.7) for non-current cannabis users ($P = 0.04$). Mixing cannabis and tobacco was not significantly associated with motivation

Table II. *Smoking-related characteristics of the sample by cannabis use status*

Characteristic	No use/used < once per week in the past 4 weeks (n = 298; 81%)	Used ≥ once per week in the past 4 weeks (n = 71; 19%)	Total (N = 369)	P-value*
Type of tobacco smoked				0.03
Cigarettes (pre-rolled)	217 (73%)	41 (58%)	258 (70%)	
Cigarettes (roll your own)	72 (24%)	28 (39%)	100 (27%)	
Chop-chop (cheaper loose leaf tobacco)	9 (3.0%)	2 (2.8%)	11 (3.0%)	
HSI; mean (SD)	2.8 (1.6)	3.4 (1.4)	2.9 (1.6)	0.01
Number of cigarettes smoked; median (IQR)	14 (8,20)	20 (10, 25)	15 (9, 20)	0.02
Age of tobacco smoking initiation; mean (SD)	16 (4)	14 (4)	15 (4)	<0.01
Motivation to quit tobacco; mean (SD)	6 (2)	5 (2)	5 (2)	0.01
Low motivation (1–3)	53 (18%)	21 (28%)	74 (20%)	0.03
Moderate motivation (4–6)	139 (47%)	35 (20%)	174 (48%)	
High motivation (7–10)	102 (35%)	15 (13%)	117 (32%)	
Intentions regarding quitting tobacco				0.80
Don't know	105 (35%)	27 (20%)	132 (36%)	
Never quit	15 (5.0%)	4 (21%)	19 (5.1%)	
Quit but not in the next 6 months	42 (14%)	10 (19%)	52 (14%)	
Quit in the next 6 months	89 (30%)	23 (21%)	112 (30%)	
Quit in the next 30 days	47 (16%)	7 (13%)	54 (15%)	
Self-efficacy for tobacco cessation				0.46
Not at all sure	99 (33%)	29 (23%)	128 (35%)	
Slightly sure	57 (19%)	17 (23%)	74 (20%)	
Moderately sure	85 (29%)	15 (15%)	100 (27%)	
Very sure	45 (15%)	8 (15%)	53 (14%)	
Extremely sure	12 (4.0%)	2 (14%)	14 (3.8%)	

*P-values from χ^2, ANOVA or Kruskal–Wallis test for association.

Table III. *Cannabis use in a sample of socioeconomically disadvantaged current smokers and percentage reporting simultaneous use of both substances*

Variable	Characteristic Levels	Frequency (%)	95% CI
Cannabis use group	Never used	150 (40.7)	132–168 (35.6–45.7%)
	Used < once per week in the past 4 weeks	148 (40.1)	130–166 (35.1–45.1%)
	Used ≥ once per week in the past 4 weeks	71 (19.2)	56–86 (15.2–23.3%)
Cannabis/tobacco mixed (simultaneous use)	Not applicable (never used cannabis)	150 (40.7)	132–168 (35.6–45.7%)
	No	40 (10.8)	28–52 (7.7–14%)
	Yes	179 (48.5)	160–198 (43.4–53.6%)

Table IV. *Current cannabis use, motivation and intention to quit*

Parameter		Motivation to quit tobacco use ($n = 362$)[a]		Intentions to quit tobacco use ($n = 366$)[a]	
Parameter	Comparison	β (95% CI)[b]	*P*-values	OR (95% CI)[c]	*P*-values
Current cannabis use	Yes versus No	−0.70 (−1.37, −0.03)	0.04	0.81 (0.3, 2.18)	0.67
Cannabis and tobacco mixed	Yes versus No	0.40 (−0.13, 0.94)	0.14	1.2 (0.61, 2.37)	0.59
Age	Per year	0.01 (−0.01, 0.03)	0.35	1.02 (0.99, 1.05)	0.08
Gender	Female versus male	−0.16 (−0.63, 0.32)	0.52	1.22 (0.64, 2.31)	0.54
HSI	Per 1 score increase	−0.53 (−0.67, −0.38)	<0.01	0.79 (0.65, 0.96)	0.02
Indigenous status	Indigenous versus non-indigenous	−0.004 (−0.57, 0.56)	0.99	0.61 (0.26, 1.46)	0.27
Education	Secondary/tertiary qualifications versus primary school	0.78 (0.15, 1.41)	0.02	3.41 (0.98, 11.84)	0.05

[a]Total ns < 369 due to missing data.
[b]Adjusted β estimate (95% CI) and *P*-values from linear regression.
[c]Adjusted OR (95% CI) and *P*-values from binary logistic regression.

score. Current cannabis use was not significantly associated with intention to quit tobacco smoking.

