NOTE TO USERS

Page(s) missing in number only; text follows. Page(s) were scanned as received.

90

This reproduction is the best copy available.

UMI®

Adolescents' Initiation and Cessation of Cigarette Smoking and Marijuana Use:
The Influence of their Attitudes, Peers, and Prenatal Exposure to Nicotine and Marijuana

Amy Jo Porath

Thesis presented to the Faculty of Graduate Studies and Research
in partial fulfilment of the requirements for the Degree of Master of Arts, Department of
Psychology, Carleton University, Ottawa, Canada.

©Amy Jo Porath 2003

National Library
of Canada

Bibliothèque nationale
du Canada

Acquisitions and
Bibliographic Services

Acquisitions et
services bibliographiques

395 Wellington Street
Ottawa ON K1A 0N4
Canada

395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file   Votre référence

ISBN: 0-612-89059-7

Our file   Notre référence

ISBN: 0-612-89059-7

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

In compliance with the Canadian Privacy Act some supporting forms may have been removed from this dissertation.

Conformément à la loi canadienne sur la protection de la vie privée, quelques formulaires secondaires ont été enlevés de ce manuscrit.

While these forms may be included in the document page count, their removal does not represent any loss of content from the dissertation.

Bien que ces formulaires aient inclus dans la pagination, il n'y aura aucun contenu manquant.

Canada

Abstract

The correlates of the initiation and cessation of cigarette smoking and marijuana use were investigated among 152, 16- to 21-year-old adolescents for whom prenatal exposure to nicotine and marijuana was ascertained. The subjects were from a low risk, predominately middle-class sample. Participants reported their history and current use of several drugs and provided a urine sample, allowing the validity of this self-report data to be determined. Subjects also provided data on several drug attitudinal measures and the proportion of their friends who have tried and who regularly use drugs. Results showed that prenatal exposure to nicotine and marijuana were found to be associated with the initiation of cigarette smoking, although only exposure to marijuana was related with marijuana use initiation. Perceived risk of cigarette smoking was not found to be related to the initiation or cessation of adolescent cigarette smoking. Also, girls reported greater access and perceived availability of marijuana than did the boys.

Acknowledgements

I wish to gratefully acknowledge the following people for their roles and invaluable assistance in helping me complete this project:

Dr. Peter Fried for his countless constructive suggestions, and for his continued guidance and support throughout this research project;

Members of the Ottawa Prenatal Prospective Study Research Group – Barbara Watkinson, Robert Gray, and Heather Lintell – for providing me with the necessary tools, research materials, statistical assistance, and expert advice which were both essential and very much appreciated;

The cooperative families in the Ottawa Prenatal Prospective Study who have been participating in the study for approximately 25 years;

Member of my thesis committee – Dr. Anne Bowker, Dr. Robert Hoge, Dr. Colleen Anne Dell, and Dr. Warren Thorngate – for their participation and helpful feedback;

The staff of the Department of Psychology and Graduate Studies, who have been consistently cooperative and helpful throughout the duration of this project;

Finally, I wish to thank my family, friends, and Tim for all of their interest and enthusiasm for this project, and for providing with much-needed support and encouragement.

Table of Contents

List of Tables	ix
List of Appendices	xii
Introduction	1
Prevalence Rates of Youth Cigarette Smoking and Marijuana Use in North America	4
Cigarette Smoking	4
Marijuana Use	6
Adolescents' Initiation of Cigarette Smoking and Marijuana Use	7
Influence of Attitudes	7
Approval/Disapproval of Drugs	8
Cigarette Smoking	9
Gender differences	9
Marijuana Use	11
Summary	12
Perceived Disapproval of Others	12
Cigarettes and Marijuana	13
Cigarette Smoking	15
Marijuana Use	16
Perceived Familial Disapproval	17
Summary	17
Perceived Risk of Harm	18
Cigarette Smoking	18
Marijuana Use	19
Gender, Age, and Other Differences	20
Summary	22
Perceived Availability	22
Summary	24
Influence of Peers	24
Cigarette Smoking	25
Significance of peer influences	27
Gender differences	28
Peer marijuana use	30
Marijuana use	30
Summary	32
Other Influences	33
Familial Influences	33
Physiological and Genetic Influences	35
Cigarette smoking	35
Prenatal nicotine exposure	37
Marijuana use	40

Prenatal cannabis exposure	41
Summary	42
Adolescents' Cessation of Cigarette Smoking and Marijuana Use	43
Influence of Attitudes	43
Cigarette Smoking	43
Marijuana Use	45
Social Influences	48
Cigarette Smoking	48
Gender differences	48
Marijuana Use	49
Other Influences	50
Summary	52
Progression of Adolescent Drug Use	53
Sequence of Drug Use	54
Important Considerations	56
Summary	58
Overview of the Present Study	58
Method	61
Methodological Considerations	61
Participants	64
Instruments and Procedure	67
Reliability and Validity	69
Statistical Analysis	72
Group Categorization	72
Correlates of drug use initiation and cessation	72
Prenatal drug exposure group and gender differences	73
Confounding Variables	74
Plan of Analysis	75
Data reduction scheme	75
Correlates of drug use initiation and cessation	83
Prenatal drug exposure group and gender differences	87
Progression of drug use	88
Results	89
Demographic Characteristics	89
Adolescents' Drug Involvement	89
Cigarette Smoking	89
Marijuana Use	94
Correlates of Drug Use Initiation	95
Cigarette Smoking Initiation	96
Prenatal Drug Exposure	96
Peer Influences	99
Attitudinal Influences	101
Full Model	104

Summary	108
Marijuana Use Initiation	109
Prenatal Drug Exposure	109
Peer Influences	112
Attitudinal Influences	115
Full Model	118
Summary	123
Correlates of Drug Use Cessation	123
Cigarette Smoking Cessation	124
Prenatal Drug Exposure	125
Peer Influences	127
Attitudinal Influences	129
Full Model	131
Summary	136
Marijuana Use Cessation	136
Prenatal Drug Exposure	141
Summary	143
Differences Between Prenatal Drug Exposure Groups and Gender	143
Differences in Attitudinal Influences	144
Prenatal Exposure to Nicotine	144
Gender differences	146
Prenatal nicotine exposure group differences	148
Prenatal Exposure to Marijuana	149
Gender differences	151
Differences in Peer Influences	152
Prenatal Exposure to Nicotine	152
Gender differences	156
Prenatal Exposure to Marijuana	156
Gender differences	160
Prenatal marijuana exposure group differences	160
Summary	162
Progression of Drug Use	163
Drug Use Experience	164
Progression of Involvement in Drug Use	167
Summary	169
Discussion	169
Adolescents' Drug Involvement	170
Correlates of Drug Use Initiation	174
Cigarette Smoking Initiation	174
Expected Findings	174
Prenatal nicotine exposure	174
Peer influences	176
Influence of attitudes	180
Unexpected Findings	183

Prenatal marijuana exposure	184
Peer influences	185
Influence of attitudes	188
Marijuana Use Initiation	191
Prenatal Marijuana Exposure	192
Peer Influences	194
Influence of Attitudes	196
Correlates of Drug Use Cessation	198
Cigarette Smoking Cessation	199
Expected Findings	199
Peer influences	199
Influence of attitudes	200
Unexpected Findings	201
Prenatal nicotine exposure	201
Peer influences	203
Influence of attitudes	203
Marijuana Use Cessation	204
Prenatal Marijuana Exposure	205
Peer Influences	206
Influence of Attitudes	207
Differences Between Prenatal Drug Exposure Groups and Gender	207
Prenatal Drug Exposure Group Differences	208
Gender Differences	210
Expected Findings	210
Unexpected Findings	211
Progression of Drug Use	213
Strengths and Limitations	215
Future Directions for Research	219
Summary and Conclusions	220
 References	 224
 Appendix A	 260
Appendix B	262
Appendix C	288
Appendix D	290
Appendix E	295

List of Tables

Table 1	Intercorrelations Between 17 Items on the Your Thoughts on Drugs Questionnaire ($N = 152$)	77
Table 2	Component Loadings, Communalities (h^2) and Percents of Variance for Principal Components Extraction and Varimax Rotation on Your Thoughts on Drugs Questionnaire Items ($N = 152$)	80
Table 3	Demographic Characteristics of Prenatal Drug Exposure Groups ($N = 152$)	91
Table 4	Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Prenatal Drug Exposure Variables ($N = 152$)	97
Table 5	Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Peer Influence Variables ($N = 152$)	100
Table 6	Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Attitudinal Components ($N = 152$)	102
Table 7	Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables ($N = 152$)	105
Table 8	Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Prenatal Drug Exposure Variables ($N = 152$)	111
Table 9	Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Peer Influence Variables ($N = 152$)	113
Table 10	Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Attitudinal Components ($N = 152$)	116
Table 11	Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables ($N = 152$)	120
Table 12	Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Prenatal Drug Exposure Variables ($N = 70$)	126

Table 13	Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Peer Influence Variables ($N = 70$)	128
Table 14	Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Attitudinal Components ($N = 70$)	130
Table 15	Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables ($N = 70$)	133
Table 16	Descriptive Statistics for Peer Influence and Attitudinal Variables for Youth Reporting Ever Regular Use of Marijuana ($N = 31$)	138
Table 17	Intercorrelations Between Current Regular Use of Marijuana and the Attitudinal and Peer Influence Variables ($N = 31$)	139
Table 18	Results of Logistic Regression Analysis Predicting Cessation of Regular Use of Marijuana from Prenatal Drug Exposure Variables ($N = 31$)	142
Table 19	Unadjusted and Adjusted Attitudinal Dependent Variables Across Prenatal Nicotine Exposure Groups ($N = 152$)	145
Table 20	Univariate Tests of Gender and Prenatal Nicotine Exposure Groups for Attitudinal Dependent Variables ($N = 152$)	147
Table 21	Unadjusted and Adjusted Attitudinal Dependent Variables Across Prenatal Marijuana Exposure Groups ($N = 152$)	150
Table 22	Univariate Tests of Gender for the Attitudinal Dependent Variables ($N = 152$)	153
Table 23	Unadjusted and Adjusted Peer Influence Dependent Variables Across Prenatal Nicotine Exposure Groups ($N = 152$)	155
Table 24	Univariate Tests of Gender for Peer Influence Dependent Variables ($N = 152$)	157
Table 25	Unadjusted and Adjusted Peer Influence Dependent Variables Across Prenatal Marijuana Exposure Groups ($N = 152$)	159

Table 26	Univariate Tests of Gender and Prenatal Marijuana Exposure Groups for Peer Influence Dependent Variables ($N = 152$)	161
Table 27	Percentage of Adolescents Reporting 'Ever Use' of Various Drugs from the Drug History Questionnaire ($N = 152$)	165
Table 28	General Pathways of Substance Use Among the Ottawa Prenatal Prospective Study Adolescents ($N = 152$)	168
Table D1	Unadjusted and Adjusted Logarithmic Transformed Peer Influence Dependent Variables Across Prenatal Marijuana Exposure Groups ($N = 152$)	291
Table D2	Univariate Tests of Gender and Prenatal Marijuana Exposure for Logarithmic Transformed Peer Influence Dependent Variables ($N = 152$)	293

List of Appendices

Appendix A	Participants Consent Form	260
Appendix B	Drug History Questionnaire	262
Appendix C	Your Thoughts on Drugs Questionnaire	288
Appendix D	Prenatal Marijuana Exposure Group Differences in Peer Influences Using Logarithmic Transformed Peer Variables	290
Appendix E	Sequences of Drug Use Among Adolescents in Ottawa Prenatal Prospective Study ($N = 152$)	295

Adolescents' Initiation and Cessation of Cigarette Smoking and Marijuana Use:

The Influence of their Attitudes, Peers, and Prenatal Exposure to Nicotine and Marijuana

It has been well documented that adolescence is the time of first exposure to drugs for almost all who will ever use drugs (Chen & Kandel, 1995; Fiore, 1992; Kandel, Chen, Warner, Kessler, & Grant, 1997; Kandel & Yamaguchi, 1993; National Institute on Drug Abuse, 1998; Nelson et al., 1995), with initiation of use occurring most often in grades 6 through 9 (i.e., modal ages 11-12 to 14-15) for cigarette smoking (Johnston, O'Malley, & Bachman, 2001a), and age 14 for marijuana (Substance Abuse and Mental Health Services Administration [SAMHSA], 1997). Yet despite growing concern about preventing substance use among individuals of this age group, many North American youth continue to engage in drug-using behaviours. Further contributing to this problem, however, is the fact that many women of reproductive age also engage in drug use, which may in turn expose fetuses to the harmful effects of these dangerous substances. Two of the most commonly used non-medicinal drugs that are taken during pregnancy are cigarettes and marijuana (Fried, 1993) and the damaging effects of these substances, especially those caused by nicotine, have received much research attention in the past few decades (for reviews, see Cornelius & Day, 2000; Ernst, Moolchan, & Robinson, 2001; Fried, 1993, 1995; Gruber & Pope, 2002; Hellstrom-Lindahl & Nordberg, 2002; Niaura et al., 2001; Walker, Rosenberg, & Balaban-Gill, 1999). For the sake of brevity, cigarette smoking and marijuana use have often been referred to as "drug use" or "substance use" in the following sections of the current study.

In recent years, numerous etiological theories have been proposed to account for adolescent substance use and the cessation of such behaviour (for reviews, see Lettieri, 1985; Newcomb & Bentler, 1988; Niaura & Abrams, 2002; Petraitis, Flay, & Miller, 1995; Scheier, 2001). As a result, a number of factors have been the focus of many empirical investigations in an attempt to determine the complex etiology associated with these phenomena. Two important themes that seem to recur in the literature on adolescent drug involvement are the influences of young people's attitudes and their peers. In sharp contrast to the comprehensive literature on youth substance use, however, there are relatively fewer investigations which have concentrated on adolescent drug use cessation. In those studies which have been conducted, though, adolescents' attitudes and the influence of their peers also appear to exert quite an important effect on young people's decisions to quit using drugs.

Another important theme in the literature on youth drug involvement is that of the progression of substance use, with many studies finding evidence of a clear developmental sequence. Briefly, drug use is found to generally follow a sequential pattern, with the majority of adolescents first using alcohol and/or tobacco, before progressing onto the use of marijuana and other illicit drugs.

The current study is part of an ongoing longitudinal investigation, comprised of a low-risk, predominately White, middle-class sample of children who have been followed since birth. Since 1978, the Ottawa Prenatal Prospective Study (OPPS) has been examining the consequences of prenatal exposure to a number of different substances that are commonly used during pregnancy, on various aspects of development in the offspring

of maternal drug users. The primary objective of this research was to corroborate and extend the youth drug involvement literature by investigating the influences of adolescents' attitudes and their peers, in addition to the influence of prenatal exposure to nicotine and marijuana, on the initiation and cessation of cigarette smoking and marijuana use among participants in the OPPS sample. This study significantly extends previous research on adolescent drug involvement in several respects. First of all, it has investigated a wide range of attitudinal and psychosocial variables that previous theory and research indicate may be relevant to both the initiation and cessation of substance use including disapproval of drug use, perceived risk of harm from using drugs, perceived availability of drugs, peer substance use, and perceptions of the drug-related attitudes of one's peers. Moreover, unlike previous investigations which have typically involved samples of high-risk youth, the current study is comprised of a low-risk, predominately White, middle class sample which may allow for greater generalizability in the findings. Of particular importance, however, is the fact that (a) the prenatal histories of the OPPS participants have been extensively examined, and (b) the OPPS participants have been investigated since birth. Therefore, the current study was able to assess the influence of prenatal exposure to nicotine and marijuana on both the initiation and cessation of adolescent cigarette smoking and marijuana use. With the exception of a few studies linking prenatal nicotine exposure to the initiation of cigarette smoking during adolescence, no other study to date has examined the potential effect of prenatal exposure to nicotine and marijuana on the initiation and cessation of youth marijuana use, or on the cessation of adolescent cigarette smoking.

Another important objective of the current study was to determine the extent to which the influences of adolescents' attitudes and their peers differ between those youth in the OPPS who were prenatally exposed to differing levels of nicotine and marijuana and those who were not, and to try and identify any possible sex differences. No other investigation to date has looked for potential differences in these attitudinal and peer influence variables as a function of prenatal drug exposure.

Additionally, the current study has also examined the progression of drug use in order to determine if a particular sequence of such use exists among adolescents in the OPPS sample.

In the literature review that follows, several broad areas of research have been covered. A brief synopsis of the topics presented is provided here. First, the prevalence rates of youth cigarette smoking and marijuana use in North America have been briefly presented, in order to capture the magnitude of this serious problem. Second, factors contributing to the initiation and cessation of the aforementioned substances by adolescents is discussed, respectively, with the roles of young people's attitudes and their peers representing the primary focus of this review. Finally, an overview of the literature describing the progression of drug use among adolescents has been presented.

Prevalence Rates of Youth Cigarette Smoking and Marijuana Use in North America

Cigarette Smoking

While rates of cigarette smoking among adults have remained relatively stable since 1990 at about 23-26% (Centers for Disease Control and Prevention [CDC], 1998a;

Health Canada, 2002; SAMHSA, 2001), recent trends in youth cigarette smoking show that this behaviour is on the decline among this age group. Despite this positive pattern, though, significant numbers of adolescents in both Canada and the United States (U.S.) continue to adopt the smoking habit. For instance, recent results from the Ontario Student Drug Use Survey (OSDUS), which is the largest ongoing study of adolescent drug use in Canada, indicate that 23.6% of grades 7 to 13 Ontario students smoked cigarettes during 2001, representing a 5.6% decrease from rates reported in 1999 (Centre for Addiction and Mental Health [CAMH], 2001). Rates of smoking among males (23%) were found to be similar to those reported by females (23.8%; CAMH, 2001). Such figures of adolescent smoking in Canada are generally consistent with those obtained from the Monitoring the Future (MTF) study in the U.S. The design of the MTF study has been extensively described elsewhere (Johnston, O'Malley, & Bachman, 2001b; Johnston, O'Malley, & Bachman, 2002a); briefly, it is a series of large, annual surveys of nationally representative samples of students in public and private secondary schools throughout the 48 contiguous states, and has tracked high school seniors' substance use patterns and attitudes towards drugs since 1975. In 1991, 8th- and 10th-graders were added to the study. According to recent results from the MTF study, 62.5% of high school seniors reported lifetime use of cigarettes, while 31.4% reported smoking cigarettes in the previous 30 days (Johnston et al., 2001b). Interestingly, this survey found no striking gender differences in terms of young people's general or daily use of cigarettes in the month prior to being surveyed (Johnston et al., 2002a). It is important to note, however, that neither of the above mentioned surveys of adolescents included high

school dropouts in their samples; thus, rates of youth cigarette smoking are likely to be even higher than those reported.

In sum, the use of cigarettes among North America youth, although declining, appears not to be an isolated phenomenon affecting only a small segment of this population. Rather, the above prevalence rates indicate that cigarettes are widely used by both genders of this age group.

Marijuana Use

Marijuana is the most commonly used illicit drug (Adlaf, Paglia, Ivis, & Ialomiteanu, 2000; Anthony, Warner, & Kessler, 1994; Gilvarry, 2000; Hall, Johnston, & Donnelly, 1999; Smart & Ogborne, 2000). More than half of the U.S. population have reported trying this substance at some point in their lives, with most first using it as adolescents (Chen & Kandel, 1998; Hubbard, Franco, & Onaivi, 1999). Since the early part of the 1990s, the use of marijuana by adolescents has been on the rise. According to the OSDUS, the percentage of 7th- to 13th-grade students reporting marijuana use in 2001 rose 0.5% in 1999 to 29.8% in 2001 (CAMH, 2001). The use of this illicit substance was found to be more frequent among males (33.7%) than females (26.0%; CAMH, 2001). Additionally, recent data from the U.S. MTF study indicate that 36.5% of high school seniors' reported using marijuana in the past year, with approximately 20% reporting daily use (Johnston et al., 2001b). In terms of gender differences, this survey found a greater proportion of males to have used marijuana in the past year than females (Johnston et al., 2001a; Johnston et al., 2002a). If high school dropouts were included in

the above mentioned studies' samples, these trends in youth marijuana use would likely be even more disturbing.

As is indicated by the prevalence figures noted above, marijuana is also widely used by both male and female adolescents across North America, and to an even greater degree than cigarettes. There are considerable implications associated with such widespread use of these two substances, and this is especially the case among women of reproductive age. It has been reported that at least half of all pregnancies in North America are unplanned (Walker et al., 1999), which indicates the potential that exists for fetuses being prenatally exposed to nicotine and marijuana.

Adolescents' Initiation of Cigarette Smoking and Marijuana Use

Influence of Attitudes

Attitudes refer to evaluations of people, objects or ideas that consist of either a positive or negative reaction (Eagly & Chaiken, 1993, 1998; Petty & Wegener, 1998). They represent useful concepts of our understanding of the outside world as they are evaluative judgements, and are formed to summarize our past experiences and thus simplify choices of future behavioural patterns (Weber, 1992). There are several components which make up attitudes, (Rosselli, Skelly, & Mackie, 1995; Tesser & Martin, 1996) including an affective component, consisting of emotional reactions toward the attitude object, a cognitive component, consisting of thoughts and beliefs about the attitude object, and a behavioural component, consisting of actions or observable behaviours toward the attitude object. It has also been suggested that a genetic

component contributes to the formation of attitudes in the sense that they are related to temperament and personality, which in turn are directly related to genes (Tesser, 1993).

Adolescents' attitudes towards drugs and drug use have been consistently identified as strong influences in determining whether or not this group of individuals will initiate substance-using behaviours. In recent years, several different types of attitudes have been implicated by researchers as being significantly associated with adolescents' initiation of cigarette smoking and marijuana use including personal approval or disapproval of using, perceived disapproval of others using, perceived risk of harm from using, and the perceived availability of drugs. Evidence in support of the link between youths' initiation of cigarette smoking and marijuana use and each of these various types of attitudes will be discussed in the following portion of the literature review.

Approval/Disapproval of Drugs

A logical deduction is that favourable attitudes toward an activity will result in a greater likelihood of and level of participation in that activity, while negative attitudes or rather disapproval tend to decrease such likelihood. This deduction appears to apply to adolescents' initiation of substance use in that youth with favourable attitudes towards cigarettes and marijuana are more likely to become involved with such substances, whereas those with more negative attitudes do not. In the following section of the literature review, findings relating adolescents' favourable or negative attitudes towards cigarettes and marijuana to their involvement with these substances will be reviewed, with findings related to cigarettes and marijuana discussed separately.

Cigarette Smoking

Several studies have consistently shown that adolescents' pro-smoking attitudes are positively linked to their smoking behaviour. For instance, in their 8-year follow-up study of a cohort of Ontario high school students, Pederson and Lefcoe (1987) attempted to predict the onset of cigarette smoking and found that adolescents who had more positive attitudes toward cigarette smoking and less knowledge about its associated health effects were much more likely to have an increased involvement with cigarette smoking as compared to those youths with more negative attitudes towards tobacco. Similarly, Spear and Akers (1988) also found that positive attitudes toward smoking, in addition to other factors such as integration of smoking into lifestyle, and association with peers who smoke and who have a positive attitude toward cigarette smoking, were the variables that most highly correlated with smoking frequency.

Other studies of student-only samples have reported similar findings with respect to the association between favourable attitudes towards cigarettes and smoking behaviour (Armstrong, de Klerk, Shean, Dunn, & Dolin, 1990; Christie, Cormack, Wyllie, & Bungey, 1989; de Vries & Kok, 1986; Griffin, Botvin, Doyle, Diaz, & Epstein, 1999; King, Robertson, & Warren, 1985; Lo, Blaze-Temple, Binns, & Ovenden, 1993; Piko, 2001; Reid, 1989).

Gender differences. More recent studies investigating the association between adolescents' attitudes of approval or disapproval and their patterns of cigarette smoking have noted some important gender differences. In general, these studies have shown that the influence of attitudes plays a more important role in the smoking behaviour of

females as opposed to males. Griffin and colleagues (1999) recently conducted a 6-year follow-up study of the determinants of heavy cigarette smoking (i.e., 20 cigarettes per day or more) among a sample of predominately White, American high school seniors from middle-class backgrounds. Measures of attitudes and smoking were first taken while the students were in the 7th-grade, with follow-up measures taken during the 12th-grade. Logistic regression analyses revealed that less heavy smoking was predicted by early antismoking attitudes among the girls in this sample, but this was not found to be the case among the boys.

Another study which has reported the significant influence of positive attitudes towards cigarettes on smoking behaviour among females is one conducted by Charlton and Blair (1989). These authors attempted to determine the important predictors of smoking initiation including perceived positive and negative values of cigarette smoking, and found that for girls, having positive views of smoking was one of the four most significant variables that predicted cigarette smoking, although for boys, perceived positive values about smoking was found to be the least important predictor of cigarette smoking.

Piko (2001) has studied a sample of adolescents from inner-city Szolnok, Hungary and found that an antismoking attitude proved to be the most important influencing factor of tobacco use among these youth. The stronger the adolescents' antismoking attitude, the less they were found to smoke cigarettes. Interestingly, it was found that while the number of smoking friends could definitely moderate this attitude and thus the linkage between attitude and smoking activity in girls and younger adolescents, this variable was not found to moderate the effect of an antismoking attitude

in boys and older adolescents. Such a finding suggests that girls and younger adolescents are more susceptible to social influences, such as peers, and concurs with results from other studies that will be reviewed later on (Chassin, Presson, Sherman, Corty, & Olshavsky, 1984; Chassin, Presson, Sherman, Montello, & McGrew, 1986; Hu, Flay, Hedeker, Siddiqui, & Day, 1995; Sarason, Mankowski, Peterson, & Dinh, 1992).

An important limitation of Piko's study, however, is that her results are based on a sample of inner-city youth, and may not necessarily reflect those obtained from a low-risk sample, such as the OPPS. These findings, therefore, should be interpreted as possibly representative of only other high-risk samples.

Marijuana Use

A relatively fewer number of studies have examined the association between adolescents' approval of marijuana use and their own patterns of use of this substance. Of those which have been conducted, their results appear to indicate that such an association exists. Kosterman, Hawkins, Guo, Catalano, and Abbott (2000) longitudinally examined the patterns and predictors of marijuana use initiation in an ethnically diverse sample of predominantly lower-class youth from high crime neighbourhoods. The participants were interviewed annually from 10 to 16 years of age and again at 18 years of age, and were asked about their marijuana use norms (i.e., whether they thought it is okay for someone of their age to smoke marijuana, and whether they thought it hurts people to use this substance). The results revealed that the adolescents' norms against marijuana use showed a highly significant effect in inhibiting their initiation of marijuana use. The results from this study, however, are based on a

high-risk sample of youth and should, therefore, be interpreted as possibly representative of only other high-risk samples.

A study of high school pupils from Holon (a city in the centre of Israel) has also reported the significance of adolescents' attitudes in influencing their use of marijuana. This study found that adolescents who consumed illicit drugs (including marijuana) had a much more liberal attitude towards such substances as compared to non-users (U. Brook, Feigin, Sherer, & Geva, 2001).

Summary

The results of several studies show a significant link between adolescents' favourable or negative attitudes towards cigarettes and marijuana, and their degree of use of such substances. Interestingly, the influence of this variable appears to be more important to females as opposed to males, as was demonstrated in a number of recent studies focusing on cigarette smoking. It would be of interest to see if such a relationship applies to marijuana use.

Perceived Disapproval of Others

Another type of attitude that has been studied by researchers is adolescents' ideas about the attitudes of others, particularly their peers, concerning the initiation of substance use. As will be reviewed later, peers are a significant influence on adolescents' attitudes and behaviours toward drug use, and there is a vast number of studies showing strong relationships between young peoples' substance use and that of their friends. In the following section of the literature review, research relating adolescents' perceived

disapproval of others for using drugs to their own patterns of cigarette smoking and marijuana use will be presented, with a particular emphasis on the perceived disapproval of peers. Research examining the effects of perceived familial disapproval will only be reviewed briefly. The findings of studies which have involved both cigarettes and marijuana will be discussed jointly, whereas studies which have only focused on one of these drugs will be discussed separately.

Cigarettes and Marijuana

Several research studies investigating adolescents' ideas about their friends' attitudes on drug use, or adolescents' ideas about the negative impact of their drug use on their friendships, have reported that young people who believe that their friends disapprove of using drugs are less likely to use drugs themselves. For instance, using a subset of data from the MTF study, Robin and Johnson (1996) examined the influence of perceived peer disapproval of drug use (including cigarettes and marijuana), in predicting the frequency of adolescent substance use among high school students. It was found that the adolescents' perceived peer disapproval was negatively associated with both their cigarette smoking and marijuana use, with the association being slightly higher for the latter substance. Results also revealed that the adolescents' perceptions of peer disapproval of cigarette smoking decreased as their grade level increased, with a similar pattern being observed for marijuana use, although each higher level of marijuana use (i.e., from once or twice to occasionally to regularly) was generally more greatly disapproved of.

Similarly, a study by Needle and colleagues (1986) reported that peer attitudes towards cigarettes and marijuana, as perceived by adolescents, were significantly related to the adolescents' reported annual use of these two substances. Drawing upon data from the first year of their longitudinal investigation involving a sample of predominately White, middle to middle-to-high income families with at least one child being 11, 12, or 13 years of age at the onset of the study, the authors found that the greater the adolescents perceived the disapproval of their friends to be, the less likely they were to have reported smoking cigarettes or using marijuana in the past year. Interestingly, the results from this study also indicated that the youths' perceptions of their peers' attitudes towards cigarette smoking, relative to their perceived attitudes of their parents and older siblings, were more strongly correlated with their own use of cigarettes.

Towberman and McDonald (1993) have also reported a significant relationship between youth smoking and marijuana use, and the perceived attitudes of their peers. Their study cross-sectionally examined the attitudinal components related to adolescent drug experimentation and use, by using data from an ongoing longitudinal study of high school students. While results revealed a significant relationship between youth drug use (including cigarettes and marijuana) and the perceived attitudes towards substance use of friends and school peers, the strongest correlation observed in this study involved an adolescent's drug avoidant attitude. Such a finding, therefore, concurs with the previously reviewed research suggesting that young people who hold negative or avoidant attitudes towards drugs may also exhibit lower rates of drug involvement (U. Brook et al., 2001; Griffin et al., 1999; Kosterman et al., 2000; Piko, 2001).

Cigarette Smoking

A number of studies which have focused solely on cigarette smoking have also found a significant association between adolescents' perceived attitudes of their peers concerning cigarettes, and their own smoking behaviour. For instance, a recent study by Barber, Bolitho, and Bertrand (1999) involving middle-class, junior and senior high school Canadian students found evidence of a link between youth cigarette smoking and the perceived approval of such behaviour by peers. Specifically, this study's results revealed that adolescents' perceived friends' approval of cigarette smoking was significantly associated with smoking behaviour across all ages for both males and females. Interestingly, within the 14- to 15-year-old age group, adolescents' perceived peer approval of cigarette smoking emerged as a significantly more important predictor of girls' rather than boys smoking.

The importance of adolescents' perceptions of the attitudes of their peers has also been demonstrated in a recent study by Unger, Rohrbach, Howard-Pitney, Ritt-Olson, and Mouttapa (2001). These authors investigated the association between peer influence variables and susceptibility to cigarette smoking, and found that among both never-smokers and ever-smokers, respondents were more likely to be susceptible to cigarette smoking if they believed that their best friends would act friendly if they smoked, or that smoking makes young people look cool. It has been suggested that these peer influence variables may increase adolescents' willingness to consider smoking in the future (susceptibility), which may in turn increase the likelihood that they will experiment with cigarettes (Unger et al., 2001).

Griffin and colleagues' (1999) earlier mentioned study also underscores the importance of the perceived attitudes of peers in influencing youth cigarette smoking, and has even revealed an important gender difference. Specifically, results from this study have indicated that the perceived pro-smoking attitudes of peers were strongly associated with later heavy smoking for girls, although not for boys, in this sample. In fact, the adolescents' perceived friends' attitudes toward cigarette smoking were found to be the strongest predictor of later smoking for girls in this study, such that those who reported that their friends were not strongly against cigarette smoking were about 11 times more likely to become heavy smokers, relative to girls who reported that their friends were strongly against cigarette smoking.

Marijuana Use

In contrast to the smoking literature, there is almost a lack of research solely examining the effects of perceived peer disapproval on adolescent marijuana use. One study which has explored this influence, however, is that of Bailey and Hubbard (1990), and it highlights the importance of perceived peer disapproval of marijuana use on young people's initiation of this illicit substance. Specifically, the results from this study revealed that greater perceived peer disapproval of marijuana use was significantly associated with a decreased likelihood of initiation of marijuana use by young people. Interestingly, it was found that the adolescents' perceived disapproval of use from friends was more effective than the perceived disapproval from parents in discouraging the initiation of marijuana use, especially for the older adolescents in this sample.

Perceived Familial Disapproval

There are also a number of studies that have examined the association between adolescents' perceived parental disapproval of drug use and their own use of such substances. In general, these studies have indicated that when youth perceive that their parents have favourable attitudes towards substance use, they use drugs at high rates (Marston, Jacobs, Singer, Widaman, & Little, 1988; Rees & Wilborn, 1983). The reverse has also been found such that those adolescents who perceive that their parents disapprove of substance use are less likely to initiate using drugs themselves (Bailey, Flewelling, & Rachal, 1992; Como-Lesko, Primavera, & Szesko, 1994; Krosnick & Judd, 1982; Needle et al., 1986; Towberman & McDonald, 1993). A similar association has also been documented with perceived sibling disapproval (Krohn, Naughton, & Lauer, 1987; Needle et al., 1986).

Summary

In sum, the results of several studies indicate strong and consistent associations between adolescents' ideas about the attitudes of others concerning cigarette and marijuana use, and their own patterns of use of these substances. Although the majority of studies have dealt with the perceived attitudes of others towards the use of cigarettes, a few have focused on marijuana. Further research is needed in order to develop this growing body of literature.

An important sex difference emerged within the reviewed studies; that is, the perceived disapproval of others was found to be a more important influence for females as opposed to males. Also of interest is the fact that adolescents' perceived peer

disapproval of drug use was generally found to be more effective than the perceived disapproval from parents in discouraging the initiation of drug use. The perceived disapproval of siblings tended to fall somewhere in the middle.

Perceived Risk of Harm

In recent years, one of the attitudes that researchers have found to be significantly associated with drug use in general, and cigarette and marijuana use in particular, is perceived risk. Perceived risk refers to perceptions of the negative effects from using drugs, and has consistently been found to be significantly correlated with rates of youth substance use. An area of perceived risk that has received a great deal of research attention is that of physical harm, or the negative effects of substance use on the body. The following section will review evidence relating adolescents' perceived risk of harm with their use of cigarettes and marijuana, with findings related to each of these substances discussed separately.

Cigarette Smoking

A number of studies have reported a significant link between adolescents' perceived risk of harm from cigarettes and their patterns of smoking behaviour. For instance, a recent study by Tomori, Zalar, Kores Plesnicar, Ziherl, and Stergar (2001) of Slovenian high school students investigated which psychosocial factors distinguish adolescent cigarette smokers from non-smokers, and examined the most important factors that were correlated with smoking. Results from their study indicate that the smokers of both sexes differed significantly from the non-smokers in terms of attitudes towards the

harmful physical effects of cigarette smoking. Additionally, it was also found that a lower estimate of the harmfulness of cigarette smoking on one's health was one of the most important predictive factors of smoking behaviour for adolescents of both sexes.

Similar results were reported in a study by Williams and Covington (1997). Using a standard multiple regression procedure, these researchers found that the perceived health risks of cigarette smoking were one of the most important variables predicting youth smoking behaviour. Interestingly, some of the other variables that predicted smoking among adolescents in this sample included peer smoking, family smoking, and family closeness.

Results from Robin and Johnson's (1996) earlier reviewed study also underscore the importance of perceived risk in influencing adolescent cigarette smoking and marijuana use. In order to predict the frequency of use of these two substances among high school students, this study examined the influence of perceived riskiness of both cigarettes and marijuana. Results showed that the perceived risk associated with drug use tended to vary among substances and patterns of use. Specifically, the highest level of perceived risk was found to be associated with cigarette smoking and regular marijuana use, whereas only low levels of perceived risk were found to be associated with once or twice, or occasional use of marijuana.

Marijuana Use

Studies have also shown a link between adolescents' perceived riskiness of marijuana use and their own use of this substance, with nonusers of marijuana generally having higher levels of perceived risk of harm compared with users (e.g., Duitsman &

Colbry, 1995; Johnston, O'Malley, & Bachman, 1996; Szalay, Inn, Strohl, & Wilson, 1993). Bachman, Johnston, and O'Malley (1998) examined the degree to which perceived risk and disapproval towards substance use influenced marijuana use among American high school seniors by using data from the MTF study. They found that both of these variables were among the most important determinants of marijuana use among young people in this sample. Similarly, results from a recent meta-analysis involving close to 200 studies indicated that perceived risk was the fifth most important factor among more than 20 factors that influenced the use of marijuana among adolescents (Derzon & Lipsey, 1999). An earlier study conducted by Goodstadt, Sheppard, and Chan (1984), however, did not find the perceived risks of marijuana use (defined as likelihood and seriousness of consequences) to be strongly associated with either trying or continuing marijuana use among a sample of grades 7 to 13 Ontario students.

Gender, Age, and Other Differences

There are also important gender differences that have been found to be associated with perceptions of risk. For instance, several studies have indicated that males tend to have lower levels of perceived harmfulness of marijuana use compared with females (Danseco, Kingery, & Coggeshall, 1999; Pascale & Evans, 1993; Tyler & Lichtenstein, 1997). Interestingly, however, results from a study by Hemmelstein (1995) of U.S. high school students found no differences between male and female students with regard to perceptions of risk as it relates to marijuana use, although perceptions of risk were found to correlate negatively with level of marijuana use. There have been no studies to date

that have examined the existence of gender differences in terms of perceived risk of cigarettes. This issue, however, has been addressed in the current study.

Perceptions of risk from drug use have also been found to vary with age (Danseco et al., 1999). Adolescents tend to be quite optimistic about avoiding harm compared with adults' perceptions of physical harm, which is consistent with the view that youth often feel invulnerable (e.g., Cohen, MacFarlane, Yanez, & Imai, 1995; Hemmelstein, 1995; Spear, 2000).

Researchers have also found that the levels of perceived risk tend to be specific to the frequency of drug use (e.g., Danseco et al., 1999; Gonzalez & Haney, 1990; Johnston et al., 2001b; Lo & Globetti, 1995). That is, adolescents are likely to perceive lower levels of risk from occasional or experimental use of drugs as opposed to regular use. A recent study by Resnicow, Smith, Harrison, and Drucker (1999) examined the characteristics that distinguished heavy and occasional cigarette and marijuana use among American high school seniors who had completed the 1994 MTF survey. Results revealed that the heavy users of cigarettes or marijuana reported significantly lower levels of perceived risk of regular use of each substance compared to occasional users. In addition, it was also found that the heavy and occasional users did not generally differ with respect to levels of perceived risk of occasional substance use. The authors also found that compared to heavy users, occasional cigarette or marijuana users reported significantly lower rates of illicit drug use.

Summary

Results from several studies examining the effects of adolescents' perceived risk of harm from drug use on their patterns of substance use have consistently demonstrated a significant association between these two variables. An area of perceived risk that has received a great deal of research attention is that of physical harm, with studies reporting that youth concerned with the perceived health risks of cigarette smoking and marijuana use are less inclined to initiate using these drugs. Perceptions of risk from drug use have been found to vary with a number of variables: namely gender, age, and frequency of substance use. Several studies have reported that males and younger adolescents generally have much lower levels of perceived risk than do females or older adolescents. In addition, it has been noted that adolescents tend to perceive lower levels of risk from occasional or experimental use of drugs, as opposed to regular use.

Perceived Availability

There have been relatively few empirical studies to date which have examined how the perceived availability of drugs relates to actual drug use among young people. Of those which have been conducted, however, the results do appear to suggest that this factor plays an important role. For instance, an early study conducted by Smart (1977) surveying students from all areas of Ontario indicated that the perceived availability of marijuana was significantly associated with the use of this substance among adolescents in the sample, and accounted for approximately 47% of the variance in use of marijuana. Perceived availability of cigarettes was also found to be significantly related to the use of tobacco, and accounted for 36% of the variance in tobacco use in this study.

In another study which used a sample of Ontario students (grades 7-13), Goodstadt et al. (1984) found that the initiation of marijuana use was more common among those youth who indicated that it would be easy for them to obtain this drug if they wanted it. Results from the 2001 OSDUS also appear to concur with these earlier reports by Smart (1977) and Goodstadt et al. (1984).

According to the OSDUS, perceptions of easy availability were the highest for marijuana, and recent increases in the use of this illicit substance by young people were found to be associated with increases in its perceived availability (CAMH, 2001). Perceptions of availability of cigarettes were not examined in this study, probably as a result of their high degree of accessibility. Furthermore, the OSDUS has reported that adolescents' increasing perceptions of availability of drugs, in addition to their weakening perceptions of risk of harm and personal disapproval of drug use, are the three most significant factors that have added to the increasing rates of adolescent drug use in Canada (CAMH, 2001).

It is important to take into account, however, that studies examining the perceived availability of drugs are dealing with the perceptions of adolescents and may not necessarily reflect the actual availability of such substances per se. Nonetheless, the way in which youth perceive the availability of drugs is more important than the actual availability of these substances in influencing their behaviour (Newcomb, Huba, & Bentler, 1983).

Summary

Although there is a paucity of research examining the influence of adolescents' perceived availability of drugs on their own patterns of drug use, work by Canadian researchers indicates that this factor does indeed play an important role. Further research must continue to be conducted, then, in order to provide additional support for the role of this type of attitude in influencing youth substance use. Such an endeavour, however, has been undertaken in the current study.

Influence of Peers

Relationships and social interactions with peers take on particular importance during adolescence (Bee, 2000; Schaffer, 1997; Spear, 2000; Thornberry & Krohn, 1997). During an average week in the academic year, adolescents have been reported to spend close to one-third of normal waking hours talking with peers, but only 8% of this time talking with adults (Csikszentmihalyi, Larson, & Prescott, 1977). Although peers provide a significant source of positive experiences for adolescents, with youth reporting that they are most happy when talking with their peers (Csikszentmihalyi et al., 1977), peers can also in some cases facilitate antisocial behaviour, such as drug use. In the following section of the literature review, evidence relating the influence of peers to adolescents' initiation of substance use will be presented, with findings related to cigarettes and marijuana discussed separately.

Cigarette Smoking

There is a wealth of evidence reporting that peers play a pivotal role in the adolescent's decision to smoke cigarettes, and it has been suggested that the influence of peers is the single most important factor related to smoking acquisition (Petraitis et al., 1995). Many youths take their first cigarette in the presence of peers (Botvin, Eng, & Williams, 1980; Evans, Smith, & Raines, 1984) and peer smoking has been found to be one of the most consistent predictors of adolescent smoking, typically accounting for more of the variance in smoking behaviour among this age group than any other variable. Recent empirical studies in this area are summarized below.

Urberg, Cheng, and Shyu (1991) longitudinally investigated the effects of peer influences on adolescent cigarette smoking in a sample of White, middle-class students in grades 8 and 11. In addition to providing information about their own smoking behaviour and that of their friends at two points in time (i.e., Time 1 and Time 2), the adolescents in this study also provided the identity of their best friend. Hence, the data from the individual named as best friend was used to measure peer smoking, rather than the adolescent's perceptions of the friend's smoking. Results from this study revealed that the smoking behaviour of 8th-graders was more like that of their best friends' at Time 2 than it had been at Time 1, suggesting that close peers influence each other in decisions about whether and how much to smoke.

A recent prospective study by Killen and colleagues (1997) also supports the contention that adolescents' cigarette smoking is significantly influenced by that of their peers. Killen et al. examined several risk factors for the initiation of cigarette smoking in a sample of predominately White high school students. For both genders, it was found

that among youth with no history of cigarette smoking at a baseline assessment, those with more friends who smoked at baseline were significantly more likely to have initiated smoking over the study interval.

Similar results have been reported by Pederson, Koval, and O'Connor (1997), in their examination of the psychosocial characteristics associated with cigarette smoking behaviour. Using a sample of Ontario students, these researchers found that those youth who had ever tried cigarettes reported, on average, 2.0 of their 5 closest friends having tried smoking compared to 0.4 for never smokers. No gender differences were found with respect to the number of the 5 closest friends who were reported to have tried smoking.

Urberg, Degirmencioglu, and Pilgrim (1997) examined the relative influences of closest friend's and friendship group's smoking on adolescents' cigarette smoking in a longitudinal study of high school students. Closest friend's use was found to be influential, albeit modestly, in the initiation of youth cigarette use. Results also indicated that neither grade nor gender were related to the amount of influence, suggesting that peer influence on cigarette smoking during adolescence may operate similarly for different aged adolescents of both genders.

Stanton, Currie, Oei, and Silva (1996) followed a sample of New Zealand adolescents for three years in order to examine changes in social influences on smoking behaviour. At 18 years of age, cigarette smoking was found to be associated with having a close friend who smokes, having a significant other who smokes, and having a majority of smokers as one's friends. These associations, however, were not found to vary as a function of gender.

Significance of peer influences. As has been shown, adolescents' initiation of cigarette smoking behaviour is significantly influenced by that of their peers. It is of interest to note, however, that a number of studies have reported that peer influences are actually more influential than parental influences with respect to adolescent smoking. For example, using structural equation modelling, Flay and colleagues' (1994) demonstrated that friends' smoking was a significant predictor of cigarette smoking among adolescents in their sample, with the influence of friends' smoking exerting stronger and more direct effects on adolescent smoking than parental smoking. Interestingly, the effects of parental smoking were found to be stronger for girls than boys.

Consistent with Flay et al.'s (1994) results were Wang, Fitzhugh, Westerfield, and Eddy's (1995) finding that parents' cigarette smoking exerted little influence on adolescent cigarette smoking. In their examination of the age trend of peer and family influence on adolescent cigarette smoking, Wang and colleagues used a computer-assisted telephone interview to collect data from adolescents aged between 14 and 18 years. Peer influences, especially the smoking status of one's best friend, proved to be the most significant and consistent predictor across all ages. Parental cigarette smoking, however, was found to exert little influence on adolescent smoking overall. A possible explanation for this recurring finding comes from the fact that cigarette smoking begins at a time when the orientation of the growing adolescent shifts from the family to the peer group (Bee, 2000; Schaffer, 1997). Therefore, the increasing bonds with peers, and the possible weakening of bonds with parents, may have an important influence on adolescents' cigarette smoking behaviour.

Gender differences. There have been a number of investigations that have examined gender differences with respect to the influence of peers on adolescent cigarette smoking, and it appears that the smoking behaviours and attitudes of peers may be more influential in girls' smoking than in boys' smoking. Recent empirical studies that have reported this finding are summarized below.

van Roosmalen and McDaniel (1992) compared boys' and girls' smoking habits and attitudes vis-à-vis the smoking behaviours and attitudes of their peers. It was found that teenage female smokers had a greater proportion of friends who smoked than did teenage male smokers. When their best friend smokes regularly, 77.8% of adolescent female smokers said they were not sure if they would quit smoking, versus 49.3% of adolescent male smokers. This finding was also found to extend to close friends of the opposite sex; female smokers with a close male friend who smoked were more likely to report that they were not sure if they would quit smoking than male smokers with a close female friend who smokes. Among young adults who report that they have a best friend who smokes regularly, 62.4% of girls were smokers, and 56.6% of boys were smokers.

Chassin, Presson, Sherman, Corty, et al. (1984) followed a sample of junior and high school students for two years to examine the influences of social psychological variables on cigarette smoking transitions. It was found that adolescents who started smoking cigarettes had greater numbers of friends who smoked, with the influence of peers being more important to the initiation of smoking than to the transition to regular smoking. With respect to gender differences, the smoking transitions of girls were found to be better predicted by peer influences than were the smoking transitions of boys. In a further analysis of this same sample, Chassin and colleagues (1986) examined the

importance of peers in relation to smoking transitions over the course of one year. It was found that initially non-smoking adolescents with more smoking peers were more likely to initiate smoking, while early stage smokers with more smoking friends were more likely to become regular smokers. When gender differences were examined, peer influences proved significant for girls but not for boys.

