

Driving Behavior Under the Influence of Cannabis or Cocaine

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Objective. The purpose of this study is first to describe perceptions of driving under the influence of cannabis or cocaine among clients in treatment and, second, to assess whether these perceptions are related to the frequency of driving under the influence of cannabis or cocaine.

Methods. A questionnaire was administered to clients in treatment for abuse of either cocaine or cannabis, many of whom also had a problem with alcohol; additional groups of clients consisted of those in smoking cessation and gambling programs ($N = 1021$). Open-ended and close-ended questions were used to assess self-reported effects of cannabis or cocaine on driving and frequency of driving under the influence of cannabis, cocaine, or alcohol.

Results. Two dimensions of driving behavior under the influence of cocaine or cannabis were found in both qualitative and quantitative analyses: 1) physical effects and 2) reckless styles of driving. Common physical effects for both drugs were heightened nervousness, greater alertness, and poorer concentration. In terms of driving behavior, cautious or normal driving was commonly reported for cannabis, whereas reckless or reduced driving ability was frequently reported for cocaine. When comparing negative physical effects and reckless style of driving with frequency of driving under the influence of cannabis or cocaine, increased negative physical effects from cannabis were inversely related to frequency of driving under the influence of cannabis ($p = .001$), but other relationships were not significant.

Conclusions. The findings indicate that both cannabis and cocaine have detrimental but different effects on driving. The negative physical effects of cannabis may reduce the likelihood of driving under the influence of cannabis.

Keywords Cannabis; Cocaine; Driving Style; Driving Under the Influence; Driving Behavior; Questionnaire Survey

INTRODUCTION

In the past decade, collision risk associated with the use of cannabis and cocaine has been of interest to policy-makers and researchers. Much of the research in this area has focused on the pharmacological effects of these drugs. Limited research has been conducted on the perceptions of cannabis or cocaine among those who drive under the influence. The purpose of this study is to describe perceptions and experiences of driving under the influence of cannabis or cocaine among clients in treatment for addictions problems. Specifically, we examine

the perceived effects of cannabis or cocaine and the relationship between these effects and frequency of driving under the influence.

An area of particular interest is how users perceive the effects of cannabis or cocaine on driving and how they deal with these effects in driving situations. For example, do those who drive under the influence of cannabis or cocaine attempt to compensate for the negative pharmacological effects of these drugs by driving more cautiously than normal? Alternatively, do people who drive under the influence of cocaine or cannabis tend to drive more recklessly? Do people who report more negative pharmacological effects drive less frequently under the influence of cannabis or cocaine than those who report fewer negative effects? In this paper, these questions will be addressed within a sample of clients in treatment for substance abuse problems.

Received 14 December 2007; accepted 9 March 2008

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A Comparison of Harms Related to Cannabis and Cocaine Among Treatment Clients

Hathaway et al. (in press) utilized the same database as this study to compare the physiological effects of cocaine and cannabis. The authors found that cocaine clients were significantly more likely than cannabis clients to report effects of feeling powerful and to have problems with sleeping, nervousness, sensory difficulties, paranoia, and violent behavior. Cannabis clients reported significantly more forgetfulness, less alertness, and an increased sense of well-being compared to cocaine clients.

Prevalence of Driving Under the Influence of Cannabis and Cocaine

Cannabis is the most widely used illicit drug in Canada, and therefore the prevalence of driving under the influence of cannabis could be expected to be higher than for the less frequently used substances, such as cocaine (Health Canada, 2004). The prevalence of driving under the influence of cannabis among cannabis users has been reported at about 22% in Ontario (Walsh and Mann, 1999). Laberge and Ward (2004) found that as many as 90% of users were willing to drive after consuming a typical dose. Substance abusers in treatment are much more likely to have driven under the influence of drugs than casual users. Macdonald et al. (2004) found that 50% of the treatment group drove within one hour of consuming cannabis compared with 6% for a sample from the general population, and that 16% of treatment subjects drove under the influence of cocaine compared with 1% of the general population sample. Epidemiological studies have found that the average of injured drivers testing positive for cannabis by urinalysis was about 11%, and slightly over 4% for cocaine, with large variations in the proportions noted for different jurisdictions (Macdonald et al., 2003).