Discussion

This study is the first to report both concurrent and simultaneous cannabis and tobacco use in a socio-economically disadvantaged sample of Australian smokers. Of the tobacco smokers who used cannabis in their lifetime, 19% reported using cannabis and tobacco concurrently. This rate of concurrent use is comparable to studies conducted with smokers from other disadvantaged groups [18]. The high rate of simultaneous cannabis and tobacco use in our sample highlights the imperative to consider cannabis use in tobacco smokers who are considering a cessation attempt, and to ensure support programs are tailored to this simultaneous use. The high rates of concurrent and simultaneous use of cannabis and tobacco have a number of other important implications; as a barrier to quitting tobacco [10], in the development of nicotine dependence and stronger withdrawal symptoms [44, 45] and the worsening of respiratory outcomes compared with those who use either substance alone [16, 17].

Current cannabis use was significantly associated with lower motivation to quit tobacco smoking while adjusting for factors including nicotine dependence. However, the clinical significance of this difference must be considered. Overall, smokers in this study reported high levels of ambivalence regarding quitting (mean motivation scores were 5 on a 10 point scale) and around a third reported 'not knowing' what their intentions were regarding quitting tobacco. Current cannabis use was not significantly associated with intentions to quit.

Other factors are likely to play a role in the association between cannabis use and difficulty quitting tobacco. Individuals who use cannabis and tobacco may be more likely to be nicotine dependent than those who only use tobacco [25, 46]. Nicotine dependence is a consistent predictor of ability to remain abstinent [47], therefore nicotine dependence levels in smokers who also use cannabis may also partly account for the association between cannabis use and difficulty quitting tobacco smoking. Additionally, users of both cannabis and tobacco may report intensified severity of some withdrawal symptoms than those that use only one substance [27], and more intense withdrawal symptoms may compromise maintenance of smoking cessation [48]. Hence, clinicians supporting disadvantaged

tobacco smokers to make a cessation attempt need to consider whether cannabis use is also present, and offer specific interventions to ameliorate the increased withdrawal symptoms likely to be experienced during a tobacco quit attempt.

Aspects of mental health, including experiencing symptoms of depression and anxiety, may play an important role in both tobacco and cannabis use [49], especially in smokers from disadvantaged groups. In Australia, mental illness is more common in people who smoke tobacco and in people with cannabis use disorder [50]. Use of cannabis and tobacco as a coping mechanism and to manage stress is a commonly reported reason for use of both substances [51, 52]. Further research examining the precise functions of mental health and stress on cannabis and tobacco use and quitting is important to inform the development of interventions to better meet the needs of smokers with complex needs.

Implications

The substantial proportion of current cannabis use (at least once a week in the past 4 weeks) in our sample suggests smoking cessation interventions targeted at socioeconomically disadvantaged smokers must consider cannabis and its role in tobacco cessation. Given that tobacco and cannabis use frequently co-occurs in the wider general population, the implications of these research findings may also be applicable to all dual users of cannabis and tobacco. Smokers and clinicians should be educated about the adverse health effects of dual use of both substances and that they may need additional support to achieve and maintain cessation from both substances [5, 18, 20–23].

Limited research has examined the effectiveness of addressing tobacco and cannabis use together [6]. A pilot study with 77 participants conducted in Switzerland demonstrated high levels of acceptability of a group based cessation program for users of both cannabis and tobacco [53, 54]. The content of the program included motivational enhancement therapy, cognitive behavioural therapy (CBT) and relapse prevention. A second pilot study in the United States that tested the effectiveness of CBT

and nicotine replacement therapy patches for tobacco and cannabis users ($n = 12$) found significant positive outcomes for tobacco cessation but not for cannabis cessation [55]. The results of these pilot studies suggest that combinations of evidence based approaches like CBT and relapse prevention approaches may be effective in treating both behaviours simultaneously for concurrent users. However, there is also evidence that programs may not need to address both behaviours explicitly in order for cessation to occur in both substances. In a sample of 236 heavy drinkers enrolled in a smoking cessation trial in the United States, heavy drinkers reduced their marijuana use alongside their tobacco use even though the intervention did not explicitly address marijuana [24]. Although the number of marijuana users in the sample was low ($n = 57$), this result provides a promising indication that changes in cannabis use may occur even when cannabis use is not addressed explicitly. Future studies assessing the effectiveness of interventions for tobacco or alcohol use should also consider assessing cannabis use to identify changes occurring in behaviours that are not specifically targeted as part of interventions.