Similar results have been reported by Sarason and colleagues (1992), who investigated adolescents' reasons for cigarette smoking in a sample of 10th-grade students. Results from their study revealed that girls were significantly more likely than boys to report smoking because their friends did and because their friends pressured them to start. Such findings are consistent with those of other studies suggesting that girls' smoking is more strongly linked with peers' smoking than is boys' smoking.

Hu and colleagues (1995) longitudinally examined the relative importance of both friends' and parental influences on youth cigarette smoking in a large sample of middle school students followed from the 7th-grade through to the 9th-grade. The associations between current smoking and friends' smoking, and between parental smoking and current smoking, were found to be significant. When gender differences were examined, the influences of peers and parents' smoking were found to be greater for females than males. For both genders, the influence of friends' smoking was found to be stronger than the influence of parental smoking, a finding that is consistent with earlier reviewed studies (Flay et al., 1994; Wang et al., 1995). Additionally, it was found that for females, but not for males, the effects of friends' smoking on current smoking increased significantly over time. The authors concluded that girls may be more susceptible to social influences, and especially peer influences, than are boys.

Peer marijuana use. The results from a number of studies have indicated that peers' use of marijuana also influences cigarette smoking among adolescents. For instance, using discriminate analysis with a sample of New York State junior and senior high school students, Welte and Barnes (1987) found that the second best predictor of adolescents' cigarette smoking was the proportion of their friends who were high on drugs weekly; the best predictor was the adolescents' own marijuana use. Similar results were found in a multiple regression analysis by Robinson and colleagues (1987) with respect to the influence of peer marijuana use on adolescent cigarette smoking. Using a sample of predominately White, middle-class, 10th-grade students, these authors found that peer marijuana use most strongly predicted increased levels of both cigarette smoking and marijuana use among adolescents of both genders. Additionally, results from a study by Lo and colleagues' (1993) have shown that peers' use of marijuana (which is also likely to be related to peers' use of cigarettes, although not measured in this analysis) is the most significant variable when discriminating between past and non-cigarette smokers. Such findings appear to suggest that young people start smoking cigarettes in an environment where their friends are smoking either tobacco or marijuana.

Marijuana Use

In comparison to the smoking literature, there are relatively fewer studies that have focused on the influence of peers on the initiation of marijuana use among youth. Nonetheless, peer influences have been found to be associated with marijuana use among adolescents, and are suggested to be the strongest predictor of the use of this substance among this age group (Glynn, 1981; Kandel & Adler, 1982).

Several longitudinal and cross-sectional studies have identified peer use of marijuana as an important predictor and correlate of adolescent marijuana use (e.g., Kosterman et al., 2000; Needle et al., 1986). Moreover, adolescents' perceptions of their peers' use of marijuana have also been found to be significantly associated with their own use of this illicit substance. Such a finding was reported in an early study by Stein, Newcomb and Bentler (1987), who conducted an 8-year study of multiple influences on youth drug use. Using a sample of students who were in junior high school at the study's inception, results revealed that the students' perceptions of their peers' drug use exerted a significant influence on their own patterns of marijuana use. Although there is a possibility of inaccuracies and projective biases in the students' responses since the data in this study are based on the perceptions of others, one may argue that the way in which one perceives the behaviour of others is more important than the actual behaviours performed by others (Newcomb et al., 1983).

The significant influence of peers on adolescent marijuana use is also underscored by results from a recent study by J.S. Brook, D.W. Brook, Arencibia-Mireles, Richter, and Whiteman (2001). These authors conducted an integrated analysis of data from three different studies in order to examine the early psychosocial predictors of later marijuana use among adolescents from different environments. The data used in this analysis were derived from (a) a sample of predominately White adolescents representative of the northeastern U.S., (b) a sample of minority adolescents from the East Harlem section of New York City, and (c) a sample of Colombian adolescents from two cities in Colombia, South America. The results from this study revealed that peer cigarette smoking and

marijuana use significantly increased the odds of the adolescents' own marijuana use, whereas having high-achieving peers was found to significantly reduce such odds.

Griffin, Botvin, Scheier, and Nichols (2002) investigated whether several behavioural and psychosocial factors measured during early adolescence predicted regular marijuana use six years later in a sample of predominately White, middle-class 7th-grade students. Findings from this study indicate that cigarette smoking-related behaviours of friends in the 7th-grade predicted later regular marijuana use for both boys and girls. Boys who reported that half or more of their friends smoked cigarettes were 3.32 times as likely to be subsequent monthly marijuana users as high school seniors compared to boys who reported that none of their friends smoked cigarettes. Correspondingly, girls who reported that half or more of their friends smoked cigarettes were 2.6 times as likely to be regular marijuana users as high school seniors compared to girls whose friends had never smoked cigarettes. The authors of this study also found that the early use of cigarettes predicted later regular marijuana use for both genders, while anti-marijuana attitudes were associated with less later regular marijuana use in girls. Although it appears that the influence of peers is exerting a stronger influence on male adolescents' use of marijuana as compared to that of females, it is important to keep in mind that the use of marijuana is more common among males than females (CAMH, 2001; Johnston et al., 2002a).

Summary

As a whole, the literature suggests that there are strong and consistent associations between the influences of peers and adolescent cigarette smoking and marijuana use.

With respect to cigarette smoking, peer influences appear to be the strongest in the transition from experimental to regular smoking, and seem to increase through mid-adolescence, peaking between the ages of 15 to 18 years. There is some evidence that girls' smoking may be more strongly associated with peers' smoking behaviour and attitudes than is boys' smoking, however, there are several studies that have found no gender differences in the association between peer influences and cigarette smoking. Although this area of research is not yet as comprehensive as that of cigarette smoking, there is a definite association between peer influences and youth marijuana use. Further research will help to further our current understanding of this important relationship.

Other Influences

In addition to peers, there are several other variables that have been linked with adolescents' initiation of cigarette smoking and marijuana use, including familial and physiological and genetic influences. The following section briefly reviews findings relating these important influences to adolescent cigarette smoking and marijuana use.

Familial Influences

There is now an abundance of research implicating familial factors in influencing young people's initiation of cigarette smoking and marijuana use. Parental drug use appears to be one of the most important familial influences on youth substance use, with findings from several studies reporting this association. For example, in a comprehensive review on the predictors of cigarette smoking initiation among adolescents, Conrad, Flay, and Hill (1992) reported that seven of the 13 studies examining the influences of parental

smoking showed significant results (Charlton & Blair, 1989; Chassin, Presson, Sherman, Carty et al., 1984; Chassin et al., 1986; Goddard, 1990; Murray, Swan, Johnson, & Bewley, 1983; Semmer, Cleary, Dwyer, Fuchs, & Lippert, 1987; Semmer, Dwyer et al., 1987). Moreover, evidence from more recent research also supports the association between parental and adolescent smoking (e.g., Bauman, Foshee, Linzer, & Koch, 1990; Chassin, Presson, Todd, Rose, & Sherman, 1998; Kandel & Wu, 1995; Tuakli, Smith, & Heaton, 1990).

Similar results have also been documented with marijuana, such that parental use of this substance influences adolescents' decision to initiate using it (e.g., Aseltine, 1995; J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Brook, Brook, De La Rosa et al., 2001; Duncan, Duncan, & Hops, 1996; Ellis & Stone, 1979; Hops, Duncan, Duncan, & Stoolmiller, 1996; Kandel, 1973; Needle et al., 1986; Newcomb et al., 1983).

Another important familial influence on adolescents' initiation of drug use is that of siblings, and this association has also been reported in several studies (e.g., J.S. Brook, Whiteman, & Gordon, 1982, 1983; Burchfiel, Higgins, Keller, Butler, & Donahue, 1989; Duncan et al., 1996; Foon, 1986; Kosterman et al., 2000; Krohn et al., 1987; McKilip, Johnson, & Pretzel, 1973; Needle et al., 1986; Presson et al., 1984; Santi, Best, Brown, & Cargo, 1990-1991; Tuakli et al., 1990). It is suggested that older siblings constitute a separate, important, and additional reference group for younger siblings that influences both drug-using and non-using behaviours (Needle et al., 1986).

Family structure and closeness also appear to be important factors that are associated with the initiation of youth substance use. Several studies have reported that adolescents who experience family disruption (through parental death, separation, or

divorce) or who are in a non-traditional living arrangement are generally found to be involved with drugs (Jenkins & Zunguze, 1998; Needle, Su, & Doherty, 1990; Simantov, Schoen, & Klein, 2000; Stein et al., 1987; Williams & Covington, 1997).

Physiological and Genetic Influences

Recent research has shown that the etiology of drug use among adolescents is not to be found solely in the psychosocial factors discussed previously. Rather, physiological and genetic factors have also been found to play an important role. Such factors may include malfunctioning of the brain's neurotransmitters, which carry impulses from one neuron to the next. More likely, though, it is the interaction between psychosocial and biological/genetic factors, formally referred to as the *stress-diathesis model*, that determines the presence of drug use. The inherited genotype is acted on by environmental psychosocial factors, and this interaction results in the phenotypic presence of drug use. Many investigators are currently exploring the exact genetic/biological inherited factors that predispose someone to drug use. Although not the focus of this literature review, these findings should be mentioned here because of their role in adolescent substance use. Research related to cigarette smoking and marijuana use will be discussed separately.

Cigarette smoking. Recently, there has been a growing body of literature suggesting that genetic factors play a significant role in influencing both the initiation of cigarette smoking and the risk of becoming a long-term persistent smoker once smoking is initiated. A study of male twins found that genetic factors contributed 50% and

environmental factors, 30%, to the variance in risk for smoking initiation. In terms of smoking persistence, only genetic factors were found to play a major role in determining whether smoking initiation would be followed by regular smoking, and accounted for 70% of the variance in liability (True et al., 1997). Similarly, a study of both male and female twins found that genetic effects accounted for 74% of the variance in risk of being a current smoker, with shared environmental effects being non-significant. Interestingly, there was a trend for a higher heritability in men (70%) than in women (51%), with shared environmental effects accounting for 25% of the variance in women (but having no significant effect in men) when parameters specific to each sex were estimated. This study also found that genetics contributed 58% to the variance in risk for smoking persistence in both males and females (Heath et al., 1993; see also Kendler et al., 1993).

Studies of adopted children have also revealed that the increased similarity in smoking behaviour between monozygotic twins, as opposed to dizygotic twins, is the result of a genetic influence and not just a shared family environment (i.e., parents, older siblings, neighbourhood, school, or shared peer influences). Osler, Holst, Prescott, and Sorenson (2001) have reported that male adoptees had an increased probability of being a cigarette smoker when their biological mothers were current smokers, but this was not found to be the case for female adoptees. Another adoption study found that the resemblance of biological parents and their adopted-away children ($r = .21$) in terms of average consumption of cigarettes, exceeded that of adoptive parents and their adoptive children ($r = -.02$; Eaves & Eysenck, 1980).

Although the acquisition and maintenance of cigarette smoking are quite different processes, research as a whole supports the contribution of genotype on both. That is,

genetic factors not only seem to influence which individuals will initiate cigarette smoking, but they also appear to play a considerable role in determining which individuals will subsequently become persistent, long-term smokers.

Prenatal nicotine exposure. There have also been several studies evaluating the relationship between prenatal nicotine exposure and subsequent substance use initiation in the offspring of maternal cigarette smokers. For instance, animal researchers have noted that changes resulting from prenatal nicotine exposure might affect susceptibility to later tobacco use (Miao et al., 1998; Nordberg, Zhang, Fredriksson, & Eriksson, 1991; Smith, Weidler, & Slotkin, 1991). In a 13-year follow-up study of 6- to 18-year-old children, the conclusion was that maternal smoking during childhood increases children's risk of becoming adult smokers, independent of paternal smoking, parent's education and household income (Oesler, Clausen, Ibsen, & Jensen, 1995). In Denmark, 28% of smoking young adults could be attributed to maternal smoking (Oesler et al., 1995).

In a retrospective study, Kandel, Wu, and Davies (1994) reported a 4-fold increased risk of tobacco use and persistence in tobacco use among female (but not male) offspring who were exposed to tobacco prenatally. Somewhat similarly, Weissman, Warner, Wickramaratne, and Kandel (1999) found that maternal prenatal cigarette smoking predicted drug dependence in female but not in male offspring and also predicted conduct disorder in male but not in female offspring. The statistical control of parental psychiatric diagnoses, family risk factors, and a variety of pregnancy and delivery complications showed that these variables did not account for their findings. Unfortunately, the results of this study are somewhat limited by the use of retrospective

reports of maternal smoking, the small size of the study group, and the clinical-based selection of participants.

In attempting to understand the mechanisms accounting for a relationship between prenatal nicotine exposure and the later initiation and use of cigarettes during adolescence, Kandel et al. (1994) hypothesized that since nicotine stimulates the actions of cholinergic neurons and enhances activity in dopaminergic systems involved in addictive behaviour (Dani & Heinemann, 1996), it is quite plausible that nicotine can affect the fetus, perhaps through the nicotine input into the mesolimbic dopaminergic reward system, so as to predispose the brain in a critical period of its development to the subsequent addictive influence of nicotine consumed later in life (Collins, 1990-1991; Corrigall, 1991; Koob, 1992; Mereu et al., 1987; Nestler, 1992). The prenatally induced predisposition to smoking might be enhanced further after birth by passive smoking and/or by nicotine in the breast milk. Due to its lipophilic character, nicotine rapidly passes into human milk, where it builds up concentrations 3 times as in the blood (Luck & Nau, 1984). These hypotheses, however, have not been clinically examined.

Why this effect should appear for female and not male offspring also remains to be understood. Several possible explanations have been put forth. The sex difference may reflect the distinctive sexual dimorphism of the brain, including hormonal and structural factors, which emerge during fetal development. Additionally, the release of androgens may protect the male against the priming effect of nicotine. Prenatal exposure also could potentiate different genetic vulnerabilities for girls and boys (Kandel et al., 1994).

In another report, Griesler, Kandel, and Davies (1998) showed that maternal smoking during pregnancy was significantly associated with higher levels of child behaviour problems and that these behaviour problems increased the likelihood of smoking among daughters between the ages of 9 and 17. Similarly, the association between prenatal tobacco exposure and early tobacco experimentation was also found in the recent Maternal Health Practices and Child Development prospective study of adult women and their offspring (Cornelius, Leech, Goldschmidt, Lebow, & Day, 2000). In this study, 10-year-old children exposed to tobacco at the level of at least one-half pack per day during gestation had a 5.5-fold increased risk for early tobacco experimentation, after controlling for prenatal exposure to other substances and their mothers' current smoking habits. The only factor that produced a greater risk of early experimentation was exposure to smoking within the child's peer group. In an attempt to understand why prenatal nicotine exposure is related to early smoking experimentation, these authors have suggested that the nervous system damage caused by maternal smoking may later be expressed as impulsivity, inattention, aggression, depression, and/or anxiety, and may in effect create a vulnerability in the adolescent that could contribute to poorer adjustment and an increased likelihood of early initiation of tobacco use. Moreover, Cornelius and her colleagues' finding that pre-adolescents who were prenatally exposed to tobacco were more likely to have experimented with smoking than those whose mothers were current smokers reinforces the hypothesis that a physiological effect of prenatal exposure to smoking, rather than a genetic vulnerability affecting both mother and child, may be an important link between mothers' smoking during pregnancy and pre-adolescent smoking experimentation.

Many epidemiological studies, therefore, support a relationship between maternal smoking during pregnancy and the later use of tobacco by the offspring. However, it is important to note that these effects are difficult to separate from numerous confounding environmental and genetic factors, and that types and number of confounding variables and corrections for their effects vary across studies (Hellstrom-Lindahl & Nordberg, 2002). For instance, women who smoke during pregnancy are more likely to be depressed, anxious, or to have other mental health problems that could affect parent-child interactions and/or impose a genetic influence on the development of the child. Moreover, it has been reported that the nicotinic receptors are already present in the brain during the first trimester (Hellstrom-Lindahl & Nordberg, 2002). Thus, it remains unclear whether *in utero* exposure to nicotine serves to increase the risk of psychiatric problems and neurocognitive deficits which may in turn increase the susceptibility to nicotine dependence among adolescents, or whether prenatal nicotine exposure sensitizes the central nervous system to nicotine directly (Hellstrom-Lindahl & Nordberg, 2002).

Marijuana use. Although there is a lack of research which has examined the influence of physiological and genetic factors on the initiation of marijuana use, there are a number of recent studies that have strongly associated genetic factors with cannabis dependence. A study of female twins found that environmental factors played a major role in determining whether marijuana use would be initiated, but only a minor role in determining whether initiation would be followed by regular use. In contrast, genetic factors were found to play a moderate role in determining whether marijuana use would be initiated and a major role in determining whether initiation would be followed by

regular use, abuse, and dependence. This study suggests that, at least for women, marijuana abuse and dependence are highly heritable, with genetic factors accounting for 60 to 80% of the variance in liability (Kendler & Prescott, 1998).

In a study of male twins, significant genetic contributions were found for the transition from exposure to use, from initial use to use more than five times, and from use more than five times to regular use (Tsuang et al., 1999). Another study of male twins found that genetics contributed 43.9% and common family environmental factors, 21.3%, to the variance in risk for marijuana abuse or dependence (True et al., 1999). Further evidence supporting heritability is a study showing that non-twin siblings of marijuana-dependent individuals are more likely than are siblings of controls to develop marijuana dependence (Bierut et al., 1998).

Prenatal cannabis exposure. Similarly to nicotine, cannabinoids cross the placenta so that marijuana use during pregnancy exposes the fetus. Although there have been several studies examining the effects of prenatal marijuana exposure on pregnancy outcome (Shiono et al., 1995), growth measures (Cornelius, Taylor, Geva, & Day, 1995; Fried, Watkinson, & Gray, 1999), and cognitive and attentional deficits (Fried & Watkinson, 1990; Fried, Watkinson, & Gray, 1992, 1998; Goldschmidt, Day, & Richardson, 2000), there have been no studies to date which have examined the effects of prenatal cannabis exposure on later drug use in the offspring of maternal marijuana users. It has been shown that cannabinoid receptors are present in the fetal and neonatal brain at levels which are substantially higher than those seen in the adult human brain (Glass, Dragunow, & Faull, 1997). Moreover, results from a recent study by Park, Gibbons,

Mitchell and Glassa (2003) suggest that CB1 cannabinoid receptors are present in the placenta. Thus, as was speculated with respect to prenatal nicotine exposure, prenatal marijuana exposure may also sensitize the central nervous system to cannabis directly, and in effect influence the later development of substance use in the offspring of maternal drug users.

Summary

Genetic influences have been found to influence young people's decisions to smoke cigarettes and use marijuana. Results from large epidemiological surveys of twin panels indicate that heredity influences both the initiation and persistence of cigarette smoking, as well as the abuse of marijuana. Although the number of adoption studies are meagre, their results also appear to suggest a strong association between genetic factors and substance use.

There is also recent data from several epidemiological studies that indicate that maternal smoking during pregnancy might induce a predisposition in the offspring to initiate smoking later in life. Moreover, exposure to nicotine *in utero* may also increase the risk of nicotine dependence among female (but not male) adolescents. Although it is not yet clear exactly how the effect of prenatal nicotine exposure is related to later smoking behaviour, the physiological effects of such exposure have been suggested. One may only speculate that this line of reasoning extends to the later use of marijuana during adolescence, since there is a total lack of research to date which has examined the effect, if any, of prenatal exposure to marijuana on the subsequent use of this substance in adolescence. Such an association, however, has been examined in the current study.

Adolescents' Cessation of Cigarette Smoking and Marijuana Use

Compared to the vast literature on the factors related to the initiation of adolescent cigarette smoking and marijuana use, there is a contrasting lack of research on those factors that are associated with the cessation of these behaviours. Moreover, there are even fewer studies that have focused on sex differences, despite evidence from several substance use prevention programs indicating that they are not equally effective for boys and girls (Botvin, Baker, Filazzola, & Botvin, 1990; DeJong, 1987; Graham, Johnson, Hansen, Flay, & Gee, 1990). Understanding the determinants of adolescent cessation behaviour, including whether there are any sex differences in these determinants, is important in terms of better informing drug use prevention efforts that may need to be adapted in order to meet the special needs of male and female drug users. In the following section of the literature review, factors related to the cessation of youth cigarette smoking and marijuana use will be presented, with an emphasis on the influences of adolescents' attitudes and their peers. Findings related to the cessation of cigarette smoking and marijuana use will be discussed separately.

Influence of Attitudes

Cigarette Smoking

Smoking attitudes have been found to be relevant to the cessation process, with quitting more likely among adolescents who hold less positive and more negative attitudes towards cigarettes, feel efficacious in resisting cigarettes, and intend not to use cigarettes in the future. Moreover, personal health concerns and knowledge about the harmful effects of cigarettes also appear to contribute to smoking cessation (Jensen &

Overgaard, 1993). From research among adult smokers, it is known that beliefs regarding the social and health consequences of cigarette smoking predict quitting attempts (Eiser, van de Pligt, Raw, & Sutton, 1985) and success (Kirscht, Janz, & Becker, 1989). In addition, an explorative study by Stone and Kristeller (1992) of occasional and daily adolescent smokers revealed that health reasons and discontentment with the addiction were related to intentions to quit. Similar results were obtained from a study by Tuakli and colleagues (1990) in that one of the major reasons cited for smoking cessation was health concerns.

The importance of smoking attitudes in contributing to the cessation of this behaviour has also been demonstrated in a longitudinal study by Hansen, Collins, Johnson, and Graham (1985). Using a sample of high school students who were identified as cigarette smokers at a pre-test, the authors of this study re-examined these adolescent smokers three months and fifteen months later in order to determine the predictors of self-initiated cessation. The results indicated that the adolescents who quit smoking were more concerned with the consequences for others and the morality of cigarette smoking - they perceived smoking as devaluing their personal worth. In addition, those students who quit smoking tended to have fewer friends who smoked.

Skinner, Massey, Krohn, and Lauer (1985) collected three-year panel data from 7th- to 12th-grade adolescents and found that those youth who quit smoking were more inclined than continuing smokers to believe that alcohol and tobacco use are wrong. Similarly, a study of Dutch adolescent smokers found that negative attitudes toward cigarette smoking and strong resistance self-efficacy differentiated between adolescents

who were not motivated to quit and those who had quit at a 3-year follow-up (Engels, Knibbe, de Vries, & Drop, 1998).

Having intentions to discontinue smoking in the future has also been found to be associated with youth cigarette smoking cessation. For example, in a prospective school-based cohort study by Sargent, Mott, and Stevens (1998), a sample of White, predominately low- and middle-class, high school students were surveyed at baseline and then annually up to three subsequent years regarding their substance use behaviours. Of those adolescents who were identified as smokers at baseline, it was found that those who could definitely rule out smoking in the future had higher cessation rates compared to those who could not. A statistically significant association was also found between youth smoking cessation and their personal disapproval of others smoking one or more packs of cigarettes per day.

Thus, it is clear that adolescents' attitudes play a significant role in the discontinuation of cigarette smoking.

Marijuana Use

Research examining the precursors of marijuana use cessation has also demonstrated the importance of adolescents' attitudes in this process. Recent empirical studies in this area are summarized below.

As was found to be the case in the literature on smoking cessation, several studies have found that the most compelling reasons for quitting marijuana use may be related to the perceived physiological and psychological effects of the drug. For instance, Bailey and colleagues (1992) investigated whether predictors from a social context domain (e.g.,

peers' use of drugs) or a drug-specific domain (e.g., perceived consequences of drug use on psychological and physiological functioning) would better distinguish between those who became regular users of marijuana versus those who experimented with its use but never became regular users. Using a sample of high school students, they found that those who reported never having gotten "stoned" from marijuana use, and those who believed that the physical and mental adverse effects of marijuana were important, were less likely to continue to use marijuana. Similarly, Goodstadt et al. (1984) investigated reasons for marijuana use cessation among Ontario high school students, and found that the main reasons for quitting included not considering marijuana use as being very important, having alternative interests, and being worried about the health consequences associated with its use.

In a study of adult marijuana users (mean age of 31.74 years) seeking cessation treatment (Stephens, Roffman, & Simpson, 1993), it was revealed that two reasons related to the negative physiological effects of marijuana use, "self-control" and "health concerns," received the highest ratings on a "Reasons for Quitting" scale. Receiving lower ratings were social context variables such as "self-image," "not socially acceptable," and "legal problems." Similarly, P.A. Fried's (personal communication, 2001) work with the OPPS has revealed that one of the reasons cited by adolescents for discontinuing the use of marijuana is the impact this drug has on their immediate memory. Taken together, these findings suggest that the primary reason people quit using marijuana is because of drug-specific physiological and psychological effects.

The importance of negative attitudes towards marijuana use in contributing to the cessation of this behaviour has also been demonstrated in a recent study by Sussman and Dent (1999). These authors conducted a large-scale study of the predictors of marijuana use cessation one year later among a sample of predominately White, continuation high school adolescents who were regular users of marijuana at a baseline assessment. Marijuana cessation was defined as not having used marijuana in the last 30 days and having no intentions to use it in the future. It was found that those youth who reported receiving relatively less approval for using drugs and who held relatively unfavourable attitudes about the acceptability of drug use were relatively likely to quit using marijuana. This study also revealed that those adolescents who quit using marijuana reported more certainty than did nonquitters that it was wrong to use drugs, and they scored higher on expectations of negative outcomes for marijuana use.

The representativeness of these findings, however, is questionable since this study's sample was comprised of continuation high school youth. Continuation high school youth are those who have transferred out of the regular school system owing to functional problems (e.g., lack of credits, drug use; Sussman, 1996). The population represented, therefore, was unique and may not necessarily be representative of other low-risk samples of adolescents. As a result, these findings should be interpreted as possibly representative of only other high-risk samples.

Thus, adolescents' attitudes appear to play an influential role in the cessation of both cigarette smoking and marijuana use. Of particular importance are young people's health concerns, unfavourable attitudes, and intentions to discontinue drug use in the future, in contributing to the cessation of the use of these two substances.

Social Influences

Cigarette Smoking

Youth drug use cessation has also been found to be associated with various social influences, particularly family and peers. Several studies have reported that cigarette smokers with a nonsmoking family background or who have nonsmoking peers feel more strongly motivated and supported to quit (Chassin, Presson, & Sherman, 1984; Rose, Chassin, Presson, & Sherman, 1996; Stanton et al., 1996; Stone & Kristeller, 1992; Tuakli et al., 1990). It has also been found that less smoking among peers predicts cessation over periods ranging from 6 to 15 months (Burt & Peterson, 1998; Ershler, Leventhal, Fleming, & Glynn, 1989; Hansen et al., 1985), although other studies with relatively long follow-ups of 3-4 years have not found associations between peer smoking and cessation (Engels et al., 1998; Zhu, Sun, Billings, Choi, & Malarcher, 1999).

Peer groups tend to be quite homogenous in their substance use patterns, and thus, it is possible that smoking friends could stimulate others to continue smoking and discourage smoking cessation. This was in fact found to be the case in a qualitative study by Presti, Ary, and Lichtenstein (1992), whereby almost 20% of those adolescents who tried to quit smoking reported that their friends made it harder to stop by offering cigarettes, providing harassment, and smoking around the individual.

Gender differences. There is a paucity of research that has addressed the issue of sex differences with respect to peer influences on adolescent smoking cessation. In one of the few studies that has addressed this issue, Skinner and colleagues (1985) have reported that peer smoking is a significant predictor of quitting for girls but not boys. A

limitation of this study, however, is that conclusions were based on an analysis that stratified by sex, rather than one that explicitly tested for sex differences. Nonetheless, this finding is consistent with research on cigarette smoking initiation suggesting that adolescent girls are more vulnerable to social influences than are adolescent boys (e.g., Chassin, Presson, Sherman et al, 1984; Chassin et al., 1986; Hu et al., 1995; Sarason et al., 1992).

Similar findings were obtained in a more recent study by Ellickson, Tucker, and Klein (2001) which investigated sex differences in the predictors of smoking cessation from the 10th- to 12th-grade, among a predominately White sample of high school students who reported smoking at least 11-20 times during the past year at grade 10. Cessation was defined as not smoking during the past year at grade 12. Sex-specific analyses indicated that girls who quit smoking within 2 years had friends who smoked less frequently, perceived less parental approval of their smoking, had weaker intentions to continue smoking, used marijuana less frequently, were more likely to have an intact nuclear family, experienced peer support, and rated themselves as healthier. Similar analyses for boys yielded results that were generally weaker and non-significant, with only less perceived parental approval being related to cessation.

Marijuana Use

In sharp contrast to the literature on youth cigarette smoking cessation, there are relatively fewer studies to date which have examined the effects of social influences on youth marijuana use cessation. Results from two studies which have examined this important association, however, indicate the significance of peers in the cessation

process. Chen and Kandel (1998) applied an event history analysis to monthly life and drug histories of a representative community sample of marijuana users, followed from ages 15-16 years to 34-35 years, in order to investigate the factors associated with the cessation of marijuana use from adolescence to adulthood. Results from this analysis revealed that some of the most important determinants of cessation were having friends who disapproved of using marijuana, and considering marijuana use to be harmful. Similar results have been reported by Sussman and Dent (1999). These authors have found that adolescents who quit using marijuana have reported receiving peer approval from a fewer number of their close friends (of five) for using this substance, and that fewer of their closest friends used marijuana in the last month than did nonquitters.

Other Influences

In addition to the influences of one's attitudes and peers, there are a number of other factors that have been found to contribute to the cessation of cigarette smoking and marijuana use among young people. For instance, it has been reported that those adolescents who are occasional users of cigarettes and/or marijuana may have less difficulty in quitting as compared to regular users (Chen & Kandel, 1998; McWhorter, Boyd, & Mattson, 1990; Owen, Kent, Wakefield, & Roberts, 1995; Sargent et al., 1998; Shiffman, 1989; Wilson, Wakefield, Owen, & Roberts, 1992).

Age has also been identified as one of the most important predictors of drug use cessation (Chen & Kandel, 1998; Kandel & Logan, 1984; O'Malley, Bachman, & Johnston, 1984). Ageing can be associated with changes in interests, psychological needs

and attitudes, which may eventually lead adolescent drug users to lose interest in their substance-using behaviours.

Age of initiation of drug use has also been found to be related, albeit inversely, to the probability of drug use cessation (Breslau & Peterson, 1996; Chen & Millar, 1998; Chen & Kandel, 1998; Coombs, Li, & Kozlowski, 1992; Fergusson & Horwood, 1997; Goodstadt et al., 1984). Rates of drug use cessation appear to be greater among adolescents who started using drugs when they were older as compared to those who started when they were younger. One controlled, longitudinal study showed that the earlier the cigarette smoking habit was begun, the more cigarettes smoked per day in adult life (Taioli & Wynder, 1991). Not only does a decreased age of initiation increase the risk for smoking-related illnesses due to a heavier smoking pattern (defined as more than 10 cigarettes per day), but it also sets these adolescents up for increased nicotine addiction, and thus a decreased success rate at cessation. In fact, a number of recent studies of smoking cessation have suggested that quitting is predicted by nicotine-dependence levels (Engels et al., 1998; Fagerstrom et al., 1996; Hughes, 1993; Sargent et al., 1998) and factors such as the intensity and frequency of smoking or the years of smoking (Breslau & Peterson, 1996; Marlatt, Curry, & Gordon, 1988; Rose et al., 1996). With respect to nicotine dependency, there is new evidence suggesting that many adolescent smokers, in comparison to adult smokers, exhibit signs of dependence in a matter of days to weeks after the initiation of occasional tobacco use, often well before the development of daily smoking (DiFranza et al., 2000).

In addition to decreasing the likelihood of drug-use cessation, the early onset of substance use, particularly that of marijuana, has also been found to contribute to various

psychosocial adjustment problems including significantly higher rates of later substance use, juvenile offending, mental health problems, unemployment, and school dropout in later adolescence (Fergusson & Horwood, 1997).

Gender has also been found to be an important variable associated with the cessation of cigarette smoking. Research on adolescents indicates that girls have more difficulty quitting than boys (Brownson, DiLorenzo, Van Tuinen, & Finger, 1990; Burt & Peterson, 1998), despite evidencing less nicotine dependence (Wetter et al., 1999). Various explanations for this sex difference have been offered (Grunberg, Winders, & Wewers, 1991), but the data supporting such explanations are limited. Moreover, there are other studies that have not reported this sex difference (see Sussman, Dent, Severson, Burton, & Flay, 1998). Interestingly, however, there is evidence suggesting that females are more likely than males to have attempted to quit smoking (CDC, 1998b). There are no studies to date which have examined the influence of gender on the cessation of marijuana use.

Summary

In light of the magnitude of the problem of adolescent cigarette smoking and marijuana use, it is surprising that there are relatively fewer studies that have investigated the predictors and/or correlates of the cessation of such behaviour, compared to those that have focused on its initiation. Nonetheless, the significance of adolescents' attitudes and the social influences of peers in contributing to the cessation of smoking and marijuana use has been well documented. A number of other factors have also been reported as playing an important role in the quitting process including age, gender, age of drug-use

initiation, frequency of use, and nicotine dependency. As was found to be the case in the literature on the initiation of drug use, the influence of peers also appears to be a more significant predictor of drug use cessation for girls than boys. Further research into the cessation of drug use, particularly marijuana use, among adolescents is needed in order to continue to broaden our current understanding of this important process. Such an objective has been undertaken in the current study.

Progression of Adolescent Drug Use

In developing an understanding of adolescent substance use, and the reasons for it, it is useful to know something about the sequential nature of drug involvement. The idea that substance use tends to follow a typical sequence was first proposed more than 25 years ago (Hamburg, Kraemer, & Jahnke, 1975; Kandel, 1975, 1978, 1980), and represented an influential model to describe the developmental progression of young people's involvement with drugs. Briefly, the sequencing was found to generally follow a pattern, with the clear majority of adolescents first using either alcohol or tobacco (both often referred to as "licit" drugs in the literature), and then usually moving on to the other substance. Widely recognized as the next step in this progression was marijuana use, followed by the use of other illicit substances such as lysergic acid diethylamide (LSD), cocaine, and amphetamines. This sequential model of youth drug involvement continues to be an important theme in the research of adolescent substance use, and will be the focus of this section of the literature review. First, there will be a general overview of the research substantiating the model of a sequential pattern of drug use, followed by a discussion of some important considerations that are associated with this model.

Sequence of Drug Use

The sequential model of drug use was formulated on the basis of two longitudinal surveys based on random samples of New York State public high school students in 1971-1972 (Kandel, 1975). Information was collected from these students on their histories of use of 12 drugs or drug classes: two legal (cigarettes and alcohol), four illegal (marijuana, psychedelics, cocaine, and heroin), and medical and non-medical use of six classes of psychotropic drugs (methadone, minor and major tranquilizers, sedatives, stimulants, antidepressants, and opiates other than heroin). The timing of the use of these different substances was also collected, using timelines with differentiations in years and months. No distinctions were made between males and females at this time, however.

Four steps in the sequence of youth drug use could be identified: (1) beer or wine, (2) cigarettes and/or hard liquor, (3) marijuana, and (4) other illicit drugs. For the overwhelming majority of adolescents in this study, their first experience with drugs was with beer or wine, followed by the use of tobacco and hard liquor. It was also found that the use of marijuana rarely took place without prior use of liquor and/or cigarettes. Thus, the legal drugs appeared to be necessary intermediates between non-drug use and marijuana use. Marijuana, in turn, was also found to be a crucial step on the way to other illicit drug use in that the use of illicit substances other than marijuana rarely occurred in the absence of prior experimentation with marijuana.

In subsequent analyses carried out from adolescence to young adulthood and among men and women separately, further elaboration and specification of the basic model have been obtained (Kandel, Yamaguchi, & Chen, 1992; Yamaguchi & Kandel, 1984a, b). Kandel and her colleagues have combined beer and wine with distilled spirits

in the alcohol category, and examined prescribed psychotropic drugs as an additional stage in the drug-use sequence. The results of these analyses confirmed the original sequence and introduced further specifications. In particular, the role of medically prescribed psychotropic agents as the final stage in the sequence, and the different role played by cigarettes in the progression among men and women, were identified. For instance, cigarettes were found to play a more important role in the sequence for women, whereas for men, alcohol was found to exert a much stronger influence. That is, the results showed that cigarette smoking could precede the use of marijuana or other illicit drugs in the absence of alcohol among women. Among men, however, the use of alcohol, even in the absence of cigarette smoking, was consistently found to precede marijuana and other illicit drugs (Kandel et al., 1992).

Since its inception, Kandel's (1975, 1978, 1980) sequential model of drug use has gained increasing acceptance as an appropriate model to describe the developmental progression of adolescents' involvement with drugs. A number of cross-sectional and longitudinal investigations confirm that regular sequences of progression from legal (or rather licit) to illegal (or rather illicit) drugs appear among adolescents and young adults of both sexes, irrespective of the age of first initiation into drugs (J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; J.S. Brook et al., 1983; Brunswick & Boyle, 1979; Donovan & Jessor, 1983; Duncan, Duncan, & Hops, 1998; Ensminger, Brown, & Kellam, 1982; Fleming, Leventhal, Glynn, & Ershler, 1989; Huba, Wingard, & Bentler, 1981; Huizinga & Elliott, 1981; Kandel & Yamaguchi, 1993, 1999; Miller & Miller, 1997; Mills & Noyes, 1984; Newcomb & Felix-Ortiz, 1992; O'Donnell, 1985; O'Donnell & Clayton, 1982; Welte & Barnes, 1985; Windle, Barnes, & Welte, 1989). This same

sequence has also been observed among different ethnic groups and different countries, including France, Israel (Adler & Kandel, 1981), and Australia (Blaze-Temple & Lo, 1992), and also at different historical periods spanning a 20-year interval. Moreover, the same steps appear in the regression of substance use as in the progression of such use (Kandel, 1975; Kandel & Faust, 1975), although much less work has been done to uncover steps in regression than in progression.

Important Considerations

It appears then, that the basic sequence from alcohol and/or cigarettes, to marijuana, and to illicit drugs other than marijuana is almost universally accepted. The steps in the sequence are hierarchical and cumulative, and characterize not only lifetime but also current patterns of substance use. It has been emphasized (Kandel et al., 1992), however, that although a clear developmental sequence in drug involvement has been identified, the use of a substance at a particular stage in the sequence does not invariably lead to the use of other drugs higher up in the sequence. Many adolescents discontinue drug use at a particular stage and do not progress further, and most young people eventually stop using most drugs in adulthood (Chen & Kandel, 1995; Kandel & Logan, 1984). The notion of a progression of drug-use behaviour does not imply that all adolescents complete the full sequence of involvement. Fortunately, most youth stop at alcohol or tobacco use, and many stop at marijuana use. Rather, the phases in drug-use behaviour are facilitative, in the sense that the use of a substance at a lower stage is a necessary but not a sufficient condition for the progression to a higher stage of drug involvement.

It has also been suggested (Kandel, 1988) that timing and sequence are not sufficient to establish developmental linkages. That is, the existence of a sequential pattern of progression does not necessarily imply causal linkages among different drugs. The observed sequence could simply reflect the association of each class of drugs with different ages of initiation or individual attributes, such as personality, peer, and family influences (J.S. Brook et al., 1983; Kandel & Yamaguchi, 1999). There also tends to be a gradual, and to some degree age-graded, involvement with drugs, with the pattern of progressive involvement correlating with adolescents' perceptions of how dangerous the drugs are (Johnston, O'Malley, & Bachman, 1995). Another factor that appears to be related to the progression of drug use is the perceived deviance of the behaviour. While it is not very deviant to use alcohol and tobacco in a society which widely extols their virtues, it is somewhat deviant for an adolescent to do so. It is even more deviant to cross the line into illegal drug use and even more so to use so-called harder drugs, such as heroin.

As a result, it becomes necessary to assess the extent to which the use of a drug at a particular stage in the sequence actually determines or influences initiation of the use of a drug at the next higher stage. In an event history analysis conducted by Yamaguchi and Kandel (1984b), it was found that the use of a drug lower in the sequence remained to be a significant predictor of transition to the next stage, after controlling for age and other covariates. Additionally, Osgood, Johnston, O'Malley, and Bachman (1988) found that when controlling for a general deviance factor, marijuana use still predicted the use of other illicit drugs.

Summary

In sum, adolescents' involvement with drugs tends to follow a typical sequence. For many youth, their first experience with drugs usually involves alcohol and/or cigarettes, followed by the use of marijuana. There are some adolescents, however, who will progress even further to the use of other illicit drugs, such as LSD, cocaine, and amphetamines. Fortunately, not all young adults will complete this sequence of involvement; many stop at alcohol or tobacco use, and most stop at marijuana use. Results from a number of cross-sectional and longitudinal investigations have confirmed the progression from licit to illicit drugs among adolescents of both sexes and different ethnic groups and countries. It is important to bear in mind, however, that the steps involved in the progression of substance use are neither obligatory nor universal such that all adolescents must progress through them each in turn. Rather, the phases in drug-use behaviour are facilitative. Entry into a particular phase is a common and perhaps even a necessary although not a sufficient condition for entry into the next higher phase. Many youths stop at a particular phase in the sequence without progressing any further. Most youths eventually stop using most drugs.

Overview of the Present Study

This review of the literature has provided a comprehensive summary of the research concerning the etiologic factors of the initiation and cessation of cigarette smoking and marijuana use among adolescents. Such factors can be categorized into three broad categories: adolescents' attitudes, their peers, and prenatal drug exposure.

This review has also introduced the notion that youth substance use is a sequential process, with the use of licit drugs generally preceding the use of illicit ones.

Currently, only a small number of investigations examining the correlates and/or predictors of adolescents' initiation of cigarette smoking have involved youth who were prenatally exposed to nicotine, allowing the influence of such exposure on smoking initiation to be studied (e.g., Cornelius et al., 2000; Griesler et al., 1998; Kandel et al., 1994). There have been no studies to date, however, which have looked at the potential influence of prenatal exposure to marijuana (or nicotine for that matter) on the later initiation of marijuana use during adolescence. Moreover, neither prenatal exposure to nicotine nor marijuana have been considered as possible factors influencing the cessation of regular cigarette smoking and marijuana use. The present study, however, is in a unique position to address this lack of research in the existing literature since the prenatal histories of the OPPS participants have been extensively examined.

The primary objective of the current study, therefore, was to corroborate and extend the youth drug involvement literature by investigating the influences of adolescents' attitudes and their peers, in addition to the influence of prenatal exposure to nicotine and marijuana, on both the initiation and cessation of cigarette smoking and marijuana use among the participants in the OPPS sample.

With respect to the initiation of cigarette smoking and marijuana use, it was expected that adolescents who were prenatally exposed to nicotine would be more likely to have initiated cigarette smoking while those youth who were prenatally exposed to marijuana would be more inclined to initiate the use of this drug. Based on previous

findings in the existing literature, it was also hypothesized that adolescents in the OPPS who held favourable attitudes towards cigarette smoking or marijuana use, and perceived relatively low levels of risk of harm from smoking either cigarettes or marijuana as well as easy availability of these two substances would be more likely to initiate the use of these drugs. In addition, it was predicted that having friends who smoked either cigarettes or marijuana would also be an important correlate influencing the initiation of cigarette smoking and marijuana use.

In terms of the cessation of regular cigarette smoking and marijuana use, it was hypothesized that prenatal exposure to a particular substance would decrease the likelihood of discontinuing the use that substance (i.e., prenatal exposure to nicotine would decrease the likelihood of regular cigarette smoking cessation). It was also expected that adolescents who disapproved, and perceived that their friends disapproved, of smoking cigarettes and marijuana, and perceived great risk associated with using these two substances would be more likely to quit smoking cigarettes and marijuana on a regular basis. Finally, those OPPS youth who had friends who smoked cigarettes or marijuana were hypothesized to be less likely to quit smoking cigarettes or marijuana on a regular basis.

Another important objective of the present investigation was to determine the extent to which the influences of adolescents' attitudes and their peers differ between those youth in the OPPS who were prenatally exposed to differing levels of nicotine and marijuana and those who were not, and to try and identify any possible sex differences. In this respect, the current study is extending a new area of research since no other investigation to date has looked for potential differences in these attitudinal and peer

influence variables as a function of prenatal drug exposure. It was hypothesized that males and females would differ with respect to their attitudes of disapproval, perceived risk, and availability of drugs such that males would be less disapproving, have lower levels of perceived risk, and have greater perceptions of easy availability of cigarettes and marijuana than would females. No hypotheses were made, however, regarding prenatal drug exposure group differences in terms of the influences of adolescents' attitudes and their peers.

The final objective of the current study was to examine the progression of drug use among the adolescents in the OPPS sample in order to determine if a particular sequence of such use existed. Based on previous findings in the adolescent drug involvement literature, it was hypothesized that the youth would first begin using cigarettes and/or alcohol, then marijuana, followed by the use of other illicit substances, such as amphetamines, mushrooms, or LSD.

METHOD

Methodological Considerations

Many of the studies that have attempted to identify the correlates of adolescents' initiation and cessation of drug use are fraught with several interpretative problems. To begin, most investigations are either retrospective or cross-sectional in their approach, rather than prospective or longitudinal, which makes it impossible to establish causality for the variables that appear to be associated with the initiation and cessation of cigarette smoking and marijuana use among youth. The current study, however, is a cross-sectional examination of data from the OPPS (briefly described on p. 2) which is

longitudinal in nature. Although a longitudinal approach is essential in order to identify the correlates and/or predictors of adolescents' initiation and cessation of substance use, studies of this type have also been criticized for a variety of reasons.

One important criticism of prospective longitudinal investigations concerns participant attrition which generally occurs to some degree with this type of research. High rates of attrition are problematic since they tend to reduce the representativeness of the participants in the study. The OPPS, however, has maintained a retention rate of approximately 98% since its inception in 1978, not including those families who have moved away or participant loss due to budgetary cut-backs. Fortunately, participants who could not be followed were found to be no different from those who were studied with respect to prenatal drug exposure and a variety of health and demographic characteristics (e.g., diet, socio-economic status [i.e. income and education; SES]). This suggests that participant loss is not a significant problem for the current study. Staff continuity has undoubtedly been an important factor associated with this high retention rate.

Another problem that is often associated with longitudinal investigations relates to problems with the original selection of the sample. Participants who are willing to make a long-term commitment to a prospective study are not necessarily representative of the population in that they tend to be co-operative and well-educated (Bayley, 1974). However, upon examination of the demographic characteristics of the OPPS sample, it can be noted that it was representative of the Ottawa region with respect to family income and maternal age at the time of delivery, but not in terms of education (Fried, Innes, & Barnes, 1984; Fried, Watkinson, Grant, & Knights, 1980).

The relatively short time spans that are often captured in longitudinal studies, which may be insufficient to study developmental processes, is a further limitation that tends to plague prospective research, as is the role and control of confounding variables. Variables such as maternal age, education, income, and other drug use all represent other important prenatal determinants of behaviour that can confound the relationship between maternal drug exposure and later behavioural outcomes. In addition, there are also several postnatal determinants of behaviour, such as gender and the home environment, which may also be potentially confounding. The role of covariates, therefore, has been considered in the current analysis.

Accepting adolescents' self-reports of drug use behaviour at face value, rather than incorporating objective checks on substance use via biochemical measures or attempting to enhance the validity of self-reports, is yet another criticism of most research studies aimed at determining the correlates of the initiation and cessation of youth substance use. Research on rates of adolescent cigarette smoking has demonstrated that a "bogus pipeline" procedure, that is, informing adolescents that objective physiological measures of smoking will be employed, increases the level of reported cigarette smoking among youths (Evans, Hansen, & Mittelmark, 1977; Luepker et al., 1981). In the current study, the participants have been informed that an objective measure of their self-reported drug use will be undertaken. Unlike the "bogus pipeline" procedure, however, the current study has in fact incorporated an actual objective, biochemical measure of cigarette smoking and marijuana use in the design protocol in order to assess the consistency of the self-report data.