PHARMACOLOGICAL EFFECTS

Experimental research indicates that cannabis impairs various behavioral and cognitive skills, including those related to safe driving (Berghaus and Guo, 1995; Coombs & McAndrews, 1994). Cocaine, however, stimulates the central nervous system; it may therefore not be surprising that most laboratory studies have failed to find deficits in the performance of simple tasks when under the influence of cocaine (Ferrara, 1987). In some instances, improvements in performance have been reported (Coombs and McAndrews, 1994; McKim, 1986). However, the effects of cocaine are not one-dimensional in that the effects of overstimulation on performance may be qualitatively and quantitatively different than the effects of mild-to-moderate stimulation (Burns, 1993). While small doses of cocaine may improve psychomotor performance, larger amounts taken over longer periods may impair performance as a result of dependence and withdrawal effects (Bolla et al., 1999; Burns, 1993). These deficits may be related to an increased risk of collision when driving under the influence of cocaine.

COLLISION RISK WITH DRIVING UNDER THE INFLUENCE OF CANNABIS AND COCAINE

Case-control studies have been conducted using urinalysis or blood tests to assess the presence of metabolites of cannabis or cocaine. Urinalysis tests are limited, however, in that they cannot measure actual impairment and studies using this detection approach have generally not found a relationship between a positive test and collisions (Macdonald et al., 2003). Blood tests are a better indicator of cannabis impairment. One large-scale study using culpability analysis and blood tests to measure active THC metabolites did find a significant relationship between active THC and the likelihood of being culpable for the crash (Drummer et al., 2003). No significant relationship was found for cocaine. Similarly, studies by Laumon et al. (2005) and Ramaekers et al. (2004) found that as cannabis levels increased, so did the driver's responsibility for an accident. For cocaine, case-control studies have not clearly shown a significant relationship with crashes, although methodological limitations exist (see a review by Macdonald et al., 2003). There is evidence, however, that cocaine abusers are at increased risk of collisions (Macdonald et al., 2004).

Perceived Risk and Behavior

Perceived risks of driving under the influence of cannabis or cocaine have rarely been addressed in the literature. In one study, 57% of cannabis users surveyed did not think cannabis use prior to driving affected their risk of an accident (Lenne et al., 2001). Terry and Wright (2005) studied 63 regular cannabis users and 46 undergraduate students and found that most cannabis users believed that the drug impaired driving only slightly, while some considered it to promote better driving. Compared to other illicit drugs, cannabis is typically seen as producing less impairment (Kelly et al., 2004). No study was found with respondents reporting the perceived effects of cannabis or cocaine on their driving.

Very limited research exists on how cocaine affects driving under actual traffic conditions; however, some studies have been conducted on cannabis (see Ramaekers et al., 2004, for a review). Although compensatory behavior by driving more conservatively has been noted for cannabis, this behavior was not sufficient to overcome the impairing effect of the drug (Doblin and Kleiman, 1995; Smiley, 1999; Ramaekers et al., 2004). Studies based on self-reports of driving under the influence of cocaine or cannabis can provide additional insights into the effects of these drugs because they better reflect actual behavior. Subjects may behave differently when they know they are being observed.

RESEARCH QUESTIONS

1. What are the perceived physical effects of driving under the influence of cocaine or cannabis?
2. What is the relationship between the perceived physical effects and driving behavior effects of cocaine or cannabis and frequency of driving under the influence of these substances?

METHODS

Research Design

A cross-sectional study design was used, where participants were asked to recall and provide sequencing of various events. Data were collected with a self-administered questionnaire given to patients upon admission to various treatment programs. The questionnaire focused on injuries, collisions, and suspected risk factors.