Future research on whether treatments for concurrent cannabis and tobacco use should occur simultaneously or sequentially, the effectiveness of these treatments and the treatment preferences of concurrent cannabis and tobacco users is also required. The failure of treatments for tobacco or cannabis to consider the other substance has impeded the significant secondary prevention opportunities available to minimize the harms associated with both of these substances. Use of both substances is associated with socioeconomic disadvantage [14, 15]. Clearly, smoking cessation services need to adapt to the social and psychological complexities of disadvantaged smokers.

Strengths and limitations

This study measured current cannabis use at a clinically significant level (at least once per week in the past 4 weeks) [35, 36] and succeeded in reaching a group that demonstrated high and multiple forms of socioeconomic disadvantage; a group that is typically

hard to reach for research purposes. The study used the CSO setting to sample socioeconomically disadvantaged smokers, a setting which is representative of highly disadvantaged Australians as these services provide mental health, housing and financial crisis aid nationally [32]. However, the sample is not generalizable to the general Australian population.

This study used a simplified measure of cannabis use. Different measures including structured clinical interviews may have identified those individuals who were cannabis dependent, which may have had different associations with motivation and intentions to quit. Although it was stressed to participants that their responses to this survey would remain confidential, it is possible some participants may not have disclosed their cannabis use. Levels of cannabis and tobacco use reported in this study may therefore be an underrepresentation. Precise information about the mode of mixing tobacco and cannabis (blunts, spliffs or chasing) was not assessed in this study and should be considered in future research. Future studies should also assess the association between cannabis use and quitting behaviours, rather than intentions to quit.

Given the cross-sectional nature of the data, it was not possible to test whether motivation to quit mediated the association between current cannabis use and intentions to quit smoking. Future studies using longitudinal rather than cross-sectional study designs could attempt to examine the question of mediation further, with a focus on quitting behaviour and with larger sample sizes. It is also possible that an interaction between current cannabis use and lower motivation to quit tobacco use may also influence a smoker's intention to quit tobacco. Due to low numbers of participants reporting intentions to quit in the next 30 days, we have very limited power to detect significant interactions. However, this is also an important question for future research to consider.

Conclusions

Almost one in five socioeconomically disadvantaged smokers reported at least weekly use of cannabis within the last 4 weeks. Additionally, current cannabis use was significantly associated with lower levels of motivation to quit tobacco smoking. However, current cannabis use was not shown to be associated with intentions to quit tobacco in this study. Smoking cessation interventions targeted at disadvantaged smokers should assess and address cannabis use to improve intervention effectiveness.

Conflict of interest statement

None declared.

References

1. World Health Organization (WHO). *WHO report on the Global Tobacco Epidemic*. Geneva, 2008.
2. Degenhardt L, Hall W, Lynskey M. Alcohol, cannabis and tobacco use among Australians: a comparison of their associations with other drug use and use disorders, affective and anxiety disorders, and psychosis. *Addiction* 2001; **96**:1603–14.
3. Swift W, Coffey C, Degenhardt L *et al*. Cannabis and progression to other substance use in young adults: findings from a 13-year prospective population-based study. *J Epidemiol Community Health* 2012; **66**:e26.
4. Highet G. The role of cannabis in supporting young people's cigarette smoking: a qualitative exploration. *Health Educ Res* 2004; **19**:635–43.
5. Peters EN, Budney AJ, Carroll KM. Clinical correlates of co-occurring cannabis and tobacco use: a systematic review. *Addiction* 2012; **107**:1404–17.
6. Agrawal A, Budney AJ, Lynskey MT. The co-occurring use and misuse of cannabis and tobacco: a review. *Addiction* 2012; **107**:1221–33.
7. Leatherdale ST, Ahmed R, Kaiserman M. Marijuana use by tobacco smokers and nonsmokers: who is smoking what? *CMAJ* 2006; **174**:1399.

8. Leatherdale ST, Hammond DG, Kaiserman M *et al*. Marijuana and tobacco use among young adults in Canada: are they smoking what we think they are smoking?. *Cancer Causes Control* 2007; **18**:391–7.

9. Akre C, Michaud P-A, Berchtold A *et al*. Cannabis and tobacco use: where are the boundaries? A qualitative study on cannabis consumption modes among adolescents. *Health Educ Res* 2010; **25**:74–82.

10. Amos A, Wiltshire S, Bostock Y *et al*. 'You can't go without a fag...you need it for your hash'–a qualitative exploration of smoking, cannabis and young people. *Addiction* 2004; **99**:77–81.