Somewhat related to the validity of adolescents' self-reports of drug use is the issue of *social desirability* (i.e., giving a more socially desirable response). Since the participants of the current study are involved in an ongoing prospective study and have thus been interviewed by the same female assessor, these adolescents may feel the need to provide socially desirable responses. However, as is discussed in the following “*Reliability and Validity*” subsection, there is considerable evidence in support of the validity of the OPPS adolescents' self-report data of their drug use in that high rates of concordance have been obtained with respect to the self-report and biochemical data. Since the OPPS youth have provided honest responses with respect to their use of drugs, it appears that social desirability is not a problem in the present investigation.

As was previously mentioned, an important limitation of the current study is that it is unable to determine exactly how the potential influence of prenatal drug exposure contributes to adolescents' initiation of cigarette smoking and marijuana use, as well as the cessation of these behaviours, since such information is beyond the scope of this investigation. That is, the present study is more of a descriptive as opposed to an explanatory study.

Participants

The participants have been part of an ongoing, longitudinal investigation initiated in 1978 in Ottawa, Canada. The objective of this study is to examine the effects on offspring of soft drug use, particularly cigarettes and marijuana, by women while they were pregnant. Participants in the OPPS have previously been the focus of a number of inquiries. The OPPS is comprised of a low-risk, predominantly White, middle-class

sample. There are several reasons why the OPPS sample can be considered to be low-risk. In addition to all of the women receiving prenatal care, it was ascertained at the time of birth that the vast majority had excellent nutrition throughout their pregnancies and most were married (Fried et al., 1980). The OPPS sample can also be considered to be low-risk since the rates of maternal drug use are markedly lower than what is typically reported in other more high-risk samples (Goldschmidt et al., 2000).

A total of 698 pregnant women initially volunteered to participate in the OPPS after learning of the study through their doctors, or through notices posted in the waiting rooms of the prenatal clinics in four of the largest hospitals in the Ottawa region. The study was described as an investigation of the influence of prenatal lifestyle habits on the developing fetus (Fried et al., 1980).

In order to obtain the necessary information, interviews were conducted, usually in the mother-to-be's home, during each trimester remaining in the pregnancy at the time of entrance into the study. For subjects included in the present study, 21% entered the study during their first trimester and 36% during their second trimester. The same interviewer was used throughout the entire pregnancy and this, combined with the repetition of interviews, appeared to enhance the rapport between the participant and the interviewer, while also providing an opportunity to assess the consistency of the self-report data (Fried et al., 1980).

Data were collected on several variables including the amounts and patterns of maternal drug use including cigarettes, marijuana, alcohol, caffeine, and any other medicinal or non-medicinal drugs, during each trimester of pregnancy. For cigarette use, a nicotine score was derived by multiplying the daily average of the number of cigarettes

smoked by the nicotine content of the brand specified. Marijuana use was recorded in terms of the number of joints smoked per week, whereas measurements of alcohol consumption, including beer, wine, and liquor use, were recorded in terms of both quantity and the pattern of consumption, and were converted to ounces of absolute alcohol (AA) per day. Information was also collected with respect to maternal age and height, pre-pregnancy weight, weight gained during pregnancy, regular maternal exposure to second-hand smoke, general health (both present and prior to pregnancy), obstetrical history of previous pregnancies, father's medical history, the family's SES, and the home environment. A 24-h dietary recall was also requested (e.g., protein and calorie intake) of the mother-to-be during each interview, and was evaluated in reference to a recommended standard. Data were also collected at the time of birth including gestation length, gender, type of birth, birth weight, and medication used during labour.

Of the 698 pregnant women who were interviewed, a cohort of 190 children was selected for follow-up studies beyond birth. Included in this cohort were children of women who reported any use of marijuana during pregnancy, children of women who drank alcohol beyond a daily average of 0.85 ounces AA, and children whose mothers smoked an average of at least 16 mg of nicotine (equivalent to one package of cigarettes of average strength) per day during pregnancy. In addition to these 140 children, children of 50 women who were non-users of marijuana, who abstained or drank little alcohol, and who were non-smokers were randomly selected to also be included in follow-up studies for comparison purposes.

Of the 190 participants who were initially selected for follow-up studies, 152 adolescents were available to participate in the present study. The final sample, therefore,

consisted of 85 males and 67 females, with five 16-year olds, 77 17-year olds, 42 18-year olds, 19 19-year olds, seven 20-year olds, and two 21-year olds.

Instruments and Procedure

As part of an overall neuropsychological assessment, an extensive battery of tests was administered to the participants by a trained female assessor who was blind with respect to maternal drug history. Informed consent (Appendix A) was obtained from all of the participants, and all testing was conducted in controlled conditions in the laboratory at Carleton University, Ottawa, Canada. Included in the battery were a *Drug History Questionnaire* (DHQ, Appendix B) and a *Your Thoughts on Drugs Questionnaire* (YTDQ, Appendix C). Both questionnaires were developed for use in this research and were adapted from those used in the MTF Study, a longitudinal survey focusing on the lifestyles, attitudes, and preferences of American youth (Johnston et al., 2001b).

The DHQ was intended to serve as a measure of participants' history of use, as well as their current use of a number of both licit and illicit substances. The questionnaire contains 165 items, and is divided into four subsections: (1) cigarette smoking (27 items); (2) marijuana/hashish (37 items); (3) alcohol (20 items); and (4) other drugs (includes amphetamines, crack, cocaine, tranquilizers, heroin, LSD, solvents, steroids, and mushrooms; 81 items). Each subsection of the DHQ is printed in a different colour of paper. As a result of reprography requirements, however, the DHQ (i.e., Appendix B) is printed in white paper only. Information that was gathered from the participants included whether these types of drugs have ever been used, at what age the first such experience occurred, whether any of these drugs have ever been used on a

regular basis, at what age this pattern initiated, how often were these drugs being used per week, are they currently using any of these drugs and if so, how often are they being used per week. For those participants who report current, regular marijuana use (i.e., at least one joint per week) or the consumption of alcohol on a regular basis (i.e., at least two times per week), the extent of such use for each of these substances during the previous seven days was determined. For current cigarette users, the number of cigarettes smoked in each of the past three days was ascertained. For those participants who, in the past, have used any substance on a regular basis but are no longer using it, the time since last using this particular substance was recorded. All participants are also asked whether they have been exposed to second-hand marijuana or cigarette smoke and, if they answer affirmatively, respond to further questions that determine the timing and extent of such exposure. Additionally, participants were asked to report the proportion of their friends who have tried and who regularly use a variety of substances, with higher scores being indicative of a greater proportion of peers.

The YTDQ measured participants' attitudes towards a number of licit and illicit substances. It contains 45 items, and is divided into five subsections: (1) risk (physically or in other ways) associated with using drugs (14 items); (2) degree of disapproval of people (18 years of age or older) using drugs (13 items); (3) perceptions of close friends' attitudes toward drug use (13 items); (4) frequency of association with drug users (3 items); and (5) perceived difficulty associated with acquiring drugs (2 items). Higher scores on the items pertaining to perceptions of risk, disapproval of people using drugs, perceptions of close friends' attitudes toward drug use, and frequency of association with drug users refer to greater risk, disapproval, and association; higher scores on the items

concerning perceived difficulty associated with acquiring drugs refer to greater accessibility.

Reliability and Validity

With respect to the reliability and validity of the present measures, there is a considerable amount of existing evidence that strongly suggests that the self-report questions which were adapted from those used in the MTF study produce largely reliable and valid data (Bachman, Johnston, & O'Malley, 2001; Johnston, O'Malley, & Bachman, 1998, 2002b; O'Malley, Bachman, & Johnston, 1983).

With respect to reliability, test-retest reliability coefficients from Bachman, Johnston and O'Malley (1981) have been judged to be adequate. Another earlier study which examined the reliability and stability of the MTF youths' self-reports of licit and illicit drug use also found them to be rather high (O'Malley et al., 1983). Using a three-wave panel design, it was established that the various measures of self-reported drug use had a high degree of reliability. In essence, MTF respondents were found to be highly consistent in their self-reported behaviours over a three- to four-year time interval (O'Malley et al., 1983). In the present investigation, internal consistency reliability of various measures taken from the DHQ and YTDQ and used in the current study have been judged to be in the moderate to high ranges, with alpha reliability coefficients ranging from .40 to .92.

There is also strong empirical evidence supporting the validity of the instruments used in the current study. For instance, MTF data have shown some substantial and predictable relationships between self-reported drug use and other items dealing with

attitudes about drug use, and with behaviours such as academic performance, delinquency, and the self-reported use of licit drugs (Bachman et al., 2002; Bachman, Wadsworth, O'Malley, Johnston, & Schulenberg, 1997). In addition, panel analyses employing several waves of the follow-up data have shown a high degree of stability in these self-reports of drug use (Bachman et al., 2002; O'Malley et al., 1983). These various findings are viewed as providing considerable empirical evidence of construct validity.

In terms of external (or empirical) validity, which refers to the extent to which self-report data accord with other, presumably more accurate indicators of behaviour (O'Malley et al., 1983), the current study has included a direct, objective validation of the self-report measures of recent drug use. A urine sample was obtained from the participants during the neuropsychological assessment, and was immediately frozen until later analyzed by immunoassay for the presence of cotinine (a major degradation product of nicotine metabolism), cannabinoids, cocaine, opiates, and amphetamines. Each urine specimen was analyzed under blind conditions according to the manufacturer's instructions using sensitivity measures that distinguished concentrations from zero with at least 95% confidence. For all assays, the dilution of urine was corrected for by creatinine adjustment.

By examining the concordance of the detailed self-report of recent drug use with the results of the urine assays, an estimate of the validity of the self-report data was obtained. In the current study, evidence of the concordance between the self-report of recent cigarette smoking and the urinalysis was found when correlations were conducted between the quantity reported being used and the amount of cotinine excreted in the

urine. The correlation between the number of cigarettes reported being smoked on average per day and the amount of metabolite detected in the urine was .73 ($p < .0001$). With respect to the concordance between the self-report of recent marijuana use and the results of the urine assays, the correlation between the number of joints reported being smoked on average per week and the amount of metabolite detected in the urine was .71 ($p < .0001$).

Achieving such high rates of concordance is very important in that they not only point toward the validity of the self-report data, but they also provide one with confidence in the adolescents' responses for a number of other variables, such as their age of drug use initiation and history of past drug use, for example, which are variables which cannot be verified by biochemical means. A possible factor contributing to such high rates of concordance is that in the present study, the families have been participating in an ongoing research project for approximately 25 years. The result of this voluntary commitment to the prospective study has been a marked rapport between the participants and the researchers involved in the project. Thus, this favourable relationship may lead to increased validity and reliability of the information that is given by the participants.

Although the rate of concordance between the self-report data and the biochemical data are moderately high, one might wonder why such concordance rates are not perfect. There are a number of factors which can affect these rates including intersubject variation in drug metabolism (Wall, Johnson, Jacob, & Benowitz, 1988) and urine concentrations, the sensitivity and specificity of the immunoassay, and the fact that the adolescents' self-report is a retrospective measure that depends on memory.

Statistical Analysis

All analyses were carried out using archival data collected as part of the OPPS protocol which began in 1978. Data analyses reflect the goals of the present study; to examine the influence of adolescents' attitudes and peers, in addition to the effect of prenatal drug exposure, on both the initiation and cessation of cigarette smoking and marijuana use in the OPPS sample. Moreover, the current study aimed to determine the extent to which these influences differ between those youth who were prenatally exposed to differing levels of nicotine and marijuana and those who were not, and if any gender differences were present. A final goal of the present investigation was to examine the progression of substance use among the OPPS sample. Separate analyses have been conducted for the initiation of cigarette smoking and marijuana use, as well as for the cessation of these behaviours. For the sake of brevity, cigarette smoking and marijuana use have often been referred to as "drug use" or "substance use" in the following sections of the current study.

Group Categorization

In the present investigation, two different approaches have been adopted with respect to categorizing the prenatal drug exposure variables. Each approach has been utilized in separate sets of analyses and is described below.

Correlates of drug use initiation and cessation. As has been previously mentioned, the primary objective of the current study was to examine the correlates of cigarette smoking and marijuana use initiation and cessation among the OPPS

adolescents. One of the correlates that were considered for study was prenatal exposure to nicotine and marijuana so that it could be determined whether or not there was an effect of such exposure on adolescents' initiation and cessation of cigarette smoking and marijuana use.

For the statistical analyses concerning the correlates of drug use initiation and cessation, maternal cigarette smoking (average use across pregnancy) was categorized into two groups: non-smoking and smoking (> 0 cigarettes/day). Similarly, maternal average marijuana use across pregnancy has also been categorized into two groups: no use and use (> 0 joints/week). In the case of cigarettes, the control group was comprised of non-smokers. For marijuana, the control group included mothers reporting no use of marijuana during their pregnancies.

The prenatal drug exposure variables were categorized in this manner (i.e., exposure vs. no exposure) in order to respect the subject to variable ratio and to ensure sufficient levels of statistical power (Tabachnick & Fidell, 2001). In addition to the influence of prenatal drug exposure, there were a number of other variables (e.g., adolescents' attitudes and their peers) and covariates which were also being examined as possible correlates of youth drug use initiation and cessation. Thus, in order to maintain a satisfactory subject to variable ratio and a reasonable amount of statistical power, the prenatal drug exposure variables were categorized into two groups for purposes of these analyses.

Prenatal drug exposure group and gender differences. In order to address the second objective of the current study, a different approach to categorizing the prenatal

drug exposure variables was employed. As has been previously discussed, the second objective of this investigation was to determine the extent to which the influences of adolescents' attitudes and their peers differ between those youth in the OPPS who were prenatally exposed to differing levels of nicotine and marijuana and those who were not, and to try and identify any possible sex differences.

For statistical analyses examining both prenatal drug exposure group and gender differences, maternal cigarette smoking (average use across pregnancy) was categorized into three groups (as has been done in previous publications involving the OPPS [e.g., Fried et al., 1984; Fried & Watkinson, 1988, 1990]): non-smoking, light (0.1-15.9 mg nicotine/day), and heavy (≥ 16 mg nicotine/day, which approximates a minimum of one package of average strength). Maternal average marijuana use across pregnancy has also been categorized into three groups: no use, infrequent or moderate use (> 0 and < 6 joints/week), and heavy use (≥ 6 joints/week). In the case of cigarettes, the control group was comprised of non-smokers, whereas for marijuana the control group included mothers reporting no use of this drug during their pregnancies.

Confounding Variables

Because this study is a quasi-experimental design, random assignment to groups was not possible. As a result, there was a risk that observed differences would represent only the pre-existing differences in history and background. A number of variables, therefore, were examined as potential confounding variables prior to conducting any statistical analyses, as has been done in previous publications involving the OPPS (e.g., Fried & Watkinson, 2000; Fried, Watkinson, James, & Gray, 2002). Variables that were

examined included family income during pregnancy, average level of parental education, postnatal passive cigarette and marijuana smoke exposure, parity, age and gender of the participants, maternal use of cigarettes, marijuana, alcohol, and caffeine during pregnancy, and the participant's age of initiation of drug use. Mother's age at the time of the child's birth was also considered since women who smoke cigarettes during pregnancy tend to be younger than non-smokers (Fried, 1992).

Using one-way analyses of variance (ANOVA), each of the potentially confounding variables were tested for association with prenatal nicotine and marijuana exposure, respectively, using an alpha level of .10. Variables that were found to significantly relate to either drug at an alpha level of .10 or less were then further examined for association with each of the outcome variables. Those variables that were found to be significantly related to the outcome variable of interest at an alpha level of .05 or less were subsequently included as covariates in the analysis (Jacobson & Jacobson, 1996; Noland, Singer, Arendt, Minnes, Short, & Bearer, 2003). Additionally, maternal alcohol use and maternal use of the drug that was not considered to be of primary interest (i.e., in the case of cigarettes, use of marijuana) were statistically controlled in all analyses. This was to ensure that any observed differences could not be attributable to pre-existing differences in prenatal exposure to either alcohol or the drug that was not considered to be of primary interest.

Plan of Analysis

Data reduction scheme. A principal components analysis with Varimax rotation was performed as a data reduction scheme on the 17 items from the Your Thoughts on

Drugs Questionnaire (YTDQ) pertaining to attitudes towards cigarettes and marijuana for the sample of 152 adolescents. Prior to conducting the principal components analysis, the distributions of scores for each of the items were examined with respect to outliers and the factorability of the correlation matrix. Table 1 presents the intercorrelations between the 17 items of interest on the YTDQ.

Using Kaiser's (1960) conventional criterion of maintaining eigenvalues greater than 1.0, the principal components extraction resulted in five components, which in combination accounted for 73.15% of the variance in the 17 items of interest from the YTDQ.

Table 1

Intercorrelations Between 17 Items on the Your Thoughts on Drugs Questionnaire (N=152)

Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Risk: once or twice MJ [†]	-	.72 ^d	.51 ^d	.29 ^d	.15 ^a	.50 ^d	.54 ^d	.40 ^d	.35 ^d	.26 ^c	.40 ^d	.48 ^d	.38 ^d	.36 ^d	.28 ^d	-.36 ^d	-.17
2. Risk: occasional MJ [†]		-	.76 ^d	.30 ^d	.14 ^a	.38 ^d	.59 ^d	.60 ^d	.45 ^d	.40 ^d	.37 ^d	.56 ^d	.51 ^d	.38 ^d	.36 ^d	-.43 ^d	-.14 ^a
3. Risk: regular MJ [†]			-	.40 ^d	.20 ^b	.24 ^c	.51 ^d	.66 ^d	.35 ^d	.33 ^d	.24 ^c	.45 ^d	.48 ^d	.26 ^c	.32 ^d	-.35 ^d	-.16 ^a
4. Risk: ½ pack CG/day [†]				-	.60 ^d	.22 ^b	.24 ^b	.31 ^d	.41 ^d	.39 ^d	.07	.11	.18 ^b	.19 ^b	.17 ^a	-.18 ^a	-.01
5. Risk: 1+ pack CG/day [†]					-	.12	.12	.18 ^b	.26 ^c	.35 ^d	-.002	.06	.14 ^a	.16 ^a	.19 ^b	-.08	-.04
6. Disapproval: once or twice MJ						-	.67 ^d	.35 ^d	.29 ^d	.27 ^d	.38 ^d	.39 ^d	.26 ^c	.27 ^d	.27 ^d	-.23 ^b	.01
7. Disapproval: occasional MJ							-	.71 ^d	.42 ^d	.39 ^d	.37 ^d	.55 ^d	.45 ^d	.32 ^d	.29 ^d	-.41 ^d	-.24 ^b
8. Disapproval: regular MJ								-	.50 ^d	.49 ^d	.23 ^b	.48 ^d	.56 ^d	.25 ^c	.35 ^d	-.48 ^d	-.23 ^b
9. Disapproval: ½ pack CG/day									-	.81 ^d	.21 ^b	.26 ^c	.32 ^d	.55 ^d	.42 ^d	-.35 ^d	-.14 ^a
10. Disapproval: 1+ pack CG/day										-	.12	.25 ^c	.34 ^d	.45 ^d	.47 ^d	-.25 ^c	-.11
11. Peer disapproval: once or twice MJ [†]											-	.71 ^d	.44 ^d	.39 ^d	.29 ^d	-.41 ^d	-.15 ^a

Items	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12. Peer disapproval: occasional MJ [†]												-	.73 ^d	.45 ^d	.44 ^d	-.53 ^d	-.28 ^d
13. Peer disapproval: regular MJ [†]													-	.50 ^d	.55 ^d	-.50 ^d	-.26 ^e
14. Peer disapproval: ½ pack CG/day [†]														-	.77 ^d	-.35 ^d	-.23 ^b
15. Peer disapproval: 1+ pack CG/day [†]														-		-.28 ^d	-.20 ^b
16. Access to MJ																-	.42 ^d
17. Availability of MJ [§]																	-

Note. MJ = Marijuana; CG = Cigarettes.

[†]Refers to perceived risk of using the drug. [†]Refers to perceived peer disapproval of using the drug. [§]Refers to perceived availability.

^a $p \leq .05$. ^b $p \leq .01$. ^c $p \leq .001$. ^d $p \leq .0001$.

Varimax rotation of the five principal components took 14 iterations to produce orthogonal components. Orthogonal components were chosen as theory of attitude suggests that as an attitude is an evaluative reaction (i.e., a judgement regarding one's liking or disliking), it is either negative or positive but never neutral (Weber, 1992).

As per Stevens' (2002) suggested practice, the statistical significance of the loadings was assessed by doubling the standard error, that is, the critical value required for an ordinary correlation. With an alpha level equal to .01 (two-tailed test), the critical value for a significant loading was determined to be approximately .43 [i.e., $2(.217) = .43$]. Therefore, only loadings greater than .43 in absolute value have been declared statistically significant and are included in the interpretation.

Loadings of variables on components, communalities, and percents of variance are shown in Table 2. Variables are ordered and grouped by size of loading to facilitate interpretation. Loadings under .43 (18% of variance) are replaced by zeros. Inspection of Table 2 also indicates that the component structure has good convergent validity (Aiken, 1997), with no items failing to weight on any component. Moreover, the component loadings indicate that this solution also has rather good discriminant validity (Aiken, 1997), with only two items (item 9: "Perceived peer disapproval of smoking half a pack of cigarettes per day"; and item 10: "Perceived peer disapproval of smoking one pack of cigarettes per day") weighting across components.

The internal consistency reliability of each of the five components was assessed using Cronbach's alpha coefficient of reliability (Cronbach, 1951). Item content for each of the components was considered in order to develop appropriate labels.

Table 2

Component Loadings, Communalities (h^2) and Percents of Variance for Principal Components Extraction and Varimax Rotation on Your Thoughts on Drugs Questionnaire Items ($N = 152$)

Item	C_1^a	C_2	C_3	C_4	C_5	h^2
Disapproval: occasional use of MJ	.80	.00	.00	.00	.00	.75
Perceived risk: occasional use of MJ	.77	.00	.00	.00	.00	.73
Disapproval: regular use of MJ	.76	.00	.00	.00	.00	.78
Perceived risk: regular use of MJ	.72	.00	.00	.00	.00	.68
Perceived risk: once or twice use of MJ	.65	.00	.00	.00	.00	.62
Disapproval: once or twice use of MJ	.57	.00	.00	.00	.00	.70
Disapproval: smoking 1+ pack CG/day	.00	.80	.00	.00	.00	.81
Disapproval: smoking ½ pack CG/day	.00	.78	.00	.00	.00	.79
Perceived peer disapproval: smoking ½ pack CG/day	.00	.73	.51	.00	.00	.82
Perceived peer disapproval: smoking 1+ pack CG/day	.00	.71	.45	.00	.00	.74
Perceived peer disapproval: once or twice use of MJ	.00	.00	.82	.00	.00	.72
Perceived peer disapproval: occasional use of MJ	.00	.00	.74	.00	.00	.82
Perceived peer disapproval: regular use of MJ	.00	.00	.52	.00	.00	.67
Perceived risk: smoking 1+ pack CG/day	.00	.00	.00	.89	.00	.81
Perceived risk: smoking ½ pack CG/day	.00	.00	.00	.84	.00	.80
Perceived availability of MJ	.00	.00	.00	.00	-.76	.60

Item	C ₁ ^a	C ₂	C ₃	C ₄	C ₅	<i>h</i> ²
Access to MJ	.00	.00	.00	.00	-.58	.60
Percent of variance	22.78	15.67	15.08	10.06	9.56	

Note. MJ = Marijuana; CG = Cigarettes. Loadings under .43 (18% of variance) are replaced by zeros.

^aComponent labels: C₁ = Disapproval and Perceived Risk of Marijuana Use; C₂ = Disapproval and Perceived Peer Disapproval of Cigarette Smoking; C₃ = Perceived Peer Disapproval of Drug Use (i.e., use of both marijuana and cigarettes); C₄ = Perceived Risk of Cigarette Smoking; C₅ = Access and Perceived Availability of Marijuana.

The first component was labelled as “Disapproval and Perceived Risk of Marijuana Use,” and consisted of six items from the YTDQ (i.e., disapproval and perceived risk of once or twice, occasional, and regular use of marijuana). The Cronbach’s alpha coefficient of reliability for this component was .88, indicating satisfactory reliability (Helmstadter, 1964).

The second component was labelled as “Disapproval and Perceived Peer Disapproval of Cigarette Smoking,” and was composed of four items (i.e., disapproval and perceived peer disapproval for smoking half a pack and a pack of cigarettes per day), with Cronbach’s alpha coefficient of reliability being .85.

“Perceived Peer Disapproval of Drug Use” (i.e., use of marijuana and cigarettes) was the label assigned to the third component, and it was made up of five items from the YTDQ (i.e., perceived peer disapproval of smoking a half a pack and one pack of cigarettes per day, and use of marijuana once or twice, occasionally, and regularly). This component also had satisfactory reliability, with a Cronbach’s alpha coefficient equal to .85.

The fourth component was labelled as “Perceived Risk of Cigarette Smoking,” and it consisted of two items (i.e., perceived risk of smoking half a pack and one pack of cigarettes per day). It also had a reasonable amount of internal consistency reliability ($\alpha = .75$).

The final component that was obtained from the PCA was labelled as “Access and Perceived Availability of Marijuana” and it also consisted of two items (i.e., perceived availability of marijuana and access to marijuana). The Cronbach’s alpha coefficient of reliability for this component was .59.

The variance explained by each of these components is also included in Table 2. These five components have subsequently been used as the attitudinal predictor variables for all further analyses in the current study.

In all of the subsequent analyses where maternal drug use variables were used as covariates, nicotine, marijuana, and alcohol were all expressed as continuous variables. All distributions of maternal drug scores were found to be positively skewed; to correct for non-normal distributions, maternal nicotine and marijuana use were normalized using logarithm transformations, while maternal alcohol use required an inverse transformation (Tabachnick & Fidell, 2001). Additionally, the distribution of scores for the attitudinal components perceived peer disapproval of drug use and perceived risk of cigarette smoking were both normalized using a square root transformation (Tabachnick & Fidell, 2001). The untransformed versions of all of these variables were used, however, in the logistic regression analyses since there are no assumptions regarding the distributions of variables in such analyses (i.e., variables do not have to be normally distributed, linearly related, or of equal variance within each group; Pedhazur, 1997; Tabachnick & Fidell, 2001).

Correlates of drug use initiation and cessation. A series of logistic regression analyses were performed in order to assess the contribution of adolescents' attitudes, the influence of their peers, and prenatal drug exposure (i.e., both nicotine and marijuana) to both the initiation and cessation of cigarette smoking and marijuana use. When appropriate, logistic regression analyses for analysis of covariance (ANCOVA; Pedhazur,

1997) were employed in order to control for any potential confounding variables.

Separate logistic regression models were conducted for the initiation of cigarette smoking and marijuana use, respectively, as well as for the cessation of these two behaviours.

In analyses concerning the initiation of cigarette smoking, the outcome variable was the adolescent's ever use of cigarettes (beyond just trying out one or two), and it was coded as a dichotomy (i.e., never smoked cigarettes vs. have smoked cigarettes). The operational definition for regular cigarette smoking differed slightly from that used for the initiation of cigarette smoking in that it referred to smoking cigarettes at least once per day. With respect to analyses concerning the initiation of marijuana use, the outcome variable was the OPPS youths' ever use of marijuana and it was also coded as a dichotomy (i.e., never tried marijuana vs. have tried marijuana). Regular use in this case was defined as using marijuana at least once per week.

Analyses concerning the cessation of cigarette smoking and marijuana use included only those adolescents who answered affirmatively to having ever used the drug of interest (either cigarettes or marijuana) on a regular basis on the Drug History Questionnaire (DHQ). The outcome variable for the drug use cessation analyses was the adolescent's current regular use of the drug of interest and it was coded as a dichotomy (i.e., no current regular drug use vs. current regular drug use), with no current regular drug use being indicative of cessation. Thus, the measures of interest from the DHQ for analyses pertaining to the correlates of drug use initiation and cessation include the "ever use," "ever regular use," and "current regular use" of cigarettes (3-item index; $\alpha = .92$) and marijuana (3-item index; $\alpha = .40$).

A number of predictor variables were used in the logistic regression analyses. The attitudinal predictor variables were the five components obtained from the previous principal components analysis: disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use (i.e., use of marijuana and cigarettes), perceived risk of cigarette smoking, and access and perceived availability of marijuana. As has been previously mentioned, the alpha reliability coefficients for these attitudinal components were found to range from .59 to .88.

The peer influence predictor variables consisted of the proportion (i.e., none, some, most, all, and do not know) of peers who have tried and who regularly use cigarettes and marijuana, respectively. These four items were obtained from the DHQ, and their alpha reliability was found to be adequate ($\alpha = .78$).

The prenatal drug exposure predictors were the level of prenatal exposure to nicotine and marijuana (no exposure vs. exposure). The covariates that were selected for inclusion in each of the logistic regression analyses varied across the different analyses depending on their association with prenatal nicotine and marijuana, as well as their association with the dependent variable of interest. Maternal use of alcohol during pregnancy, however, was included as a covariate in all analyses.

Separate logistic regression analyses were first conducted for each conceptual set of predictor variables (i.e., prenatal drug exposure, peer influences, and attitudes) in order to examine their contributions to the outcome variable. Next, a logistic regression analysis including all of the predictor variables and covariates in the model (i.e., full model) was performed.

The proportion of variance explained by the predictor variables was examined using Nagelkerke's (1991) coefficient of determination, which is an analogue of the R^2 statistic for logistic regression. The magnitude of each coefficient of determination was described as per the conventional criteria for assessing the squared Pearson product-moment correlation. Odds ratios and their 95% confidence intervals were also calculated for terms identified in each of the models. An alpha level of .05 was used to test the significance of the omnibus tests for each of the logistic regression models. The significance of each predictor variable was then tested using Wald's criterion and an alpha level of .05.

Unless otherwise noted, in all subsequent logistic regression analyses the assumptions regarding independence of errors, absence of multicollinearity and outliers, homogeneity of regression slopes, and linearity in the logit have been met. Evaluation of expected frequencies for the categorical predictor variables revealed a serious violation of this assumption in that more than 20% of the expected frequencies were less than five, in addition to there being several expected frequencies whose values were less than one (Tabachnick & Fidell, 2001). Upon further inspection of the data, the "do not know" category for the peer influence variables was discovered to be problematic in that only 24 responses (i.e., 15 cases) fell into this category across the four peer variables. As a result, the "do not know" category was deleted, and these 24 responses were substituted with the median of the corresponding peer variable (Tabachnick & Fidell, 2001). Re-evaluation of the assumption of adequacy of expected frequencies following the deletion of the "do not know" category indicated that the assumption was still seriously violated. As a result, the categories for the four peer influence variables were collapsed to result in only two

categories (i.e., none/some and most/all; Tabachnick & Fidell, 2001). Such action resulted in the assumption of adequacy of expected frequencies for the categorical predictor variables to be met. This new categorization of the peer influence variables was maintained during all subsequent analyses in the current study.

Prenatal drug exposure group and gender differences. In order to determine the extent to which adolescents' attitudes and the influence of their peers differ between those youth in the OPPS who were prenatally exposed to varying levels of nicotine and marijuana and those who were not, as well as to test for gender differences, a series of multivariate analyses of covariance (MANCOVAs) were conducted for each conceptual set of dependent measures (i.e. the attitudinal and peer influence variables) for both prenatal exposure to nicotine and marijuana, respectively. In each of these analyses, there were two grouping variables: prenatal drug exposure (i.e., nicotine or marijuana) and gender. As has been previously mentioned in the subsection "*Group Categorization*," the prenatal drug exposure variables for this series of analyses were categorized into three groups. In the case of prenatal exposure to nicotine, the three groups were non-smoking, light, and heavy. The three levels of prenatal exposure to marijuana were no use, infrequent/moderate, and heavy. The covariates that were selected for inclusion in each of the MANCOVAs varied across the different analyses depending on their association with prenatal nicotine and marijuana, as well as their association with the various dependent measures. Maternal use of alcohol and the drug not considered to be of primary interest (i.e., in the case of cigarettes, use of marijuana), however, were included in all analyses. The 24 responses for the four peer influence variables that fell into the

“do not know” category that were previously deleted were replaced with the mean of the corresponding peer influence variable (Tabachnick & Fidell, 2001).

Unless otherwise specified, results of evaluation of assumptions of normality, homogeneity of variance-covariance matrices, homogeneity of regression planes (and regression hyperplanes in the case of more than two covariates), linearity, and absence of multicollinearity and influential univariate and multivariate outliers were satisfactory. When a non-significant interaction was found, the significant main effects were interpreted. When a significant overall multivariate main effect was found using Wilks' criterion and an alpha level of .05, univariate analyses were subsequently conducted using a Bonferroni correction (i.e., $\alpha = .05/\text{no. of dependent variables [DVs]}$) in order to determine which dependent variables were responsible for the overall difference while controlling for Type I error (Stevens, 2002). When significant univariate main effects were found, pairwise comparisons were then conducted also using a Bonferroni correction (i.e., $\alpha = .05/\text{no. of comparisons}$) in order to control for Type I error (Stevens, 2002). Effect sizes for all main effects have been evaluated using η^2 s and Cohen's (1977) conventions (i.e., small effect: $\eta^2 = .02$; medium effect: $\eta^2 = .13$; large effect: $\eta^2 = .30$).

Progression of drug use. The final analysis that was conducted in the current study involved determining if there is a particular sequence of drug use among adolescents in the OPPS sample. Various descriptive statistics were employed in this case.

RESULTS

Demographic Characteristics

Demographic characteristics of the sample for both maternal cigarette smoking and marijuana groups are presented in Table 3. Annual family income and mother's age at time of birth are similar to those of women who gave birth in the Ottawa region at the time that participants in the OPPS sample were recruited for the study (Fried & Watkinson, 1988). Several of the demographic and behavioural characteristics were found to significantly vary across the various prenatal drug exposure groups including annual income, average parental education, mother's age, parity, maternal use of cigarettes and marijuana during pregnancy, passive exposure to both cigarettes and marijuana postnatally, and the adolescents' age of initiation of cigarette smoking.

Adolescents' Drug Involvement

Cigarette Smoking

More than half (52.6%; $n = 80$) of the adolescents in this study reported having initiated cigarette smoking (beyond just trying out one or two cigarettes) at some point in their lifetime, with the mean age of initiation being 13.99 years ($SD = 1.75$). No significant gender difference was found with respect to smoking initiation, $\chi^2(1, N = 152) = .32, p = .57$.

Table 3

Demographic Characteristics of Prenatal Drug Exposure Groups (N = 152)

Characteristic	Prenatal Nicotine Exposure (mg/day)			Prenatal Marijuana Exposure (joints/week)		
	None (0) Group 1 <i>n</i> = 65	Light (0.1-15.9) Group 2 <i>n</i> = 50	Heavy (≥16) Group 3 <i>n</i> = 37	None (0) Group 1 <i>n</i> = 103	Infrequent/Moderate (>0 and <6) Group 2 <i>n</i> = 27	Heavy (≥6) Group 3 <i>n</i> = 22
<i>Family characteristics</i>						
Annual income (CDN\$) ^a	35928	29534	27100 ^{d,†}	36328	21099	22877 ^{b,§,e,†}
Mother's age ^a	29.66	26.92	26.76 ^{e,§}	29.54	25.52	24.18 ^{b,§}
Ave. parent education ^{a,b}	3.02	2.46	2.05 ^{b,§,d,¶}	2.82	2.35	1.91 ^{d,§,b,†}
Parity	2.02	1.70	1.89	2.03	1.70	1.41 ^{d,†}
<i>Prenatal substance exposure</i>						
Nicotine (mg/day) [*]	.00 (.00)	5.86 (.71)	26.35 (1.41) ^{b,†}	8.23 (.55)	9.40 (.68)	7.57 (.58)
Marijuana (joints/week) [*]	2.89 (.21)	5.06 (.35)	2.70 (.22)	.00 (.00)	1.85 (.40)	22.31 ^{b,¶} (1.29 ^{b,†})
Alcohol (oz AA/day) [*]	.21 (.86)	.15 (.88)	.19 (.86)	.18 (.87)	.21 (.84)	.15 (.88)
<i>Postnatal substance exposure</i>						
Passive exposure to nicotine until age 15 (no. of years exposed as a prop. of age)	.25	.57	.79 ^{f,§,b,†}	.42	.42	.79 ^{d,†}

	Prenatal Nicotine Exposure (mg/day)			Prenatal Marijuana Exposure (joints/week)		
	None (0) Group 1 <i>n</i> = 65	Light (0.1-15.9) Group 2 <i>n</i> = 50	Heavy (≥16) Group 3 <i>n</i> = 37	None (0) Group 1 <i>n</i> = 103	Infrequent/Moderate (>0 and ≤6) Group 2 <i>n</i> = 27	Heavy (≥6) Group 3 <i>n</i> = 22
Characteristic						
Passive exposure to nicotine at assessment (no. of hours exposed both in and out of home)*	8.85 (2.36)	15.51 (3.29)	21.82 ^{c†} (4.12 ^{††})	11.03 (2.74)	16.83 (3.42)	25.78 (4.34) ^{c†}
Passive exposure to marijuana at assessment ^e	1.23	1.20	1.22	1.05	1.44	1.73 ^{d†}
<i>Subject characteristics</i>						
Sex, % female	41.54	44.00	48.65	43.69	44.44	45.45
Age at assessment (years)	18.01	18.10	18.04	18.04	18.03	18.10
Age of cigarette smoking initiation (years)	14.19	14.39	13.05 ^{d‡}	14.02	14.38	13.47
Cigarettes smoked/day*	2.39 (.26)	3.69 (.39)	4.23 (.40)	2.50 (.27)	3.41 (.38)	6.70 ^{c†} (.58 ^{d†})
Age of marijuana use initiation (years)	14.68	14.72	14.44	14.77	14.79	13.92
Joints smoked/week*	2.20 (.23)	2.23 (.22)	2.86 (.25)	.93 (.14)	2.75 (.28)	8.63 ^{c††, f‡} (.60 ^{c††, d‡})

Note. *Transformed data in parentheses. Maternal nicotine and marijuana use, as well as subjects' use of cigarettes and marijuana, were log transformed prior to statistical analyses. Maternal alcohol use was normalized using an inverse transformation, while passive exposure to nicotine at assessment was normalized using a square root transformation. Statistical tests were one-way between-subjects analysis of variance with Bonferroni's criteria ($\alpha = .05$) used for post hoc comparisons (Stevens, 2002).

^aV values are based on figures obtained at birth. ^bEducation coded as: 1 = did not finish high school; 2 = graduated high school; 3 = graduated college or university; 4 = post-graduate degree. ^cCoding for passive exposure to marijuana: 1 = more than one month ago; 2 = between 1 week and 4 weeks ago; 3 = between 2 and 6 days ago; 4 = yesterday; 5 = today.

^d $p \leq .05$. ^e $p \leq .01$. ^f $p \leq .001$. ^g $p \leq .0001$. ^hAll pairwise comparisons differ. ⁸Group 1 differs from group 2. ⁴Group 1 differs from group 3.

⁹Group 2 differs from group 3. [#]Group 1 differs from groups 2 and 3. ¹⁰Group 3 differs from groups 1 and 2.

Of those 80 youth who reported having initiated cigarette smoking at some point in their lifetime, 87.5% ($n = 70$) of them have also reported having smoked on a regular basis (i.e., at least once a day), with such use first occurring at the mean age of 14.72 years ($SD = 1.61$). There was also no significant gender difference found with respect to cigarette smoking on a regular basis among the adolescents in the OPPS, $\chi^2(1, N = 152) = .08, p = .78$.

A number of adolescents in the OPPS were also found to be current, regular cigarette smokers. Of those 70 youth in the present study who have reported regular cigarette smoking at some point in their lifetime, 24.3% ($n = 17$) of them had reported that they discontinued smoking cigarettes on a regular basis at assessment, whereas 75.7% ($n = 53$) of the adolescents answered affirmatively on the DHQ to currently smoking on a regular basis and are smoking an average of 9.37 ($SD = 5.14$) cigarettes per day. Thus, 34.9% of the entire sample of adolescents in the OPPS are currently smoking cigarettes on a regular basis. No significant gender difference was found with respect to current, regular cigarette smoking, $\chi^2(1, N = 70) = .93, p = .33$.

Marijuana Use

The majority (73.7%; $n = 112$) of adolescents in this study reported having initiated the use of marijuana at some point in their lifetime, with the average age of initiation being 14.64 years ($SD = 1.57$). No significant gender difference was found, however, with respect to the initiation of marijuana use, $\chi^2(1, N = 152) = .02, p = .89$.

Of those 112 youth in the OPPS who have reported to have initiated the use of marijuana at some point in their lifetime, only 27.6% ($n = 31$) of them have also reported

having used marijuana on a regular basis (i.e., at least once a week), with such use first occurring at the mean age of 15.30 years ($SD = 1.67$). No significant gender difference was found with respect to using marijuana on a regular basis, $\chi^2(1, N = 152) = 1.17, p = .28$.

In sharp contrast to the number of current, regular cigarette smokers in the OPPS sample, a much smaller number of adolescents in the present study were found to be current, regular marijuana users. Of those 31 youth in the current investigation who have reported regular marijuana use at some point in their lifetime, 83.9% ($n = 26$) of them reported that they discontinued using marijuana on a regular basis, whereas only 16.1% ($n = 5$) of the adolescents answered affirmatively on the DHQ to currently using marijuana on a regular basis and are smoking an average of 3 ($SD = 3.18$) joints per week. Thus, only 3.4% of the entire sample of adolescents in the OPPS are currently using marijuana on a regular basis. No significant gender difference was found with respect to the current, regular use of marijuana, $\chi^2(1, N = 31) = 3.28, p = .07$.

Correlates of Drug Use Initiation

The following analyses have examined the correlates of cigarette smoking and marijuana use initiation, respectively, among adolescents in the OPPS. Separate analyses were first conducted for each conceptual set of predictor variables (i.e., prenatal drug exposure, peer influences, and attitudes), followed by an analysis including all of the predictor variables and covariates in the model (i.e., full model).

Cigarette Smoking Initiation

As was previously mentioned, 52.6% ($n = 80$) of the adolescents in this study reported having initiated cigarette smoking at some point in their lifetime (beyond just trying out one or two cigarettes). Of those 80 youth who reported having initiated cigarette smoking at some point in their lifetime, 87.5% ($n = 70$) of them have also reported having smoked on a regular basis (i.e., at least once a day).

Prenatal Drug Exposure

A logistic regression analysis for ANCOVA was performed on cigarette smoking initiation as outcome and prenatal exposure to nicotine and marijuana as the predictor variables. Maternal use of alcohol during pregnancy was included as a covariate in the model.

A test of the full model with the two prenatal drug exposure predictors and the covariate against a constant-only model was found to be significant, $\chi^2(3, N = 152) = 10.76, p = .01$. Such a result indicates that as a set, prenatal exposure to both nicotine and marijuana, as well as maternal use of alcohol during pregnancy, significantly classify whether or not adolescents in this sample initiated cigarette smoking. The variance in cigarette smoking initiation accounted for by the set of predictors and the covariate is small, however, with Nagelkerke's $R^2 = .09$. Table 4 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables in to the model.

Table 4

Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Prenatal Drug Exposure Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	-.42	.73	.33	.66 (.16, 2.75)
Prenatal nicotine exposure ^a	.67	.34	3.79*	1.95 (1.00, 3.81)
Prenatal marijuana exposure ^a	.81	.37	4.71*	2.24 (1.08, 4.63)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure.

*p < .05.

According to the Wald criterion, both prenatal exposure to nicotine ($z = 3.79, p = .05$) and prenatal exposure to marijuana ($z = 4.71, p = .03$) account for a significantly unique proportion of variance in cigarette smoking initiation, when the effects of the other variables are held constant. Maternal use of alcohol during pregnancy (i.e., the covariate), however, did not reach statistical significance ($z = .33, p = .57$).

As is shown in Table 4, the odds for cigarette smoking initiation for adolescents who were prenatally exposed to nicotine were 1.95 times higher than those youth who were not prenatally exposed to nicotine, with the effects of prenatal exposure to alcohol and marijuana controlled. In addition, the odds for cigarette smoking initiation for young people who were prenatally exposed to marijuana were 2.24 times higher than those adolescents who were not prenatally exposed to this drug, with the effects of prenatal exposure to alcohol and nicotine controlled.

Such results indicate that youth in the OPPS sample were more likely to have initiated cigarette smoking, beyond just trying out one or two cigarettes, if they were prenatally exposed to either nicotine or marijuana.

With only maternal alcohol use during pregnancy (i.e., the covariate) included in the model, the results indicate that it did not significantly classify whether or not adolescents in this sample initiated cigarette smoking, $\chi^2(1, N = 152) = .49, p = .48$, Nagelkerke's $R^2 = .004$. However, after controlling for this covariate, a test of the model with the addition of the two prenatal drug exposure predictors was found to be significant, $\chi^2(2, N = 152) = 10.27, p = .01$. This result indicates that with the effects of maternal alcohol use during pregnancy controlled, prenatal exposure to both nicotine and marijuana provides a significant improvement in the model.

Peer Influences

A logistic regression analysis was performed on cigarette smoking initiation as outcome and the four peer influence variables (i.e., proportion of one's peers who have tried and who regularly use cigarettes and marijuana) as predictors.

A test of the full model with all of the peer influence predictor variables against a constant-only model was found to be significant, $\chi^2(4, N = 152) = 76.70, p < .0001$. This result indicates that as a set, the peer influence variables significantly classify whether or not youth in this sample initiated cigarette smoking. The variance in cigarette smoking initiation accounted for by the set of peer influence predictors is moderate, with Nagelkerke's $R^2 = .53$. Table 5 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the peer predictor variables after entry of all of the variables into the model.

According to the Wald criterion, the only peer influence variable that accounts for a significantly unique proportion of variance in cigarette smoking initiation is the proportion of one's peers who regularly smoke cigarettes ($z = 26.80, p < .0001$). The proportion of one's peers who have tried cigarettes ($z = 2.13, p = .14$) or marijuana ($z = .25, p = .62$), and the proportion who regularly use marijuana ($z = 1.58, p = .21$) were not found to be significant.

As is shown in Table 5, the odds for cigarette smoking initiation for adolescents who reported that most or all of their friends regularly smoke cigarettes were 15.51 times higher than those youth who reported that none or some of their friends regularly smoke cigarettes, when the effects of the other peer influence variables are controlled.

Table 5

Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Peer Influence Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Proportion of peers who have tried cigarette smoking ^a	1.03	.71	2.13	2.80 (.70, 11.15)
Proportion of peers who regularly smoke cigarettes ^a	2.74	.53	26.80****	15.51 (5.49, 43.79)
Proportion of peers who have tried marijuana ^a	.30	.60	.25	1.35 (.42, 4.34)
Proportion of peers who regularly use marijuana ^a	.73	.58	1.58	2.07 (.66, 6.47)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

^aReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

**** $p < .0001$.

Thus, young people in the current study were more likely to have initiated smoking cigarettes (beyond just trying out one or two) if the majority of their friends are regular cigarette smokers.

Attitudinal Influences

A logistic regression analysis was performed on cigarette smoking initiation as outcome and the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana) as predictors.

A test of the full model with all of the attitudinal predictors against a constant-only model was found to be significant, $\chi^2(5, N = 152) = 53.87, p < .0001$. This result indicates that as a set, the attitudinal components significantly classify whether or not youth in this sample initiated cigarette smoking. The variance in cigarette smoking initiation accounted for by the set of attitudinal predictors is moderate, with Nagelkerke's $R^2 = .40$. Table 6 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the attitudinal predictors after entry of all of the components into the model.

According to the Wald criterion, several of the attitudinal components were found to account for a significantly unique proportion of variance in cigarette smoking initiation including disapproval and perceived risk of marijuana use ($z = 20.49, p < .0001$), disapproval and perceived peer disapproval of cigarette smoking ($z = 16.66, p < .0001$), and access and perceived availability of marijuana ($z = 10.24, p = .001$).