The Sample

The main target subjects for this study were groups of clients, 18 years and older, voluntarily entering treatment for problems with cocaine or cannabis. Many of the subjects had additional substance use problems with alcohol and other psycho-actives. Additional groups of clients attending a tobacco smoking cessation clinic and a gambling program who also reported driving under the influence were chosen to allow for sufficient heterogeneity of subjects in terms of frequency of drug use. Respondents received \$20 for their participation. The subjects were recruited from various treatment agencies in Ontario. The response rate was 93.6%.

Data Sources and Measurement

A self-administered questionnaire was used to assess the impact of substance use and various psychosocial characteristics on collisions. A self-administered questionnaire was chosen to help avoid interviewer effects, given the sensitive nature of some of the questions. Wherever possible, existing validated scales with good psychometric properties were selected to assess the constructs of interest.

Two open-ended questions asked the subjects to describe how being under the influence of cannabis or cocaine affects their ability to drive a car. Subjects were asked eighteen quantitative Likert-style items (5-point response categories from strongly disagree to strongly agree), derived from the dangerous styles of driving under the influence scale (Macdonald, 1987). Respondents were able to indicate multiple self-reported effects in relation to their usual driving behavior when under the influence of either cannabis or cocaine. Finally, subjects were asked to report the number of times per month they drove under the influence of cannabis only, cocaine only, alcohol only, and combinations of cannabis or cocaine with alcohol.

RESULTS

Table I presents a breakdown of the proportion of subjects by primary problem for which they were seeking treatment and the proportion of subjects who ever have driven under the influence of cannabis or cocaine. Driving under the influence of cannabis was reported by 75.0% of the subjects receiving treatment for a cannabis problem, and 39.8% of these drove more than 10 times per month. Similarly, 75.7% of cocaine clients drove after using cocaine and 27.2% drove more than 10 times per month. A large proportion of subjects had polydrug problems or used other substances; subjects in treatment for a primary problem with

Table I Sample size of treatment groups

Primary Treatment Problems With	Ever Drove Under the Influence of Cannabis N (%)	Ever Drove Under the Influence of Cocaine N (%)	Total Sample N
Cocaine	209 (69.7)	227 (75.6)	300
Cannabis	96 (75.0)	23 (18.0)	128
Alcohol	81 (73.6)	37 (33.6)	110
Other	24 (68.6)	17 (48.6)	35
Gambling	35 (17.6)	14 (7.0)	199
Tobacco	48 (19.3)	8 (3.2)	249
Total	493	326	1021

cocaine reported the highest rates of driving under the influence of cannabis or cocaine.

A total of 467 respondents provided comments on how cannabis affected their ability to drive a car, and 306 indicated how cocaine affected their driving. We identified 35 distinct responses and noted that these could be classified into two broad themes: 1) *physical effects* of the drugs and 2) how the drugs affected *driving behavior*. Each grouping within these themes was then further combined to reflect the most common responses. The percentage of total responses in each of these two themes are summarized in Figures 1 and 2.

When comparing the physical effects of cannabis and cocaine, paranoia or nervousness was reported more frequently for cocaine (56.7%) than for cannabis (43.5%). Poor concentration was more often reported as an effect of cannabis (21.1%) than cocaine (11.6%). Overall, the rank order of the physical effects for cocaine and cannabis were similar. However, when respondents described how these drugs affected their driving behavior, a dramatically different picture emerged. For driving under the influence of cocaine, 29.7% of the responses indicated that reckless driving was a common behavior, compared with only 2.4% of the responses for driving under the influence of cannabis. Conversely, 39.9% of those who drove under the influence of cannabis reported the attempt to drive more carefully or cautiously, compared with 19% for driving under the influence of cocaine. A higher proportion of responses by the cannabis subjects (27.9%) indicated that they drive normally when under the influence of cannabis, compared with 11.8% of cocaine subjects who drove under the influence of cocaine.