11. Daniel JZ, Hickman M, Macleod J *et al*. Is socioeconomic status in early life associated with drug use? A systematic review of the evidence. *Drug Alcohol Rev* 2009; **28**:142–53.

12. Hiscock R, Bauld L, Amos A *et al*. Socioeconomic status and smoking: a review. *Ann N Y Acad Sci* 2012; **1248**:107–23.

13. Redonnet B, Chollet A, Fombonne E *et al*. Tobacco, alcohol, cannabis and other illegal drug use among young adults: the socioeconomic context. *Drug Alcohol Depend* 2012; **121**:231–9.

14. Bowes L, Chollet A, Fombonne E *et al*. Lifecourse SEP and tobacco and cannabis use. *Eur J Public Health* 2013; **23**:322–7.

15. Schauer GL, Berg CJ, Kegler MC *et al*. Assessing the overlap between tobacco and marijuana: trends in patterns of co-use of tobacco and marijuana in adults from 2003–2012. *Addict Behav* 2015; **49**:26–32.

16. Moore BA, Augustson EM, Moser RP *et al*. Respiratory effects of marijuana and tobacco use in a U.S. sample. *J Gen Intern Med* 2005; **20**:33–7.

17. Taylor DR, Poulton R, Moffitt TE *et al*. The respiratory effects of cannabis dependence in young adults. *Addiction* 2000; **95**:1669–77.

18. Haskins A, Bertone-Johnson E, Pekow P *et al*. Correlates of smoking cessation at pregnancy onset among Hispanic women in Massachusetts. *Am J Health Promot* 2010; **25**:100–8.

19. Bonevski B, Randell M, Paul C *et al*. Reaching the hard-to-reach: a systematic review of strategies for improving health and medical research with socially disadvantaged groups. *BMC Med Res Methodol* 2014; **14**:42.

20. Abrantes AM, Lee CS, MacPherson L *et al*. Health risk behaviors in relation to making a smoking quit attempt among adolescents. *J Behav Med* 2009; **32**:142–9.

21. Ford DE, Vu HT, Anthony JC. Marijuana use and cessation of tobacco smoking in adults from a community sample. *Drug Alcohol Depend* 2002; **67**:243–8.

22. Gourlay SG, Forbes A, Marriner T *et al*. Prospective study of factors predicting outcome of transdermal nicotine treatment in smoking cessation. *BMJ* 1994; **309**:842–6.

23. Stapleton JA, Keaney F, Sutherland G. Illicit drug use as a predictor of smoking cessation treatment outcome. *Nicotine Tob Res* 2009; **11**:685–9.

24. Metrik J, Spillane NS, Leventhal AM *et al*. Marijuana use and tobacco smoking cessation among heavy alcohol drinkers. *Drug Alcohol Depend* 2011; **119**:194–200.

25. Patton GC, Coffey C, Carlin JB *et al*. Reverse gateways? Frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. *Addiction* 2005; **100**:1518–25.

26. Humfleet GL, Haas AL. Is marijuana use becoming a 'gateway' to nicotine dependence?. *Addiction* 2004; **99**:5–6.

27. Vandrey RG, Budney AJ, Hughes JR *et al*. A within-subject comparison of withdrawal symptoms during abstinence from cannabis, tobacco, and both substances. *Drug Alcohol Depend* 2008; **92**:48–54.

28. Ramo DE, Liu H, Prochaska JJ. Validity and reliability of the nicotine and marijuana interaction expectancy (NAMIE) questionnaire. *Drug Alcohol Depend* 2013; **131**:166–70.

29. Bloomfield MA, Morgan CJ, Egerton A *et al*. Dopaminergic function in cannabis users and its relationship to cannabis-induced psychotic symptoms. *Biol Psychiatry* 2014; **75**:470–8.

30. Barnwell SS, Earleywine M, Wilcox R. Cannabis, motivation, and life satisfaction in an internet sample. *Subst Abuse Treat Prev Policy* 2006; **1**:2.

31. Borland R, Yong HH, Balmford J *et al*. Motivational factors predict quit attempts but not maintenance of smoking cessation: findings from the International Tobacco Control Four country project. *Nicotine Tob Res* 2010; **12(Suppl**.): S4–11.

32. ACOSS. Australian Community Sector Survey. NSW, Australia: Australian Council of Social Service (ACOSS), 2014.

33. Bryant J, Bonevski B, Paul CL *et al*. A cross-sectional survey of health risk behaviour clusters among a sample of socially disadvantaged Australian welfare recipients. *Aust N Z J Public Health* 2013; **37**:118–23.