Table 6

Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Attitudinal Components (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Disapproval and perceived risk of marijuana use	-.94	.21	20.49****	.39 (.26, .59)
Disapproval and perceived peer disapproval of cigarette smoking	-.85	.21	16.66****	.43 (.28, .64)
Perceived peer disapproval of drug use	-.24	.20	1.49	.79 (.54, 1.16)
Perceived risk of cigarette smoking	-.04	.19	.05	.96 (.66, 1.39)
Access and perceived availability of marijuana	-.70	.22	10.24***	.50 (.33, .76)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

***p < .001. ****p < .0001.

Neither perceived peer disapproval of drug use ($z = 1.49, p = .22$) nor perceived risk of cigarette smoking ($z = .05, p = .83$), however, were found to reach statistical significance.

As is shown in Table 6, a negative relationship was found between adolescents' disapproval and perceived risk of marijuana use, and their initiation of cigarette smoking. The odds for cigarette smoking initiation are .39 times lower for each one point increase in the attitudinal scores for disapproval and perceived risk of marijuana use (with higher scores being indicative of more disapproval and perceived risk), when the effects of the other attitudinal components are held constant. That is, youth who report greater disapproval and perceived risk associated with using marijuana are less likely to initiate cigarette smoking.

Similarly, with the effects of the other attitudinal components controlled, the odds for cigarette smoking initiation are .43 times lower for each one point increase in the attitudinal scores for disapproval and perceived peer disapproval of cigarette smoking (with higher scores being indicative of more disapproval and perceived peer disapproval). That is, adolescents who report greater disapproval and perceived peer disapproval of cigarette smoking are less likely to initiate smoking cigarettes.

Finally, the results also reveal that the odds for cigarette smoking initiation are .50 times lower for each one point decrease in the attitudinal scores for access and perceived availability of marijuana (with higher scores being indicative of greater access and perceived availability), when the effects of the other attitudinal components are held constant. That is, youth who report less access to and perceived availability of marijuana are less likely to initiate cigarette smoking.

Full Model

A logistic regression analysis for ANCOVA was performed on cigarette smoking initiation as outcome and the two prenatal drug exposure variables (i.e., nicotine and marijuana), the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana) and the four peer influence variables (i.e., proportion of one's peers who have tried and who regularly use cigarettes and marijuana) as predictors. Maternal use of alcohol during pregnancy was also included as a covariate in the model.

A test of the full model with all of the prenatal drug exposure, attitudinal, and peer influence predictors and the covariate against a constant-only model was found to be significant, $\chi^2(12, N = 152) = 92.83, p < .0001$. This result indicates that as a set, prenatal exposure to both nicotine and marijuana, the five attitudinal components, the four peer influence variables, and maternal use of alcohol during pregnancy all significantly classify whether or not youth in this sample initiated cigarette smoking. The variance in cigarette smoking initiation accounted for by the set of predictors and the covariate is moderate, with Nagelkerke's $R^2 = .61$. Table 7 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictors and the covariate after entry of all of the variables into the model.

Table 7

Results of Logistic Regression Analysis Predicting Cigarette Smoking Initiation from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	-.21	1.11	.04	.81 (.09, 7.08)
Prenatal nicotine exposure ^a	.89	.50	3.09	2.42 (.90, 6.50)
Prenatal marijuana exposure ^a	.19	.55	.12	1.21 (.41, 3.59)
Disapproval and perceived risk of marijuana use	-.80	.27	8.88**	.45 (.27, .76)
Disapproval and perceived peer disapproval of cigarette smoking	-.24	.28	.70	.79 (.46, 1.37)
Perceived peer disapproval of drug use	-.04	.27	.02	.96 (.57, 1.64)
Perceived risk of cigarette smoking	.01	.23	.001	1.01 (.64, 1.57)
Access and perceived availability of marijuana	-.50	.28	3.21	.61 (.36, 1.05)
Proportion of peers who have tried cigarette smoking ^b	.46	.82	.32	1.58 (.32, 7.85)
Proportion of peers who regularly smoke cigarettes ^b	2.61	.62	18.00****	13.60 (4.07, 45.44)
Proportion of peers who have tried marijuana ^b	.50	.70	.50	1.64 (.41, 6.53)
Proportion of peers who regularly use marijuana ^b	.16	.67	.06	1.17 (.31, 4.37)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure. ^bReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

^{**} $p < .01$. ^{****} $p < .0001$.

According to the Wald criterion, only two of the predictors were found to account for a significantly unique proportion of variance in cigarette smoking initiation including disapproval and perceived risk of marijuana use ($z = 8.88, p = .003$) and the proportion of one's peers who regularly smoke cigarettes ($z = 18.00, p < .0001$). Neither prenatal exposure to nicotine ($z = 3.09, p = .08$) nor marijuana ($z = .12, p = .73$) were found to reach significance, although prenatal exposure to nicotine approached conventional statistical significance. Additionally, the attitudinal components disapproval and perceived peer disapproval of cigarette smoking ($z = .70, p = .40$), perceived peer disapproval of drug use ($z = .02, p = .89$), perceived risk of cigarette smoking ($z = .001, p = .98$), and access and perceived availability of marijuana ($z = 3.21, p = .07$) were not found to be significant. Moreover, the proportion of one's peers who have tried cigarettes ($z = .32, p = .57$) or marijuana ($z = .50, p = .48$), as well as the proportion who regularly use marijuana ($z = .06, p = .81$), were also not found to be significant. Maternal use of alcohol during pregnancy (i.e., the covariate) was also not found to be significant ($z = .04, p = .85$).

As is shown in Table 7, a negative relationship was found between adolescents' attitudes of disapproval and perceived risk of marijuana use, and their initiation of cigarette smoking. That is, the odds for cigarette smoking initiation are .45 times lower for each one point increase in the attitudinal scores for disapproval and perceived risk of marijuana use (with higher scores being indicative of more disapproval and perceived risk), when the effects of the other variables are held constant. That is, youth who report greater disapproval and perceived risk associated with marijuana use are less likely to initiate cigarette smoking, when all other variables are held constant.

The results also reveal that the odds for cigarette smoking initiation for adolescents who reported that most or all of their friends regularly smoke cigarettes were 13.60 times higher than those youth who reported that none or some of their friends regularly smoke cigarettes, when the effects of the other variables are controlled. Thus, adolescents in the current study were more likely to have initiated cigarette smoking, beyond just trying out one or two cigarettes, if the majority of their friends are regular cigarette smokers.

With only maternal alcohol use (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not adolescents in this sample initiated cigarette smoking, $\chi^2(1, N = 152) = .49, p = .48$, Nagelkerke's $R^2 = .004$. After controlling for this covariate, however, a test of the model with the addition of the 11 prenatal drug exposure, attitudinal, and peer influence variables was found to be significant, $\chi^2(11, N = 152) = 92.34, p < .0001$. This result indicates that with the effects of maternal drug use during pregnancy controlled, the set of 11 prenatal drug exposure, attitudinal, and peer influence predictors provides a significant improvement in the model.

Summary

Several variables were found to be significantly associated with the initiation of cigarette smoking among the OPPS youth. First of all, prenatal exposure to both nicotine and marijuana were found to be related to the initial use of cigarettes (i.e., beyond just trying out one or two cigarettes) in that youth who were exposed to these substances were more likely to initiate smoking as compared to those who were unexposed. The

proportion of one's peers who regularly smoke cigarettes was also found to be an important correlate since adolescents in the current study were more likely to have initiated cigarette smoking if most or all of their friends are regular cigarette smokers. Finally, several attitudinal measures emerged as influential correlates of cigarette smoking initiation including disapproval and perceived risk of using marijuana, disapproval and perceived peer disapproval of cigarette smoking, and access and perceived availability of marijuana. In general, youth in the current study who reported greater disapproval, perceived risk and perceived peer disapproval and less access and perceived availability were less likely to have initiated smoking cigarettes.

Marijuana Use Initiation

As has been previously discussed, the majority (73.7%; $n = 112$) of adolescents in this study reported having initiated the use of marijuana at some point in their lifetime. Of those 112 youth in the OPPS who reported having initiated the use of marijuana, only 27.6% ($n = 31$) of them have also reported the use of marijuana on a regular basis (i.e., at least once a week) at some point in their lifetime.

Prenatal Drug Exposure

A logistic regression analysis for ANCOVA was performed on marijuana use initiation as outcome and prenatal exposure to nicotine and marijuana as the predictor variables. Maternal use of alcohol during pregnancy was included in the model as a covariate.

A test of the full model with the two prenatal drug exposure predictors and the covariate against a constant-only model was not found to be significant, $\chi^2(3, N = 152) = 6.01, p = .11$. Such a result indicates that as a set, prenatal exposure to nicotine and marijuana, as well as maternal alcohol use during pregnancy, does not significantly classify whether or not adolescents in this sample initiated the use of marijuana. The variance in marijuana use initiation accounted for by the set of predictors and the covariate is small, with Nagelkerke's $R^2 = .06$.

With only maternal use of alcohol during pregnancy (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not youth in this study initiated marijuana use, $\chi^2(1, N = 152) = .09, p = .76$, Nagelkerke's $R^2 = .001$. However, after controlling for this covariate, a test of the model with the addition of the two prenatal drug exposure predictors was found to be significant, $\chi^2(2, N = 152) = 5.92, p = .05$. Such a result indicates that with the effects of maternal alcohol use during pregnancy controlled, prenatal exposure to nicotine and marijuana provides a significant improvement in the model. Table 8 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables in the model.

According to the Wald criterion, only prenatal exposure to marijuana ($z = 4.78, p = .03$) was found to account for a significantly unique proportion of variance in marijuana use initiation, when the effects of prenatal exposure to alcohol and nicotine are held constant. Neither prenatal exposure to nicotine ($z = .12, p = .73$) nor maternal use of alcohol during pregnancy ($z = .09, p = .77$) were found to be significant.

Table 8

Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Prenatal Drug Exposure Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	.23	.78	.09	1.26 (.27, 5.79)
Prenatal nicotine exposure ^a	.13	.38	.12	1.14 (.54, 2.41)
Prenatal marijuana exposure ^a	1.02	.46	4.78*	2.76 (1.11, 6.86)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure.

*p < .05.

As is shown in Table 8, the odds for marijuana use initiation for adolescents who were prenatally exposed to marijuana were 2.76 times higher than those youth who were not prenatally exposed to this drug, when the effects of *in utero* exposure to alcohol and nicotine are controlled. Such a result indicates that young people in the OPPS sample were more likely to have initiated using marijuana if they were prenatally exposed to this substance.

Peer Influences

A logistic regression analysis was performed on marijuana use initiation as outcome and the four peer influence variables (i.e., proportion of one's peers who have tried and who regularly use cigarettes and marijuana) as predictors.

A test of the full model with all of the peer influence predictor variables against a constant-only model was found to be significant, $\chi^2(4, N = 152) = 67.23, p < .0001$, indicating that as a set, the peer influence variables significantly classify whether or not youth in this sample initiated using marijuana. The variance in marijuana use initiation accounted for by the set of peer influence predictors was found to be moderate, with Nagelkerke's $R^2 = .52$. Table 9 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the peer influence predictor variables after entry of all of the variables into the model.

Table 9

Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Peer Influence Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Proportion of peers who have tried cigarette smoking ^a	1.32	.56	5.43*	3.73 (1.23, 11.26)
Proportion of peers who regularly smoke cigarettes ^a	1.42	.71	4.03*	4.12 (1.03, 16.44)
Proportion of peers who have tried marijuana ^a	1.23	.52	5.56*	3.42 (1.23, 9.50)
Proportion of peers who regularly use marijuana ^a	.02	.02	.77	1.02 (.98, 1.07)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

^aReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

*p < .05.

According to the Wald criterion, several of the peer influence variables were found to account for a significantly unique proportion of variance in marijuana use initiation including the proportion of one's peers who have tried smoking cigarettes ($z = 5.43, p = .02$) and using marijuana ($z = 5.56, p = .02$), as well as the proportion of one's peers who regularly smoke cigarettes ($z = 4.03, p = .05$). The proportion of one's peers who regularly use marijuana ($z = .77, p = .38$), however, was not found to be significant.

As is shown in Table 9, the odds for marijuana use initiation for adolescents who reported that most or all of their friends have ever tried smoking cigarettes were 3.73 times higher than those youth who reported that none or some of their friends have ever tried smoking cigarettes, when the effects of the other peer influence variables are controlled.

Similarly, the odds for the initiation of marijuana use for youth who reported that most or all of their friends regularly smoke cigarettes were 4.12 times higher than those adolescents who reported that none or some of their friends regularly smoke cigarettes, when the effects of the other peer influence variables are held constant.

Additionally, Table 9 shows that the odds for marijuana use initiation for young people who reported that most or all of their friends have ever tried using marijuana were 3.42 times higher than those adolescents who reported that none or some of their friends have ever tried using marijuana, with the effects of all of the other peer variables are controlled.

In sum, the results from the current analysis indicate that with the effects of the other peer influence variables controlled, youth in the OPPS study were more likely to

have initiated using marijuana if the majority of their friends have tried smoking cigarettes or marijuana, or if they are regular cigarette smokers.

Attitudinal Influences

A logistic regression analysis was performed on marijuana use initiation as outcome and the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana) as predictors.

A test of the full model with all of the attitudinal predictor variables against a constant-only model was found to be significant, $\chi^2(5, N = 152) = 65.96, p < .0001$, indicating that as a set, the attitudinal components significantly classify whether or not youth in this sample initiated the use of marijuana. The variance in marijuana use initiation accounted for by the set of attitudinal predictors is moderate, with Nagelkerke's $R^2 = .52$. Table 10 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the attitudinal predictors after entry of all of the components into the model.

Table 10

Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Attitudinal Components (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Disapproval and perceived risk of marijuana use	-1.40	.28	25.40****	.25 (.14, .43)
Disapproval and perceived peer disapproval of cigarette smoking	-.43	.25	3.09	.65 (.40, 1.05)
Perceived peer disapproval of drug use	-.92	.23	16.43****	.40 (.25, .62)
Perceived risk of cigarette smoking	-.41	.28	2.23	.66 (.39, 1.14)
Access and perceived availability of marijuana	-.76	.25	9.54**	.47 (.29, .76)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

**p < .01. ****p < .0001.

According to the Wald criterion, several of the attitudinal components were found to account for a significantly unique proportion of variance in marijuana use initiation including disapproval and perceived risk of marijuana use ($z = 25.40, p < .0001$), perceived peer disapproval of drug use ($z = 16.43, p < .0001$), and access and perceived availability of marijuana ($z = 9.54, p = .002$). Disapproval and perceived peer disapproval of cigarette smoking ($z = 3.09, p = .08$) and perceived risk of cigarette smoking ($z = 2.23, p = .14$), however, were not found to be significant.

As is shown in Table 10, a negative relationship was observed between adolescents' disapproval and perceived risk of marijuana use, and their initiation of use of this drug. The odds for the initiation of marijuana use are .25 times lower for each one point increase in the attitudinal scores for disapproval and perceived risk of marijuana use (with higher scores being indicative of more disapproval and perceived risk), when the effects of the other attitudinal components are held constant. That is, youth who report greater disapproval and perceived risk associated with using marijuana are less likely to initiate the use of this drug.

Similarly, with the effects of the other attitudinal components controlled, the odds for marijuana use initiation are .40 times lower for each one point increase in the attitudinal scores for perceived peer disapproval of drug use (with higher scores being indicative of more perceived peer disapproval). That is, adolescents in the OPPS sample who report greater perceived peer disapproval of using both cigarettes and marijuana are less likely themselves to initiate using marijuana.

Table 10 also shows that the odds for marijuana use initiation are .47 times lower for each one point decrease in the attitudinal scores for access and perceived availability

of marijuana (with higher scores being indicative of greater access and perceived availability), when the effects of the other attitudinal components are held constant. That is, youth who report less access to and perceived availability of marijuana are less likely to initiate using this substance.

Full Model

A logistic regression analysis for ANCOVA was performed on marijuana use initiation as outcome and the two prenatal drug exposure variables (i.e., nicotine and marijuana), the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana), and the four peer influence variables (i.e., proportion of one's peers who have tried and who regularly use cigarettes and marijuana) as predictors. Maternal use of alcohol during pregnancy was also included as a covariate in the model.

A test of the full model with all of the prenatal drug exposure, attitudinal and peer influence predictor variables, as well as maternal alcohol use, against a constant-only model was found to be significant, $\chi^2(12, N = 152) = 96.21, p < .0001$. This result indicates that as a set, prenatal exposure to nicotine and marijuana, the five attitudinal components, the four peer influence variables, and maternal alcohol use all significantly classify whether or not youth in the OPPS sample initiated the use of marijuana. The variance in marijuana use initiation accounted for by the set of predictors and the covariate is moderately high, with Nagelkerke's $R^2 = .69$. Table 11 presents regression

coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables into the model.

According to the Wald criterion, several of the predictor variables were found to account for a significantly unique proportion of variance in marijuana use initiation including the attitudinal components disapproval and perceived risk of marijuana use ($z = 12.72, p < .0001$) and perceived peer disapproval of drug use ($z = 6.63, p = .01$), as well as the proportion of one's peers who have tried using marijuana ($z = 5.06, p = .03$). The predictors that were not found to reach significance include prenatal exposure to both nicotine ($z = 1.89, p = .17$) and marijuana ($z = .47, p = .49$), adolescents' disapproval and perceived peer disapproval of cigarette smoking ($z = .56, p = .45$), perceived risk of cigarette smoking ($z = 1.70, p = .19$), access and perceived availability of marijuana ($z = 3.31, p = .07$), the proportion of one's peers who have tried smoking cigarettes ($z = .78, p = .38$), and the proportion of peers who regularly smoke both cigarettes ($z = 3.56, p = .06$) and marijuana ($z = .11, p = .74$). In addition, maternal use of alcohol during pregnancy (i.e., the covariate) was also not found to be significant ($z = 1.70, p = .19$).

Table 11

Results of Logistic Regression Analysis Predicting Marijuana Use Initiation from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables (N = 152)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	1.32	1.01	1.70	3.73 (.51, 27.04)
Prenatal nicotine exposure ^a	.89	.65	1.89	2.44 (.68, 8.71)
Prenatal marijuana exposure ^a	.52	.76	.47	1.69 (.38, 7.52)
Disapproval and perceived risk of marijuana use	-1.25	.35	12.72****	.29 (.15, .57)
Disapproval and perceived peer disapproval of cigarette smoking	.29	.38	.56	1.33 (.63, 2.82)
Perceived peer disapproval of drug use	-.75	.29	6.63**	.47 (.27, .84)
Perceived risk of cigarette smoking	-.43	.33	1.70	.65 (.34, 1.24)
Access and perceived availability of marijuana	-.59	.32	3.31	.56 (.30, 1.05)
Proportion of peers who have tried cigarette smoking ^b	.62	.70	.78	1.86 (.47, 7.25)
Proportion of peers who regularly smoke cigarettes ^b	1.76	.93	3.56	5.79 (.94, 35.91)
Proportion of peers who have tried marijuana ^b	1.55	.69	5.06*	4.72 (1.22, 18.24)
Proportion of peers who regularly use marijuana ^b	.24	.72	.11	1.27 (.31, 5.24)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure. ^bReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

* $p < .05$. ** $p < .01$. **** $p < .0001$.

As is shown in Table 11, negative relationships were identified between the two significant attitudinal measures and adolescents' initiation of marijuana use. It was found that the odds for marijuana use initiation are .29 times lower for each one point increase in the attitudinal scores for disapproval and perceived risk of marijuana use (with higher scores being indicative of more disapproval and perceived risk), when the effects of the other variables are held constant. That is, youth who report greater disapproval and perceived risk associated with marijuana use are less likely to initiate using this drug.

Similarly, the odds for marijuana use initiation are .47 times lower for each one point increase in the attitudinal scores for perceived peer disapproval of drug use (with higher scores being indicative of more perceived peer disapproval), when the effects of the other variables are controlled. That is, adolescents in the current study who report greater perceptions of peer disapproval for using both cigarettes and marijuana are less likely to initiate using marijuana.

Table 11 also shows that the odds for the initiation of marijuana use for young people who reported that most or all of their friends have ever tried using marijuana were 4.72 times higher than those youth who reported that none or some of their friends have ever tried using marijuana, when the effects of the other variables are controlled. That is, adolescents in the OPPS sample were more likely to initiate using marijuana if the majority of their friends have ever tried using this substance.

With only maternal alcohol use during pregnancy (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not adolescents in this sample initiated using marijuana $\chi^2(1, N = 152) = .09, p = .76$, Nagelkerke's $R^2 = .001$. After controlling for this covariate, however, a test of the model

with the addition of the 11 prenatal drug exposure, attitudinal, and peer influence variables was found to be significant, $\chi^2(11, N = 152) = 96.12, p < .0001$. This result indicates that with the effect of maternal alcohol use during pregnancy controlled, the set of 11 predictors provides a significant improvement in the model.

Summary

Several of the variables which were found to be significantly related to youth cigarette smoking initiation were also found to be associated with the initiation of marijuana use including prenatal exposure to marijuana, the proportion of one's peers who regularly smoke cigarettes, and the attitudinal measures disapproval and perceived risk of using marijuana, and access and perceived availability of marijuana. Other variables that were found to be correlates of the initiation of adolescent marijuana use included the proportion of one's peers who have tried smoking cigarettes or marijuana, and the adolescents' perceived peer disapproval of cigarette smoking and marijuana use. Essentially, adolescents in the OPPS who reported that the majority of their friends have tried smoking cigarettes or marijuana were more likely to have initiated the use of marijuana themselves. Additionally, those youth who reported greater perceived peer disapproval associated with drug use were less likely to have started using marijuana themselves.

Correlates of Drug Use Cessation

As was previously discussed, analyses concerning the correlates of the cessation of regular cigarette smoking and marijuana use included only those adolescents in the

OPPS who answered affirmatively to having ever used the drug of interest (either cigarettes or marijuana) on a regular basis in the Drug History Questionnaire (DHQ). To briefly reiterate, regular cigarette smoking in this study has been defined as smoking at least once per day whereas regular use of marijuana refers to the use of this substance at least once per week. Cessation has been defined as not currently using the drug of interest (i.e., either cigarettes or marijuana) on a regular basis.

Again, separate analyses were first conducted for each conceptual set of predictor variables (i.e., prenatal drug exposure, peer influences, and attitudes), followed by an analysis including all of the predictor variables and covariates in the model (i.e., full model).

Cigarette Smoking Cessation

As was previously mentioned in the “*Adolescents' Drug Involvement*” section of the Results, 46% ($n = 70$) of the entire sample of adolescents in the current study reported having smoked cigarettes on a regular basis (i.e., at least once a day) at some point in their lifetime. Of these 70 OPPS youth who have reported regular cigarette smoking, 24.3% ($n = 17$) of them had reported that they discontinued smoking cigarettes on a regular basis, whereas 75.7% ($n = 53$) of the adolescents answered affirmatively on the DHQ to currently smoking on a regular basis. No significant gender difference was found with respect to the cessation of regular cigarette smoking, $\chi^2(1, N = 70) = .93, p = .33$.

Prenatal Drug Exposure

A logistic regression analysis for ANCOVA was performed on the cessation of regular cigarette smoking as outcome and prenatal exposure to nicotine and marijuana as the predictor variables. Maternal use of alcohol during pregnancy was also included in the model as a covariate.

A test of the full model with both prenatal exposure to nicotine and marijuana, as well as maternal use of alcohol during pregnancy against a constant-only model was not found to be significant, $\chi^2(3, N = 70) = .83, p = .84$. This result indicates that as a set, prenatal exposure to both nicotine and marijuana, as well as maternal alcohol use during pregnancy, do not significantly classify whether or not adolescents in this sample have discontinued current, regular cigarette smoking. The variance in the cessation of regular cigarette smoking accounted for by the set of predictors and the covariate is small, with Nagelkerke's $R^2 = .02$. Table 12 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables in the model.

With only maternal alcohol use during pregnancy (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not youth in the OPPS sample have discontinued current, regular cigarette smoking, $\chi^2(1, N = 70) = .61, p = .44$. After controlling for this covariate, a test of the model with the addition of prenatal exposure to nicotine and marijuana was also found to be nonsignificant, $\chi^2(2, N = 70) = .22, p = .90$. Such a result indicates that with the effect of maternal alcohol use during pregnancy controlled, the prenatal drug exposure predictor variables do not provide a significant improvement in the model.

Table 12

Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Prenatal Drug Exposure Variables (N = 70)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	1.28	1.55	.68	3.59 (.17, 75.01)
Prenatal nicotine exposure ^a	.23	.62	.14	1.26 (.38, 4.23)
Prenatal marijuana exposure ^a	.12	.57	.05	1.13 (.37, 3.45)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure.

Peer Influences

A logistic regression analysis was performed on the cessation of regular cigarette smoking as outcome and the four peer influence variables (i.e., proportion of one's peers who have tried and who regularly use cigarettes and marijuana) as predictors.

A test of the full model with all of the peer influence predictor variables against a constant-only model was found to be significant, $\chi^2(4, N = 70) = 20.42, p < .0001$, indicating that as a set, all of the peer influence variables significantly classify whether or not youth in this sample have quit smoking cigarettes on a regular basis. The variance in the cessation of regular cigarette smoking accounted for by the set of peer influence predictors is slightly moderate, with Nagelkerke's $R^2 = .38$. Table 13 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the peer influence predictor variables after entry of all of the variables into the model.

According to the Wald criterion, the only peer influence variable that accounts for a significantly unique proportion of variance in the cessation of regular cigarette smoking is the proportion of one's peers who regularly smoke cigarettes ($z = 11.19, p = .001$). The proportion of one's peers who have tried cigarettes ($z = 2.37, p = .12$) and marijuana ($z = 1.72, p = .19$), as well as the proportion who regularly use marijuana ($z = 2.73, p = .10$), were not found to be significant.

Table 13

Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Peer Influence Variables (N = 70)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Proportion of peers who have tried cigarette smoking ^a	3.06	1.98	2.37	21.26 (.44, 1038.35)
Proportion of peers who regularly smoke cigarettes ^a	-3.73	1.12	11.19***	.02 (.003, .21)
Proportion of peers who have tried marijuana ^a	-2.07	1.58	1.72	.13 (.01, 2.78)
Proportion of peers who regularly use marijuana ^a	1.86	1.12	2.73	6.40 (.71, 57.90)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

^aReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

***p < .001.

As is shown in Table 13, a negative relationship was observed between adolescents' cessation of regular cigarette smoking and the influence of their peers such that the odds for discontinuing cigarette smoking on a regular basis for youth who reported that most or all of their friends regularly smoke cigarettes were .02 times lower than those adolescents who reported that none or some of their friends regularly smoke cigarettes, when the effects of the other peer influence variables are controlled. That is, young people in this study were less likely to quit smoking cigarettes on a regular basis if the majority of their friends are regular cigarette smokers.

Attitudinal Influences

A logistic regression analysis was performed on the cessation of regular cigarette smoking as outcome and the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana) as predictors.

A test of the full model with all of the attitudinal components against a constant-only model was found to be significant, $\chi^2(5, N = 70) = 24.78, p < .0001$. This result indicates that as a set, the five attitudinal components significantly classify whether or not youth in this sample have quit smoking cigarettes on a regular basis. The variance in the cessation of regular cigarette smoking accounted for by the set of attitudinal components was found to be moderate, with Nagelkerke's $R^2 = .45$. Table 14 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the attitudinal predictors after entry of all of the components into the model.

Table 14

Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Attitudinal Components (N = 70)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Disapproval and perceived risk of marijuana use	.30	.43	.49	1.35 (.58, 3.13)
Disapproval and perceived peer disapproval of cigarette smoking	1.59	.43	14.02****	4.92 (2.14, 11.34)
Perceived peer disapproval of drug use	-.50	.48	1.08	.61 (.24, 1.56)
Perceived risk of cigarette smoking	-.22	.31	.49	.81 (.44, 1.48)
Access and perceived availability of marijuana	.63	.46	1.83	1.87 (.76, 4.63)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval.

****p < .0001.

According to the Wald criterion, the only attitudinal component that was found to account for a significantly unique proportion of variance in the cessation of regular cigarette smoking was adolescents' disapproval and perceived peer disapproval of cigarette smoking ($z = 14.02, p < .0001$). The attitudinal components that were not found to reach statistical significance include adolescents' disapproval and perceived risk of marijuana use ($z = .49, p = .48$), perceived peer disapproval of drug use ($z = 1.08, p = .30$), perceived risk of cigarette smoking ($z = .49, p = .49$), and access and perceived availability of marijuana ($z = 1.83, p = .18$).

As is shown in Table 14, the odds for discontinuing current regular cigarette smoking are 4.92 times higher for each one point increase in the attitudinal scores for disapproval and perceived peer disapproval of cigarette smoking (with higher scores being indicative of more disapproval and perceived peer disapproval), with the effects of the other attitudinal components controlled. That is, adolescents in the OPPS sample who report greater disapproval and perceived peer disapproval of cigarette smoking are more likely to quit smoking cigarettes on a regular basis.

Full Model

A logistic regression analysis for ANCOVA was performed on the cessation of regular cigarette smoking as outcome and prenatal exposure to nicotine and marijuana, the five attitudinal components (i.e., disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use, perceived risk of cigarette smoking, and access and perceived availability of marijuana) and the four peer influence variables (i.e., proportion of one's

peers who have tried and who regularly use cigarettes and marijuana) as predictors.

Maternal use of alcohol during pregnancy was also included as a covariate in the model.

The results for this analysis must be interpreted with some caution, however, since they are based on a sample size of only 70 youth, which makes the ratio of subjects to variables less than ideal (Tabachnick & Fidell, 2001).

A test of the full model with all of the prenatal drug exposure, attitudinal, and peer influence predictors and maternal alcohol use during pregnancy (i.e., the covariate) against a constant-only model was found to be significant, $\chi^2(12, N = 70) = 45.08, p < .0001$. This result indicates that as a set, prenatal exposure to nicotine and marijuana, the five attitudinal and four peer influence variables, as well as maternal alcohol use during pregnancy all significantly classify whether or not youth in the OPPS sample have discontinued smoking cigarettes on a regular basis. The variance in the cessation of regular cigarette smoking accounted for by the set of predictors and the covariate is moderately high, with Nagelkerke's $R^2 = .71$. Table 15 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables into the model.

According to the Wald criterion, only two of the predictors were found to account for a significantly unique proportion of variance in the cessation of regular cigarette smoking including adolescents' disapproval and perceived peer disapproval of cigarette smoking ($z = 7.41, p = .01$) and the proportion of their peers who regularly smoke cigarettes ($z = 8.26, p = .004$). Predictors that were not found to be significant include

Table 15

Results of Logistic Regression Analysis Predicting Cessation of Regular Cigarette Smoking from Prenatal Drug Exposure, Attitudinal and Peer Influence Variables
(*N* = 70)

Variables	<i>B</i>	<i>SE</i>	Wald Test (<i>z</i> -ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	-4.56	5.12	.79	.01 (.00, 239.24)
Prenatal nicotine exposure ^a	3.42	1.89	3.28	30.40 (.75, 1226.52)
Prenatal marijuana exposure ^a	-.64	1.28	.25	.53 (.04, 6.54)
Disapproval and perceived risk of marijuana use	.52	.75	.48	1.68 (.39, 7.26)
Disapproval and perceived peer disapproval of cigarette smoking	1.80	.66	7.41**	6.05 (1.66, 22.09)
Perceived peer disapproval of drug use	-.78	.85	.84	.46 (.09, 2.44)
Perceived risk of cigarette smoking	-.44	.43	1.06	.64 (.28, 1.49)
Access and perceived availability of marijuana	.93	.71	1.69	2.52 (.63, 10.18)
Proportion of peers who have tried cigarette smoking ^b	-.09	.05	2.97	.92 (.83, 1.01)
Proportion of peers who regularly smoke cigarettes ^b	-5.70	1.98	8.26**	.003 (.00, .16)
Proportion of peers who have tried marijuana ^b	-2.37	3.23	.54	.09 (.00, 52.26)
Proportion of peers who regularly use marijuana ^b	2.40	1.68	2.04	11.06 (.41, 299.84)

Note. *B* = unstandardized regression coefficient; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure. ^bReference category was adolescents in the sample who reported that none or some of their friends have tried/regularly use the drug.

^{**} $p < .01$.

prenatal exposure to both nicotine ($z = 3.28, p = .07$) and marijuana ($z = .25, p = .62$), disapproval and perceived risk of marijuana use ($z = .48, p = .49$), perceived peer disapproval of drug use ($z = .84, p = .36$), perceived risk of cigarette smoking ($z = 1.06, p = .30$), access and perceived availability of marijuana ($z = 1.69, p = .19$), the proportion of one's peers who have tried cigarettes ($z = 2.97, p = .09$) and marijuana ($z = .54, p = .46$), and the proportion of one's peers who regularly use marijuana ($z = 2.04, p = .15$). Additionally, maternal use of alcohol during pregnancy was also not found to be significant ($z = .79, p = .37$).

As is shown in Table 15, the odds for cessation of current, regular cigarette smoking are 6.05 times higher for each one point increase in the attitudinal scores for disapproval and perceived peer disapproval of cigarette smoking (with higher scores being indicative of more disapproval and perceived peer disapproval), with the effects of the other variables controlled. That is, adolescents who report greater disapproval and perceived peer disapproval of cigarette smoking are more likely to discontinue smoking cigarettes on a regular basis.

The results also reveal a negative association between the cessation of regular cigarette smoking and the influence of one's peers such that the odds for regular smoking cessation for youth who reported that most or all of their friends regularly smoke cigarettes were .003 times lower than those youth who reported that none or some of their friends regularly smoke cigarettes, when the effects of the other variables are controlled. Thus, adolescents in this study were less likely to quit smoking cigarettes on a regular basis if the majority of their friends are regular cigarette smokers.

With only maternal alcohol use during pregnancy (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not youth in this sample have quit smoking cigarettes on a regular basis, $\chi^2(1, N = 70) = .61, p = .44$, Nagelkerke's $R^2 = .01$. After controlling for this covariate, however, a test of the model with the addition of prenatal exposure to nicotine and marijuana, the five attitudinal components, and the four peer influence variables was found to be significant, $\chi^2(11, N = 70) = 44.46, p < .0001$. This result indicates that with the effects of maternal drug use during pregnancy controlled, the set of prenatal drug exposure, attitudinal, and peer influence predictors provide a significant improvement in the model.

Summary

In sum, only two variables emerged as significant correlates of the cessation of regular cigarette smoking: the proportion of one's peers who regularly smoke cigarettes and adolescents' disapproval and perceived peer disapproval of cigarette smoking. In general, it was found that young people who reported that the majority of their friends are regular cigarette smokers were less likely to quit smoking cigarettes on a regular basis themselves. Additionally, youth who reported greater disapproval and perceived peer disapproval were found to be more likely to discontinue smoking cigarettes on a regular basis.

Marijuana Use Cessation

As was previously mentioned in the Results section entitled "*Adolescents' Drug Involvement*," 20.4% ($n = 31$) of the entire sample of adolescents in the current study

reported having used marijuana on a regular basis (i.e., at least once a week) at some point in their lifetime. Of these 31 OPPS youth who have reported regular marijuana use, 83.9% ($n = 26$) of them had reported that they discontinued using marijuana on a regular basis at assessment, whereas 16.1% ($n = 5$) of the adolescents answered affirmatively on the DHQ to currently using marijuana on a regular basis. No significant gender difference was found with respect to the cessation of regular marijuana use, $\chi^2(1, N = 31) = 3.28, p = .07$.

Since only 31 adolescents in this entire sample of 152 have reported ever using marijuana on a regular basis (i.e., at least once a week), the subject to variable ratio suggests that it is not appropriate to examine the contribution of the peer influence variables and the attitudinal components to the cessation of regular marijuana use via logistic regression analysis as has been previously done with the drug use initiation and cigarette smoking cessation analyses, since statistical power would be too low to detect the potential effects of such variables (Tabachnick & Fidell, 2001). As a result, the frequencies, means, and standard deviations for these two sets of variables are presented in Table 16, while their intercorrelations with the current, regular use of marijuana (with no current use being indicative of cessation) are shown in Table 17.

As is observed in Table 17, the proportion of one's peers who have tried cigarettes was found to be the only predictor variable that was significantly associated with adolescents' cessation of the use of marijuana on a regular basis ($r = -.42, p < .05$). Thus, adolescents in the OPPS sample who reported at assessment that the majority of their friends have tried smoking cigarettes were found to be less inclined to discontinue using marijuana on a regular basis.

Table 16

Descriptive Statistics for Peer Influence and Attitudinal Variables for Youth Reporting Ever Regular Use of Marijuana (N = 31)

Variable	<i>M</i>	<i>SD</i>
Proportion of peers who have tried smoking cigarettes ^a	.97	.18
None/some (<i>n</i> = 1)		
Most/all (<i>n</i> = 30)		
Proportion of peers who regularly smoke cigarettes ^a	.65	.49
None/some (<i>n</i> = 11)		
Most/all (<i>n</i> = 20)		
Proportion of peers who have tried using marijuana ^a	.87	.34
None/some (<i>n</i> = 4)		
Most/all (<i>n</i> = 27)		
Proportion of peers who regularly use marijuana ^a	.42	.50
None/some (<i>n</i> = 18)		
Most/all (<i>n</i> = 13)		
Disapproval and perceived risk of marijuana use ^b	-.20	.83
Disapproval and perceived peer disapproval of cigarette smoking ^b	-.09	1.06
Perceived peer disapproval of drug use ^b	-.25	.86
Perceived risk of cigarette smoking ^b	-.01	1.14
Access and perceived availability of marijuana ^b	-.13	.62

Note. *M* = mean; *SD* = standard deviation.

^aCoding for peer influence variables: 0 = none/some; 1 = most/all. The mean in this case also refers to the proportion of youth reporting that most/all of their peers have tried/regularly use the drug of interest. ^bHigher scores are indicative of greater disapproval, perceived risk, perceived peer disapproval, and access and perceived availability.

Note. ^aCurrent regular use of marijuana coded as: 0 = no current regular use (i.e., cessation); 1 = current regular use. ^bHigher scores on these components are indicative of greater disapproval, perceived risk, perceived peer disapproval, and access and perceived availability. ^cCoding for peer influence variables: 0 = none/some; 1 = most/all.

* $p \leq .05$. ** $p \leq .01$.

Despite the small sample size associated with the current analysis, the contribution of prenatal nicotine and marijuana exposure to the cessation of regular marijuana use was examined using logistic regression. These results must be interpreted with considerable caution, however, since they are based on only a sample of 31 participants.

Prenatal Drug Exposure

A logistic regression analysis for ANCOVA was performed on the cessation of regular marijuana use as outcome and prenatal exposure to nicotine and marijuana as the predictor variables. Maternal use of alcohol during pregnancy was also included in the model as a covariate.

A test of the full model with prenatal exposure to both nicotine and marijuana, as well as maternal use of alcohol during pregnancy against a constant-only model was not found to be significant, $\chi^2(3, N = 31) = 3.65, p = .30$. Such a result indicates that as a set, prenatal exposure to both nicotine and marijuana, as well as maternal alcohol use during pregnancy, does not significantly classify whether or not adolescents in this sample quit using marijuana on a regular basis. The variance in the cessation of regular marijuana use accounted for by the set of predictors and the covariate was found to be small, with Nagelkerke's $R^2 = .19$. Table 18 presents regression coefficients, Wald statistics, odds ratios and 95% confidence intervals for odds ratios for each of the predictor variables and the covariate after entry of all of the variables in the model.

Table 18

Results of Logistic Regression Analysis Predicting Cessation of the Regular Use of Marijuana from Prenatal Drug Exposure Variables (N = 31)

Variables	<i>B</i>	<i>SE</i>	Wald Test (z-ratio)	OR (95% CI)
Maternal alcohol use (oz AA/day)	1.16	1.00	1.35	3.18 (.45, 22.49)
Prenatal nicotine exposure ^a	.36	1.15	.10	1.44 (.15, 13.60)
Prenatal marijuana exposure ^a	.69	1.31	.28	1.99 (.15, 25.68)

Note. *B* = unstandardized regression coefficients; *SE* = standard error; OR = odds ratio; CI = confidence interval; AA = absolute alcohol.

^aReference category was no prenatal drug exposure.

With only maternal alcohol use during pregnancy (i.e., the covariate) included in the model, the results indicate that it does not significantly classify whether or not youth in this sample quit using marijuana on a regular basis, $\chi^2(1, N = 31) = 3.08, p = .08$. After controlling for this covariate, a test of the model with the addition of prenatal exposure to nicotine and marijuana was also found to be nonsignificant, $\chi^2(2, N = 31) = .58, p = .75$, indicating that even with the effect of maternal alcohol use during pregnancy controlled, prenatal exposure to nicotine and marijuana do not provide a significant improvement in the model.

Summary

The small number of adolescents in the OPPS who have ever used marijuana on a regular basis severely limited the type of analysis that could be performed. However, the proportion of one's peers who have tried cigarette smoking was found to significantly correlate in a negative manner with the cessation of regular marijuana use. That is, youth who reported that the majority of their friends have tried cigarettes were found to be less inclined to discontinue using marijuana on a regular basis.

Differences Between Prenatal Drug Exposure Groups and Gender

As has been previously mentioned, the following series of analyses looked for differences with respect to adolescents' attitudes towards drugs and their peer influences as a function of their level of prenatal drug exposure (either nicotine or marijuana) and their gender. Separate analyses have been conducted for the attitudinal and peer influence variables, as well as for prenatal exposure to nicotine and marijuana.

*Differences in Attitudinal Influences**Prenatal Exposure to Nicotine*

A 2 x 3 (Gender x Prenatal Nicotine Exposure Group) between-subjects MANCOVA was performed on the five attitudinal dependent variables: disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use (i.e., use of marijuana and cigarettes), perceived risk of cigarette smoking, and access and perceived availability of marijuana. Adjustment was made for two covariates: maternal use of marijuana and alcohol during pregnancy. The two independent variables were the degree of prenatal exposure to nicotine (none, light, heavy) and gender. Table 19 presents the means of the dependent variables across the levels of maternal cigarette smoking. Unadjusted means and standard deviations as well as the means and standard errors adjusted for covariates are included.

In order to determine if there were any overall significant prenatal nicotine exposure group and/or sex differences in the set of attitudinal measures, and to assess if the attitudinal measures were significantly related to the covariates, an alpha level of .05 was used in conjunction with Wilks' criterion.

The results indicate that as a set, the attitudinal measures were significantly related to the set of two covariates, Wilks' $\Lambda = .91$, $F(5, 141) = 2.70$, $p = .02$, $\eta^2 = .09$. With adjustment for the two covariates, no significant multivariate gender by prenatal nicotine exposure group interaction was found, Wilks' $\Lambda = .92$, $F(10, 282) = 1.62$, $p = .32$, $\eta^2 = .04$.

Table 19

Unadjusted and Adjusted Attitudinal Dependent Variables Across Prenatal Nicotine Exposure Groups (N = 152)

Dependent variables	Prenatal maternal use of cigarettes (nicotine mg/day)					
	Unadjusted (mean [<i>SD</i>])			Adjusted for covariates (adj. mean [<i>SE</i>])		
	None (0) <i>n</i> = 65	Light (0.1-15.9) <i>n</i> = 50	Heavy (≥16) <i>n</i> = 37	None (0) <i>n</i> = 65	Light (0.1-15.9) <i>n</i> = 50	Heavy (≥16) <i>n</i> = 37
Disapproval and perceived risk of marijuana use	-.005(.94)	-.13(1.03)	.18(1.06)	-.02(.12)	-.05(.14)	.16(.16)
Disapproval and perceived peer disapproval of cigarette smoking	.26(.93)	-.04(.98)	-.40(1.03)	.25(.12)	-.02(.14)	-.41(.16)
Perceived peer disapproval of drug use	1.31(.35)	1.43(.36)	1.39(.33)	1.32(.04)	1.42(.05)	1.39(.06)
Perceived risk of cigarette smoking	1.15(.34)	1.10(.34)	1.29(.45)	1.14(.05)	1.10(.06)	1.29(.06)
Access and perceived availability of marijuana	-.11(.85)	-.05(.89)	.25(1.32)	-.08(.12)	-.01(.14)	.26(.16)

Note. *SD* = standard deviation; *SE* = standard error. Perceived peer disapproval of drug use and perceived risk of cigarette smoking were both normalized using a square root transformation prior to statistical analyses.

There was, however, a significant multivariate main effect of gender, Wilks' $\Lambda = .91$, $F(5, 141) = 2.95$, $p = .02$, $\eta^2 = .10$, and prenatal nicotine exposure, Wilks' $\Lambda = .84$, $F(10, 282) = 2.60$, $p = .01$, $\eta^2 = .08$. As is evident from the η^2 s, only small associations were found between the set of attitudinal measures and the covariates and main effects (Cohen, 1977).

In order to determine which attitudinal measures were contributing to the overall multivariate significance for the effects of prenatal exposure to nicotine and gender, univariate analyses on each of the dependent variables were conducted as follow-up tests to the MANCOVA. A Bonferroni correction (i.e. $\alpha = .05/5$ DVs = .01) was used in order to control for Type I error. In order to assist the reader, the results concerning the effect of gender have been presented separately from those pertaining to the effect of prenatal nicotine exposure.

Gender differences. With respect to the main effect of gender, the univariate analyses showed that only the attitudinal component access and perceived availability of marijuana was significant, $F(1, 145) = 10.65$, $p = .001$, $\eta^2 = .07$, with females ($M = .32$, $SE = .12$) in this sample reporting significantly greater access and perceived availability of marijuana as compared to males ($M = -.21$, $SE = .11$; $p = .001$). Table 20 presents the results for the univariate F tests which were not found to be significant.

Table 20

*Univariate Tests of Gender and Prenatal Nicotine Exposure Groups for Attitudinal
Dependent Variables (N = 152)*

Effect	Dependent variables	<i>df</i>	<i>F</i>	η^2
Gender	Disapproval and perceived risk of marijuana use	1/145	1.84	.01
	Disapproval and perceived peer disapproval of cigarette smoking	1/145	.04	.00
	Perceived peer disapproval of drug use	1/145	.02	.00
	Perceived risk of cigarette smoking	1/145	2.02	.01
	Access and perceived availability to marijuana	1/145	10.65***	.07
Prenatal nicotine exposure	Disapproval and perceived risk of marijuana use	2/145	.62	.01
	Disapproval and perceived peer disapproval of cigarette smoking	2/145	5.48**	.07
	Perceived peer disapproval of drug use	2/145	1.67	.02
	Perceived risk of cigarette smoking	2/145	3.21*	.04
	Access and perceived availability to marijuana	2/145	1.39	.02

* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

Prenatal nicotine exposure group differences. With respect to the main effect of prenatal nicotine exposure, the univariate analyses revealed that the only attitudinal measure which was found to reach statistical significance was adolescents' disapproval and perceived peer disapproval of cigarette smoking, $F(2, 145) = 5.48, p = .01, \eta^2 = .07$. The results for these nonsignificant univariate F tests are also shown in Table 20.

Since a significant univariate main effect was found for the attitudinal measure disapproval and perceived peer disapproval of cigarette smoking, pairwise comparisons were then conducted on this attitudinal measure using a Bonferroni correction (i.e., $\alpha = .05/3$ comparisons = .017) in order to control for Type I error.

With respect to this attitudinal measure, the results show that adolescents in the current sample who were heavily exposed to nicotine prenatally (i.e., ≥ 16 mg/day) reported significantly less disapproval and perceived peer disapproval of cigarette smoking ($M = -.41, SE = .16$) as compared to those adolescents who were not prenatally exposed to nicotine ($M = .25, SE = .12; p = .002$). No significant differences were found, however, with respect to disapproval and perceived peer disapproval of cigarette smoking between youth who were prenatally exposed to light (i.e., 0.1-15.9 mg/day) levels of nicotine ($M = -.02, SE = .14$) and those who were heavily exposed to this substance ($p = .07$). Similarly, adolescents who were prenatally exposed to light levels of nicotine were not found to significantly differ from those who were not prenatally exposed to this drug with respect to their attitudes of disapproval and perceived peer disapproval of cigarette smoking ($p = .17$).