The dangerous styles of driving under the influence of cannabis or cocaine scales were factor analyzed. Two distinct uncorrelated factors emerged with no items appearing on both factors. The first factor comprised of eight items that describe *physical effects* of use. The second factor refers to driving behaviors that can be termed *reckless driving behavior* (see Table II for a list of all items). These factors are very similar to the two dimensions derived from the open-ended questions. Cronbach's alphas, measuring interreliability of the items, were excellent for effects of cannabis (.909) and cocaine (.902); however, the reckless driving subscales were lower (.632 for cannabis and .713 for cocaine).

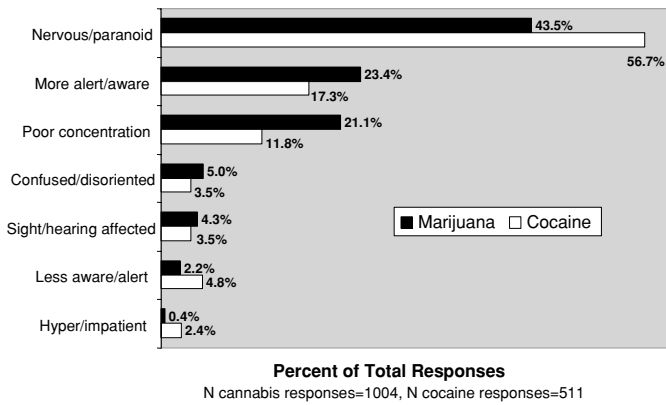


Figure 1 Physical effects of cocaine or cannabis while driving under the influence.

Dropping the tobacco and gambling groups to exclude casual users was considered. In order to determine possible group effects, one-way ANOVA analyses (least square differences) were conducted to assess whether the means for physical effects and reckless driving significantly differed for the treatment groups. For driving under the influence of cannabis, the cannabis group had significantly less physical effects than either the gambling or tobacco groups. In terms of driving behavior, the cocaine group reported significantly more reckless driving under the influence of cannabis driving than the tobacco or alcohol groups. For driving under the influence of cocaine, the cocaine group reported the greatest physical effects overall and significantly more effects than the alcohol group. In terms of driving behavior, the gambling group reported significantly less risky driving under the influence of cocaine than the cannabis group. All other contrasts were nonsignificant. Overall, small nonsignificant differences were noted between groups for the scales.

The next research objective addressed whether scores on these scales were significantly related to frequency of driving under the influence of cannabis or cocaine. Greater negative physical effects of cannabis were significantly related to lesser frequency of driving under the influence of cannabis ($p = .001$, $r = -.18$). Reckless driving behavior was not significantly related to frequency of driving under the influence of cannabis. For

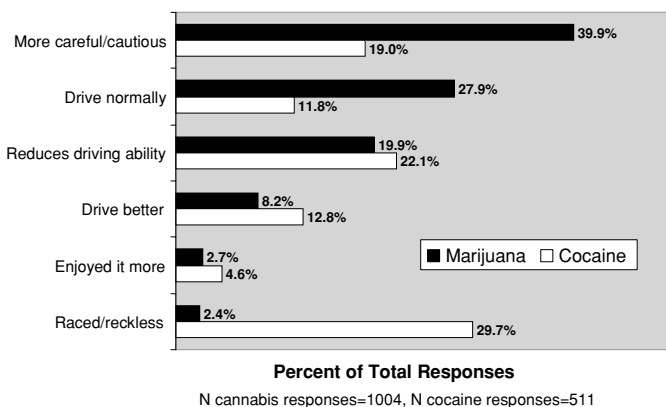


Figure 2 Driving behavior while driving under the influence of cocaine or cannabis.