34. Darke S, Heather N, Hall W *et al*. Estimating drug consumption in opioid users: reliability and validity of a 'recent use' episodes method. *Br J Addict* 1991; **86**:1311–6.

35. Baker A, Bucci S, Lewin TJ *et al*. Cognitive-behavioural therapy for substance use disorders in people with psychotic disorders: randomised controlled trial. *Br J Psychiatry* 2006; **188**:439–48.

36. Kay-Lambkin FJ, Baker AL, Kelly B *et al*. Clinician-assisted computerised versus therapist-delivered treatment for depressive and addictive disorders: a randomised controlled trial. *Med J Aust* 2011; **195**:S44–50.

37. Zhou X, Nonnemaker J, Sherrill B *et al*. Attempts to quit smoking and relapse: factors associated with success or failure from the ATTEMPT cohort study. *Addict Behav* 2009; **34**:365–73.

38. Kozlowski LT, Porter CQ, Orleans CT *et al*. Predicting smoking cessation with self-reported measures of nicotine dependence: FTQ, FTND, and HSI. *Drug Alcohol Depend* 1994; **34**:211–6.

39. Fidler JA, Shahab L, West O *et al*. 'The smoking toolkit study': a national study of smoking and smoking cessation in England. *BMC Public Health* 2011; **11**:479.

40. SAS Institute Inc. SAS 9.4. Cary, NC, USA.

41. Australian Bureau of Statistics. Population distribution, Aboriginal and Torres Strait Islander Australians, 2006.

42. Melbourne Institute of Applied and Social Research. Poverty Lines Australia June Quarter 2014. University of Melbourne, 2014.

43. Borland R, Yong HH, O'Connor RJ *et al*. The reliability and predictive validity of the Heaviness of Smoking Index and its two components: findings from the International Tobacco Control Four Country study. *Nicotine Tob Res* 2010; **12(Suppl**.):S45–50.

44. Burns CB, Ivers RG, Lindorff KJ *et al*. Cannabis: a Trojan horse for nicotine?. *Aust N Z J Public Health* 2000; **24**:637.

45. van Beurden EK, Zask A, Passey M *et al*. The Mull Hypothesis: is cannabis use contributing to high tobacco use prevalence among young North Coast males?. *N S W Public Health Bull* 2008; **19**:72–4.

46. Timberlake DS, Haberstick BC, Hopfer CJ *et al*. Progression from marijuana use to daily smoking and nicotine dependence in a national sample of U.S. adolescents. *Drug Alcohol Depend* 2007; **88**:272–81.

47. Vangeli E, Stapleton J, Smit ES *et al*. Predictors of attempts to stop smoking and their success in adult general population samples: a systematic review. *Addiction* 2011; **106**:2110–21.

48. West RJ, Hajek P, Belcher M. Severity of withdrawal symptoms as a predictor of outcome of an attempt to quit smoking. *Psychol Med* 1989; **19**:981–5.

49. Jane-Llopis E, Matytsina I. Mental health and alcohol, drugs and tobacco: a review of the comorbidity between mental disorders and the use of alcohol, tobacco and illicit drugs. *Drug Alcohol Rev* 2006; **25**:515–36.

50. Mathews RR, Hall WD, Gartner CE. Depression and psychological distress in tobacco smokers and people with cannabis dependence in the National Survey of Mental Health and Wellbeing. *Med J Aust* 2011; **195**:S12–5.

51. Bonn-Miller MO, Zvolensky MJ. An evaluation of the nature of marijuana use and its motives among young adult active users. *Am J Addict* 2009; **18**:409–16.

52. Fidler JA, West R. Self-perceived smoking motives and their correlates in a general population sample. *Nicotine Tob Res* 2009; **11**:1182–8.

53. Becker J, Haug S, Kraemer T *et al*. Feasibility of a group cessation program for co-smokers of cannabis and tobacco. *Drug Alcohol Rev* 2015; **34**:418–26.

54. Becker J, Hungerbuehler I, Berg O *et al*. Development of an integrative cessation program for co-smokers of cigarettes and cannabis: demand analysis, program description, and acceptability. *Subst Abuse Treat Prev Policy* 2013; **8**:33.

55. Hill KP, Toto LH, Lukas SE *et al*. Cognitive behavioral therapy and the nicotine transdermal patch for dual nicotine and cannabis dependence: a pilot study. *Am J Addict* 2013; **22**:233–8.