Prenatal Exposure to Marijuana

A 2 x 3 (Gender x Prenatal Marijuana Exposure Group) between-subjects MANCOVA was performed on the five attitudinal dependent variables: disapproval and perceived risk of marijuana use, disapproval and perceived peer disapproval of cigarette smoking, perceived peer disapproval of drug use (i.e., use of marijuana and cigarettes), perceived risk of cigarette smoking, and access and perceived availability of marijuana. Adjustment was made for three covariates: maternal use of nicotine and alcohol during pregnancy and parity. The two independent variables were the degree of prenatal exposure to marijuana (none, infrequent/moderate, heavy) and gender. Table 21 presents the means of the dependent variables across the levels of maternal marijuana use. Unadjusted means and standard deviations as well as the means and standard errors adjusted for covariates are included.

In order to determine if there were any overall significant prenatal marijuana exposure group and/or sex differences in the set of attitudinal measures, and to assess if the attitudinal measures were significantly related to the covariates, an alpha level of .05 was used in conjunction with Wilks' criterion.

The results indicate that as a set, the attitudinal measures were significantly related to the set of three covariates, Wilks' $\Lambda = .85$, $F(5, 141) = 4.87$, $p < .0001$, $\eta^2 = .15$. With adjustment for the three covariates, there was no significant multivariate gender by prenatal marijuana exposure group interaction, Wilks' $\Lambda = .95$, $F(10, 282) = .70$, $p = .73$, $\eta^2 = .02$, or main effect of prenatal marijuana exposure, Wilks' $\Lambda = .88$, $F(10, 282) = 1.70$, $p = .06$, $\eta^2 = .06$.

Table 21

Unadjusted and Adjusted Attitudinal Dependent Variables Across Prenatal Marijuana Exposure Groups (N = 152)

Dependent variables	Prenatal maternal use of marijuana (joints/day)					
	Unadjusted (mean [SD])			Adjusted for covariates (adj. mean [SE])		
	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22
Disapproval and perceived risk of marijuana use	.18(1.04)	-.18(.82)	-.63(.65)	.20(.09)	-.18(.18)	-.57(.20)
Disapproval and perceived peer disapproval of cigarette smoking	.06(1.00)	-.20(1.08)	-.04(.92)	.05(.10)	-.19(.19)	-.06(.21)
Perceived peer disapproval of drug use	1.38(.37)	1.33(.27)	1.39(.31)	1.38(.04)	1.35(.07)	1.40(.08)
Perceived risk of cigarette smoking	1.16(.39)	1.15(.35)	1.20(.35)	1.16(.04)	1.14(.07)	1.22(.08)
Access and perceived availability of marijuana	-.01(1.01)	.18(1.14)	-.18(.76)	.01(.10)	.24(.19)	-.16(.21)

Note. *SD* = standard deviation; *SE* = standard error. Perceived peer disapproval of drug use and perceived risk of cigarette smoking were both normalized using a square root transformation prior to statistical analyses.

There was, however, a significant multivariate main effect of gender, Wilks' $\Lambda = .90$, $F(5, 141) = 2.98$, $p = .01$, $\eta^2 = .08$, as was similarly found in the previous MANCOVA concerning prenatal exposure to nicotine.

As per Cohen's (1977) conventions, there was a modest association between the set of attitudinal measures and the combined covariates, with $\eta^2 = .15$. A somewhat smaller association was found between the set of attitudinal measures and the main effect of gender $\eta^2 = .08$, and the association between the main effect of prenatal marijuana exposure and the combined dependent measures was smaller yet, $\eta^2 = .06$.

In order to investigate which attitudinal measures were contributing to the overall multivariate significance for the main effect of gender, univariate analyses on each of the dependent variables were conducted as follow-up tests to the MANCOVA. A Bonferroni correction (i.e., $\alpha = .05/5$ DVs = .01) was used in order to control for Type I error. Since the overall effect for prenatal marijuana exposure was not found to be significant at the multivariate level, it was not appropriate to conduct follow-up tests for this effect.

Gender differences. In terms of the main effect of gender, the univariate analyses showed that the only attitudinal measure that reached statistical significance was access and perceived availability of marijuana, $F(1, 145) = 10.74$, $p = .001$, $\eta^2 = .07$. This result reveals that females in this study ($M = .36$, $SE = .15$) reported significantly higher scores than males ($M = -.30$, $SE = .13$) on the attitudinal component access and perceived availability of marijuana ($p = .001$). This finding confirms that obtained in the previous MANCOVA concerning prenatal nicotine exposure in that compared to male adolescents in the OPPS sample, young females reported significantly greater access to and greater

perceptions of easy availability of marijuana. Table 22 presents the results for the nonsignificant univariate F tests.

Differences in Peer Influences

Prenatal Exposure to Nicotine

A 2 x 3 (Gender x Prenatal Nicotine Exposure Group) between-subjects MANCOVA was performed on the four peer influence variables: the proportion of peers who have tried and who regularly use cigarettes and marijuana. Adjustment was made for two covariates: maternal use of marijuana and alcohol during pregnancy. The two independent variables were the degree of prenatal exposure to nicotine (none, light, heavy) and gender.

Table 22

Univariate Tests of Gender for the Attitudinal Dependent Variables (N = 152)

Effect	Dependent variables	<i>df</i>	<i>F</i>	η^2
Gender	Disapproval and perceived risk of marijuana use	1/145	2.08	.01
	Disapproval and perceived peer disapproval of cigarette smoking	1/145	.04	.00
	Perceived peer disapproval of drug use	1/145	.02	.00
	Perceived risk of cigarette smoking	1/145	1.95	.01
	Access and perceived availability to marijuana	1/145	10.74***	.07

*** $p \leq .001$.

Table 23 presents the means of the dependent variables across the levels of maternal nicotine use. Unadjusted means and standard deviations as well as the means and standard errors adjusted for covariates are included.

In order to determine if there were any overall significant prenatal nicotine exposure group and/or gender differences in the set of peer influence variables, and to assess if these peer influence variables were significantly related to the covariates, an alpha level of .05 was used in conjunction with Wilks' criterion.

The results indicate that the set of peer influence variables were significantly related to the set of two covariates, Wilks' $\Lambda = .92$, $F(4, 142) = 3.03$, $p = .02$, $\eta^2 = .08$. With adjustment for the two covariates, there was no significant multivariate gender by prenatal nicotine exposure group interaction, Wilks' $\Lambda = .94$, $F(8, 284) = 1.08$, $p = .38$, $\eta^2 = .03$, or significant main effect of prenatal nicotine exposure, Wilks' $\Lambda = .94$, $F(8, 284) = 1.21$, $p = .29$, $\eta^2 = .03$. There was, however, a significant multivariate main effect found for gender, Wilks' $\Lambda = .94$, $F(4, 142) = 2.42$, $p = .05$, $\eta^2 = .06$. As is evident from the η^2 s, only small associations were found between the set of peer influence variables and the covariates and main effects (Cohen, 1977).

In order to determine which peer influence variables were contributing to the overall multivariate significance for the main effect of gender, univariate analyses on each of the dependent variables were conducted as follow-up tests to the MANCOVA. A Bonferroni correction (i.e., $\alpha = .05/4$ DVs = .0125) was used in order to control for Type I error. Since the overall effect for prenatal nicotine exposure was not found to be significant at the multivariate level, it was not appropriate to conduct follow-up tests for this effect.

Table 23

Unadjusted and Adjusted Peer Influence Dependent Variables Across Prenatal Nicotine Exposure Groups (N = 152)

Dependent variables	Prenatal maternal use of cigarettes (nicotine mg/day)					
	Unadjusted (mean [SD])			Adjusted for covariates (adj. mean [SE])		
	None (0) n = 65	Light (0.1-15.9) n = 50	Heavy (≥16) n = 37	None (0) n = 65	Light (0.1-15.9) n = 50	Heavy (≥16) n = 37
Proportion of peers who have tried cigarette smoking	.80(.40)	.85(.35)	.72(.45)	.81(.05)	.83(.06)	.73(.07)
Proportion of peers who regularly smoke cigarettes	.33(.47)	.48(.50)	.50(.50)	.34(.06)	.44(.07)	.50(.08)
Proportion of peers who have tried marijuana	.76(.42)	.75(.43)	.66(.47)	.77(.05)	.74(.06)	.66(.07)
Proportion of peers who regularly use marijuana	.29(.45)	.31(.46)	.37(.48)	.29(.06)	.27(.06)	.37(.07)

Note. SD = standard deviation; SE = standard error.

Gender differences. In terms of the main effect of gender, the univariate analyses showed that only the proportion of one's peers who regularly use marijuana was found to be significant, $F(1, 145) = 8.84, p = .003, \eta^2 = .06$. This result indicates that males ($M = .42, SE = .05$) in this study reported having a significantly greater proportion of friends who regularly use marijuana as compared to females ($M = .20, SE = .05; p = .002$). Table 24 presents the results for the nonsignificant univariate F tests.

Prenatal Exposure to Marijuana

A 2 x 3 (Gender x Prenatal Marijuana Exposure Group) between-subjects MANCOVA was performed on the four peer influence variables: the proportion of peers who have tried and who regularly use cigarettes and marijuana. Adjustment was made for three covariates: average level of parental education and maternal use of nicotine and alcohol during pregnancy. The two independent variables were the degree of prenatal exposure to marijuana (none, infrequent/moderate, heavy) and gender.

Using Box's M test (Box, 1949), the assumption of homogeneity of variance-covariance matrices was found to be violated in this analysis, Box's $M = 92.39, F(40, 5375.29) = 2.04, p < .0001$. Since sample sizes were found to be widely discrepant according to Stevens' (2002) criterion (i.e., largest sample size/smallest sample size > 1.5), the determinants of the covariance matrices were examined in order to determine whether the multivariate test statistic was liberal or conservative. In this case, the largest generalized variance was found to be in the group with the largest sample size (i.e., youth not prenatally exposed to marijuana), producing a conservatively biased multivariate test statistic (Stevens, 2002; Tabachnick & Fidell, 2001).

Table 24

Univariate Tests of Gender for Peer Influence Dependent Variables (N = 152)

Effect	Dependent variables	<i>df</i>	<i>F</i>	η^2
Gender	Proportion of peers who have tried cigarette smoking	1/145	.002	.00
	Proportion of peers who regularly smoke cigarettes	1/145	1.92	.01
	Proportion of peers who have tried marijuana	1/145	.45	.003
	Proportion of peers who regularly use marijuana	1/145	8.84**	.06

** $p \leq .01$.

Since it remained unclear as to whether the conservativeness of the test statistic was the reason why the prenatal marijuana exposure group effect was not found to be significant at the multivariate level with respect to the set of peer influence variables, variance stabilizing (logarithm) transformations were then performed on the four peer influence variables. Following these transformations, Box's M test was still found to be violated, although to a lesser degree, Box's $M = 83.57$, $F(40, 5375.29) = 1.84$, $p = .001$.

The results from the MANCOVA with the untransformed peer influence variables produced identical results to that which used the transformed variables. For the sake of parsimony, the results that follow are based on the untransformed peer influence variables. The results that are based on the transformed dependent variables are presented in Appendix D. Table 25 presents the means of the dependent variables across the levels of maternal marijuana use. Unadjusted means and standard deviations as well as the means and standard errors adjusted for covariates are included.

In order to determine if there were any overall significant prenatal marijuana exposure group and/or sex differences in the set of peer influence variables, and to assess if these peer influence measures were significantly related to the covariates, an alpha level of .05 was used in conjunction with Wilks' criterion.

The results indicate that as a set, the peer influence variables were not significantly related to the set of three covariates, Wilks' $\Lambda = .96$, $F(4, 142) = 1.38$, $p = .25$, $\eta^2 = .04$. With adjustment for the three covariates, it was found that there was no significant multivariate gender by prenatal marijuana exposure group interaction, Wilks' $\Lambda = .99$, $F(8, 284) = .16$, $p = .99$, $\eta^2 = .01$.

Table 25

Unadjusted and Adjusted Peer Influence Dependent Variables Across Prenatal Marijuana Exposure Groups (N = 152)

Dependent variables	Prenatal maternal use of marijuana (joints/day)					
	Unadjusted (mean [<i>SD</i>])			Adjusted for covariates (adj. mean [<i>SE</i>])		
	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22
Proportion of peers who have tried cigarette smoking	.74(.43)	.87(.32)	.95(.21)	.74(.04)	.87(.08)	.94(.09)
Proportion of peers who regularly smoke cigarettes	.36(.48)	.48(.51)	.64(.49)	.36(.05)	.49(.09)	.65(.10)
Proportion of peers who have tried marijuana	.69(.46)	.84(.36)	.81(.39)	.68(.04)	.83(.08)	.79(.09)
Proportion of peers who regularly use marijuana	.24(.42)	.42(.49)	.55(.51)	.23(.04)	.42(.09)	.55(.09)

Note. *SD* = standard deviation; *SE* = standard error.

There was, however, a significant multivariate main effect of gender, Wilks' $\Lambda = .93$, $F(4, 142) = 2.59$, $p = .04$, $\eta^2 = .07$, and a significant multivariate main effect of prenatal marijuana exposure, Wilks' $\Lambda = .90$, $F(8, 284) = 1.97$, $p = .05$, $\eta^2 = .05$. As is evident from the η^2 s, only small associations were found between the set of peer influence variables and the covariates and main effects (Cohen, 1977).

To investigate which peer influence variables were contributing to the overall multivariate significance for the effects of prenatal exposure to marijuana and gender, univariate analyses on each of the peer influence variables were conducted as follow-up tests to the MANCOVA. A Bonferroni correction (i.e., $\alpha = .05/4$ DVs = .0125) was used in order to control for Type I error. The results concerning the effect of gender have been presented separately from those pertaining to the effect of prenatal marijuana exposure.

Gender differences. With respect to the main effect of gender, the univariate analyses showed that only the proportion of peers who regularly use marijuana was significant, $F(1, 145) = 9.41$, $p = .003$, $\eta^2 = .06$, indicating that males ($M = .51$, $SE = .06$) in this sample reported having a significantly greater proportion of peers who regularly use marijuana as compared to females ($M = .29$, $SE = .07$; $p = .02$). Table 26 presents the results from the nonsignificant univariate F tests.

Prenatal marijuana exposure group differences. In terms of the main effect of prenatal marijuana exposure, the univariate analyses also showed that only the proportion of peers who regularly use marijuana was significant, $F(2, 145) = 5.82$, $p = .004$, $\eta^2 = .07$. Table 26 also presents the results from these nonsignificant univariate F tests.

Table 26

*Univariate Tests of Gender and Prenatal Marijuana Exposure Groups for Peer Influence
Dependent Variables (N = 152)*

Effect	Dependent variables	<i>df</i>	<i>F</i>	η^2
Gender	Proportion of peers who have tried cigarette smoking	1/145	.01	.00
	Proportion of peers who regularly smoke cigarettes	1/145	2.36	.02
	Proportion of peers who have tried marijuana	1/145	.33	.002
	Proportion of peers who regularly use marijuana	1/145	9.41**	.06
Prenatal marijuana exposure	Proportion of peers who have tried cigarette smoking	2/145	2.96	.04
	Proportion of peers who regularly smoke cigarettes	2/145	3.72*	.05
	Proportion of peers who have tried marijuana	2/145	1.56	.02
	Proportion of peers who regularly use marijuana	2/145	5.82**	.07

* $p \leq .05$. ** $p \leq .01$.

Since a significant univariate main effect was found for the proportion of one's peers who regularly use marijuana, pairwise comparisons were then conducted on this peer influence variable using a Bonferroni correction (i.e., $\alpha = .05/3$ comparisons = .017) in order to control for Type I error. The results show that adolescents in this sample who were heavily exposed to marijuana prenatally (i.e., ≥ 6 joints/week) reported having a significantly greater proportion of peers who regularly use marijuana ($M = .55$, $SE = .09$) as compared to those adolescents who were not prenatally exposed to marijuana ($M = .23$, $SE = .04$; $p = .003$). No significant differences were found, however, with respect to the proportion of one's peers who regularly use marijuana between youth who were infrequently/moderately exposed (i.e., > 0 and < 6 joints/week) prenatally to marijuana ($M = .42$, $SE = .09$) and those who were heavily exposed ($p = .31$). Similarly, adolescents in this study who were infrequently/moderately exposed to marijuana prenatally were not found to significantly differ from those youth who were not prenatally exposed to this drug ($p = .05$).

Summary

In the preceding analyses, differences in the OPPS adolescents' attitudes and peer influences have been examined as a function of their level of prenatal exposure to nicotine and marijuana, respectively, and also as a function of their gender. Several prenatal drug exposure group and gender differences are evident in the OPPS sample, and the findings concerning each of these two variables are summarized separately below.

In terms of the prenatal drug exposure group differences, adolescents in this study who were heavily exposed to nicotine prenatally reported significantly less disapproval

and perceived peer disapproval of cigarette smoking as compared to those youth in the OPPS who were not prenatally exposed to this substance. Another important prenatal drug exposure group difference which emerged from the data concerned the proportion of one's peers who regularly use marijuana. It was found that youth in the OPPS study who were heavily exposed to marijuana prenatally reported having a significantly greater proportion of friends who regularly use marijuana, as compared to those who were not prenatally exposed.

The effect of gender was also studied in the previous series of analyses, and two important sex differences were found. First of all, it was found that males in the OPPS reported having a significantly greater proportion of peers who regularly use marijuana as compared to females. Additionally, it was found that female adolescents in the current study reported significantly greater access to and greater perceptions of easy availability of marijuana than did the males.

Progression of Drug Use

The final analysis that was conducted in the current study involved determining if a particular sequence of drug use existed among the OPPS sample of youth. The adolescents' experience with the variety of drugs included in the Drug History Questionnaire (DHQ) is first presented, followed by their progression of involvement with these substances.

Drug Use Experience

The experience of the adolescents in the OPPS with the various licit and illicit drugs from the DHQ is presented in Table 27. Alcohol was the most frequently used substance with 93.42% of the OPPS sample reporting having had a complete drink (i.e., a bottle of beer, a shot of liquor or a glass of wine) at some point in their lives. As was previously mentioned, the next frequently used drug by adolescents in this study was marijuana (73.68%) followed by cigarettes (52.63%). The percentages of these youth who have ever used illicit drugs other than marijuana ranged from 0% for solvents and heroin to 31.58% for mushrooms. Interestingly, 50% of the entire sample had reported ever use of at least one illicit substance other than marijuana at some point in their lives. No significant difference was found between males and females in their lifetime experience of using these various drugs.

In examining the ages at which the OPPS sample reported first using the variety of drugs included in the DHQ, it was generally found that the use of the licit drugs occurred at an earlier age than that of the illicit drugs. As is presented in Table 27, adolescents reported first using cigarettes ($M = 13.99$, $SD = 1.75$) and alcohol ($M = 14.07$, $SD = 1.67$) at an earlier age as compared to marijuana ($M = 14.64$, $SD = 1.57$), amphetamines ($M = 16.27$, $SD = 1.53$), or LSD ($M = 15.06$, $SD = 1.35$), for example.

Table 27

Number and Percentage of Adolescents Reporting 'Ever Use' of Various Drugs from the Drug History Questionnaire (N = 152)

Drug	Overall N (%)	Mean (SD) Age of Initiation (years)	Mean (SD) Age of Initiation (years) by Sex			
			Overall N by Sex (%)		M	F
			M	F		
Alcohol	142 (93.42)	14.07 (1.67)	79 (55.63)	63 (44.37)	14.02 (1.61)	14.13(1.74)
Marijuana	112 (73.68)	14.64 (1.57)	63 (56.25)	49 (43.75)	14.42 (1.50)	14.92 (1.63)
Cigarettes	80 (52.63)	13.99 (1.75)	43 (53.75)	37 (46.25)	14.03 (1.87)	13.93 (1.61)
Mushrooms	48 (31.58)	15.50 (1.29)	28 (58.33)	20 (41.66)	15.93 (1.12)	14.90 (1.29)
LSD	35 (23.03)	15.06 (1.35)	19 (54.29)	16 (45.71)	15.47 (1.13)	14.56 (1.26)
Amphetamines	30 (19.74)	16.27 (1.53)	14 (46.67)	16 (53.33)	16.29 (1.20)	16.25 (1.81)
Tranquilizers	12 (7.89)	15.83 (1.34)	7 (58.33)	5 (41.67)	15.86 (1.22)	15.80 (1.64)
Crack/cocaine	9 (5.92)	16.00 (1.32)	6 (66.67)	3 (33.33)	16.33 (.82)	15.33 (2.08)
Steroids	4 (2.63)	16.25 (.96)	4 (100)	0	16.25 (.96)	-
Mescaline ^a	2 (1.32)	14.00	0	2 (100)	-	14.00
Opium	1 (.66)	17.00	1 (100)	0	17.00	-
PCP ^b	1 (.66)	-	0	1 (100)	-	-
Heroin	0	-	-	-	-	-
Solvents	0	-	-	-	-	-

Note. SD = standard deviation; LSD = lysergic acid diethylamide; PCP = phencyclidine. ^aMissing datum on age of initiation for one of the participants. ^bMissing datum on age of initiation for the participant.

Progression of Involvement in Drug Use

A total of 84 unique sequences of substance use were identified among the adolescents in the OPPS, and these, along with the number (and percentage) of youth who undertook each sequence, are outlined in Appendix E. From these 84 unique sequences, 16 general pathways were identified and these are presented in Table 28.

The most commonly identified general pathway involved the initial use of cigarettes and/or alcohol (i.e., commonly referred to as the licit drugs in the youth drug involvement literature) before moving on to marijuana use, with 20.39% of the sample undergoing this pathway. Approximately 17% of youth in the OPPS reported only ever using licit drugs, while 16.45% were found to first begin using licit drugs, then marijuana, followed by the use of other illicit substances, such as mushrooms, amphetamines, or LSD. Interesting, 11.18% of the OPPS sample reported using initially both licit drugs and marijuana prior to using other illicit substances, whereas 7.24% of the adolescents reported first using cigarettes and/or alcohol before progressing on to the simultaneous use of marijuana and other illicit drugs. Also worth mentioning is the finding that 3.29% of the youth in this sample were found to first use alcohol and/or cigarettes before progressing on to the use of illicit drugs other than marijuana. Only 5.92% of the sample reported never using any licit or illicit substance.

Table 28

General Pathways of Substance Use Among the Ottawa Prenatal Prospective Study Adolescents (N = 152)

Pathway	Percentage of Youth
Licit drugs → Marijuana	20.39%
Licit drugs only	17.11%
Licit drugs → Marijuana → Illicit drugs	16.45%
Licit drugs + Marijuana → Illicit drugs	11.18%
Licit drugs → Marijuana + Illicit drugs	7.24%
No drug use	5.92%
Licit drugs + Marijuana	3.95%
Licit drugs → Illicit drugs	3.29%
Marijuana → Licit drugs	3.29%
Licit drugs → Illicit drugs → Marijuana	2.63%
Marijuana → Licit drugs → Illicit drugs	2.63%
Licit drugs + Marijuana + Illicit drugs	2.63%
Licit drugs + Illicit drugs → Marijuana	1.32%
Illicit drugs only	.66%
Marijuana → Illicit drugs → Licit drugs	.66%
Marijuana → Licit drugs + Illicit drugs	.66%

Note. Licit drugs refer to cigarettes and alcohol. Illicit drugs may include amphetamines, crack/cocaine, tranquilizers, lysergic acid diethylamide (LSD), mescaline, opium, steroids, or mushrooms.

Summary

In sum, alcohol was found to be the most frequently used substance among adolescents in the OPPS followed by marijuana and then cigarettes. Additionally, it was found that the use of the licit drugs (i.e., cigarettes and/or alcohol) typically preceded that of the illicit substances.

DISCUSSION

The current report continues the presentation of findings arising from the OPPS – a long-term prospective study of the effects of *in utero* exposure to cigarettes and marijuana. The present study was undertaken to corroborate and extend the adolescent drug involvement literature by investigating a wide variety of influences on the initiation and cessation of cigarette smoking and marijuana use among youth aged 16 to 21 years. Specifically, this research focused on the influences of adolescents' attitudes towards drugs, their peers, and prenatal exposure to nicotine and marijuana. An additional goal of the present work was to determine the extent to which the influences of adolescents' attitudes and their peers differed between those youth in the OPPS who were prenatally exposed to differing levels of nicotine and marijuana and those who were not exposed, and to identify any potential gender differences. Also of interest was to determine if a particular sequence of drug use existed among the adolescents in the current study.

This discussion and synthesis of findings and implications from the present investigation has been divided into several sections in an attempt to assist the reader's understanding. To begin, findings concerning the OPPS adolescents' rates of cigarette

smoking and marijuana use are presented, followed by a discussion of the correlates of the initiation and cessation, respectively, of youth cigarette smoking and marijuana use. Next, prenatal drug exposure group and gender differences which were obtained in the current study are considered, followed by a discussion of the progression of substance use among the OPPS youth. Finally, an overview of the strengths and limitations associated with the current study and some future directions for research are provided.

Adolescents' Drug Involvement

Findings from the present work have indicated that more than half (52.6%) of the adolescents in the OPPS reported initiating cigarette smoking, beyond just trying out one or two cigarettes, at some point in their lifetime. No significant sex difference was found with respect to smoking initiation, which is consistent with results from various prevalence studies in Canada and the U.S. (CAMH, 2001; Johnston et al., 2002a). A little more than one-third of the adolescents in the present study indicated that they were current, regular cigarette smokers (i.e., smoking cigarettes at least once a day).

In terms of marijuana use, a higher rate of initiation was observed among youth in the OPPS, with 73.7% of the sample reporting that they initiated the use of marijuana at some point in their lives. Contrary to what has been reported in the literature (CAMH, 2001; Johnston et al., 2001a, 2002a), however, the current study did not find a greater number of males to have initiated the use of marijuana than females. Also somewhat surprising was the percentage of youth in the OPPS reporting current, regular marijuana use (i.e., using at least once a week) as compared to the percentage that identified themselves as current, regular cigarette smokers. Whereas only 3.4% of the entire sample

of adolescents reported that they are currently using marijuana on a regular basis, 34.9% of the OPPS sample indicated that they are current, regular cigarette smokers. Such a discrepancy in these two rates of current, regular drug use serves as an important reminder of the addictive properties of nicotine (Pinel, 1997; United States Department of Health and Human Services, 1988) and the potential for addiction once cigarette smoking is initiated.

An important observation can be made regarding these rates of cigarette smoking and marijuana use initiation among youth in the current study; that is, they are somewhat higher than those rates reported by the MTF study in the U.S. In interpreting this inconsistency in prevalence rates, however, it is important to keep in mind that in the original OPPS sample of approximately 700 mothers, only 190 were selected for follow-up studies based on their consumption of cigarettes and marijuana during pregnancy. In other words, the adolescents in the current study were selected to take part in the OPPS as a result of their level of prenatal exposure to nicotine and/or marijuana. Thus, in contrast to the MTF study where nationally representative samples of high school students are used (and the degree of their prenatal drug exposure is unknown; Johnston et al., 2001b, 2002a), the OPPS sample cannot be considered to be representative of either the general population or a middle-class population, due to the inherent selection bias of the sample.

The results from the present investigation have also revealed differences in adolescents' marijuana consumption as a function of their level of prenatal exposure to this drug. Although significant differences were found across all prenatal marijuana exposure groups (i.e., none, infrequent/moderate, and heavy) with respect to the number of joints reported being smoked per week, the contrast in such use between those youth

who were infrequently or moderately exposed to marijuana (i.e., > 0 and < 6 joints/week) and those who were heavily exposed (i.e., ≥ 6 joints/week) deserves further mention. It was found that adolescents who were heavily exposed to marijuana prenatally reported smoking more than three times the number of joints per week as compared to those youth who were only infrequently or moderately exposed to marijuana prenatally. In comparing these rates to the control group (i.e., those youth who were unexposed to marijuana prenatally), it was found that the infrequently/moderately exposed adolescents reported smoking almost three times the number of joints per week than the non-exposed youth, whereas those who were heavily exposed to marijuana *in utero* have reported that they smoke more than nine times the number of joints per week as compared to the non-exposed youth.

These results, therefore, are suggestive of a dose-response relationship existing between prenatal marijuana exposure and adolescents' current use of the drug. A possible, but speculative, explanation of this relationship is that the familial attitudes towards marijuana use (and perhaps even drug use in general) that are being conveyed to the offspring postnatally may be influencing their own attitudes towards marijuana and the use of this substance. Thus, adolescents may come to adopt norms and expectations regarding marijuana use that are similar to those of their parents. One may also speculate that the influence of familial attitudes toward marijuana is linearly related to the amount of marijuana that is smoked by the mother while she was pregnant. Presumably, mothers who used marijuana during their pregnancies were likely to have had liberal attitudes towards this drug, whereas those mothers who did not use marijuana while pregnant were likely to have had more negative attitudes towards its use. Hence, the more favourable

the family's attitudes are towards marijuana, the more marijuana that is likely to be smoked by the mother during pregnancy. One may also argue, albeit somewhat tenuously, that attitudes towards marijuana were likely to be somewhat similar among those mothers who infrequently/moderately used marijuana during their pregnancies, and those who heavily used this drug prenatally. It is understandable then, why those adolescents who were infrequently/moderately and heavily exposed to marijuana prenatally would have higher rates of marijuana consumption as compared to those youth who were unexposed, because this group of youth likely grew up in an environment where attitudes towards marijuana and its use were fairly liberal. Future prospective studies which include questions pertaining to familial attitudes towards drug use are needed, however, in order to empirically test this hypothesis.

Another possible explanation of this dose-response relationship between prenatal marijuana exposure and the offspring's current use of marijuana may be the physiological effects of *in utero* exposure to marijuana. Although there is a paucity of research with respect to the effects of maternal marijuana use during pregnancy, several studies have investigated the effects of prenatal exposure to nicotine and have found an association between it and the initiation of cigarette smoking during adolescence (Cornelius et al., 2000; Griesler et al., 1998; Kandel et al., 1994; Oesler et al., 1995; Weissman et al., 1999). While the mechanisms behind this relationship are poorly understood (Heath & Martin, 1993; Hughes, 1986), the genetic transmission of a vulnerability to substance use has been hypothesized (Cornelius et al., 2000; Kandel et al., 1994). This hypothesis is further discussed in the following section of the Discussion. In any event, these findings suggest the importance of programs aimed at drug use prevention in women during

pregnancy. These findings also have important implications for youth marijuana prevention and cessation programs. It may be necessary for such programs to consider the influence of prenatal marijuana exposure in order to be more effective, since the data indicate a dose-response relationship between the level of prenatal exposure and the number of joints consumed.

Correlates of Drug Use Initiation

As was previously mentioned, one of the major objectives of the current study was to examine the correlates of cigarette smoking and marijuana use initiation among adolescents in the OPPS. A number of both expected and unexpected findings were found with respect to the correlates of these two behaviours, and these are discussed separately below.

Cigarette Smoking Initiation

Expected Findings

Prenatal nicotine exposure. As was originally hypothesized, the results of this study indicate that prenatal exposure to nicotine significantly increases the odds of initiating cigarette smoking (beyond just trying out one or two cigarettes) during adolescence, after controlling for prenatal exposure to alcohol and marijuana. This finding supports previous research which has also suggested an association between nicotine exposure *in utero* and youth cigarette smoking initiation and use (Cornelius et al., 2000; Griesler et al., 1998; Kandel et al., 1994; Oesler et al., 1995; Weissman et al., 1999). It is of interest to note that in their retrospective study, Kandel et al. (1994)

reported a 4-fold increased risk of cigarette use and persistence in use among female, but not male, adolescents who were prenatally exposed to nicotine. Similar results were obtained in another retrospective study by the same group of researchers (Weissman et al., 1999). In this study, Weissman and colleagues (1999) found that maternal prenatal smoking predicted drug dependence (which included cigarette smoking) in female but not in male offspring. Although sample sizes in the current study precluded separate analyses from being conducted for each gender, future research should be directed at studying this observed sex difference. If in fact prenatal nicotine exposure potentiates different genetic vulnerabilities for females and males, this may possibly explain the reason why evidence from several substance use prevention programs indicate that they are not equally effective for boys and girls (Botvin et al., 1990; DeJong, 1987; Graham et al., 1990).

Mechanisms accounting for a relationship between prenatal nicotine exposure and the later initiation of cigarette smoking during adolescence deserve study. The physiological effects of *in utero* nicotine exposure is one possibility. Nicotine is known to stimulate the actions of cholinergic neurons and enhance activity in dopaminergic systems which are involved in addictive behaviours (Dani & Heinemann, 1996). As hypothesized by Kandel et al. (1994), it is possible that nicotine affects the fetus, perhaps through the nicotine input into the mesolimbic dopaminergic reward system, so as to predispose the brain in a critical period of its development to the subsequent addictive influence of nicotine consumed later in life (Collins, 1990-1991; Corrigall, 1991; Koob, 1992; Mereu et al., 1987; Nestler, 1992). If this effect of prenatal exposure to nicotine is not drug specific, then one might expect the use of marijuana to also be enhanced among

adolescents who were prenatally exposed to nicotine. This result, however, was not found in the current study.

Cornelius et al. (2000) have suggested that maternal cigarette smoking during pregnancy inflicts damage to the nervous system which may be expressed as impulsivity, inattention, aggression, depression, and/or anxiety, and may in effect create a vulnerability in the adolescent that could contribute to poorer adjustment and an increased likelihood of early initiation of cigarette smoking. The relationship between maternal prenatal cigarette smoking and adolescent smoking initiation could also be accounted for by inherited genotypes being passed down from the mother to the offspring. As has been previously mentioned, the influence of familial attitudes towards cigarette smoking which are transmitted to the offspring postnatally is yet another possibility explaining this relationship between prenatal nicotine exposure and the initiation of cigarette smoking. Until the pathophysiology of nicotine is better understood, from a public health perspective, the findings from the present investigation suggest the importance of programs aimed at cigarette smoking prevention and cessation in women during pregnancy.

Peer influences. Given that relationships and social interactions with friends take on particular importance during adolescence (Bee, 2000; Schaffer, 1997; Spear, 2000; Thornberry & Krohn, 1997), it was not surprising to find that youth in the current study who reported having a large proportion of friends who regularly smoke cigarettes were at an increased odds of initiating cigarette smoking. The influence of peer cigarette smoking has been consistently identified in the adolescent drug involvement literature as

being an important factor that is associated with youths' initiation of cigarette smoking (Chassin et al., 1986; Killen et al., 1997; van Roosmalen & McDaniel, 1992). Although friends provide a significant source of positive experiences for adolescents, they can also in some cases facilitate deviant behaviour such as cigarette smoking.

In interpreting this relationship between peer influences and adolescents' initiation of cigarette smoking, several different theories have been put forth. The classic modeling theory (Bandura, 1969) suggests that friends influence adolescents' initiation of cigarette smoking by setting an example and providing social reinforcement. Thus, by directly observing their peers smoking cigarettes, modeling theory suggests that youth will imitate their friends' smoking behaviour. Akers' social learning theory (Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979, p. 638) also emphasizes that "social behaviour is acquired through direct conditioning and through imitation or modeling others' behaviour." According to Bandura's social cognitive/learning theory (1982, 1986), observing friends who smoke cigarettes will not only directly affect adolescents' own smoking behaviour, but it will also shape their outcome expectations, which are their beliefs about the most immediate and most likely social, personal, and physiological consequences of cigarette smoking. This theory also suggests that friends can shape adolescents' self-efficacy. For instance, observing peers purchase and inhale cigarettes can provide youth with the necessary knowledge and skills to obtain and smoke cigarettes, thereby increasing their odds of initiation. Observing peers smoking cigarettes may also increase adolescents' willingness to consider cigarette smoking in the future, which may in turn increase the likelihood that they will initiate cigarette smoking. It is

also possible that peer pressure is an important element in an adolescent's decision to initiate cigarette smoking.

On the other hand, however, some part of the relationship between the influence of friends and adolescent smoking initiation may possibly be due to selective association and socialization (Kandel, 1980). That is, to the extent that the selection of a friend is based on similar cigarette smoking status, the observed relationship between peer and adolescent cigarette smoking would be accounted for by selective association rather than by peer influence. In support of this theory, a review of the literature on friendship selection by Epstein (1989) has suggested that similarity is likely to play a more important role in friendship selection in adolescents as compared to elementary-school-age children. Curran, Stice, and Chassin (1997), however, have proposed bidirectional influences of peer socialization and peer selection. Both of these mechanisms were supported in their longitudinal study of adolescent alcohol use: Peer alcohol use predicted subsequent adolescent use, and adolescent use predicted increases in peers' use. A similar relationship may be operating in the current study, with adolescents influenced to initiate cigarette smoking by their friends who regularly smoke and at the same time increasingly identifying and affiliating with peers who smoke.

Because the data in the present study are cross-sectional, any observations that are found are simply associations and as such they do not provide information about causal direction. Although cross-sectional studies can rule out possible causes when relationships between variables are not found, they do not, however, determine with certainty which variable came first. Therefore, while peer influences may affect adolescents' initiation of cigarette smoking, it is also possible that such behaviour might

lead to changes in adolescents' peer group affiliation (i.e., selective association and socialization). Thus, it becomes very difficult to separate these individual effects and determine the direction of this relationship. Having measures of the adolescents' attitudes towards drugs and their peer influences prior to their initiation of cigarette smoking might perhaps shed some light on the directionality of this important relationship. An alternative method of determining the direction of this relationship between peer influences and adolescent cigarette smoking initiation would be to first identify those youth who serve as models for the majority of smokers in their peer or friendship groups, possibly by using sociometric research techniques. After identifying these models, efforts may be directed at changing their cigarette smoking behaviour. Subsequent changes in peer or friendship group smoking behaviour could then be evaluated in terms of changes in the behaviour of the model.

In any event, there are important implications associated with both interpretations of the relationship between peer influences and adolescents' initiation of cigarette smoking. While many programs for youth smoking prevention emphasize teaching adolescents to resist peer pressure for taking up cigarette smoking, many have ignored the fact that peers' smoking influence may simply be the result of social selection as adolescent cigarette smokers seek out smoking friends (Ennett & Bauman, 1994). While teaching adolescents to resist peer pressure may be necessary, it is also perhaps important to identify particular factors that influence adolescents' decisions in choosing smoking friends. Doing so may allow for the development of more effective prevention strategies.

Although not examined in the current investigation due to sample size restrictions, it is of interest to note that several studies in the literature have reported that the smoking

behaviours of peers may be more influential for female adolescents than males (Hu et al., 1995; Sarason et al., 1992; vanRoosmalen & McDaniel, 1992), suggesting that girls may be more susceptible to social influences than are boys. When considering the fact that adolescent females have been found to have closer bonds and intimacy ties with their friends than do adolescent males (Maccoby, 1990, 1998), it seems reasonable to assert that peer influences would play a more significant role in the initiation of cigarette smoking among females than males. However, much more work needs to be done to test this model and examine how it may impact attempts to prevent or treat cigarette smoking among female and male youth. Doing so may increase the effectiveness of smoking prevention programs.

Influence of attitudes. Associations between adolescents' attitudes of disapproval and perceived peer disapproval of cigarette smoking and their initiation of such behaviour have been reported by several researchers in the youth drug involvement literature (Barber et al., 1999; Griffin et al., 1999; Piko, 2001; Towberman & McDonald, 1993). Based on this literature, it was hypothesized that adolescents who disapproved and perceived that their friends also disapproval of cigarette smoking would be less likely to initiate cigarette smoking themselves. This was in fact found to be the case in the current study, such that attitudes of greater disapproval and perceived peer disapproval significantly decreased the odds of youth initiating cigarette smoking.

In interpreting these results, it is important to keep in mind that causal inferences regarding the association of adolescents' disapproval and perceived peer disapproval of cigarette smoking and their initiation of smoking cannot be made because of the cross-

sectional nature of this study. Thus, while it is possible that adolescents' attitudes towards cigarette smoking may lead to their initiation of cigarette smoking, it may also be the case that these attitudes are the result of youth initiating cigarette smoking. Results from correlational and intervention studies addressing cigarette and alcohol use, however, have suggested that attitude is antecedent to change in drug use rather than a consequence of it (Botvin, Baker, Goldberg, Dusenbury, & Botvin, 1992; Downs, 1987).

These results from the current study have important implications for cigarette smoking prevention programs. Adolescents may become susceptible to cigarette smoking initiation because they believe that smoking will have positive social consequences, such as approval from friends. As a result, programs need to target youths' attitudes toward smoking, particularly their attitudes of disapproval and perceived peer disapproval. Future research is also needed to determine to what extent these attitudes can be taught or reinforced among adolescents. Classroom-based activities may be able to demonstrate to youth at a young age that most of their peers do in fact disapprove of smoking. For example, in one popular classroom activity, students are asked to stand in one side of the classroom if they think it is acceptable for an adolescent to smoke, or to stand in the opposite side of the classroom if they think adolescent cigarette smoking is unacceptable. Most students tend to stand on the "non acceptable" side of the room, demonstrating that adolescent smoking is not normative or acceptable within the peer group (Unger et al., 2001). If adolescents can be shown that cigarette smoking does not have the expected positive social consequences, perhaps they will be less motivated to initiate smoking. Also, since one adolescent's acceptant attitude toward cigarette smoking can infect other adolescents' attitudes, more work is also needed to

develop, implement, evaluate, and refine strategies designed to harden youths' resistance and to equip them to defend against such negative external pressures from their peers. It is important, however, that cigarette smoking and other drug use prevention efforts aimed at addressing adolescents' attitudes and beliefs begin at an early age. It has been shown that by the time youth enter high school, their attitudes toward the use of drugs have, for the most part, solidified (Kleinman, Wish, Deren, & Rainone, 1988). As a result, smoking and other drug use prevention efforts need to take advantage of the "teachable moment" when youth are first beginning to form their attitudes and beliefs about substance use and before negative peer influence has configured these attitudes in a drug-acceptant direction.

Although not examined in the current study because of sample size restrictions, gender differences with respect to the influence of adolescents' attitudes towards cigarette smoking have been identified in the smoking literature and should be noted. Reports have indicated that girls tend to be more strongly influenced by their own antismoking attitudes, and those of their family and friends, than are boys (Charlton & Blair, 1989; Griffin et al., 1999; Piko, 2001). Griffin et al. (1999) actually found that friends' attitudes toward smoking was the strongest predictor of all those measured in their study with respect to later cigarette smoking for girls. Although Griffin and colleagues were predicting heavy cigarette smoking rather than initiation, the pattern of their findings are consistent with previous studies showing that the effects of friends' smoking tend to be stronger for females than for males (Hu et al., 1995), that parental approval of smoking is more strongly related to smoking in female adolescents relative to males (Flay et al., 1994), and that one's own attitudes toward smoking are a particularly long-term predictor

of smoking behaviour among females (Pederson & Lefcoe, 1985). Although the reason for these gender differences are presently unclear, one possibility is that girls are more concerned about the opinions of others regarding their cigarette smoking, which in turn may be a function of personality factors such as lower self-esteem relative to males (Feingold, 1994).

Given the gender differences in smoking etiology observed in past research, a legitimate question remains regarding whether different smoking prevention programs are needed for adolescent girls and boys. Previous smoking etiology studies have found gender differences in susceptibility to social influences (Chassin et al., 1986), level of social skills (French & Perry, 1996), and reliance on cigarette smoking as a copy strategy (Fried, 1994), as well as concerns relating to body weight, body image, self-esteem, and the way women are portrayed in the media (French & Perry, 1996). Some researchers have argued that sex differences in the determinants of adolescent cigarette smoking may well warrant the development and testing of gender-specific prevention programs (Clayton, 1991). For instance, prevention programs targeted specifically toward girls may be more effective if they place an increased emphasis on social influence factors and media analysis skills, as well as self-image and body weight concerns.

Unexpected Findings

A number of quite unexpected findings were also found in the present investigation concerning the correlates of adolescent smoking initiation, and these are discussed below.

Prenatal marijuana exposure. As was previously discussed, results from earlier studies as well as the current one have found that prenatal exposure to nicotine is associated with the later initiation of cigarette smoking during adolescence. Extending these findings, the present study also surprisingly found that prenatal exposure to marijuana significantly increases the odds of cigarette smoking initiation during adolescence, after controlling for prenatal exposure to alcohol and nicotine.

It is unclear at this point, however, what mechanisms may be accounting for this observed relationship between maternal use of marijuana during pregnancy and the later initiation of cigarette smoking during adolescence since to the author's knowledge, this is the first study to date which has uncovered this apparent relationship. However, finding that prenatal exposure to either nicotine or marijuana is associated with the initiation of cigarette smoking during adolescence provides some suggestive evidence in support of the hypothesis that these drugs are predisposing the brain via the mesolimbic dopaminergic reward system to the subsequent addictive influence of nicotine consumed later in life (Kandel et al., 1994). As was previously discussed in the context of prenatal nicotine exposure, some other possible factors accounting for this association may be a genetic transmission of a vulnerability to substance use and/or the postnatal transmission of parental attitudes towards drugs to the offspring.

In any event, this finding from the current study provides some promising preliminary evidence that maternal marijuana use during pregnancy is associated with later cigarette smoking initiation during adolescence. Further research is required, however, in order to replicate this relationship and to better understand the mechanisms underlying it. Research attention should also be directed towards studying potential sex

differences which may be evident with respect to the effect of prenatal marijuana exposure and the later initiation of cigarette smoking, since gender differences have been noted in studies examining the effects of prenatal nicotine exposure (Kandel et al., 1994; Weissman et al., 1999).

Finding that prenatal exposure to nicotine and marijuana is associated with cigarette smoking in adolescence has important implications for drug use prevention programs aimed at women who are pregnant or who are thinking of becoming pregnant. If women are more fully aware of the potential long-term risks that are associated with their use of drugs, such as cigarettes and marijuana, during pregnancy, perhaps they will be less motivated to use such substances during this critical period of time. Another implication of these current findings is that adolescent cigarette smoking prevention programs may be more effective if they are specifically tailored for individuals. For example, research from the current study suggests that youth who have been prenatally exposed to nicotine or marijuana are at an increased risk of initiating cigarette smoking as compared to those adolescents who were not prenatally exposed. As a result, the former group of individuals may require a more intensive prevention program than their unexposed counterparts. Thus, in order to be more effective, programs may need to start with an assessment of the adolescents' vulnerabilities and address them accordingly.

Peer influences. Another somewhat unexpected finding from the current study concerned the influence of adolescents' peers. As was previously mentioned, the proportion of peers who regularly smoke cigarettes was found to significantly increase the odds of cigarette smoking initiation among youth in this study. However, the results

also unexpectedly revealed that the proportion of peers who have tried smoking cigarettes was not found to be significantly related to the OPPS adolescents' initiation of cigarette smoking.

Such a finding contrasts with earlier research conducted by Pederson et al. (1997) which reported that youth who had ever tried cigarettes were found to have a greater proportion of their closest friends who had also tried smoking as compared to never smokers. It is unclear exactly why this discrepancy exists between the results obtained by Pederson et al. and the present study. One possibility is that Pederson et al.'s peer influence measure was defined as the proportion of one's *closest* friends who have ever tried cigarettes, whereas in the current investigation a more general definition was used (i.e., the proportion of one's peers who have tried cigarettes) which could represent influences from a wide group of friends that probably includes casual acquaintances as well as close friends. Presumably, the behaviours of one's close friends would be more influential than those of casual acquaintances. Thus, this inconsistency in results may simply reflect a difference in the operational definitions of peer influence.

Another possibility underlying these contrasting results may be due to the fact that Pederson et al. did not include a question in their instrument pertaining to the proportion of one's peers who regularly smoke cigarettes, whereas the current study did. If such a measure was included in their instrument, Pederson et al. may have obtained results similar to those in the current study. Alternatively, if the current study failed to include a question regarding peers' regular smoking in the Drug History Questionnaire (DHQ), it is quite possible that it would have obtained similar results to Pederson and colleagues.