Table II Driving under the influence of cannabis and cocaine items and two dimensions selected by factor analysis

Negative Physical Effects	Reckless Driving Behavior
Coordination is not as good	More likely to obey laws (R)*
Judging distance was more difficult	Drove more carefully (R)
Reactions were slower	More likely to look all around (R)
Driving was more difficult	More likely to drive faster
My vision was worse	More likely to cut in and out
Jumpy and edgy	More likely to take corners as fast as possible
Too many things happening	More likely to drive recklessly
More difficult to stay in my lane	

Cronbach's alphas: .909 for effects of cannabis and .902 for cocaine *Cronbach's alphas: .632 for effects of cannabis and .713 for cocaine*

*(R) Recoded.

cocaine, neither negative physical effects nor reckless driving behavior were related to frequency of driving under the influence of cocaine.

DISCUSSION

Some limitations of this research should be noted. The data are based on self-perception and no independent objective measures were available to corroborate these perceptions. Second, the sample was composed of voluntary treatment subjects. Those who were ordered to receive treatment may have responded differently, as might those who have not chosen to comply with a treatment order. Finally, we asked about the effects of either cocaine alone or cannabis alone. Many of the subjects likely frequently used these drugs in combination with alcohol or other drugs, and their reports may have been influenced by their typical behavior.

One interesting debate in the literature is the degree to which people compensate for the effects of drugs while driving. This study has shown that a large proportion of substance abuse clients reported that they drove more cautiously when driving under the influence of cannabis. Those who reported greater negative effects of cannabis also showed a lower frequency of driving under the influence of cannabis. These findings appear to support suggestions made in other studies that cannabis impairment may result in avoidance to drive altogether or in compensating by being more cautious (Doblin and Kleiman, 1995; Smiley, 1999). The degree to which users might actually be able to compensate for the effects of cannabis in order to reduce their risks is unknown. Also, a large proportion of clients in this study indicated that they drive normally when under the influence of cannabis, which highlights the heterogeneous nature of driving under the influence of cannabis.

By contrast, those who drove under the influence of cocaine were more likely to report driving recklessly. This finding might be partially attributable to the sense of feeling powerful, which has been reported by the majority of the cocaine clients (Hathaway et al., in press) and noted elsewhere (Erickson et al., 1994). If cocaine produces a sense of feeling powerful, those who drive under the influence may not feel as vulnerable to collisions or other adverse traffic outcomes. While the direct pharmacological effects of cocaine have not been shown to impair psychomotor

capability, the reports of greater risk-taking among those who drove under the influence of cocaine are troubling.

Research has shown that a large proportion of those who use cocaine tend to use alcohol simultaneously (Pakula et al., in press). If this observation of greater risk-taking occurs with simultaneous use of alcohol, the risk of traffic crashes may be extremely great. Similarly, the negative effects of cannabis may be further exacerbated if is used in combination with alcohol; however, given the substantial differences between self-reported driving for cannabis compared with cocaine, current research suggests that the combination of alcohol with cannabis is likely additive in relation to reduction in driving capabilities (Ramaekers et al., 2004).

The intensity of negative drug effects was not statistically related to frequency of driving under the influence of cocaine but was significantly related to the frequency of driving under the influence of cannabis. The finding might be explained in that cocaine is a stimulant, which does not adversely affect psychomotor capabilities. On the other hand, cannabis, a hallucinogen, affects driving ability more adversely. Therefore, less need was taken to drive more cautiously when driving under the influence of cocaine than cannabis.

Findings in this study highlight major perceptions of cannabis and cocaine in relation to driving; however, large differences were noted among individuals. A better understanding for the reasons for these differences should be addressed in future research. Future research will focus on developing subscales to examine relationships with psychosocial measures in order to develop a typology of user groups with risk-taking or harm-avoiding characteristics. Future research is also planned to examine the combinational use of multiple substances, including simultaneous use of alcohol and cocaine.

ACKNOWLEDGMENT

This article received financial support from the Canadian Institutes of Health Research.

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