One other explanation of these differing results may relate to the age groups of the participants that were used in both studies. In Pederson et al.'s investigation, the youth were Grade 6 Ontario students (which is approximately 11 years of age), which incidentally may or may not explain why the proportion of one's peers who regularly smoke cigarettes was not included as a measure in this study. That is, one would not anticipate a high rate of regular cigarette smokers among this age group, which in fact was found to be the case in that only 1.1% of Pederson and colleagues' sample were found to be current regular and occasional smokers. In the OPPS, however, the participants ranged in age from 16 to 21 years and 34.9% of the sample reported that they were current, regular cigarette smokers. Therefore, it is possible that the proportion of one's friends who regularly smoke cigarettes may be a more influential factor for cigarette smoking initiation among this older age group, as opposed to the proportion of one's friends who have ever tried cigarettes.

The current work also observed another finding related to peer influences of adolescent cigarette smoking initiation that appears to conflict with previous reports in the literature. That is, the present work did not find the proportion of one's peers who have tried or who regularly use marijuana to be significantly associated with adolescent cigarette smoking initiation, which is opposite to what has been reported in other studies (Lo et al., 1993; Robinson et al., 1987; Welte & Barnes, 1987). Since these results are based on samples of youth from Australia, northern California and New York, however, it is possible that this inconsistency in results is due to genuine cultural and demographic differences between these aforementioned locales and Ottawa, Canada. Further research with other Canadian samples of youth, however, needs to be conducted before any firm

conclusions can be made regarding the influence of peers' marijuana use on adolescents' initiation of cigarette smoking.

Another more plausible interpretation of this inconsistency in results, however, may relate to the year in which the previously reviewed studies were published. That is, adolescents' attitudes towards cigarette smoking may not be as favourable today as they perhaps were one or two decades ago (when the previously reviewed studies were published). In support of this interpretation, data from the MTF study (Johnston et al., 2001b) indicate that among 12th grade students in the U.S., there has been a gradual decrease in disapproval rates for cigarette smoking (i.e., disapproval of smoking a pack or more of cigarettes per day) from 1987 until 1997. Since 1997, however, adolescent disapproval rates for cigarette smoking have been on the rise. Thus, it appears that today's generation of youth do not view cigarette smoking as favourable as did those adolescents who grew up during the late 1980s and early 1990s.

Influence of attitudes. Results from the current study also revealed that several attitudinal measures were found to significantly decrease the odds of cigarette smoking initiation among youth in the current study. Although such measures have been consistently identified in the literature as being significant correlates of cigarette smoking initiation (Barber et al., 1999; Griffin et al., 1999; Piko, 2001), what is quite surprising about these findings is the type of attitudes that were found to be influential. It was discovered that adolescents' disapproval and perceived risk of marijuana use, as well as their access and perceived availability of marijuana, were found to be associated with their initiation of cigarette smoking. More specifically, the results showed that youth

who reported greater levels of disapproval and perceived risk of marijuana use, and less access and perceived availability of this drug, were less likely to have initiated cigarette smoking. To the best of the author's knowledge, these preceding findings pertaining to the influence of adolescents' attitudes towards marijuana on their decision to initiate cigarette smoking represent the first detailed analysis of this apparent association.

Further studies, therefore, are needed in order to replicate these findings and to better understand the rationale of this relationship. As will be discussed further on in the Discussion, adolescents' attitudes towards marijuana have consistently been found to be significantly associated with their initiation of marijuana use (Bachman et al., 1998; U. Brook et al., 2001; Derzon & Lipsey, 1999; Goodstadt et al., 1984; Kosterman et al., 2000; Robin & Johnson, 1996; Smart, 1977; Towberman & McDonald, 1993). With the current study indicating that adolescents' attitudes toward marijuana are also linked with their initiation of cigarette smoking, this pattern of results appears to suggest that some of the etiological factors for youth cigarette smoking and marijuana use are interrelated. Such a contention also supports the notion that problem behaviours have similar causes and tend to cluster together throughout adolescence (Jessor & Jessor, 1977).

One of the implications of this observed relationship between adolescents' attitudes toward marijuana and the initiation of cigarette smoking concerns the Canadian government's recent decision to reassess the legal status of marijuana ("Marijuana: Federal Smoke," 2001; Panetta, 2003). As a result of decriminalizing this substance, youth may begin to believe that marijuana use is not that risky and in effect they may begin to weaken their attitudes of disapproval towards the drug. Since results from the current study are suggesting an apparent relationship between adolescents' attitudes

towards marijuana and cigarette smoking initiation, one possible outcome of the decriminalization of marijuana in Canada could be a sharp increase in the number of Canadian youth initiating cigarette smoking. This observed relationship between youths' attitudes toward marijuana and their initiation of cigarette smoking also has important implications for cigarette smoking prevention programs. That is, in addition to targeting adolescents' attitudes toward cigarettes, these programs may also need to address youths' attitudes toward marijuana in order to be effective.

One final unexpected result obtained from the current investigation was that adolescents' attitudes of perceived risk of cigarette smoking were not found to be significantly associated with their initiation of cigarette smoking. This result is somewhat surprising given that this variable has been consistently identified in the literature as being a significant correlate of cigarette smoking initiation among youth (Robin & Johnson, 1996; Tomori et al., 2001; Williams & Covington, 1997), and has been heavily emphasized in several smoking prevention programs (Oei & Fea, 1987; Stein, 1997; Tobler, 1997). Since this finding is somewhat inconsistent with prevailing views, it is important to consider what other explanations could account for it. Two possible explanations may be underlying this result.

First of all, it is possible that adolescents in the OPPS may not be fully aware of the risks associated with cigarette smoking. However, previous research has suggested that a considerable number of adolescent smokers are well aware of the dangers and drawbacks of their tobacco use (Tuakli et al., 1990). Alternatively, these youth in the current study are aware of the risks of cigarette smoking, however, this awareness is not affecting their decisions to initiate cigarette smoking. This latter interpretation of the

findings may, in part, explain the limited effectiveness of traditional prevention programs that stress the long-term health risks and consequences of cigarette smoking (Bachman, Johnston, & O'Malley, 1991; Miller & Slap, 1989; Stein, 1997; Tobler, 1997). These results, therefore, may lead researchers and practitioners to conclude that information on the harmful effects of cigarette smoking is not necessary for effective smoking prevention programs. However, it is premature to discard such programs. On the contrary, these results point toward the need to rethink how perceived risk affects cigarette smoking initiation and to re-examine how knowledge on the negative consequences of smoking can best be utilized in prevention programs. Further research also needs to be conducted in order to learn more about the dimensions of perceived risk and how such perceptions affect adolescents' initiation of cigarette smoking. Educational strategies aimed at teaching the risks and harmful effects of smoking may also need to be improved based on what is currently known about effective programs. While prevention programs should address the risks and health problems associated with cigarette smoking, it is important that other factors be included. That is, programs should adopt a multidimensional approach to prevention by recognizing the role of various etiological factors that are known to be associated with smoking initiation.

Marijuana Use Initiation

This portion of the Discussion has not been divided into "Expected" and "Unexpected Findings" as has been done in the previous section, as all of the results concerning the correlates of marijuana use initiation were found to support the present study's original hypotheses. This section also highlights and discusses a number of

interesting contrasts that can be noted with respect to the results concerning the initiation of cigarette smoking and marijuana use.

Prenatal Marijuana Exposure

As was previously mentioned, the results from several studies (including the current one) have revealed an association between prenatal exposure to nicotine and the initiation of cigarette smoking during adolescence (Cornelius et al., 2000; Griesler et al., 1998; Kandel et al., 1994; Oesler et al., 1995; Weissman et al., 1999). Based on these findings, it was hypothesized that maternal use of marijuana during pregnancy would be associated with the later initiation of marijuana use in adolescence. This hypothesis was in fact confirmed in the current investigation. Specifically, the results showed that prenatal exposure to marijuana significantly increased the odds of marijuana use initiation among the OPPS youth, after controlling for prenatal exposure to alcohol and nicotine.

As has been the case with a number of findings in the present report, this study is also the first to suggest an apparent relationship between prenatal marijuana exposure and the later initiation of this drug. In contrast to the growing literature surrounding the effects of prenatal nicotine exposure, there is a paucity of research on the effects of *in utero* exposure to marijuana. As a result, the mechanisms accounting for this observed relationship between maternal marijuana use and the later initiation of marijuana use during adolescence are largely unknown. Based on the literature concerning the effects of prenatal nicotine exposure, however, one may speculate that the factors underlying this relationship may also be physiologic in nature. That is, prenatal exposure to marijuana sensitizes the nervous system to cannabis directly. Given that recent data suggest that the

cannabinoid receptors are present in the placenta (Park et al., 2003) and the fetal and neonatal brain (Glass et al., 1997), it is possible that prenatal exposure to marijuana is predisposing the brain to the subsequent influence of marijuana consumed during adolescence. Another possible interpretation is that adolescents whose mothers used marijuana while they were pregnant might be genetically predisposed to develop drug-prone personality traits that are then related to marijuana use initiation. As noted by True and colleagues (1999), future research should investigate the impact of genetic influences as well as the interaction of genetic and environmental influences on the adolescent's marijuana use initiation. It is also possible that this relationship is explained by familial attitudes toward marijuana being passed on to the offspring postnatally.

Further research is needed, therefore, in order to replicate this observed association between prenatal marijuana exposure and the later initiation of use of this substance, and to determine the mechanisms underlying this association. It would also be of interest to look for potential sex differences which may be evident with respect to the effects of prenatal marijuana exposure and the later initiation of marijuana use, since such differences have been reported by some studies which have examined the effects of prenatal nicotine exposure on cigarette smoking initiation during adolescence (Kandel et al., 1994; Weissman et al., 1999).

It is interesting to draw attention to the differential results which have been obtained with respect to the initiation of cigarette smoking and marijuana use in the current study. Although prenatal exposure to either nicotine or marijuana was found to significantly increase the odds of youth initiating cigarette smoking during adolescence, only *in utero* exposure to marijuana was found to significantly increases the odds of later

marijuana use initiation. Such contrasting results are important because they highlight differences in the potential long-term risks that are associated with maternal use of cigarettes and marijuana during pregnancy. Given that they represent preventable risks to youth, women should be cautioned against the use of cigarettes and marijuana during pregnancy. These results also have important implications in terms of youth substance use prevention programming. That is, in order to be more effective, prevention programs may need to consider the differential effects of prenatal exposure to various drugs on adolescents' initiation of substance use.

Peer Influences

Findings from this research have also indicated that several peer influence variables significantly increase the odds of marijuana use initiation among youth, which confirms original hypotheses of this study. First of all, the proportion of one's peers who have tried marijuana was found to be associated with the initiation of marijuana use, which is a result that is supported in the growing literature on the importance of peer influences on youth marijuana use initiation (J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Kosterman et al., 2000; Needle et al., 1986). The other peer influence variables which were found to increase the odds of adolescents' initiation of marijuana use were the proportion of one's peers who have tried cigarette smoking and the proportion who regularly smoke cigarettes. These results also corroborate past findings in the existing literature which have indicated that friends' use of cigarettes is associated with the initiation of marijuana use among youth (J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Griffin et al., 2002).

Some interesting contrasts can be noted regarding the type of peer influence variables that were found to be significantly associated with the initiation of cigarette smoking and marijuana use. Earlier in the Discussion, it was mentioned that the only peer influence variable which was found to be related to the initiation of cigarette smoking was the proportion of one's peers who regularly smoke cigarettes, while the proportion of peers who have tried cigarettes did not reach statistical significance. With respect to the initiation of marijuana use, however, the opposite result was obtained; that is, the proportion of peers who regularly use marijuana was not found to be significantly associated with the initiation of marijuana use, whereas the proportion of peers who have tried marijuana was found to be a significant correlate.

Another interesting difference in the results is the fact that the two peer influence variables related to cigarette smoking (i.e., proportion of peers who have tried and who regularly smoke cigarettes) were both found to be influential in adolescents' initiation of marijuana use, whereas the peer influence variables related to marijuana use (i.e., proportion of peers who have tried and who regularly use marijuana) were not found to be significantly associated with the initiation of cigarette smoking. Thus, although it appears that peer influences regarding cigarette smoking are influential in the initiation of marijuana use (which is a finding that has been previously reported in the literature [i.e., J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Griffin et al., 2002]), such influences regarding marijuana use do not appear to be significantly linked with adolescents' cigarette smoking initiation. It is unclear why this discrepancy in peer influences exists with respect to the initiation of cigarette smoking and marijuana use. A possible, but speculative, explanation of this result may relate to Kandel's (1975) stage

theory of drug use. According to Kandel, adolescents' progression of substance use typically begins with the use of alcohol and/or cigarettes before moving on to the use of marijuana. It may be that peers' use of a drug lower in the sequence (i.e., cigarettes) is a good predictor of adolescents' transition to the next stage (i.e., marijuana). Since the results of several studies (J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Blaze-Temple & Lo, 1992; Huba et al., 1981; Kandel, 1975; Kandel et al., 1992) have reported that the use of cigarettes generally occurs before the use of marijuana, this may explain why peers' use of marijuana is not significantly associated with adolescents' initiation of cigarette smoking. Further research, however, is needed in order to test this hypothesis.

In interpreting these results related to the peer influences of cigarette smoking and marijuana use initiation among the OPPS youth, it is important to keep in mind that since the data in this investigation are cross-sectional, it is not possible to determine with certainty the causal direction of the observed relationships between the peer influence variables and adolescents' initiation of cigarette smoking or marijuana use. Thus, the influences of one's friends may affect adolescents' initiation of marijuana use, perhaps as a result of observing and replicating peers' marijuana use behaviours and/or internalizing their marijuana use norms. However, youths' marijuana use might also lead to changes in their peer group affiliation (i.e., selective association and socialization).

Influence of Attitudes

As was originally hypothesized, several attitudinal measures in the present study were also found to decrease the odds of marijuana use initiation among adolescents, including disapproval and perceived risk of marijuana use, perceived peer disapproval of

cigarette and marijuana use, and access and perceived availability of marijuana. That is, youth in the OPPS who reported greater disapproval and perceived risk of marijuana use, perceived greater peer disapproval of cigarette smoking and marijuana use, and reported less access and perceived availability of marijuana, were less likely to have initiated using this drug. Not surprising, each of these different types of attitudes have also been found in previous studies to be significantly related to marijuana use initiation (Bachman et al., 1998; U. Brook et al., 2001; Derzon & Lipsey, 1999; Goodstadt et al., 1984; Kosterman et al., 2000; Robin & Johnson, 1996; Smart, 1977; Towberman & McDonald, 1993).

These results from the current study, however, have several important implications in terms of marijuana use prevention. Based on the data, it is clear that adolescents' attitudes toward marijuana should be made an important component of marijuana use prevention programs. In terms of strategies, programs need to highlight to youth the various negative consequences of initiating the use of marijuana, such as physical risk or harm and peer disapproval, in an attempt to change their attitudes and norms about this drug. Since adolescents' desires for peer approval can be overwhelming pressures when faced with a decision to either initiate or not initiate the use of marijuana, prevention programs should equip youth with strategies to defend themselves against such negative external pressures. Programs also need to demonstrate to youth that most adolescents do in fact disapprove of marijuana use. Since the results of this study have also indicated that the perceived availability of marijuana is also a factor significantly related with adolescents' initiation of use of this drug, prevention programs may also need to deliver the message to youth that marijuana is not a readily available substance.

An interesting contrast can be noted in the results of the present study concerning the attitudinal correlates of the initiation of cigarette smoking and marijuana use. In terms of cigarette smoking initiation, a significant association was found between it and two of the attitudes related to marijuana and its use (i.e., disapproval and perceived risk of marijuana use and access and perceived availability of marijuana). However, attitudes pertaining mostly to marijuana (i.e., disapproval and perceived risk of marijuana use, perceived peer disapproval of cigarette and marijuana use, and access and perceived availability of marijuana) were found to be related to the initiation of marijuana use, whereas attitudes concerning cigarettes were not. Again, these findings may have important implications for adolescent drug use prevention programs. In order to be more effective, adolescents' attitudes towards marijuana may need to be targeted in cigarette smoking prevention programs, whereas programs aimed at marijuana use prevention may only need to focus on young people's attitudes towards this particular substance.

Correlates of Drug Use Cessation

As was previously mentioned, one of the other major objectives of the present study was to examine the correlates of the cessation of regular cigarette smoking and marijuana use among youth in the OPPS. A number of both expected and unexpected findings were found with respect to the correlates of the cessation of these two behaviours, and these are discussed separately below.

*Cigarette Smoking Cessation**Expected Findings*

Peer influences. As was originally hypothesized, findings from the current study indicate that adolescents' odds for quitting cigarette smoking on a regular basis (i.e., smoking at least once per day) were significantly decreased if they reported that a large proportion of their friends are regular cigarette smokers. This result is also supported by the growing literature on the importance of peer influences in the smoking cessation process (Burt & Peterson, 1998; Ershler et al., 1989; Hansen et al., 1985; Presti et al., 1992). Based on these findings, it appears that smoking cessation is influenced by the social environment of adolescent smokers and that programs supporting youth cessation would do well to consider adolescent smokers not only as individuals but as members of a social group that can potentially influence its members' cigarette smoking behaviour. These findings also appear to suggest that an effective strategy for adolescents looking to quit smoking cigarettes would be to change their peer group affiliation. It is worth noting in this context that among a group of adolescents who tried to quit smoking, almost 20% of them reported that their friends made it harder for them to stop by offering cigarettes, providing harassment, and smoking around them (Presti et al., 1992).

Although not examined in the current study due to sample size restrictions, it is of interest to note that there is evidence from studies in the smoking cessation literature indicating that peer cigarette smoking is a significant predictor of smoking cessation for girls but not for boys (Ellickson et al., 2001; Skinner et al., 1985). Such findings are consistent with the cigarette smoking initiation literature which suggests that adolescent girls are more vulnerable to the social influences of peers than are adolescent boys

(Chassin et al., 1986; Hu et al., 1995; Sarason et al., 1992). Further research attention should be directed at investigating this apparent sex difference in peer influences of cigarette smoking cessation, and examining its implications for smoking cessation programs.

Having a large proportion of friends who have tried cigarette smoking, however, was not found to be a significant negative correlate of the cessation of regular cigarette smoking among the OPPS youth. This finding is further discussed in the following “*Unexpected Findings*” section. It is interesting to point out, though, that these results are consistent with those reported earlier in the Discussion pertaining to the peer influences of cigarette smoking initiation. That is, while a significant association was observed between the initiation of cigarette smoking and the proportion of peers who regularly smoke, no such relationship was observed between smoking initiation and the proportion of peers who have tried cigarettes.

Influence of attitudes. The results from this current work have also shown that adolescents' disapproval and perceived peer disapproval of cigarette smoking are significantly associated with their cessation of regular cigarette smoking. More specifically, youth in the OPPS reporting greater levels of disapproval and perceived peer disapproval of cigarette smoking were found to be more likely to quit smoking cigarettes on a regular basis, which confirms one of the current study's original hypotheses and corroborates previous research findings (Engels et al., 1998; Hansen et al., 1985; Kirscht et al., 1989; Skinner et al., 1985).

An important implication of these findings is that smoking cessation programs should work towards addressing and changing adolescents' positive attitudes towards cigarette smoking. Programs that can educate and instil negative attitudes and beliefs surrounding cigarette smoking may prove to be effective in successful smoking cessation. Another effective strategy for cessation programs may be to encourage youth to change their peer group so that they are not influenced by friends who have positive attitudes toward cigarette smoking. Since youths' perceptions of their friends attitudes toward smoking may not necessarily reflect the actual attitudes of their peers, cessation programs should also try to convey the message to adolescents wishing to quit cigarette smoking that most young people actually disapprove of such behaviour.

In addition to adolescents' disapproval and perceived peer disapproval being significantly associated with the cessation of regular cigarette smoking, it is interesting to mention that a significant relationship was also observed between this attitudinal measure and the initiation of cigarette smoking among the OPPS youth. Therefore, it appears that this attitudinal measure is a significant correlate of both the initiation and cessation of adolescent cigarette smoking.

Unexpected Findings

Prenatal nicotine exposure. Contrary to the study's original hypothesis, prenatal exposure to nicotine was not found to significantly decrease the odds of cessation of regular cigarette smoking among the OPPS youth, after controlling for prenatal exposure to alcohol and marijuana. In fact, no significant association was even found between these two variables. Thus, this finding appears to suggest that prenatal exposure to

nicotine is not related to the cessation of regular cigarette smoking. As one may recall, prenatal exposure to nicotine was found to be significantly associated with the initiation of cigarette smoking among youth in the current study. If in fact there is no relationship between prenatal exposure to nicotine and regular cigarette smoking cessation, then one may hypothesize that the initiation and cessation of cigarette smoking are two distinct processes, with the influence of prenatal nicotine exposure being more influential in the former than in the latter.

The finding that prenatal exposure to nicotine is not related to the cessation of regular cigarette smoking has important implications in terms of the physical model of addiction (Pinel, 1997). One would expect that the physical properties of nicotine which are instrumental in influencing youth to initiate regular cigarette smoking should also play a significant role in making it more difficult for these adolescents to quit smoking once the behaviour is initiated. The results from the current study, however, suggest otherwise. As a result, it may be speculated that attitudes (including those of the adolescent and his/her family and peers) are possibly playing an increasingly more influential role in the continuation or cessation of the cigarette smoking habit.

An alternative interpretation of the nonsignificant relationship which was observed between prenatal nicotine exposure and the cessation of regular cigarette smoking is that there was insufficient power in the current study to detect a significant association between these two variables (i.e., Type II error) due to the relatively small sample size (i.e., $N = 70$) which was used. Since this is the first investigation to date which has studied the effect of prenatal nicotine exposure on the cessation of regular

cigarette smoking, further research must be conducted with larger sample sizes prior to drawing any firm conclusions regarding the effect of this variable.

Peer influences. As was previously mentioned, another somewhat surprising finding that was obtained in the current study is that adolescents' proportion of peers who have tried cigarettes was not found to be significantly related to their cessation of regular cigarette smoking. One possible interpretation of this result is that the proportion of one's peers who regularly smoke cigarettes (which was found to be a significant correlate of regular smoking cessation) is a more influential factor associated with adolescents' cessation of regular cigarette smoking as opposed to the proportion of peers who have tried cigarettes. Interestingly, this same result was found with respect to the initiation of cigarette smoking such that the proportion of peers who regularly smoke was found to be a more influential correlate as compared to the proportion who have tried cigarettes. Another plausible explanation of the current results, however, is that there was insufficient power in the present investigation to detect a significant effect of the proportion of peers who have tried cigarettes.

Influence of attitudes. One final unexpected finding that was obtained in the present investigation relates to adolescents' perceived risk of cigarette smoking. Although this variable has been consistently identified in several previous studies as being important in the cigarette smoking cessation process (Jensen & Overgaard, 1993; Kirscht et al., 1989; Stone & Kristeller, 1992; Tuakli et al., 1990), the current study did not find a significant association between these two variables.

An interpretation of this result is that adolescent cigarette smokers today are more cognizant of the risks that are associated with smoking when they initiate this behaviour, than were youth who were growing up in the late 1980s and early 1990s. In fact, recent data from the MTF study indicate that the percentage of high school students in the U.S. seeing “great risk” in smoking a pack or more of cigarettes per day is greater today as compared to the percentage of students reporting such perceived risk during the late 1980s and early 1990s (Johnston et al., 2001b). If adolescents of this current generation are initiating cigarette smoking despite having such an awareness of the risks that are involved with this behaviour, then one would not expect that their perceived risk of smoking would be an influential factor affecting their decision to quit smoking. One may recall from the previous discussion of the correlates of cigarette smoking initiation that adolescents' perceived risk of cigarette smoking was also not found to be associated with their initiation of cigarette smoking.

As has been previously mentioned, the relatively small sample size used in the analyses examining the correlates of regular cigarette smoking cessation may be another reason why a significant association between cigarette smoking cessation and the perceived risk of smoking was not found. As a result, further study of this attitude with larger samples is warranted.

Marijuana Use Cessation

This portion of the Discussion has not been divided into “Expected” and “Unexpected Findings” as has been done in the previous section. Unlike the previous section where all of the results were in the anticipated direction, in the current section

none of the results concerning the correlates of marijuana use cessation were found to support the present study's original hypotheses.

Prenatal Marijuana Exposure

In contrast to what was originally hypothesized, prenatal exposure to marijuana was not found to significantly decrease the odds of the cessation of regular marijuana use (i.e., use at least once a week) among adolescents in the OPPS, after controlling for prenatal exposure to alcohol and nicotine. Moreover, there was no evidence even suggesting the existence of a significant association between these two variables. As was previously mentioned, prenatal exposure to marijuana was found to be significantly associated with the initiation of marijuana use in the current study. Taken together, these findings appear to suggest that the initiation and cessation of marijuana use are two distinct processes, with the influence of prenatal marijuana exposure having a greater influence in the initiation of use, rather than the cessation of use. As one may recall, this hypothesis was also offered as a possible explanation of the nonsignificant association which was found between prenatal nicotine exposure and regular cigarette smoking cessation.

Another probable interpretation of this result, however, relates to the small sample size (i.e., 31) which was used. Thus, there may have been insufficient power in the current study to detect a significant association between prenatal marijuana exposure and the cessation of regular marijuana use. However, since this is the first investigation to date which has studied the effect of prenatal marijuana exposure on the cessation of

regular marijuana use, further research must be conducted with larger sample sizes prior to drawing any firm conclusions regarding the potential effect of this variable.

Peer Influences

Another somewhat unexpected result obtained in the present investigation was that the proportion of one's peers who have tried cigarettes was discovered to be the only peer influence variable that was significantly associated with the OPPS adolescents' cessation of regular marijuana use. More specifically, youth who reported that the majority of their friends have tried smoking cigarettes were found to be less likely to discontinue the regular use of marijuana.

In interpreting this result, it appears that peers' cigarette smoking is more influential than peers' use of marijuana in relation to adolescents' cessation of regular marijuana use. Given that a sample size of only 31 participants was used in generating this result, however, there is the possibility that this may be a spurious finding. Therefore, future research with larger sample sizes is needed prior to drawing any conclusions regarding the effects of peer influences on adolescent regular marijuana use cessation.

It is of relevance to note that other studies in the marijuana use cessation literature have found a number of other peer variables to be linked with adolescents' cessation of marijuana use including peers' use of marijuana and their disapproval of this drug (Chen & Kandel, 1998; Sussman & Dent, 1999). None of these peer influences, however, were found to reach statistical significance in the current study. Therefore, it is quite possible

that the small size of the sample is the reason underlying the general lack of significant results in relation to marijuana use cessation.

Influence of Attitudes

Associations between adolescents' attitudes and their cessation of marijuana use have been reported in the literature. Among the attitudes which appear to be the most influential in the quitting process are adolescents' perceived risk of marijuana use (especially the physiological and psychological effects of the drug; Bailey et al., 1992; Chen & Kandel, 1998; Goodstadt et al., 1984; Stephens et al., 1993), their own disapproval of marijuana use (Sussman & Dent, 1999), and their perceived disapproval from friends for using marijuana (Chen & Kandel, 1998; Sussman & Dent, 1999). Based on these findings in the literature, it was hypothesized that similar associations would be observed in the current study. Contrary to these original hypotheses, however, none of the attitudinal measures were found to be correlated with the cessation of regular marijuana use. Since a small sample size was used in generating these results, it is very likely that there was insufficient power to detect a significant association between these attitudinal measures and the cessation of regular marijuana use.

Differences Between Prenatal Drug Exposure Groups and Gender

Another objective of the present study was to determine the extent to which the influences of adolescents' attitudes towards drugs and their peers differed between those youth who were prenatally exposed to differing levels of nicotine and marijuana and those who were not, and to identify any potential sex differences. Results revealed that

both adolescents' attitudes towards drugs and their peer influences differed as a function of their level of prenatal drug exposure and their gender. Findings pertaining to each of these two variables are discussed separately below.

Prenatal Drug Exposure Group Differences

Adolescents' attitudes towards drugs and their peer influences were both found to differ as a function of prenatal drug exposure in the current study. To begin, youth in the OPPS who were heavily exposed to nicotine prenatally (i.e., ≥ 16 mg nicotine/day) were found to have reported significantly less disapproval and less perceived peer disapproval of cigarette smoking as compared to those adolescents in the sample who were not prenatally exposed to this substance, after statistically controlling for potentially confounding variables. Findings from the present study also revealed that youth who were heavily exposed to marijuana prenatally (i.e., ≥ 6 joints/week) reported having a significantly greater proportion of friends who regularly use marijuana as compared to those youth in the sample who were not prenatally exposed to this drug, after statistically controlling for potentially confounding variables.

One possible interpretation of these findings is that familial attitudes towards drugs are being transmitted to the offspring postnatally. As was hypothesized earlier in the Discussion, mothers who heavily smoked cigarettes or marijuana while they were pregnant were likely to have had more liberal attitudes towards drug use (especially towards the use of cigarettes and marijuana) than did those mothers who did not use these substances during pregnancy. Such maternal attitudes towards drug use may have then been passed on to the offspring postnatally, which in turn may have influenced their own

attitudes towards cigarettes and marijuana as well as their choice of peer group affiliation. This argument can only be made tenuously, however, since questions on familial attitudes towards drugs were not included in the instruments used in the current study.

It is also reasonable to posit that maternal drug use during pregnancy directly affects adolescents' attitudes towards drugs. That is, the nervous system damage caused by maternal drug use may create a vulnerability in the adolescent which could lead to poorer adjustment and an increased likelihood of early cigarette smoking or marijuana use initiation (Cornelius et al., 2000). Such a vulnerability, therefore, may also influence adolescents to have more favourable attitudes toward cigarette smoking and other drugs, which may or may not in turn affect their choice of peer group affiliation. These prenatal drug exposure group differences may also be the result of inherited genotypes being passed down from the mother to the offspring.

To the best of the author's knowledge, the current study is the first to date which has looked for differences in attitudes towards drugs and peer influences between adolescents who were prenatally exposed to varying levels of nicotine or marijuana and those who not, and it provides some preliminary evidence that some differences do exist. Further research is needed, however, in order to replicate the prenatal drug group differences which were found in the present investigation and to better understand why these differences in adolescents' attitudes and peer influences are occurring.

Among the implications of these findings is that youth who have been heavily exposed to drugs prenatally may require a more tailored drug use prevention program than do adolescents who were not prenatally exposed to drugs. For instance, the current data suggest that youth who have been heavily exposed to nicotine prenatally may require

extra assistance in changing their attitudes toward cigarette smoking, particularly their levels of disapproval and perceived peer disapproval of this behaviour. Among those adolescents who have been heavily exposed to marijuana *in utero*, however, the emphasis in prevention programs should be placed on the negative consequences of having drug-using peers. Programs not only need to stress the importance of choosing friends who do not use drugs, but they also need to provide youth with strategies to help them move away from a predominately drug-using peer group. Techniques on how to resist pressure from drug-using peers to start using drugs would also be of benefit.

Gender Differences

Differences between the sexes in terms of their attitudes towards drugs and peer influences were also studied in the present investigation, and two gender differences were identified. As has been the case in previous sections of the Discussion, this portion has also been divided into "Expected" and "Unexpected Findings."

Expected Findings

First of all, it was found that adolescent males in the OPPS reported having a significantly greater proportion of friends who regularly use marijuana as compared to females, after statistically controlling for potentially confounding variables. Such a finding is not that surprising, however, given that the use of marijuana during adolescence is more prevalent among males than females (CAMH, 2001; Johnston et al., 2002a). Because of this important sex difference, male youth would undoubtedly have more marijuana using friends in their peer groups than would females, and as a result they

would be more exposed to peer group influences oriented around such substance use (Rutter, Giller, & Hagell, 1998). Interestingly, recent results from Griffin et al. (2002) have suggested that the influence of peers is more influential in males' regular use of marijuana than in that of females.

Taken together, these findings appear to suggest the need for separate substance use prevention programs for males and females. Given that adolescent males have been found to have a greater proportion of friends who regularly use marijuana than females, prevention efforts for boys may need to emphasize the negative consequences of selecting drug-using peers and provide strategies to assist them in adopting a more positive peer group. Such an interpretation is consistent with evidence from several substance use prevention programs indicating that they are not equally effective for boys and girls (Botvin et al., 1990; DeJong, 1987; Graham et al., 1990).

Unexpected Findings

Somewhat contrary to expectations, adolescent girls in the current study were found to have reported greater access to and greater perceptions of easy availability of marijuana as compared to boys, after statistically controlling for potentially confounding variables. Although a few studies to date have found that the perceived availability of marijuana relates to the actual initiation and use of this drug among youth (CAMH, 2001; Goodstadt et al., 1984; Smart, 1977), sex differences with respect to this factor have not yet been addressed. One possible explanation underlying this observed gender difference in the current study relates to the nature and characteristics of adolescent female peer groups. It has been consistently identified in the literature (e.g., Maccoby, 1990, 1998)

that friendships among girls during adolescence are much more intimate and involve much more disclosure than do the friendships of adolescent boys. As such, it is plausible that female adolescents more openly discuss issues surrounding involvement with marijuana use, such as their access to the drug and its perceived availability, than do their male counterparts.

One may also hypothesize that the reason why adolescent girls are reporting greater access to and greater perceptions of easy availability of marijuana is because at this period in social development, there is an increased involvement in heterosexual relationships (Bee, 2000). Since marijuana use during adolescence has been noted to be more common among males than females (CAMH, 2001; Johnston et al., 2002a), it stands to reason that in heterosexual relationships females would be frequently exposed to such behaviour. As a result, adolescent girls may perceive that it would be fairly easy for them to acquire marijuana if they so desired. This somewhat unexpected gender difference needs further research in other populations, however, in order for replication. A further examination of the implications for marijuana use prevention is also warranted.

Another somewhat unexpected finding in the current study was that no gender difference was found with respect to the OPPS adolescents' attitudes of perceived risk of marijuana use. Several studies in the literature have reported that males tend to have lower levels of perceived risk of marijuana use than females (Danseco et al., 1999; Pascale & Evans, 1993; Tyler & Lichtenstein, 1997). Based on the results of these studies, it was hypothesized that this gender difference would be replicated in the present study. It is unclear why this gender difference was not observed among the OPPS youth. One interpretation of this result is that there is in fact no difference between males and

females in the OPPS with respect to their levels of perceived risk of marijuana use.

Another possible interpretation of this result, however, may relate to the fact that a principal components analysis was employed in the current study as a data reduction scheme. As a result of the principal components analysis, the measures of adolescents' perceived risk of marijuana use were combined with those of their disapproval of marijuana use. Since the present study did not have a "pure" measure of perceived risk of marijuana use, this may explain why males were not found to have a lower level of perceived risk than females.

Progression of Drug Use

Although not a major focus in this study, the progression of substance use was examined among adolescents in the OPPS. As expected, youth in the current study were found to generally follow the typical sequence of drug use involvement that has been consistently identified in the literature (J.S. Brook, D.W. Brook, Arencibia-Mireles et al., 2001; Blaze-Temple & Lo, 1992; Huba et al., 1981; Kandel, 1975; Kandel et al., 1992). As previously mentioned, this sequence entails first using alcohol and/or cigarettes (often referred to as the licit drugs in the adolescent drug involvement literature) before moving onto the use of marijuana, followed by the use of illicit drugs other than marijuana. It is of interest to note that although alcohol and cigarettes are often termed "licit drugs" in the literature, this label may be somewhat of a misnomer since the age at which youth are initiating the use of these two substances is well before the age of 19, which is the legal age designated for purchasing and/or consuming alcohol and cigarettes in the province of Ontario, or even the age of 21, which is the designated legal age in the U.S (where the

majority of research has been conducted). Hence, it would seem more appropriate to refer to all drugs as illicit during the period of adolescence.

In the current study, the most commonly identified sequence of substance use was the initial use of alcohol and/or cigarettes followed by marijuana use, with 20.4% of the entire sample undergoing this substance use pathway. The present investigation also found, as did Huba and colleagues (1981) and Blaze-Temple and Lo (1992), that there was a direct path from alcohol and/or cigarette use to illicit drug use other than marijuana, in that 3.3% of the OPPS youth reported that they used illicit drugs other than marijuana without ever traversing the marijuana step.

From the results of this current work, however, one cannot infer that alcohol or cigarette use actually causes the use of marijuana and/or illicit drugs other than marijuana. Hence, Kandel and colleagues' (1992) warnings about what may be inferred from these results is worth repeating. The use of a particular drug does not inevitably lead to the use of other drugs higher up the sequence, although the use of a drug lower in the sequence is a good predictor of transition to the next stage after controlling for age and other covariates. Kandel stated that entry into a particular stage is a common and perhaps even a necessary although not a sufficient prerequisite for entry into the next higher stage, and that many adolescents stop at a particular stage without progressing any further. She also speculated upon drug use stages and the implication these have for prevention. In her view, since adolescents do not progress, on average, to a given stage without having experienced all prior stages, the population at risk for any given stage is that which has reached the preceding stages. In other words, non-cigarette smokers are not exposed to the risk of using marijuana. She does, however, admit that the timing of

movement from one stage to the next can be very short, for example, six months in some cases.

There are several implications for adolescent drug use prevention which can be derived from the work of Kandel and other researchers, as well as the present study. For instance, alcohol use and cigarette smoking prevention efforts should begin in a significant way, perhaps in the school setting, well before the age of 12 years if delaying the onset of use of these two substances is to be given good effect. It has not, however, been proven that delaying the onset of use of these two drugs will, in fact, have a spillover effect of reducing the numbers of youth who progress to a higher stage in the sequence of drug use. This problem definitely requires further investigation. The existence of a direct path to other illicit drug use which by-passes the marijuana step also needs further research in other populations as well as further examination of the implications for prevention.

Strengths and Limitations

There are several strengths and limitations associated with this research and these are summarized and discussed separately in the following section of the Discussion.

One of the important methodological strengths of the current study concerns the type of sample that was used. Unlike previous investigations which have typically involved samples of high-risk youth, the present investigation was comprised of a low-risk, predominately White, middle class sample of adolescents which may somewhat increase the generalizability of the findings. Another strength of this research is that a biochemical validation of the self-report recent drug use data was conducted via urine

analysis, which indicated that validity was not a major concern in this study. The current study also investigated a wide range of attitudinal and peer influence variables which previous theory and research indicate are important variables in the initiation and cessation of both cigarette smoking and marijuana use among youth. Thus, this comprehensive study was able to corroborate several previous findings in the adolescent drug involvement literature, and in many cases, extend these findings. Finally, a major methodological strength of the present work is the assessment of prenatal drug use during pregnancy, which minimizes problems that are associated with retrospective assessment. Although unwillingness to acknowledge cigarette smoking and/or marijuana use during pregnancy may now be a barrier to accurate self-report, the era in which this study began was before general knowledge about the dangers associated with cigarette smoking and marijuana use during pregnancy.

Nevertheless, in drawing conclusions from this study, one must consider its limitations. First of all, the data are cross-sectional; thus, observations from the current investigation are associations and they do not provide information about causal direction. Although cross-sectional studies can rule out possible causes when relationships between variables are not found, they do not, however, determine with certainty which variable came first. For example, peer influences may affect the initiation of drug use, but drug use behaviour also might lead to changes in adolescents' peer group affiliation, attitudes, and/or perceptions of social norms. Thus, it becomes very difficult to separate these individual effects and determine the direction of this relationship. Having prospective measures of the adolescents' attitudes towards drugs as well as their peer influences prior

to drug use initiation might offer some valuable insights into the causal direction of several associations which have been found in the current study.

Other important limitations of the present study concern the instruments that were used. Specifically, they did not contain questions about family influences (i.e., familial attitudes, patterns of use, etc.) on cigarette smoking and marijuana use. Because family members have consistently been found to influence adolescent cigarette smoking (Chassin et al., 1998; Conrad et al., 1992; Kandel & Wu, 1995) and marijuana use (Aseltine, 1995; Brook, Brook, De La Rosa et al., 2001; Hops et al., 1996) to some degree, further research should address both peer and family influences. Additionally, the measure of internal consistency reliability for the three items in the Drug History Questionnaire (DHQ) pertaining to adolescents' history and current use of marijuana was found to be somewhat low, with an alpha reliability coefficient of .40. Further work, therefore, should be directed at improving the internal consistency of these items. In fact, a more comprehensive examination of the psychometric qualities of both the DHQ and the Your Thoughts on Drugs Questionnaire (YTDQ) should also be addressed in future research.

As has been previously mentioned, another shortcoming of the current study is that it was not able to determine exactly how the influence of prenatal drug exposure contributes to the later initiation of cigarette smoking and marijuana use during adolescence. Although this was beyond the scope of this investigation, understanding the nature of this apparent relationship is important and thus, deserves further study. A number of factors could be accounting for this apparent relationship between prenatal nicotine and marijuana exposure and the subsequent initiation of use of these two drugs

including physiological changes associated with such exposure, the transmission of inherited genotypes, and the influence of parental postnatal attitudes towards drugs.

Sample sizes for the analyses concerning the cessation of drug use, particularly those pertaining to marijuana cessation, were small due to the limited number of participants who had reported ever regular use of cigarettes (i.e., smoking cigarettes at least once per day) or marijuana (i.e., using at least once per week) at some point in their lifetime. As a result of these small sample sizes, there may have been insufficient statistical power in the current study to detect significant results, thereby increasing the likelihood of Type II error. Since the present investigation is the first to examine the potential effects of prenatal nicotine and marijuana exposure on the cessation of regular cigarette smoking and marijuana use, further research must be conducted with larger sample sizes before making any firm conclusions regarding the potential effects of prenatal drug exposure on regular drug use cessation. Larger sample sizes would also permit separate analyses to be conducted for each gender, allowing one to corroborate and study new sex differences with respect to the correlates of cigarette smoking and marijuana use initiation.

Another concern of this research that should be noted is that the significant relationships among the variables measured may partly reflect shared method variance since all of the data was obtained by self-report questionnaires. The measurement of peer influence in the current study may also be somewhat limited by the adolescents' self-report of the proportion of their peers who have tried and who regularly use cigarettes and marijuana. In the cigarette literature, it has been shown that adolescent smokers, in particular experimental and regular smokers, tend to overestimate the prevalence of

cigarette smoking among peers and erroneously inflate the correlation between self and friends' behaviour (Urberg, Shyu, & Liang, 1990). Regardless, what remains clear is the significant influence of peers on adolescents' initiation and cessation of cigarette smoking and marijuana use.

The present study also did not look at interactions between predictor variables, and therefore the effects of some correlates may be more complex than this study was able to identify.

A final limitation of the current study relates to the generalizability of the sample. As has been previously discussed, the OPPS is a predominately White, middle-class, low-risk sample. Therefore, the findings in the present study may not be generalizable to other ethnic groups or other samples of youth that are not similarly low-risk. The representativeness of the OPPS sample is also questionable given that it was selected based on the drug use habits of the adolescents' mothers while they were pregnant.

Future Directions for Research

The results from the current investigation generate some important research questions for further study. A number of these have already been addressed in previous sections of the Discussion and have not been repeated here for the sake of brevity.

One of the important findings of this study was that prenatal exposure to nicotine and marijuana significantly increased the odds of cigarette smoking initiation, while *in utero* exposure to marijuana also significantly increased the odds of initiating the use of this substance. In order to achieve adequate levels of statistical power in this research, the prenatal drug exposure variables were dichotomized into two categories: no exposure

and exposure. Therefore, it remains unclear as to whether or not there is a dose-response relationship between the odds of drug use initiation and prenatal drug exposure. Further research with larger sample sizes is needed in order to address this issue. Additional research is also needed to understand how the influence of prenatal drug exposure contributes to the later initiation of cigarette smoking and marijuana use during adolescence.

Many drug use prevention programs have overlooked the issue of cessation among adolescents (CAMH, 1999). Only a few cessation programs are constructed for this group of individuals, which are based mostly on adult approaches or on the determinants of drug use initiation. Although the current study is not conclusive about the correlates of quitting, some recommendations have been formulated. As a result of this paucity of research concerning effective drug use cessation programs for youth, this issue should be put high on the research agenda.

Further research should also investigate the differential prediction and/or association of cigarette smoking and marijuana use initiation and cessation by gender and also by ethnicity. It will also be important to examine how interactions among predictors and/or correlates explain the initiation and cessation of cigarette smoking and marijuana use.

Summary and Conclusions

The current study has corroborated several previous reports in the adolescent drug involvement literature and in some cases, it has extended these findings. The primary objective of this research was to examine the correlates of cigarette smoking and

marijuana use initiation and cessation among the offspring of maternal drug users, and the findings suggest that a number of biological, social, and attitudinal factors are in fact relevant. The major correlates of the OPPS adolescents' initiation of cigarette smoking were their attitudes of disapproval and perceived risk of marijuana use, and the proportion of their friends who regularly smoke cigarettes. Youth who reported greater attitudes of disapproval and perceived risk of marijuana use were found to be at decreased odds for cigarette smoking initiation; adolescents who reported that most or all of their friends regularly smoke were at increased odds for cigarette smoking initiation. Among the implications of these results was the potential impact that decriminalization of marijuana may have on rates of cigarette smoking initiation among Canadian youth.

In terms of the cessation of regular cigarette smoking, youths' attitudes of disapproval and perceived peer disapproval of cigarette smoking and the proportion of their peers who regularly smoke cigarettes were found to be the most influential correlates. That is, adolescents who reported greater disapproval and perceived peer disapproval of cigarette smoking were more likely to quit smoking on a regular basis. However, those youth who reported that most or all of their friends regularly smoke cigarettes were found to be less likely to discontinue the regular use of cigarettes.

Several variables were also found to be major correlates of the initiation of marijuana use, including adolescents' attitudes of disapproval and perceived risk of marijuana use and their perceived peer disapproval of cigarette smoking and marijuana use. Youth who reported greater disapproval, perceived risk, and perceived peer disapproval were found to be less likely to initiate using marijuana. The proportion of one's peers who have tried marijuana was also found to be significantly associated with

adolescents' initiation of marijuana use such that youth were more likely to initiate using marijuana if they reported that the majority of their friends have tried using this drug.

With respect to the cessation of regular marijuana use, the present investigation showed that only the proportion of peers who have tried cigarette smoking was significant, indicating that adolescents who reported that most or all of their friends have tried smoking cigarettes were found to be less inclined to quit using marijuana on a regular basis.

In conclusion, the results from this investigation suggest that adolescent cigarette smoking and marijuana use are both complex and dynamic processes with somewhat interrelated etiologies. In order to be effective, it is essential that youth prevention and cessation programs aimed at these two drugs adopt multidimensional approaches.

The present study has also identified several differences in adolescents' attitudes towards drugs and their peer influences as a function of both their level of prenatal exposure to nicotine and marijuana and gender. In terms of the prenatal drug exposure group differences, this study showed that adolescents who were heavily exposed to nicotine prenatally reported significantly less disapproval and perceived peer disapproval of cigarette smoking as compared to those youth who were not prenatally exposed to this substance. Another interesting prenatal drug exposure group difference which emerged from the data concerned the proportion of one's peers who regularly use marijuana. More specifically, it was found that youth who were heavily exposed to marijuana prenatally reported having a significantly greater proportion of friends who regularly use marijuana, as compared to those who were not prenatally exposed. It was hypothesized that a number of contributing factors may be underlying these observed prenatal drug exposure

group differences including physiological changes that are associated with prenatal drug exposure, the influence of familial attitudes, and the transmission of inherited genotypes.

With respect to sex differences, this investigation showed that males in the OPPS reported having a significantly greater proportion of peers who regularly use marijuana as compared to females. Somewhat unexpectedly, however, results indicated that female adolescents reported significantly greater access to and greater perceptions of easy availability of marijuana than did the males in the OPPS, possibly as a result of their increased involvement in heterosexual relationships during this period in development. Such findings appear to suggest the need for separate substance use prevention programs for males and females.

Finally, the well-established progression of substance use was identified among the OPPS youth. That is, adolescents generally first begin using alcohol and/or cigarettes, then marijuana, followed by the use of other illicit drugs.

References

References marked with an asterisk indicate studies included in the meta-analysis.

- Adlaf, E.M., Paglia, A., Ivis, F.J., & Ialomiteanu, A. (2000). Nonmedical drug use among students: Highlights from the 1999 Ontario Student Drug Use Survey. *Canadian Medical Association Journal*, 162, 1677-1680.
- Adler, I., & Kandel, D.B. (1981). Cross-cultural perspectives on developmental stages in adolescent drug use. *Journal of Studies on Alcohol*, 42, 701-715.
- Aiken, L.R. (1997). *Psychological testing and assessment* (9th ed.). Needham Heights, MA: Allyn & Bacon.
- Akers, R.L., Krohn, M.D., Lanza-Kaduce, L., & Radosevich, M. (1979). Social learning and deviant behaviour: A specific test of a general theory. *American Sociological Review*, 44, 636-655.
- Anthony, J.C., Warner, L.A., & Kessler, R.C. (1994). Comparative epidemiology of dependence on tobacco, alcohol, controlled substances, and inhalants: Basic findings from the National Comorbidity Survey. *Experimental and Clinical Psychopharmacology*, 2, 244-268.
- Armstrong, B.K., de Klerk, N.H., Shean, R.E., Dunn, D.A., & Dolin, P.J. (1990). Influence of education and advertising on the uptake of smoking by children. *Medical Journal of Australia*, 152, 117-124.
- Aseltine, R.H. (1995). A reconsideration of parental and peer influences on adolescent deviance. *Journal of Health and Social Behaviour*, 36, 103-121.
- Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1981). Smoking, drinking and drug use among American high school students: Correlates and trends, 1975-1979.

American Journal of Public Health, 71, 59-69.

- Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1991). How changes in drug use are linked to perceived risks and disapproval: Evidence from national studies that youth and young adults respond to information about the consequences of drug use. In L. Donohew, H.E. Sypher, & W.J. Bukoski (Eds.), *Persuasive communication and drug abuse prevention* (pp. 133-155). Hillsdale, NJ: Erlbaum.
- Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (1998). Explaining recent increases in students' marijuana use: Impacts of perceived risks and disapproval, 1976 through 1996. *American Journal of Public Health, 88, 887-892.*
- Bachman, J.G., Johnston, L.D., & O'Malley, P.M. (2001). *The Monitoring the Future project after twenty-seven years: Design and procedures*. (Monitoring the Future Occasional Paper No. 54). Ann Arbor, MI: Institute for Social Research.
- Bachman, J.G., O'Malley, P.M., Schulenberg, J.E., Johnston, L.D., Bryant, A.L., & Merline, A.C. (2002). *The decline of substance use in young adulthood: Changes in social activities, roles, and beliefs*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Bachman, J.G., Wadsworth, K., O'Malley, P.M., Johnston, L.D., & Schulenberg, J. (1997). *Smoking, drinking, and drug use in young adulthood: The impact of new freedoms and new responsibilities*. Hillsdale, NJ: Lawrence Erlbaum.
- Bailey, S.L., Flewelling, R.L., & Rachal, J.V. (1992). Predicting continued use of marijuana among adolescents: The relative influence of drug-specific and social context factors. *Journal of Health and Social Behaviour, 33, 51-66.*
- Bailey, S.L., & Hubbard, R.L. (1990). Developmental variation in the context of

- marijuana initiation among adolescents. *Journal of Health and Social Behaviour*, 31, 58-70.
- Bandura, A. (1969). Social-learning theory of identificatory processes. In D.A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 213-262). Chicago: Rand McNally.
- Bandura, A. (1982). Self-efficacy mechanisms in human agency. *American Psychologist*, 37, 122-147.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. New York: Prentice-Hall.
- Barber, J.G., Bolitho, F., & Bertrand, L.D. (1999). The predictors of adolescent smoking. *Journal of Social Service Research*, 26, 51-66.
- Bauman, K.E., Foshee, V.A., Linzer, M.A., & Koch, G.G. (1990). Effect of parental smoking classification on the association between parental and adolescent smoking. *Addictive Behaviours*, 15, 413-422.
- Bayley, N. (1974). Research in child development: A longitudinal perspective. In R. Liebert, R. Poulos, & G. Strauss (Eds.), *Developmental psychology* (pp. 334-381). Englewood Cliffs, NJ: Prentice-Hall.
- Bee, H. (2000). *The developing child* (9th ed.). Needham Heights, MA: Allyn & Bacon.
- Bierut, L.J., Dinwiddie, S.H., Begleiter, H., Crowe, R.R., Hesselbrock, V., Nurnberger, J.I., et al. (1998). Familial transmission of substance dependence: Alcohol, marijuana, cocaine, and habitual smoking: A report from the Collaborative Study on the Genetics of Alcoholism. *Archives of General Psychiatry*, 55, 982-988.

- Blaze-Temple, D., & Lo, S.K. (1992). Stages of drug use: A community survey of Perth teenagers. *British Journal of Addiction*, 87, 215-225.
- Botvin, G.J., Baker, E., Filazzola, A.D., & Botvin, E.M. (1990). Cognitive-behavioural approach to substance use prevention: One year follow-up. *Addictive Behaviours*, 15, 47-63.
- Botvin, G.J., Baker, E., Goldberg, C.J., Dusenbury, L., & Botvin, E.M. (1992). Correlates and predictors of smoking among black adolescents. *Addictive Behaviours*, 17, 97-103.
- Botvin, G.J., Eng, A., & Williams, C.L. (1980). Preventing the onset of cigarette smoking through life skills training. *Preventive Medicine*, 9, 135-143.
- Box, G.E.P. (1949). A general distribution theory for a class of likelihood criteria. *Biometrika*, 36, 317-346.
- Breslau, N., & Peterson, E.L. (1996). Smoking cessation in young adults: Age at initiation of cigarette smoking and other suspected influences. *American Journal of Public Health*, 86, 214-220.
- Brook, J.S., Brook, D.W., Arencibia-Mireles, O., Richter, L., & Whiteman, M. (2001). Risk factors for adolescent marijuana use across cultures and across time. *The Journal of Genetic Psychology*, 162, 357-374.
- Brook, J.S., Brook, D.W., De La Rosa, M., Whiteman, M., Johnson, E., & Montoya, I. (2001). Adolescent illegal drug use: The impact of personality, family, and environmental factors. *Journal of Behavioural Medicine*, 24, 183-203.
- Brook, J.S., Whiteman, M., & Gordon, A.S. (1982). Qualitative and quantitative aspects of adolescent drug use: Interplay of personality, family, and peer correlates.

Psychological Reports, 51, 1151-1163.

- Brook, J.S., Whiteman, M., & Gordon, A.S. (1983). Stages of drug use in adolescence: Personality, peer, and family correlates. *Developmental Psychology, 19*, 269-277.
- Brook, U., Feigin, R., Sherer, M., & Geva, D. (2001). Prevalence, attitudes and knowledge of high school pupils towards drugs and other addictions: Implications for school health education in Israel. *Patient Education and Counseling, 43*, 199-204.
- Brownson, R.C., DiLorenzo, T.M., Van Tuinen, M., & Finger, W.W. (1990). Patterns of cigarette and smokeless tobacco use among children and adolescents. *Preventive Medicine, 19*, 170-180.
- Brunswick, A.F., & Boyle, J.M. (1979). Patterns of drug involvement: Developmental and secular influences on age at initiation. *Youth and Society, 11*, 139-162.
- Burchfiel, C.M., Higgins, M.W., Keller, J.B., Butler, W.J., & Donahue, R.P. (1989). Initiation of cigarette smoking in children and adolescents of Tecumseh, Michigan. *American Journal of Epidemiology, 130*, 410-415.
- Burt, R.D., & Peterson, A.V. (1998). Smoking cessation among high school seniors. *Preventive Medicine, 27*, 319-327.
- Centre for Addiction and Mental Health. (1999). *CAMH Best Advice Paper: Alcohol and Drug Prevention Programs for Youth: What Works?* Retrieved July 21, 2003, from http://www.camh.net/best_advice/best_prevention_youth.html
- Centre for Addiction and Mental Health. (2001). *Drug Use Among Ontario Students 1977-2001: Findings from the Ontario Student Drug Use Survey*. Retrieved January 14, 2002, from

http://www.camh.net/press_releases/osdus_200119nov2001.html

Centers for Disease Control and Prevention. (1998a). Tobacco use among high school students - United States, 1997. *Morbidity and Mortality Weekly Report*, 47, 229-233.

Centers for Disease Control and Prevention. (1998b). Selected cigarette smoking initiation and quitting behaviours among high school students - United States, 1997. *Morbidity and Mortality Weekly Report*, 47, 386-389.

*Charlton, A., & Blair, V. (1989). Predicting the onset of smoking in boys and girls. *Social Science and Medicine*, 29, 813-818.

Chassin, L., Presson, C.C., & Sherman, S.J. (1984). Cognitive and social influence factors in adolescent smoking cessation. *Addictive Behaviours*, 9, 383-390.

*Chassin, L., Presson, C.C., Sherman, S.J., Corty, E., & Olshavsky, R.W. (1984). Predicting the onset of cigarette smoking in adolescents: A longitudinal study. *Journal of Applied Social Psychology*, 14, 224-243.

*Chassin, L., Presson, C.C., Sherman, S.J., Montello, D., & McGrew, J. (1986). Changes in peer and parent influence during adolescence: Longitudinal versus cross-sectional perspectives on smoking initiation. *Developmental Psychology*, 22, 327-334.

Chassin, L., Presson, C.C., Todd, M., Rose, J.S., & Sherman, S.J. (1998). Maternal socialization of adolescent smoking: The intergenerational transmission of parenting and smoking. *Developmental Psychology*, 34, 1189-1201.

Chen, J., & Millar, W.J. (1998). Age of smoking initiation: Implications for quitting. *Health Report*, 9, 39-46.

- Chen, K., & Kandel, D.B. (1995). The natural history of drug use in a general population sample from adolescence to the mid-thirties. *American Journal of Public Health*, 85, 41-47.
- Chen, K., & Kandel, D.B. (1998). Predictors of cessation of marijuana use: An event history analysis. *Drug and Alcohol Dependence*, 50, 109-121.
- Christie, P., Cormack, S., Wyllie, C., & Bungey, J. (1989). *Survey of alcohol, tobacco and other drug use by south Australian school children, 1987: Final report*. Adelaide: Drug and Alcohol Services Council.
- Clayton, S. (1991). Gender differences in psychosocial determinants of adolescent smoking. *Journal of School Health*, 61, 115-120.
- Coambs, R.B., Li, S., & Kozlowski, L.T. (1992). Age interacts with heaviness of smoking in predicting success in cessation of smoking. *American Journal of Epidemiology*, 135, 240-246.
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. New York: Academic Press.
- Cohen, L.D., MacFarlane, S., Yanez, C., & Imai, W.K. (1995). Risk perception: Differences between adolescents and adults. *Health Psychology*, 14, 217-222.
- Collins, A.C. (1990-1991). Genetic influences on tobacco use: A review of human and animal studies. *International Journal of the Addictions*, 25, 35-55.
- Como-Lesko, N., Primavera, L.H., & Szesko, P.R. (1994). Marijuana usage in relation to harmfulness ratings, perceived likelihood of negative consequences, and defense mechanisms in high school students. *American Journal of Drug and Alcohol Abuse*, 20, 301-315.

- Conrad, K.M., Flay, B.R., & Hill, D. (1992). Why children start smoking cigarettes: Predictors of onset. *British Journal of Addiction*, 87, 1711-1724.
- Cornelius, M.D., & Day, N.L. (2000). The effects of tobacco use during and after pregnancy on exposed children: Relevance of findings for alcohol research. *Alcohol Research & Health*, 24, 242-249.
- Cornelius, M.D., Leech, S.L., Goldschmidt, L., Lebow, H., & Day, N.L. (2000). Prenatal tobacco exposure: Is it a risk factor for early tobacco experimentation? *Nicotine and Tobacco Research*, 2, 45-52.
- Cornelius, M.D., Taylor, P.M., Geva, D., & Day, N.L. (1995). Prenatal tobacco and marijuana use among adolescents: Effects on offspring gestational age, growth, and morphology. *Pediatrics*, 95, 738-743.
- Corrigall, W.A. (1991). Understanding brain mechanisms in nicotine reinforcement. *British Journal of Addiction*, 86, 507-510.
- Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.
- Curran, P.J., Stice, E., & Chassin, L. (1997). The relation between adolescent alcohol use and peer alcohol use: A random coefficients model. *Journal of Consulting and Clinical Psychology*, 65, 130-140.
- Csikszentmihalyi, M., Larson, R., & Prescott, S. (1977). The ecology of adolescent activity and experience. *Journal of Youth and Adolescence*, 6, 281-294.
- Dani, J., & Heinemann, S. (1996). Molecular and cellular aspects of nicotine abuse. *Neuron*, 16, 905-908.

- Dansecu, E.R., Kingery, P.M., & Coggeshall, M.B. (1999). Perceived risk of harm from marijuana use among youth in the USA. *School Psychology International*, 20, 39-56.
- Derzon, J.H., & Lipsey, M.W. (1999). What good predictors of marijuana use are good for. *School Psychology International*, 20, 69-85.
- DeJong, W. (1987). A short-term evaluation of Project DARE (Drug Abuse Resistance Education): Preliminary indications of effectiveness. *Journal of Drug Education*, 17, 279-294.
- de Vries, H., & Kok, G. (1986). From determinants of smoking behaviour to the implications for a prevention program. *Health Education Research*, 1, 85-94.
- DiFranza, J.R., Rigotti, N.A., McNeill, A.D., Ockene, J.K., Savageau, J.A., St. Cyr, D., et al. (2000). Initial symptoms of nicotine dependence in adolescents. *Tobacco Control*, 9, 313-319.
- Donovan, J.E., & Jessor, R. (1983). Problem drinking and the dimension of involvement with drugs: A guttman scalogram analysis of adolescent drug use. *American Journal of Public Health*, 73, 543-552.
- Downs, W.R. (1987). A panel study of normative structure, adolescent alcohol use and peer alcohol use. *Journal of Studies on Alcohol*, 48, 167-175.
- Duitsman, D.M., & Colbry, S.L. (1995). Perceived risk and use as predictors of substance use among college students. *Health Values*, 19, 44-52.
- Duncan, T.E., Duncan, S.C., & Hops, H. (1996). The role of parents and older siblings in predicting adolescent substance use: Modeling development via structural equation latent growth methodology. *Journal of Family Psychology*, 10, 158-172.

- Duncan, T.E., Duncan, S.C., & Hops, H. (1998). Progressions of alcohol, cigarette, and marijuana use in adolescence. *Journal of Behavioural Medicine*, 21, 375-388.
- Eagly, A.H., & Chaiken, S. (1993). *The psychology of attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Eagly, A.H., & Chaiken, S. (1998). Attitude structure and function. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol 1, pp. 269-322). New York: McGraw-Hill.
- Eaves, L.J., & Eysenck, H.J. (1980). *Are twins enough? The analysis of family and adoption data. The causes and effects of smoking* (pp. 236-282). London: Maurice Temple Smith.
- Eiser, J.R., van de Pligt, J., Raw, M., & Sutton, S.R. (1985). Trying to stop smoking: Effects of perceived addiction, attributions to failure, and expectancy of success. *Journal of Behavioural Medicine*, 8, 321-341.
- Ellickson, P.L., Tucker, J.S., & Klein, D.J. (2001). Sex differences in predictors of adolescent smoking cessation. *Health Psychology*, 20, 186-195.
- Ellis, G., & Stone, L.H. (1979). Marijuana use in college: An examination of a modeling explanation. *Youth and Society*, 10, 323-334.
- Engels, R.C.M.E., Knibbe, R.A., de Vries, H., & Drop, M.J. (1998). Antecedents of smoking cessation among adolescents: Who is motivated to change? *Preventive Medicine*, 27, 348-357.
- Ennett, S.T., & Bauman, K.E. (1994). The contribution of influence and selection to adolescent peer group homogeneity: The case of adolescent cigarette smoking. *Journal of Personality and Social Psychology*, 67, 653-663.

- Ensminger, M.E., Brown, C.H., & Kellam, S.G. (1982). Sex differences in antecedents of substance use among adolescents. *Journal of Social Issues*, 38, 25-42.
- Epstein, J. (1989). The selection of friends. In T. Berndt & G. Ladd (Eds.), *Peer relationships in child development*. New York: Wiley.
- Ernst, M., Moolchan, E.T., & Robinson, M.L. (2001). Behavioural and neural consequences of prenatal exposure to nicotine. *Journal of the American Academy of Child and Adolescent Psychiatry*, 40, 630-642.
- Ershler, J., Leventhal, H., Fleming, R., & Glynn, K. (1989). The quitting experience for smokers in sixth through twelfth grades. *Addictive Behaviours*, 14, 365-378.
- Evans, R.I., Hansen, W.B., & Mittelmark, M.B. (1977). Increasing the validity of self-reports of smoking behaviour in children. *Journal of Applied Psychology*, 62, 521-523.
- Evans, R.I., Smith, C.K., & Raines, B.E. (1984). Deterring cigarette smoking in adolescents: A psycho-social-behavioural analysis of an intervention strategy. In A. Baum, J. Singer, & S. Taylor (Eds.), *Social psychological aspects of health* (Vol. 4, pp. 301-318). Hillsdale, NJ: Erlbaum.
- Fagerstrom, K.O., Kunze, M., Schoberberger, J.C., Breslau, N., Hughes, J.R., Puska, P., et al. (1996). Nicotine dependence versus smoking prevalence. *Tobacco Control*, 5, 52-56.
- Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin*, 116, 429-456.
- Fergusson, D.M., & Horwood, L.J. (1997). Early onset cannabis use and psychosocial adjustment in young adults. *Addiction*, 93, 279-296.

- Fiore, M.C. (1992). Trends in cigarette smoking in the United States: The epidemiology of tobacco use. *The Medical Clinics of North America*, 76, 289-303.
- Flay, B., Hu, F.B., Siddiqui, O., Ray, L.E., Hedeker, D., Petraitis, J., et al. (1994). Differential influence of parental smoking and friends' smoking on adolescent initiation and escalation of smoking. *Journal of Health and Social Behaviour*, 35, 248-265.
- Fleming, R., Leventhal, H., Glynn, K., & Ershler, J. (1989). The role of cigarettes in the initiation and progression of early substance use. *Addictive Behaviours*, 14, 261-272.
- Foon, A.E. (1986). Smoking prevention on programs for adolescents: The value of social psychological approaches. *International Journal of the Addictions*, 21, 1017-1029.
- French, S.A., & Perry, C.L. (1996). Smoking among adolescent girls: Prevalence and etiology. *Journal of the American Medical Womens Association*, 51, 25-28.
- Fried, J.L. (1994). Women and young girls: High-risk populations for tobacco use. *Health Values*, 18, 33-40.
- Fried, P.A. (1992). Clinical implications of smoking: Determining long-term teratogenicity. In I.S. Zagon & T.A. Slotkin (Eds.), *Maternal substance use and the developing nervous system* (pp. 77-96). San Diego, CA: Academic Press.
- Fried, P.A. (1993). Prenatal exposure to tobacco and marijuana: Effects during pregnancy, infancy, and early childhood. *Clinical Obstetrics and Gynecology*, 36, 319-337.
- Fried, P.A. (1995). Prenatal exposure to marihuana and tobacco during infancy, early and

middle childhood: Effects and an attempt at synthesis. *Archives of Toxicology*, 17, 233-260.

Fried, P.A., Innes, K., & Barnes, M. (1984). Soft drug use prior to and during pregnancy: A comparison of samples over a four-year period. *Drug and Alcohol Dependence*, 13, 161-176.

Fried, P.A., & Watkinson, B. (1988). 12- and 24-month neurobehavioral follow-up of children prenatally exposed to marihuana, cigarettes and alcohol. *Neurotoxicology and Teratology*, 10, 305-313.

Fried, P.A., & Watkinson, B. (1990). 36- and 48-month neurobehavioral follow-up of children prenatally exposed to marihuana, cigarettes and alcohol. *Journal of Developmental and Behavioral Pediatrics*, 11, 49-58.

Fried, P.A., & Watkinson, B. (2000). Visuo perceptual functioning differs in 9- to 12-year olds prenatally exposed to cigarettes and marihuana. *Neurotoxicology and Teratology*, 22, 11-20.

Fried, P.A., Watkinson, B., Grant, A., & Knights, R.K. (1980). Changing patterns of soft drug use prior to and during pregnancy: A prospective study. *Drug and Alcohol Dependence*, 6, 323-343.

Fried, P.A., Watkinson, B., & Gray, R. (1992). A follow-up study of attentional behaviour in 6-year-old children exposed prenatally to marihuana, cigarettes, and alcohol. *Neurotoxicology and Teratology*, 14, 299-311.

Fried, P.A., Watkinson, B., & Gray, R. (1998). Differential effects on cognitive functioning in 9- to 12-year olds prenatally exposed to cigarettes and marihuana. *Neurotoxicology and Teratology*, 20, 293-306.

- Fried, P.A., Watkinson, B., & Gray, R. (1999). Growth from birth to early adolescence in offspring prenatally exposed to cigarettes and marijuana. *Neurotoxicology and Teratology*, 21, 513-525.
- Fried, P.A., Watkinson, B., James, D., & Gray, R. (2002). Current and former marijuana use: Preliminary findings of a longitudinal study of effects on IQ in young adults. *Canadian Medical Association Journal*, 166, 887-891.
- Gilvarry, E. (2000). Substance abuse in young people. *Journal of Child Psychology and Psychiatry*, 41, 55-80.
- Glass, M., Dragunow, M., & Faull, R.L.M. (1997). Cannabinoid receptors in the human brain: A detailed anatomical and quantitative autoradiographic study in the fetal, neonatal and adult human brain. *Neuroscience*, 77, 299-318.
- Glynn, T.J. (1981). From family to peer: A review of transitions of influence among drug-using youth. *Journal of Youth and Adolescence*, 10, 363-383.
- *Goddard, E. (1990). *Why children start smoking: An enquiry carried out by Social Service Division of OPCS on behalf of the Department of Health*. London: HMSO.
- Goldschmidt, L., Day, N.L., & Richardson, G.A. (2000). Effects of prenatal marijuana exposure on child behaviour problems at age 10. *Neurotoxicology and Teratology*, 22, 325-336.
- Gonzalez, G.M., & Haney, M.L. (1990). Perceptions of risk as predictors of alcohol, marijuana, and cocaine use among college students. *Journal of College Student Development*, 31, 313-318.

- Goodstadt, M.S., Sheppard, M.A., & Chan, G.C. (1984). Non-use and cessation of cannabis use: Neglected foci of drug education. *Addictive Behaviours*, 9, 21-31.
- Graham, J.W., Johnson, C.A., Hansen, W.B., Flay, B.R., & Gee, M. (1990). Drug use prevention programs, gender, and ethnicity: Evaluation of three seventh-grade Project SMART cohorts. *Preventive Medicine*, 19, 305-313.
- Griesler, P., Kandel, D., & Davies, M. (1998). Maternal smoking in pregnancy, child behaviour problems and adolescent smoking. *Journal of Research on Adolescence*, 8, 159-185.
- Griffin, K.W., Botvin, G.J., Doyle, M.M., Diaz, T., & Epstein, J.A. (1999). A six-year follow-up study of determinants of heavy cigarette smoking among high-school seniors. *Journal of Behavioural Medicine*, 22, 271-284.
- Griffin, K.W., Botvin, G.J., Scheier, L.M., & Nichols, T.R. (2002). Factors associated with regular marijuana use among high school students: A long-term follow-up study. *Substance Use & Misuse*, 37, 225-238.
- Gruber, A., & Pope, H.R., Jr. (2002). Marijuana use among adolescents. *Pediatric Clinics of North America*, 49, 389-413.
- Grunberg, N.E., Winders, S.E., & Wewers, M.E. (1991). Gender differences in tobacco use. *Health Psychology*, 10, 143-153.
- Hall, W., Johnston, L., & Donnelly, N. (1999). The epidemiology of cannabis use and its consequences. In H. Kalant, W. Corrigal, W. Hall, & R. Smart (Eds.), *The health effects of cannabis* (pp. 71-125). Toronto: Addiction Research Foundation.
- Hamburg, B.A., Kraemer, H.C., & Jahnke, W. (1975). A hierarchy of drug use in adolescence: Behavioural and attitudinal correlates of substantial drug use.

American Journal of Psychiatry, 132, 1155-1163.

- Hansen, W.B., Collins, L.M., Johnson, C.A., & Graham, J.W. (1985). Self-initiated smoking cessation among high school students. *Addictive Behaviours*, 10, 265-271.
- Heath, A.C., Cates, R.C., Martin, N.G., Meyer, J., Hewitt, J.K., Neale, M.C., et al. (1993). Genetic contribution to risk of smoking initiation: Comparisons across birth cohorts and across cultures. *Journal of Substance Abuse*, 5, 221-246.
- Health Canada. (2002). *Canadian Tobacco Use Monitoring Survey - February to June 2001*. Retrieved January 21, 2002, from http://www.hc-sc.gc.ca/hppb/tobacco/ctums_splash_2001.html
- Heath, A.C., & Martin, N.G. (1993). Genetic models for the natural history of smoking: Evidence for a genetic influence on smoking persistence. *Addictive Behaviours*, 18, 19-34.
- Hellstrom-Lindahl, E., & Nordberg, A. (2002). Smoking during pregnancy: A way to transfer the addiction to the next generation? *Respiration*, 69, 289-293.
- Helmstadter, G.C. (1964). *Principles of psychological measurement*. Englewood Cliffs, NJ: Prentice Hall.
- Hemmelstein, N. (1995). Adolescent marijuana use and perception of risk. *Journal of Alcohol and Drug Education*, 41, 1-15.
- Hops, H., Duncan, T.E., Duncan, S.C., & Stoolmiller, M. (1996). Parent substance use as a predictor of adolescent use: A six-year lagged analysis. *Annals of Behavioural Medicine*, 18, 157-164.
- Hu, F., Flay, B., Hedeker, D., Siddiqui, O., & Day, L. (1995). The influences of friends'

- and parental smoking on adolescent smoking behaviour: The effects of time and prior smoking. *Journal of Applied Social Psychology*, 25, 2018-2947.
- Huba, G.J., Wingard, J.A., & Bentler, P.M. (1981). A comparison of two latent variable causal models for adolescent drug use. *Journal of Personality and Social Psychology*, 40, 180-193.
- Hubbard, J.R., Franco, S.E., & Onaivi, E.S. (1999). Medical implications. *American Family Physicians*, 60, 2583-2593.
- Hughes, J.R. (1986). Genetics of smoking: A brief review. *Behaviour Therapy*, 17, 335-345.
- Hughes, J.R. (1993). Pharmacotherapy for smoking cessation: Unvalidated assumptions, anomalies, and suggestions for further research. *Journal of Consulting and Clinical Psychology*, 61, 751-760.
- Huizinga, D.H., & Elliott, D.S. (1981). *A Longitudinal Study of Drug Use and Delinquency in a National Sample of Youth: An Assessment of Causal Order*. A Report of the National Youth Survey (Project Report No. 16). Boulder, CO: Behavioural Research Institute.
- Jacobson, S.W., & Jacobson, J.L. (1996). Prospective, longitudinal assessment of developmental neurotoxicity. *Environmental Health Perspectives*, 104, 275-283.
- Jenkins, J.E., & Zunguze, S.T. (1998). The relationship of family structure to adolescent drug use, peer affiliation, and perception of peer acceptance of drug use. *Adolescence*, 33, 811-822.
- Jessor, R., & Jessor, S.L. (1977). *Problem behaviour and psychosocial development: A longitudinal study of youth*. New York: Academic Press.

- Jensen, E.J., & Overgaard, E. (1993). Investigation of smoking habits among 14-17-year-old boarding school pupils: Factors which influence smoking status. *Public Health, 107*, 117-123.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (1995). *National survey results on drug use from the Monitoring the Future study, 1975-1994. Volume I: Secondary school students* (NIH Pub. No. 95-4026). *Volume II: College students and young adults* (NIH Pub. No. 95-4027). Rockville, MD: National Institute on Drug Abuse.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (1996). *National survey results on drug use from the Monitoring the Future Study, 1975-1995* (NIH Publication No. 96-4139). Rockville, MD: National Institute on Drug Abuse.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (1998). *National survey results on drug use from the Monitoring the Future study, 1975-1997, Vol. 1*. Rockville, MD: National Institute on Drug Abuse.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (2001a). *Monitoring the Future national survey results on drug use, 1975-2000. Volume I: Secondary school students* (NIH Publication No. 01-4924). Bethesda, MD: National Institute on Drug Abuse.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (2001b). *Monitoring the Future national results on adolescent drug use: Overview of key findings, 2000* (NIH Publication No. 01-4923). Bethesda, MD: National Institute on Drug Abuse.
- Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (2002a). *Demographic subgroup trends for various licit and illicit drugs, 1975-2001* (Monitoring the Future

Occasional Paper No. 57). Ann Arbor, MI: Institute for Social Research.

Retrieved July 16, 2002, from

<http://monitoringthefuture.org/pubs/occpapers/occ57.pdf>

Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (2002b). *Monitoring the Future national survey results on drug use, 1975-2001. Volume 1: Secondary school students* (NIH Publication No. 02-5106). Bethesda, MD: National Institute on Drug Abuse.

Kaiser, H.F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement, 20*, 141-151.

Kandel, D. (1973). Adolescent marijuana use: Role of parents and peers. *Science, 181*, 1067-1070.

Kandel, D. (1975). Stages of adolescent involvement in drug use. *Science, 190*, 912-914.

Kandel, D. (1978). Convergences in prospective longitudinal surveys of drug use in normal populations. In D.B. Kandel (Ed.), *Longitudinal research on drug use: Empirical findings and methodological issues* (pp. 3-38). Washington, DC: Hemisphere.

Kandel, D.B. (1980). Developmental stages in adolescent drug involvement. In D.J. Lettieri, M. Sayers, & H. Pearson (Eds.), *Theories on drug abuse: Selected contemporary perspectives* (pp. 120-127). Rockville, MD: National Institute of Drug Abuse.

Kandel, D.B. (1988). Issues of sequencing of adolescent drug use and other problem behaviours. *Drugs and Society, 3*, 55-76.

Kandel, D., & Adler, I. (1982). Socializations into marijuana use among French

adolescents: A cross-cultural comparison with the United States. *Journal of Health and Social Behaviour*, 23, 295-309.

Kandel, D.B., & Chen, K., Warner, L.A., Kessler, R.C., & Grant, B. (1997). Prevalence and demographic correlates of symptoms of last year dependence on alcohol, nicotine, marijuana and cocaine in the US population. *Drug and Alcohol Dependence*, 44, 11-29.

Kandel, D.B., & Faust, R. (1975). Sequence and stages in patterns of adolescent drug use. *Archives of General Psychiatry*, 32, 923-932.

Kandel, D.B., & Logan, J.A. (1984). Patterns of drug use from adolescence to young adulthood - I. Periods of risk for initiation, continued use, and discontinuation. *American Journal of Public Health*, 74, 660-666.

Kandel, D.B., & Wu, P. (1995). The contributions of mothers and fathers to the intergenerational transmission of cigarette smoking in adolescence. *Journal of Research Adolescence*, 5, 225-252.

Kandel, D.B., Wu, P., & Davies, M. (1994). Maternal smoking during pregnancy and smoking by adolescent daughters. *American Journal of Public Health*, 84, 1407-1413.

Kandel, D.B., & Yamaguchi, K. (1993). From beer to crack: Developmental patterns of drug involvement. *American Journal of Psychiatry*, 144, 584-589.

Kandel, D.B., & Yamaguchi, K. (1999). Developmental stages of involvement in substance use. In P.J. Ott, R.E. Tarter, & R.T. Ammerman (Eds.), *Sourcebook on substance abuse: Etiology, epidemiology, assessment, and treatment* (pp. 50-74). Needham Heights, MA: Allyn & Bacon.

- Kandel, D.B., Yamaguchi, K., & Chen, K. (1992). Stages of progression in drug involvement from adolescence to adulthood: Further evidence for the gateway theory. *Journal of Studies on Alcohol*, 53, 447-457.
- Kendler, K.S., Neale, M.C., MacLean, C.J., Heath, A.C., Eaves, L.J., & Kessler, R.C. (1993). Smoking and major depression: A causal analysis. *Archives of General Psychiatry*, 50, 36-43.
- Kendler, K.S., & Prescott, C.A. (1998). Cannabis use, abuse and dependence in a population-based sample of female twins. *American Journal of Psychiatry*, 155, 1016-1022.
- Killen, J.D., Robinson, T.N., Haydel, K.F., Hayward, C., Wilson, D.M., Hammer, L.D., et al. (1997). Prospective study of risk factors for the initiation of cigarette smoking. *Journal of Consulting and Clinical Psychology*, 65, 1011-1016.
- King, A.J.C., Robertson, A.S., & Warren, W.K. (1985). *Summary Report: Canada Health Attitudes and Behaviours: 9, 12 and 15 Year Olds*. Toronto: Social Program Evaluation on Group.
- Kirscht, J.P., Janz, N.K., & Becker, M.H. (1989). Psychosocial predictors of change in cigarette smoking. *Journal of Applied Social Psychology*, 19, 298-308.
- Kleinman, P., Wish, E., Deren, S., & Rainone, G. (1988). Daily marijuana use and problem behaviours among adolescents. *International Journal of the Addictions*, 23, 87-101.
- Koob, G.F. (1992). Drugs of abuse: Anatomy, pharmacology and function of reward pathways. *Trends in Pharmacological Sciences*, 13, 177-184.

- Kosterman, R., Hawkins, J.D., Guo, J., Catalano, R.F., & Abbott, R.D. (2000). The dynamics of alcohol and marijuana initiation: Patterns and predictors of first use in adolescence. *American Journal of Public Health, 90*, 360-366.
- Krohn, M.D., Naughton, M.J., & Lauer, R.M. (1987). Adolescent cigarette use: The relationship between attitudes and behaviour. *Mortality and Morbidity Weekly, 36(4S)*, 25S-33S.
- Krosnick, J.A., & Judd, C.M. (1982). Transitions in social influence at adolescence: Who induces cigarette smoking? *Developmental Psychology, 18*, 359-368.
- Lettieri, D.J. (1985). Drug abuse: A review of explanations and models of explanations. *Advances in Alcohol and Substance Abuse, 4*, 9-40.
- Lo, C.C., & Globetti, G. (1995). The effects of internal and external control factors on college students' marijuana use and cessation of use. *Journal of Drug Education, 25*, 357-377.
- Lo, S.K., Blaze-Temple, D., Binns, C.W., & Ovenden, C. (1993). Adolescent cigarette consumption: The influence of attitudes and peer drug use. *The International Journal of the Addictions, 28*, 1515-1530.
- Luck, W., & Nau, H. (1984). Nicotine and cotinine concentrations in serum and milk of nursing smokers. *British Journal of Clinical Pharmacology, 18*, 9-15.
- Luepker, R.V., Pechacek, T.F., Murray, D.M., Johnson, C.A., Hurd, P., & Jacobs, D.R. (1981). Saliva thiocyanate: A chemical indicator of cigarette smoking in adolescents. *American Journal of Public Health, 71*, 1320-1324.
- Maccoby, E.E. (1990). Gender and relationships: A developmental account. *American Psychologist, 45*, 513-520.

- Maccoby, E.E. (1998). *The two sexes: Growing up apart, coming together*. Cambridge, MA: Belknap.
- Marijuana: Federal smoke clears, a little [editorial]. (2001). *Canadian Medical Association Journal*, 164, 1397. Retrieved July 21, 2003, from <http://www.cma.ca/cmaj/vol-164/issue-10/1397.asp>
- Marlatt, G.A., Curry, S., & Gordon, J.R. (1988). A longitudinal analysis of un-aided smoking cessation. *Journal of Consulting and Clinical Psychology*, 56, 715-720.
- Marston, A.R., Jacobs, D.F., Singer, R.D., Widaman, K.F., & Little, T.D. (1988). Adolescents who apparently are invulnerable to drug, alcohol, and nicotine use. *Adolescence*, 23, 595-598.
- McKilip, J., Johnson, J.E., & Pretzel, T.P. (1973). Patterns and correlates of drug use among urban high school students. *Journal of Drug Education*, 3, 1-12.
- McWhorter, W.P., Boyd, G.M., & Mattson, M.E. (1990). Predictors of quitting smoking. *Journal of Clinical Epidemiology*, 43, 1399-1405.
- Mereu, G., Yoon, K-WP, Boi, V., Gessa, G.L., Naes, L., & Westsall, T.C. (1987). Preferential stimulation of ventral tegmental area dopaminergic neurons by nicotine. *European Journal of Pharmacology*, 141, 395-399.
- Miao, H., Liu, C., Bishop, K., Gong, Z-H., Nordberg, A., & Zhang, Z. (1998). Nicotine exposure during a critical development leads to persistent changes in nicotine acetylcholine receptors of adult rat brain. *Journal of Neurochemistry*, 70, 752-762.
- Miller, D.S., & Miller, T.Q. (1997). A test of socioeconomic status as a predictor of initial marijuana use. *Addictive Behaviours*, 22, 479-489.
- Miller, S.K., & Slap, G.B. (1989). Adolescent smoking: A review of prevalence and

- prevention. *Journal of Adolescent Health Care*, 10, 129-135.
- Mills, C.J., & Noyes, H.L. (1984). Patterns and correlates of initial and subsequent drug use among adolescents. *Journal of Counseling and Clinical Psychology*, 52, 231-243.
- *Murray, M., Swan, A.V., Johnson, M.R.D., & Bewley, B.R. (1983). Some factors associated with increased risk of smoking by children. *British Journal of Psychiatry*, 24, 223-232.
- Nagelkerke, N.J. (1991). A note on a general definition of the coefficient of determination. *Biometrika*, 78, 691-692.
- National Institute on Drug Abuse. (1998). *Nicotine addiction*, NIH Publication Number 98-4342, Washington, DC.
- Needle, R., McCubbin, H., Wilson, M., Reineck, R., Lazar, R., & Mederer, H. (1986). Interpersonal influences in adolescent drug use: The role of older siblings, parents, and peers. *The International Journal of the Addictions*, 21, 739-766.
- Needle, R.H., Su, S.S., & Doherty, W.J. (1990). Divorce, remarriage, and adolescent substance use: A prospective longitudinal study. *Journal of Marriage and the Family*, 52, 157-169.
- Nelson, D.E., Giovino, G.A., Shopland, D.R., Mowery, P.D., Mills, S.L., & Eriksen, M.P. (1995). Trends in cigarette smoking among US adolescents, 1974 through 1991. *American Journal of Public Health*, 85, 34-40.
- Nestler, E.J. (1992). Molecular mechanisms of drug addiction. *Journal of Neuroscience*, 12, 2439-2450.
- Newcomb, M.D., & Bentler, P.M. (1988). *Consequences of adolescent drug use: Impact*

on the lives of young adults. Newbury Park, CA: Sage.

Newcomb, M.D., & Felix-Ortiz, M. (1992). Multiple protective and risk factors for drug use and abuse: Cross-sectional and prospective findings. *Journal of Personality and Social Psychology*, 63, 280-296.

Newcomb, M.D., Huba, G.L., & Bentler, P.M. (1983). Mothers' influence on the drug use of their children: Confirmatory tests of direct modeling and mediational theories. *Developmental Psychology*, 19, 714-726.

Niaura, R., & Abrams, D.B. (2002). Smoking cessation: Progress, priorities, and prospectus. *Journal of Consulting and Clinical Psychology*, 70, 494-509.

Niaura, R., Bock, B., Lloyd, E.E., Brown, R., Lipsitt, L.P., & Buka, S. (2001). Maternal transmission of nicotine dependence: Psychiatric, neurocognitive and prenatal factors. *The American Journal on Addictions*, 10, 16-29.

Noland, J.S., Singer, L.T., Arendt, R.E., Minnes, S., Short, E.J., & Bearer, C.F. (2003). Executive functioning in preschool-age children prenatally exposed to alcohol, cocaine, and marijuana. *Alcoholism: Clinical and Experimental Research*, 27, 647-656.

Nordberg, A., Zhang, X., Fredriksson, A., & Eriksson, P. (1991). Neonatal nicotine exposure induces permanent changes in brain nicotinic receptors and behaviour in adult mice. *Developmental Brain Research*, 63, 201-207.

O'Donnell, J.A. (1985). Interpreting progression from one drug to another. In L.N. Robins (Ed.), *Studying drug abuse*. New Brunswick, NJ: Rutgers University Press.

O'Donnell, J.A., & Clayton, R.R. (1982). The stepping-stone hypothesis - marijuana,

- heroin, and causality. *Chemical Dependency*, 4, 229-241.
- Oei, T.P.S., & Fea, A. (1987). Smoking prevention program for children: A review. *Journal of Drug Education*, 17, 11-42.
- Oesler, M., Clausen, J., Ibsen, K.K., & Jensen, G. (1995). Maternal smoking during childhood and increased risk of smoking in young adulthood. *International Journal of Epidemiology*, 24, 710-714.
- O'Malley, P.M., Bachman, J.G., & Johnston, L.D. (1983). Reliability and consistency in self-reports of drug use. *The International Journal of the Addictions*, 18, 805-824.
- O'Malley, P.M., Bachman, J.G., & Johnston, L.D. (1984). Period, age and cohort effects on substance use among American youth, 1976-1982. *American Journal of Public Health*, 74, 682-688.
- Osgood, D.W., Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (1988). The generality of deviance in late adolescence and early adulthood. *American Sociological Review*, 53, 81-93.
- Osler, M., Holst, C., Prescott, E., & Sorensen, T.I.A. (2001). Influence of genes and family environment on adult smoking behaviour assessed in an adoption study. *Genetic Epidemiology*, 21, 193-200.
- Owen, N., Kent, P., Wakefield, M., & Roberts, L. (1995). Low-rate smokers. *Preventive Medicine*, 24, 80-84.
- Panetta, A. (2003, July 7). U.S. drug envoy coming to co-ordinate pot crackdown following federal law. *The Ottawa Citizen*. Retrieved July 21, 2003, from <http://www.canada.com/search/story.aspx?id=b2cb428f-051a-4f39-a198-23a12004ebdd>

- Park, B., Gibbons, H.M., Mitchell, M.D., & Glassa, M. (2003). Identification of the CB1 cannabinoid receptor and fatty acid amide hydrolase (FAAH) in the human placenta. *Placenta*, 24, 473-478.
- Pascale, P.J., & Evans, W.J. (1993). Gender differences and similarities in patterns of drug use and attitudes of high school students. *Journal of Drug Education*, 23, 105-116.
- Pedhazur, E.J. (1997). *Multiple regression in behavioral research: Explanation and prediction* (3rd ed.). Fort Worth, TX: Harcourt Brace College Publishers.
- Pederson, L.L., Koval, J.J., & O'Connor, K. (1997). Are psychosocial factors related to smoking in grade-6 students? *Addictive Behaviours*, 22, 169-181.
- Pederson, L.L., & Lefcoe, N.M. (1985). Cross-sectional analysis of variables related to cigarette smoking in late adolescence. *Journal of Drug Education*, 15, 225-240.
- Pederson, L.L., & Lefcoe, N.M. (1987). Short- and long-term prediction of self-reported cigarette smoking in a cohort of late adolescents: Report of an 8-year follow-up of public school students. *Preventive Medicine*, 16, 432-447.
- Petratis, J., Flay, B.R., & Miller, T.Q. (1995). Reviewing theories of adolescent substance use: Organizing pieces in the puzzle. *Psychological Bulletin*, 117, 67-86.
- Petty, R.E., & Wegener, D.T. (1998). Attitude change: Multiple roles for persuasion variables. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol. 1, pp. 323-390). New York: McGraw-Hill.
- Piko, B. (2001). Smoking in adolescence: Do attitudes matter? *Addictive Behaviours*, 26, 201-217.

- Pinel, J.P.J. (1997). *Biopsychology* (3rd ed.). Needham Heights, MA: Allyn & Bacon.
- Presson, C.C., Chassin, L., Sherman, S., Olshavsky, R., Bensenberg, M., & Corty, E. (1984). Predictions of adolescents intention to smoke: Age, sex, race and regional differences. *International Journal of the Addictions*, 19, 503-519.
- Presti, D.E., Ary, D.V., & Lichtenstein, E. (1992). The context of smoking initiation and maintenance: Findings from interviews with youths. *Journal of Substance Abuse*, 4, 35-45.
- Rees, C.D., & Wilborn, B.L. (1983). Correlates of drug abuse in adolescents: A comparison of families of drug abusers with families of nondrug abusers. *Journal of Youth and Adolescence*, 12, 55-65.
- Reid, L.D. (1989). A path analytic examination of differential social control theory. *Journal of Drug Education*, 19, 139-156.
- Resnicow, K., Smith, M., Harrison, L., & Drucker, E. (1999). Correlates of occasional cigarette and marijuana use: Are teens harm reducing? *Addictive Behaviours*, 24, 251-266.
- Robin, S.S., & Johnson, E.O. (1996). Attitude and peer cross pressure: Adolescent drug and alcohol use. *Journal of Drug Education*, 26, 69-99.
- Robinson, T.N., Killen, J.D., Taylor, C.B., Telch, M.J., Bryson, S.W., Saylor, K.E., et al. (1987). Perspectives on adolescent substance use: A defined population study. *Journal of the American Medical Association*, 258, 2072-2076.
- Rose, J.S., Chassin, L., Presson, C.C., & Sherman, S.J. (1996). Prospective predictors of quit attempts and smoking cessation in young adults. *Health Psychology*, 15, 261-268.

- Rosselli, F., Skelly, J.J., & Mackie, D.M. (1995). Processing rational and emotional messages: The cognitive and affective mediation of persuasion. *Journal of Experimental Social Psychology, 31*, 163-190.
- Rutter, M., Giller, H., & Hagell, A. (1998). *Antisocial behavior by young people*. Cambridge, UK: Cambridge University Press.
- Santi, S., Best, J.A., Brown, K.S., & Cargo, M. (1990-1991). Social environment and smoking initiation. *International Journal of the Addictions, 25*, 881-903.
- Sarason, I., Mankowski, E., Peterson, A., & Dinh, K. (1992). Adolescents' reasons for smoking. *Journal of School Health, 62*, 185-190.
- Sargent, J.D., Mott, L.A., & Stevens, M. (1998). Predictors of smoking cessation in adolescents. *Archives of Pediatric and Adolescent Medicine, 152*, 388-393.
- Schaffer, H.R. (1997). *Social development*. Malden, MA: Blackwell Publishers Inc.
- Scheier, L.M. (2001). Etiologic studies of adolescent drug use: A compendium of data resources and their implications for prevention. *The Journal of Primary Prevention, 22*, 125-168.
- *Semmer, N.K., Cleary, P.D., Dwyer, J.H., Fuchs, R., & Lippert, P. (1987). Psychological predictors of adolescent smoking in two German cities: The Berlin-Bremen study. *Morbidity and Mortality Weekly Report, 36*, 3-10.
- *Semmer, N.K., Dwyer, J.H., Lippert, P. Fuchs, R., Cleary, P.D., & Schindler, A. (1987). Adolescent smoking from a functional perspective: The Berlin-Bremen study. *European Journal of Psychology of Education, 11*, 387-402.
- Shiffman, S. (1989). Tobacco "chippers"- individual differences in tobacco dependence. *Psychopharmacology, 97*, 539-547.

- Shiono, P.H., Klebanoff, M.A., Nugent, R.P., Cotch, M.F., Wilkins, D.G., Rollins, D.E., et al. (1995). The impact of cocaine and marijuana use on low birth weight and preterm birth: A multicenter study. *American Journal of Obstetrics and Gynecology*, 172, 19-27.
- Simantov, E., Schoen, C., & Klein, J.D. (2000). Health-compromising behaviours: Why do adolescents smoke or drink? Identifying underlying risk and protective factors. *Archives of Pediatric and Adolescent Medicine*, 154, 1025-1033.
- Skinner, W.F., Massey, J.L., Krohn, M.D., & Lauer, R.M. (1985). Social influences and constraints on the initiation and cessation of adolescent tobacco use. *Journal of Behavioural Medicine*, 8, 353-376.
- Smart, R.G. (1977). Perceived availability and the use of drugs. *Bulletin on Narcotics*, 29, 59-63.
- Smart, R.G., & Ogborne, A.C. (2000). Drug use and drinking among students in 36 countries. *Addictive Behaviours*, 25, 455-460.
- Smith, W., Weidler, F., & Slotkin, T. (1991). Acute stimulation of ornithine decarboxylase in neonatal rat brain regions by nicotine: A central receptor-mediated process? *Developmental Brain Research*, 63, 85-93.
- Spear, L.P. (2000). The adolescent brain and age-related behavioural manifestations. *Neuroscience and Biobehavioural Reviews*, 24, 417-463.
- Spear, S.F., & Akers, R.L. (1988). Social learning variables and the risk of habitual smoking among adolescents: The Muscatine Study. *American Journal of Preventive Medicine*, 4, 336-342.

- Stanton, W., Currie, G., Oei, T., & Silva, P. (1996). A developmental approach to influences on adolescents' smoking and quitting. *Journal of Applied Developmental Psychology, 17*, 307-319.
- Stein, D.M. (1997). *Substance use prevention: An updated review of effective components and programs (1993 to 1997)*. Logan, UT: Author.
- Stein, J.A., Newcomb, M.D., & Bentler, P.M. (1987). An 8-year study of multiple influences on drug use and drug use consequences. *Journal of Personality and Social Psychology, 53*, 1094-1105.
- Stephens, R.S., Roffman, R.A., & Simpson, E.E. (1993). Adult marijuana users seeking treatment. *Journal of Consulting and Clinical Psychology, 61*, 1100-1104.
- Stevens, J.P. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Stone, S.L., & Kristeller, J.L. (1992). Attitudes of adolescents toward smoking cessation. *American Journal of Preventive Medicine, 8*, 221-225.
- Substance Abuse and Mental Health Services Administration. (1997). *Preliminary results from the 1996 national household survey on drug abuse*. DHHS Publication # (SMA) 97-3149. Rockville, MD: SAMHSA.
- Substance Abuse and Mental Health Services Administration. (2001). *2000 National Household Survey on Drug Abuse: Highlights*. Retrieved January 14, 2002, from <http://www.samhsa.gov/oas/NHSDA/2kNHSDA/highlights.htm>
- Sussman, S. (1996). Development of a drug abuse prevention curriculum for high-risk youth. *Journal of Psychoactive Drugs, 28*, 169-182.

- Sussman, S., & Dent, C.W. (1999). One-year prospective prediction of marijuana use cessation among youth at continuation high schools. *Addictive Behaviours*, 24, 411-417.
- Sussman, S., Dent, C., Severson, H., Burton, D., & Flay, B. (1998). Self-initiated quitting among adolescent smokers. *Preventive Medicine*, 27, A19-A28.
- Szalay, L.B., Inn, A., Strohl, J.B., & Wilson, L.C. (1993). Perceived harm and drug use: Perceptual and motivational dispositions affecting drug use. *Journal of Drug Education*, 23, 333-356.
- Tabachnick, B.G., & Fidell, L.S. (2001). *Using multivariate statistics* (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Taioli, E., & Wynder, E. (1991). Effect of the age at which smoking begins on frequency of smoking in adulthood. *New England Journal of Medicine*, 325, 968-969.
- Tesser, A. (1993). The importance of heritability in psychological research: The case of attitudes. *Psychological Review*, 100, 129-142.
- Tesser, A., & Martin, L. (1996). The psychology of evaluation. In E.T. Higgins & A.W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 400-432). New York: Guilford.
- Thornberry, T.P., & Krohn, M.D. (1997). Peers, drug use, and delinquency. In D. Stoff, J. Breiling & J.D. Maser (Eds.), *Handbook of antisocial behaviour* (pp. 218-233). New York: Wiley.
- Tobler, N. (1997). Meta-analysis of adolescent drug prevention programs: Results of the 1993 meta-analysis. In W.J. Bukoski (Ed.), *Meta-analysis of drug abuse prevention programs* (NIDA Research Monograph 170). Rockville, MD: National

Institutes of Health.

- Tomori, M., Zalar, B., Kores Plesnicar, B., Ziherl, S., & Stergar, E. (2001). Smoking in relation to psychosocial risk factors in adolescents. *European Child & Adolescent Psychiatry, 10*, 143-150.
- Towberman, D.B., & McDonald, R.M. (1993). Dimensions of adolescent drug-avoidant attitude. *Journal of Substance Abuse Treatment, 10*, 45-52.
- True, W.R., Heath, A.C., Scherrer, J.F., Waterman, B., Goldberg, J., Lin, N., et al. (1997). Genetic and environmental contributions to smoking. *Addiction, 92*, 1277-1287.
- True, W.R., Heath, A.C., Scherrer, J.F., Xian, H., Lin, N., Eisen, S.A., et al. (1999). Interrelationship of genetic and environmental influences on conduct disorder and alcohol and marijuana dependence symptoms. *American Journal of Medical Genetics – Neuropsychiatric Genetics, 88*, 391-397.
- Tsuang, M.T., Lyons, M.J., Harley, R.M., Xian, H., Eisen, S., Goldberg, J., et al. (1999). Genetic and environmental influences on transitions in drug use. *Behaviour Genetics, 29*, 473-479.
- Tuakli, N., Smith, M.A., & Heaton, C. (1990). Smoking in adolescence: Methods for health education and smoking cessation. A MIRNET Study. *The Journal of Family Practice, 31*, 369-374.
- Tyler, J., & Lichtenstein, C. (1997). Risk, protective, AOD knowledge, attitude, and AOD behaviour: Factors associated with characteristics of high-risk youth. *Evaluation and Program Planning, 20*, 27-45.

- Unger, J.B., Rohrbach, L.A., Howard-Pitney, B., Ritt-Olson, A., & Mouttapa, M. (2001). Peer influences and susceptibility to smoking among California adolescents. *Substance Use & Misuse, 36*, 551-571.
- United States Department of Health and Human Services. (1988). *The health consequences of smoking: nicotine addiction: Report of the Surgeon General* (DHHS Publication No. 88-8406). Rockville, MD, Public Health Service, Office on Smoking and Health.
- Urberg, K.A., Cheng, C.H., & Shyu, S.J. (1991). Grade changes in peer influence on adolescent cigarette smoking: A comparison of two measures. *Addictive Behaviours, 16*, 21-28.
- Urberg, K.A., Degirmencioglu, S.R., & Pilgrim, C. (1997). Close friend and group influence on adolescent cigarette smoking and alcohol use. *Developmental Psychology, 33*, 834-844.
- Urberg, K.A., Shyu, S.J., & Liang, J. (1990). Peer influence in adolescent cigarette smoking. *Addictive Behaviours, 15*, 247-255.
- van Roosmalen, E., & McDaniel, S. (1992). Adolescent smoking intentions: Gender differences in peer context. *Adolescence, 27*, 87-105.
- Walker, A., Rosenberg, M., & Balaban-Gil, K. (1999). Neurodevelopmental and neurobehavioral sequelae of selected substances of abuse and psychiatric medications in utero. *Child and Adolescent Psychiatric Clinics in North America, 8*, 845-867.
- Wall, M., Johnson, J., Jacob, P., & Benowitz, N. (1988). Cotinine in the serum, saliva and other urine of nonsmokers, passive smokers and active smokers. *American*

Journal of Public Health, 78, 699-701.

Wang, M.Q., Fitzhugh, E.C., Westerfield, R.C., & Eddy, J.M. (1995). Family and peer influences on smoking behaviour among American adolescents: An age trend.

Journal of Adolescent Health, 16, 200-203.

Weber, A.L. (1992). *Social psychology*. New York: HarperPerennial.

Weissman, M.M., Warner, V., Wickramaratne, P.J., & Kandel, D.B. (1999). Maternal smoking during pregnancy and psychopathology in offspring followed to adulthood. *Journal of the American Academy of Child and Adolescent Psychiatry*, 38, 892-899.

Welte, J.W., & Barnes, G.M. (1985). Alcohol: The gateway to other drug use among secondary-school students. *Journal of Youth and Adolescence*, 14, 487-498.

Welte, J.W., & Barnes, G.M. (1987). Youthful smoking: Patterns and relationships to alcohol and other drug use. *Journal of Adolescence*, 10, 327-340.

Wetter, D., Kenford, S.L., Smith, S.S., Fiore, M.C., Jorenby, D.E., & Baker, T.B. (1999). Gender differences in smoking cessation. *Journal of Consulting and Clinical Psychology*, 67, 555-562.

Williams, J.G., & Covington, C.J. (1997). Predictors of cigarette smoking among adolescents. *Psychological Reports*, 80, 481-482.

Wilson, D., Wakefield, M., Owen, N., & Roberts, L. (1992). Characteristics of heavy smokers. *Preventive Medicine*, 21, 311-319.

Windle, M., Barnes, G.M., & Welte, J. (1989). Causal models of adolescent substance use: An examination of gender differences using distribution-free estimators. *Journal of Personality and Social Psychology*, 56, 132-142.

- Yamaguchi, K., & Kandel, D.B. (1984a). Patterns of drug use from adolescence to early adulthood-II. Sequences of progression. *American Journal of Public Health, 74*, 668-672.
- Yamaguchi, K., & Kandel, D.B. (1984b). Patterns of drug use from adolescence to early adulthood-III. Predictors of progression. *American Journal of Public Health, 74*, 673-681.
- Zhu, S-H., Sun, J., Billings, S.C., Choi, W.S., & Malarcher, A. (1999). Predictors of smoking cessation in U.S. adolescents. *American Journal of Preventive Medicine, 16*, 202-207.

Appendix A

Ottawa Prenatal Prospective Study (OPPS)

Informed Consent

I have been told about the study that I am participating in. I understand that the purpose of the study is to examine the long-term effects of the fetus being exposed to factors in its environment including cigarettes, alcohol and marihuana. The director of the study is Dr. Peter Fried and the woman who will be showing me what to do and asking me questions is Heather Lintell. I will be doing a number of tests and games (many of which will involve computers) that will examine such things as problem solving, intelligence, attention, memory, personality and emotional factors. I will be asked to fill out a very brief questionnaire about the age of the onset of my puberty, and respond to questions about my attitudes towards drugs and my own use of drugs. I will also be asked to leave a urine specimen which will be analyzed for the presence of drugs such as cocaine, marihuana and amphetamines and constituents of cigarette smoke, which may be present either because I have smoked recently or I have been anywhere that there was cigarette smoke in the air in the past few days.

I understand that feedback will be given over the phone to myself and, if I wish, to either my Mom or Dad with respect to my performance on the various games and tests. The results may assist me in deciding whether intervention (e.g., academic, counselling) might be of benefit. Dr. Fried will be available to advise me and, if necessary, direct me to appropriate professional assistance. No information will be passed on to my parents with respect to my urine sample or any of my responses about drugs or smoking habits. Further, the risk for disclosure of any confidential information to anybody, as in the past, is very slight. All the information collected is coded and is not identified by name on the record sheets or in the computer files. Any information will only be released with my signed written consent. However, if any evidence of physical or sexual abuse is noted, Dr. Fried is compelled by law to report such evidence to the appropriate authorities.

If I have any questions pertaining to the research I can contact Dr. P. Fried at the Department of Psychology, Carleton University, Ottawa at (613) 520-2676. If I have any questions with respect to my rights in this study I can contact Dr. M. Gick, Chair, Carleton University Research Ethics Committee for Psychological Research, Department of Psychology, Carleton University, Ottawa at (613) 520-2600, extension 2664 or Dr. K. Matheson, Chair, Department of Psychology at (613) 520-2600 extension 2648.

I understand that my participation in the study is up to me and I can stop anytime I wish. No one will pressure me to continue. No foreseeable risk will be experienced. I understand the procedures to be followed.
If I have any questions I can ask Heather or Dr. Fried.

Signed _____

Date _____

Print Name _____

Witness _____

Appendix B

Drug History Questionnaire
© 2000

Ottawa Prenatal Prospective Study

No portion of this questionnaire may be reproduced
without the express written permission of

Dr. Peter Fried
Department of Psychology
Carleton University
Ottawa, Canada
K1S 5B6
peter_fried@carleton.ca

7. How many hours were you exposed to secondhand smoke at home (in the same room as the person smoking) today and in each of the last 7 days? Insert the number of hours in boxes.

Last Sat. Last Sun. Last Mon.

Last Tues. Last Wed. Last Thurs.

Last Fri. Today

8. Are you exposed to secondhand smoke outside your home (e.g., friend's home, a car, a bar)?

No: Insert a N in box and skip to question 10 (page 3).

Yes: Insert a Y in box and continue.

9. How many hours were you exposed to secondhand smoke outside your home today and in each of the last 7 days? Insert the number of hours in boxes.

Last Sat. Last Sun. Last Mon.

Last Tues. Last Wed. Last Thurs.

Last Fri. Today

10. Among your friends, how many have tried cigarettes?

none ☐ some ☐ most ☐ all ☐ don't know ☐

11. Among your friends, how many smoke cigarettes on a regular basis (i.e., at least once a day)?

none ☐ some ☐ most ☐ all ☐ don't know ☐

12. Have you ever smoked (beyond just trying out one or two cigarettes)?

No: Insert a N in box : Go to Green Booklet.

☐

Yes: Insert a Y in box and continue.

13. How old were you when you first smoked cigarettes (beyond just trying out one or two)?
Insert age in years in box.

☐

14. Have you ever smoked on a **regular** basis, i.e., at least once a day?

No: Insert a N in box: Go to Green Booklet.

☐

Yes: Insert a Y in box and continue.

15. How old were you when you started to smoke on a regular basis?
Insert age in years in box.

☐

16. How many years have you been smoking (or did you smoke) on a regular basis?
Insert answer in box.

17. Are you smoking **now** on a regular basis, i.e., at least once a day?

No: Insert a **N** in box: Go to Green Booklet.

Yes: Insert a **Y** in box and continue.

18. How many cigarettes do you smoke on average per day?
Insert answer in box.

19. How many cigarettes did you smoke on each of the last three days?
Insert answers in boxes.

today:

yesterday:

day before yesterday:

20. After waking up in the morning, how many minutes pass before you usually have your first cigarette? Insert answer in box.

21. Do you usually smoke the same brand?
No: Insert a **N** in box: Skip to Question 23 on next page

Yes: Insert a **Y** in box and continue.

22. What brand (including size [e.g., king] and strength [e.g., light]) do you usually smoke?

_____

23. Have you ever tried to cut down on the use of cigarettes?

Yes ☐ No ☐

24. Have you ever felt unable to cut down on the use of cigarettes?

Yes ☐ No ☐

25. Have you ever felt the need to have more cigarettes to get the same effect?

Yes ☐ No ☐

26. Have you ever felt the need to have cigarettes or felt dependent on cigarettes?

Yes ☐ No ☐

27. Have you ever felt sick because of stopping or cutting down on cigarettes?

Yes ☐ No ☐

Go to Green Booklet

Green Booklet

Marihuana/Hashish Questionnaire

1. Among your friends how many have tried marihuana/hashish?
- none ☐ some ☐ most ☐ all ☐ don't know ☐
2. Among your friends how many smoke marihuana/hashish on a regular basis (at least once a week)?
- none ☐ some ☐ most ☐ all ☐ don't know ☐
3. Have you ever been exposed to secondhand smoke from marihuana or hashish?
- No: Insert a N in box and skip to question 6 on the next page. ☐
- Yes: Insert a Y in box and continue.
4. When was the last time you were exposed to secondhand smoke from marihuana or hashish?
- more than a month ago ☐ between 1 week and 4 weeks ago ☐
- between 2 and 6 days ago ☐ yesterday ☐ today ☐
5. The last time that you were exposed to secondhand marihuana or hashish smoke were you exposed for
- more than 3 hours ☐ between 2 and 3 hours ☐ between 1 and 2 hours ☐
- less than 1 hour ☐

6. Have you ever tried marihuana ?

No: Insert a N in box and skip to question 22 on page 4. ☐

Yes: I have tried marihuana: Insert a Y in box and continue.

7. How old were you when you first smoked marihuana? Insert age in years in box.

☐

8. Are you smoking marihuana **now** on a regular basis, i.e., at least once a week?

No: Insert a N in box and skip to question 14 (a) on next page. ☐

Yes: Insert a Y in box and continue.

9. When you use marihuana, about how many joints do you usually smoke at a time?

If you share reefers how much do YOU usually smoke? Insert the number (or fraction) in box

☐

10. On average, how often do you smoke this amount?

every day ☐ 3-6 times per week ☐ 1-2 times per week ☐

2-3 times per month ☐ once a month ☐ 6-11 times per year ☐

1-5 times a year ☐ less than once a year ☐

11. How many joints of marihuana do you **now** smoke on average per week? If you share reefers I would like to know how much YOU smoke.

Insert number (or fraction) in box.

☐

12. How many joints of marihuana did you smoke during the past 7 days?
If you share reefers I would like to know how much YOU smoked
on these days. Insert answers in boxes.

Last Sat. Last Sun. Last Mon.
Last Tues. Last Wed. Last Thurs.
Last Fri. Today

13. Please indicate the day of the week today:

Mon. ☐ Tues. ☐ Wed. ☐ Thurs. ☐ Fri. ☐ Sat. ☐ Sun. ☐

Go to Question 15

- 14.(a) If you are not smoking marihuana regularly now, did you ever smoke marihuana regularly
in the past (at least once a week)?

No: Insert a N in box and skip to question 16B on next page. ☐

If you are or were a regular user, please continue.

- 14(b) When you smoked marihuana regularly in the past, how many joints did you
usually smoke per week? If you shared reefers, how much did YOU usually smoke?

15. How old were you when you started to smoke marihuana on a regular
basis? Insert age in years in box.

16. How many years have you smoked (or did you smoke) marihuana on a regular basis?
Insert answer in box.

16(b) Have you smoked any marihuana in the past year? Yes ☐ Go to 16C

No ☐ Go to 17

16(c) How many days is it since you smoked up? ☐

16(d) When you last smoked up, how many joints did you smoke?

If you shared reefers, how much did YOU smoke? ☐

17. Have you ever tried to cut down on the use of marihuana?

Yes ☐ No ☐

18. Have you ever felt unable to cut down on the use of marihuana?

Yes ☐ No ☐

19. Have you ever felt the need to have more marihuana to get the same effect?

Yes ☐ No ☐

20. Have you ever felt the need to have marihuana or felt dependent on marihuana?

Yes ☐ No ☐

21. Have you ever felt sick because of stopping or cutting down on marihuana?

Yes ☐ No ☐

22. Have you ever tried hashish ?

No: Insert a N in box: go to Blue Booklet.

☐

Yes: I have tried hashish: Insert a Y in box and continue.

23. How old were you when you first smoked hashish ?
Insert age in years in box.

☐

24. Are you smoking hashish **now** on a regular basis, i.e., at least once a week?

No: Insert a N in box and skip to question 30.

☐

Yes: Insert a Y in box and continue.

25. On the days that you use hashish, about how many grams do you usually smoke?
If you share how much do YOU usually smoke? Insert the number of grams
(or fraction) in box.

☐

26. On average, how often do you smoke this amount?

every day ☐ 3-6 times per week ☐ 1-2 times per week ☐

2-3 times per month ☐ once a month ☐ 6-11 times per year ☐

1-5 times a year ☐ less than once a year ☐

27. How many grams of hashish do you now smoke on average per week? If you share,
I would like to know how many grams YOU smoked.
Insert number of grams (use fractions if necessary) in box.

☐

28. How many grams of hashish did you smoke during the past 7 days. If you share, I would like to know how much YOU smoked on these days. Insert number of grams (use fractions if necessary) in boxes.

Last Sat. Last Sun. Last Mon.

Last Tues. Last Wed. Last Thurs.

Last Fri. Today

29. Please indicate the day of the week today:

Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri ☐ Sat ☐ Sun ☐

30. If you don't smoke hashish regularly now, have you ever smoked hashish on a regular basis, i.e., once a week or more?

No: Insert a N in box: Go to Blue Booklet.

☐

If you are or were a regular user, please continue.

- 30(b) When you smoked hashish regularly in the past, how many grams did you usually smoke per week? If you shared, how much did YOU usually smoke?

31. How old were you when you started to smoke hashish on a regular basis? Insert age in years in box.

32. How many years have you smoked (or did you smoke) hashish on a regular basis? Insert answer in box.

32(b) Have you used any hashish in the past year? Yes ☐ Go to 32(c)

No ☐ Go to 33

32(c) How many days is it since you used hashish? ☐

33. Have you ever tried to cut down on the use of hashish?

Yes ☐ No ☐

34. Have you ever felt unable to cut down on the use of hashish?

Yes ☐ No ☐

35. Have you ever felt the need to have more hashish to get the same effect?

Yes ☐ No ☐

36. Have you ever felt the need to have hashish or felt dependent on hashish?

Yes ☐ No ☐

37. Have you ever felt sick because of stopping or cutting down on hashish?

Yes ☐ No ☐

Go to Blue Booklet

Blue Booklet

Drinking Questionnaire

1. Among your friends, how many drink alcohol on a regular basis?

none ☐ some ☐ most ☐ all ☐

2. Compared to your friends do you drink

much less ☐ slightly less ☐ about the same ☐ more ☐

much more ☐

3. Have you ever had a complete drink (i.e., a bottle of beer, a shot of liquor or a glass of wine)?

No: Insert a **N** in box: Go to Yellow Booklet.

☐

Yes: Insert a **Y** in box and continue

4. How old were you when you first had a complete drink?

Insert age in years in box.

☐

5. On the days that you drink alcohol, about how many drinks do you usually drink?
Consider a drink to be a bottle of beer, a shot of liquor or a glass of wine.

Number of drinks. Insert answer in box.

☐

6. On average, how often do you drink this amount?
- every day ☐ 3-6 times per week ☐ 1-2 times per week ☐
- 2-3 times per month ☐ once a month ☐ 6-11 times per year ☐
- 1-5 times a year ☐ less than once a year ☐
7. Do you have days when you drink more than this amount?
- No: Insert a N in box: Go to question 10 on this page. ☐
- Yes: Insert a Y in box and continue.
8. How many drinks do you usually drink then?
- Number of drinks. Insert answer in box. ☐
9. How often do you drink this amount?
- 3-6 times per week ☐ 1-2 times per week ☐
- 2-3 times per month ☐ once a month ☐
- 6-11 times per year ☐ 1-5 times a year ☐
10. Do you presently drink on a regular basis (at least 2 times a week)?
- No: Insert a N in box: Go to Yellow Booklet. ☐
- Yes: Insert a Y in box and continue.

11. At what age did you start to drink on a regular basis? Please enter the answer in years in the box.

12. What alcoholic beverage do you usually drink? If appropriate, check more than one box.

beer ☐liquor ☐wine ☐

13. How much did you drink today and during the past 7 days? Insert the number of drinks in the appropriate boxes. A drink is a bottle of beer, a shot of liquor or a glass of wine.

Last Sat. Last Sun. Last Mon. Last Tues. Last Wed. Last Thurs. Last Fri. Today

14. Please indicate the day of the week today:

Mon ☐ Tues ☐ Wed ☐ Thurs ☐ Fri ☐ Sat ☐ Sun ☐

15. Has your drinking decreased, stayed the same or increased in the past 12 months?

decreased ☐stayed the same ☐increased ☐

16. Have you ever tried to cut down on the use of alcohol?

Yes ☐

No ☐

17. Have you ever felt unable to cut down on the use of alcohol?

Yes ☐

No ☐

18. Have you ever felt the need to have more alcohol to get the same effect?

Yes ☐

No ☐

19. Have you ever felt the need to have alcohol or felt dependent on alcohol?

Yes ☐

No ☐

20. Have you ever felt sick because of stopping or cutting down on alcohol?

Yes ☐

No ☐

Go to Yellow Booklet

Yellow Booklet

Other Drug Use

1. Have you ever used Amphetamines (speed, uppers, ice, bennies, ecstasy)?

No: Insert a N in box: Go to Question 10 on the next page. ☐

Yes: Insert a Y in box and continue.

2. How old were you (in years) when you first tried them? ☐

3. When was the last time you used them (in days)? ☐

4. How many times have you used them in the past month? ☐

5. Have you ever tried to cut down on the use of amphetamines?

Yes ☐ No ☐

6. Have you ever felt unable to cut down on the use of amphetamines?

Yes ☐ No ☐

7. Have you ever felt the need to have more amphetamines to get the same effect?

Yes ☐ No ☐

8. Have you ever felt the need to have amphetamines or felt dependent on amphetamines?

Yes ☐ No ☐

9. Have you ever felt sick because of stopping or cutting down on amphetamines?

Yes ☐ No ☐

10. Have you ever used Crack and/or cocaine?

No: Insert a N in box: Go to Question 19 on the next page. ☐

Yes: Insert a Y in box and continue.

11. How old were you (in years) when you first tried it? ☐

12. When was the last time you used it (in days)? ☐

13. How many times have you used it in the past month? ☐

14. Have you ever tried to cut down on the use of crack/cocaine?

Yes ☐ No ☐

15. Have you ever felt unable to cut down on the use of crack/cocaine?

Yes ☐ No ☐

16. Have you ever felt the need to have more crack/cocaine to get the same effect?

Yes ☐ No ☐

17. Have you ever felt the need to have crack/cocaine or felt dependent on crack/cocaine?

Yes ☐ No ☐

18. Have you ever felt sick because of stopping or cutting down on crack/cocaine?

Yes ☐ No ☐

19. Have you ever used Tranquilizers (sleeping pills, barbs, downers)?

No: Insert a N in box: Go to Question 28 on the next page. ☐

Yes: Insert a Y in box and continue.

20. How old were you (in years) when you first tried them? ☐

21. When was the last time you used them (in days)? ☐

22. How many times have you used them in the past month? ☐

23. Have you ever tried to cut down on the use of tranquilizers?

Yes ☐ No ☐

24. Have you ever felt unable to cut down on the use of tranquilizers?

Yes ☐ No ☐

25. Have you ever felt the need to have more tranquilizers to get the same effect?

Yes ☐ No ☐

26. Have you ever felt the need to have tranquilizers or felt dependent on tranquilizers?

Yes ☐ No ☐

27. Have you ever felt sick because of stopping or cutting down on tranquilizers?

Yes ☐ No ☐

28. Have you ever tried Heroin?

No: Insert a N in box: Go to Question 37 on the next page. ☐

Yes: Insert a Y in box and continue.

29. How old were you (in years) when you first tried it? ☐

30. When was the last time you used it (in days)? ☐

31. How many times have you used it in the past month? ☐

32. Have you ever tried to cut down on the use of heroin?

Yes ☐ No ☐

33. Have you ever felt unable to cut down on the use of heroin?

Yes ☐ No ☐

34. Have you ever felt the need to have more heroin to get the same effect?

Yes ☐ No ☐

35. Have you ever felt the need to have heroin or felt dependent on heroin?

Yes ☐ No ☐

36. Have you ever felt sick because of stopping or cutting down on heroin?

Yes ☐ No ☐

37. Have you ever tried LSD (acid)?

No: Insert a N in box: Go to Question 46 on the next page. ☐

Yes: Insert a Y in box and continue.

38. How old were you (in years) when you first tried it? ☐

39. When was the last time you used it (in days)? ☐

40. How many times have you used it in the past month? ☐

41. Have you ever tried to cut down on the use of LSD?

Yes ☐ No ☐

42. Have you ever felt unable to cut down on the use of LSD?

Yes ☐ No ☐

43. Have you ever felt the need to have more LSD to get the same effect?

Yes ☐ No ☐

44. Have you ever felt the need to have LSD or felt dependent on LSD?

Yes ☐ No ☐

45. Have you ever felt sick because of stopping or cutting down on LSD?

Yes ☐ No ☐

46. Have you ever tried Solvents (glue, gasoline, paint thinners etc.)?

No: Insert an N in box: Go to Question 55 on the next page. ☐

Yes: Insert a Y in box and continue.

47. How old were you (in years) when you first tried it? ☐

48. When was the last time you used it (in days)? ☐

49. How many times have you used it in the past month? ☐

50. Have you ever tried to cut down on the use of Solvents?

Yes ☐ No ☐

51. Have you ever felt unable to cut down on the use of Solvents ?

Yes ☐ No ☐

52. Have you ever felt the need to have more Solvents to get the same effect?

Yes ☐ No ☐

53. Have you ever felt the need to have Solvents or felt dependent on Solvents?

Yes ☐ No ☐

54. Have you ever felt sick because of stopping or cutting down on Solvents ?

Yes ☐ No ☐

55. Have you ever tried Steroids?

No: Insert a N in box: Go to Question 64 on next page.

☐

Yes: Insert a Y in box and continue.

56. How old were you (in years) when you first tried them?

☐

57. When was the last time you used them (in days)?

☐

58. How many times have you used them in the past month?

☐

59. Have you ever tried to cut down on the use of Steroids?

Yes ☐

No ☐

60. Have you ever felt unable to cut down on the use of Steroids?

Yes ☐

No ☐

61. Have you ever felt the need to have more Steroids to get the same effect?

Yes ☐

No ☐

62. Have you ever felt the need to have Steroids or felt dependent on Steroids?

Yes ☐

No ☐

63. Have you ever felt sick because of stopping or cutting down on Steroids?

Yes ☐

No ☐

64. Have you ever tried Mushrooms?

_____

No: Insert a **N** in box: Go to Question 73 on the next page.

☐

Yes: Insert a **Y** in box and continue.

65. How old were you (in years) when you first tried mushrooms ?

☐

66. When was the last time (in days) you used mushrooms?

☐

67. How many times have you used mushrooms in the past month?

☐

68. Have you ever tried to cut down on the use of mushrooms?

Yes ☐

No ☐

69. Have you ever felt unable to cut down on the use mushrooms?

Yes ☐

No ☐

70. Have you ever felt the need to have more mushrooms to get the same effect?

Yes ☐

No ☐

71. Have you ever felt the need to have mushrooms or felt dependent on mushrooms?

Yes ☐

No ☐

72. Have you ever felt sick because of stopping or cutting down on mushrooms?

Yes ☐

No ☐

73. Have you ever tried **other** drugs (please specify)?

_____

No: Insert a N in box: Please turn in booklet to Heather.

☐

Yes: Insert a Y in box and continue.

74. How old were you (in years) when you first tried _____?

☐

75. When was the last time (in days) you used _____?

☐

76. How many times have you used _____ in the past month?

☐

77. Have you ever tried to cut down on the use of _____?

Yes ☐

No ☐

78. Have you ever felt unable to cut down on the use _____?

Yes ☐

No ☐

79. Have you ever felt the need to have more _____ to get the same effect?

Yes ☐

No ☐

80. Have you ever felt the need to have _____ or felt dependent on _____?

Yes ☐

No ☐

81. Have you ever felt sick because of stopping or cutting down on _____?

Yes ☐

No ☐

Please turn in this Booklet to Heather - If you need another page like this one, please ask her.

Appendix C
Your Thoughts on Drugs

- 1) How much do you think people risk harming themselves (physically or in other ways) if they try each of the following?

<i>Please circle the box that corresponds with your answer.</i>	No Risk	Slight Risk	Moderate Risk	Great Risk
Try marihuana once or twice	☐	☐	☐	☐
Smoke marihuana occasionally	☐	☐	☐	☐
Smoke marihuana regularly	☐	☐	☐	☐
Try cocaine once or twice	☐	☐	☐	☐
Take cocaine occasionally	☐	☐	☐	☐
Take cocaine regularly	☐	☐	☐	☐
Try 1 or 2 drinks of an alcoholic beverage ever	☐	☐	☐	☐
Take 1 or 2 drinks nearly every week	☐	☐	☐	☐
Take 1 or 2 drinks nearly every day	☐	☐	☐	☐
Take 4 or 5 drinks nearly every day	☐	☐	☐	☐
Have 5 or more drinks once or twice each weekend	☐	☐	☐	☐
Smoke ½ pack of cigarettes per day	☐	☐	☐	☐
Smoke 1 or more packs of cigarettes per day	☐	☐	☐	☐
Use smokeless tobacco regularly	☐	☐	☐	☐

- 2) Do you disapprove of people (18 or older) if they do any of the following?

<i>Please circle the box that corresponds with your answer.</i>	Don't Disapprove	Disapprove	Strongly Disapprove
Try marihuana once or twice	☐	☐	☐
Smoke marihuana occasionally	☐	☐	☐
Smoke marihuana regularly	☐	☐	☐
Try cocaine once or twice	☐	☐	☐
Take cocaine occasionally	☐	☐	☐
Take cocaine regularly	☐	☐	☐
Try 1 or 2 drinks of an alcoholic beverage ever	☐	☐	☐
Take 1 or 2 drinks nearly every week	☐	☐	☐
Take 1 or 2 drinks nearly every day	☐	☐	☐
Take 4 or 5 drinks nearly every day	☐	☐	☐
Have 5 or more drinks once or twice each weekend	☐	☐	☐
Smoke ½ pack of cigarettes per day	☐	☐	☐
Smoke 1 or more packs of cigarettes per day	☐	☐	☐

Social Situation

3) How do you think your close friends feel (or would feel) about you...

<i>Please circle the box that corresponds with your answer.</i>	Don't Disapprove	Disapprove	Strongly Disapprove
Trying marihuana once or twice?	☐	☐	☐
Smoking marihuana occasionally?	☐	☐	☐
Smoking marihuana regularly?	☐	☐	☐
Trying cocaine once or twice?	☐	☐	☐
Taking cocaine occasionally?	☐	☐	☐
Taking cocaine regularly?	☐	☐	☐
Taking 1 or 2 drinks of an alcoholic beverage ever?	☐	☐	☐
Taking 1 or 2 drinks nearly every week?	☐	☐	☐
Taking 1 or 2 drinks nearly every day?	☐	☐	☐
Taking 4 or 5 drinks nearly every day?	☐	☐	☐
Having 5 or more drinks once or twice each weekend?	☐	☐	☐
Smoking ½ pack of cigarettes per day?	☐	☐	☐
Smoking 1 or more packs of cigarettes per day?	☐	☐	☐

4) During the LAST 12 MONTHS how often have you been around people who were taking each of the following to get high or for "kicks"?

<i>Please circle the box that corresponds with your answer.</i>	Not Exposed	Occasionally Exposed	Often Exposed
Marihuana	☐	☐	☐
Cocaine	☐	☐	☐
Alcoholic beverages	☐	☐	☐

5) How difficult do you think it would be for you to get each of the following types of drugs, if you wanted some?

<i>Please circle the box that corresponds with your answer.</i>	Probably Impossible	Very Difficult	Fairly Difficult	Fairly Easy	Very Easy
Marihuana	☐	☐	☐	☐	☐
Cocaine	☐	☐	☐	☐	☐

Appendix D

Prenatal Marijuana Exposure Group and Gender Differences in Peer Influences Using Logarithmic Transformed Peer Variables

A 2 x 3 (Gender x Prenatal Marijuana Exposure Group) between-subjects MANCOVA was performed on the four logarithmic transformed peer influence variables: the proportion of peers who have tried and who regularly use cigarettes and marijuana. Adjustment was made for three covariates: combined parental level of education and maternal use of nicotine and alcohol during pregnancy. The two independent variables were the degree of prenatal exposure to marijuana (none, infrequent/moderate, heavy) and gender. Using Box's M test, the assumption of homogeneity of variance-covariance matrices was found to be slightly violated in this analysis, Box's $M = 83.57$, $F(40, 5375.29) = 1.84$, $p = .001$. Table D1 presents the means of the transformed peer variables across the levels of maternal marijuana use. Unadjusted means and standard deviations as well as the means and standard errors adjusted for covariates are included.

In order to determine if there were any overall significant prenatal marijuana exposure group and/or sex differences in the set of peer influence variables, and to assess if the peer influence variables were significantly related to the covariates, an alpha level of .05 was used in conjunction with Wilks' criterion.

The results indicate that as a set, the peer influence measures were not significantly related to the set of three covariates, Wilks' $\Lambda = .96$, $F(4, 142) = 1.36$, $p = .25$, $\eta^2 = .04$. With adjustment for the three covariates, it was found that there was no significant multivariate gender by prenatal marijuana exposure group interaction, Wilks' $\Lambda = .99$, $F(8, 284) = .17$, $p = .99$, $\eta^2 = .01$.

Table D1

Unadjusted and Adjusted Logarithmic Transformed Peer Influence Dependent Variables Across Prenatal Marijuana Exposure

Groups (N = 152)

Dependent variables	Prenatal maternal use of marijuana (joints/day)					
	Unadjusted (mean [<i>SD</i>])			Adjusted for covariates (adj. mean [<i>SE</i>])		
	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22	None (0) <i>n</i> = 103	Infrequent/ Moderate (>0 and <6) <i>n</i> = 27	Heavy (≥6) <i>n</i> = 22
Proportion of peers who have tried cigarette smoking	.08(.13)	.04(.10)	.02(.06)	.08(.01)	.04(.02)	.02(.03)
Proportion of peers who regularly smoke cigarettes	.11(.14)	.15(.15)	.19(.15)	.11(.01)	.15(.03)	.20(.03)
Proportion of peers who have tried marijuana	.10(.14)	.05(.11)	.06(.12)	.10(.01)	.05(.03)	.06(.03)
Proportion of peers who regularly use marijuana	.07(.13)	.13(.15)	.16(.15)	.07(.01)	.13(.03)	.16(.03)

Note. *SD* = standard deviation; *SE* = standard error.

There was, however, a significant multivariate main effect of gender, Wilks' $\Lambda = .93$, $F(4, 142) = 2.68$, $p = .03$, $\eta^2 = .07$, as well as a significant multivariate main effect of prenatal marijuana exposure, Wilks' $\Lambda = .90$, $F(8, 284) = 1.95$, $p = .05$, $\eta^2 = .05$. As is evident from the η^2 s, only small associations were found between the set of peer influence variables and the covariates and main effects (Cohen, 1977).

In order to determine which peer influence measures were contributing to the overall multivariate significance for the effects of prenatal exposure to marijuana and gender, univariate analyses on each of the transformed peer influence dependent variables were conducted as follow-up tests to the MANCOVA. A Bonferroni correction (i.e., $\alpha = .05/4 \text{ DVs} = .0125$) was used in order to control for Type I error. In order to assist the reader, the results concerning the effect of gender have been presented separately from those pertaining to the effect of prenatal marijuana exposure.

Gender differences. With respect to the main effect of gender, the univariate analyses showed that the only peer influence variable which was found to be significant was the proportion of peers who regularly use marijuana, $F(1, 145) = 9.82$, $p = .002$, $\eta^2 = .06$, indicating that males ($M = .15$, $SE = .02$) in this sample reported having a significantly greater proportion of peers who regularly use marijuana as compared to females ($M = .09$, $SE = .02$; $p = .01$). Table D2 presents the results for the nonsignificant univariate F tests.

Table D2

Univariate Tests of Gender and Prenatal Marijuana Exposure for Logarithmic Transformed Peer Influence Dependent Variables (N = 152)

Effect	Dependent variables	<i>df</i>	<i>F</i>	η^2
Gender	Proportion of peers who have tried cigarette smoking	1/145	.002	.00
	Proportion of peers who regularly smoke cigarettes	1/145	2.43	.02
	Proportion of peers who have tried marijuana	1/145	.33	.002
	Proportion of peers who regularly use marijuana	1/145	9.82**	.06
Prenatal marijuana exposure	Proportion of peers who have tried cigarette smoking	2/145	2.92	.04
	Proportion of peers who regularly smoke cigarettes	2/145	3.67*	.05
	Proportion of peers who have tried marijuana	2/145	1.56	.02
	Proportion of peers who regularly use marijuana	2/145	5.72**	.07

* $p \leq .05$. ** $p \leq .01$.

Prenatal marijuana exposure group differences. In terms of the significant main effect of prenatal marijuana exposure, the univariate analyses revealed that again, only the proportion of one's peers who regularly use marijuana was significant, $F(2, 145) = 5.72, p = .004, \eta^2 = .07$. Table D2 also presents the results for these nonsignificant univariate F tests.

Since a significant univariate main effect was found for the proportion of one's peers who regularly use marijuana, pairwise comparisons were then conducted on this peer influence variable using a Bonferroni correction (i.e., $\alpha = .05/3$ comparisons = .0167) in order to control for Type I error.

The results revealed that adolescents in this study who were heavily exposed to marijuana prenatally (i.e., ≥ 6 joints/week) reported having a significantly greater proportion of peers who regularly use marijuana ($M = .16, SE = .03$) as compared to those youth who were not prenatally exposed to marijuana ($M = .07, SE = .01; p = .003$). No significant differences were found, however, with respect to the proportion of one's peers who regularly use marijuana between youth who were infrequently/moderately exposed prenatally (i.e., > 0 and < 6 joints/week) to marijuana ($M = .13, SE = .03$) and those who were heavily exposed to this drug ($p = .32$). Similarly, adolescents who were infrequently/moderately exposed to marijuana prenatally were not found to significantly differ from those who were not prenatally exposed to this substance with respect to the proportion of their peers who regularly use marijuana ($p = .05$).

Appendix E

Sequences of Drug Use Among Adolescents in Ottawa Prenatal Prospective Study (N = 152)

Pathway	Number of Youth (%)
Alcohol only	22 (14.47)
Alcohol → Marijuana	16 (10.53)
No drug use	9 (5.92)
Cigarettes → Marijuana and Alcohol	5 (3.29)
Cigarettes → Alcohol	4 (2.63)
Alcohol → Tranquilizers	4 (2.63)
Marijuana and Alcohol → Mushrooms	4 (2.63)
Alcohol → Cigarettes and Marijuana	3 (1.97)
Alcohol → Cigarettes → Marijuana	3 (1.97)
Marijuana → Alcohol	3 (1.97)
Alcohol → Marijuana → Mushrooms	3 (1.97)
Alcohol → Marijuana → Cigarettes	2 (1.32)
Alcohol and Marijuana	2 (1.32)
Alcohol, Cigarettes and Marijuana	2 (1.32)
Cigarettes and Marijuana → Alcohol, Amphetamines, Crack/Cocaine, LSD, and Mushrooms	1 (.66)
Alcohol → LSD	1 (.66)
Alcohol → Marijuana and LSD → Cigarettes and Mushrooms	1 (.66)
Cigarettes and Marijuana → Alcohol	1 (.66)

Pathway	Number of Youth (%)
Alcohol → Marijuana, Cigarettes, Amphetamines, and LSD → Crack/Cocaine	1 (.66)
Marijuana → Alcohol → Cigarettes and Mushrooms → Amphetamines	1 (.66)
Alcohol and Cigarettes → Marijuana → Mushrooms → Amphetamines	1 (.66)
Alcohol → Cigarettes → Marijuana → LSD and Mushrooms	1 (.66)
Alcohol → Marijuana → Cigarettes → Mushrooms → Tranquilizers	1 (.66)
Cigarettes → Alcohol → Marijuana	1 (.66)
Alcohol → Marijuana and Mushrooms → Cigarettes → Amphetamines	1 (.66)
Alcohol → Cigarettes and Marijuana → Amphetamines, LSD, and Mushrooms	1 (.66)
Cigarettes and Alcohol → Marijuana and LSD → Amphetamines	1 (.66)
Cigarettes and Alcohol → Marijuana and LSD → Crack/Cocaine and Mushrooms	1 (.66)
Cigarettes, Alcohol, and Marijuana → Amphetamines → LSD	1 (.66)
Cigarettes, Alcohol, Marijuana, and LSD → Mushrooms → Amphetamines	1 (.66)
Alcohol and Marijuana → Cigarettes	1 (.66)
Alcohol → Cigarettes and Marijuana → Amphetamines	1 (.66)
Alcohol → Cigarettes → Marijuana and Steroids	1 (.66)
Alcohol → Cigarettes, Marijuana, and Mushrooms	1 (.66)
Alcohol and Cigarettes → Marijuana → LSD → Crack/Cocaine	1 (.66)
Cigarettes → Marijuana and Alcohol → LSD → Amphetamines → Crack/Cocaine	1 (.66)
Cigarettes → Marijuana and Alcohol → Mushrooms → LSD and Amphetamines → Crack/Cocaine	1 (.66)

Pathway	Number of Youth (%)
Alcohol → Cigarettes and Marijuana → LSD, Mescaline, and Mushrooms → Amphetamines	1 (.66)
Alcohol and Cigarettes → LSD → Marijuana	1 (.66)
Alcohol and Cigarettes → Marijuana and Crack/Cocaine → LSD and Steroids	1 (.66)
Cigarettes, Alcohol, and Marijuana → Mushrooms	1 (.66)
Alcohol and Mushrooms → Marijuana	1 (.66)
Alcohol → Tranquilizers → Marijuana	1 (.66)
Cigarettes and Alcohol → Marijuana, Amphetamines, Tranquilizers, and LSD	1 (.66)
Cigarettes, Alcohol, Marijuana, and LSD → Amphetamines and Mushrooms	1 (.66)
Alcohol → Marijuana → Cigarettes → Mushrooms	1 (.66)
Alcohol → Cigarettes and Marijuana → Mushrooms	1 (.66)
Alcohol → Cigarettes → Marijuana and Mushrooms → LSD → Amphetamines → Tranquilizers	1 (.66)
Alcohol and LSD → Cigarettes → Marijuana	1 (.66)
Cigarettes → Marijuana → Alcohol	1 (.66)
Marijuana → Cigarettes → Alcohol → LSD → Amphetamines → Crack/Cocaine → Opium	1 (.66)
Alcohol and Marijuana → Cigarettes → LSD	1 (.66)
Marijuana → Mushrooms → Cigarettes, Alcohol, Amphetamines, and LSD	1 (.66)
Cigarettes and Marijuana → Alcohol → Mushrooms	1 (.66)
Alcohol → Cigarettes and Marijuana → LSD → Mushrooms → Amphetamines	1 (.66)
Marijuana and Alcohol → Amphetamines → Cigarettes	1 (.66)
Cigarettes → Alcohol → Marijuana and LSD	1 (.66)

Pathway	Number of Youth (%)
Alcohol, Cigarettes, and Marijuana → LSD and Mushrooms	1 (.66)
Alcohol → Marijuana → Amphetamines	1 (.66)
Cigarettes and Marijuana → Alcohol, Tranquilizers, and LSD	1 (.66)
Cigarettes → Tranquilizers → Marijuana, Alcohol, Amphetamines, LSD, and Mushrooms	1 (.66)
Marijuana → Alcohol → Cigarettes	1 (.66)
Alcohol and Cigarettes → Mushrooms → Marijuana	1 (.66)
Marijuana and Alcohol → Cigarettes → LSD and Mushrooms → Amphetamines	1 (.66)
Alcohol → Marijuana → Steroids and Mushrooms	1 (.66)
Marijuana and Alcohol → Cigarettes and Mushrooms → Amphetamines	1 (.66)
Steroids only	1 (.66)
Marijuana and Alcohol → Mushrooms → Cigarettes	1 (.66)
Cigarettes, Marijuana, and Alcohol → Amphetamines	1 (.66)
Cigarettes, Marijuana, Alcohol and Mushrooms	1 (.66)
Marijuana → Cigarettes → Alcohol → Amphetamines, LSD, and Mushrooms	1 (.66)
Cigarettes → Marijuana → Alcohol → LSD	1 (.66)
Cigarettes → Marijuana → Alcohol → Tranquilizers and Mushrooms	1 (.66)
Alcohol → Marijuana → Amphetamines and LSD	1 (.66)
Alcohol → Cigarettes and Marijuana → LSD and Mushrooms	1 (.66)
Alcohol → Mushrooms and Marijuana	1 (.66)

Pathway	Number of Youth (%)
Cigarettes → Marijuana and Alcohol → Amphetamines, Crack/Cocaine, and Mushrooms	1 (.66)
Alcohol → Cigarettes → Marijuana and Tranquilizers	1 (.66)
Marijuana, Alcohol, LSD, and Mushrooms	1 (.66)
Marijuana and Alcohol → Cigarettes → Mushrooms	1 (.66)
Cigarettes → Marijuana and Alcohol → Amphetamines → Mushrooms	1 (.66)
Marijuana → Cigarettes, Alcohol, and Mushrooms	1 (.66)
Marijuana → Cigarettes → Alcohol and Mushrooms → Amphetamines and LSD	1 (.66)
Marijuana → Cigarettes → Alcohol	1 (.66)
Total <i>N</i>	152

Note. LSD = lysergic acid diethylamide.