

ABSTRACT

Title of Document: The Association of Early Conduct Problems with Early Marijuana Use in College Students

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While several studies have documented a strong association between early conduct problems and adolescent drug use, similar research has not been conducted among college students. The current study examines the association between early conduct problems and early marijuana use in a sample of 1,076 college students. A new early conduct problem scale is developed for purposes of analysis. Regression models are developed to test the strength of the association, holding constant covariates that have been shown in prior research to be related to marijuana use. Results reveal a significant positive association between early conduct problems and early marijuana use even after controlling for the covariates. The new scale produces results similar to a previously accepted scale studying early conduct problems in a non-college sample. The results have important prevention implications and suggest the importance of early interventions for reducing the risk for early marijuana use.

THE ASSOCIATION OF EARLY CONDUCT PROBLEMS WITH EARLY
MARIJUANA USE IN COLLEGE STUDENTS

By

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Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Arts
2007

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Acknowledgements

Without the support and encouragement of my wife, the completion of this seemingly endless task may have never come to fruition. I am grateful to her and the rest of my family and friends for their words of support and constant prompting that it could and would eventually get finished.

I am also thankful for the support of my committee and their help in directing this process. I am deeply grateful to Dr. Eric Wish for his continued guidance and for reviewing every version of my project. Thanks goes to Dr. Amelia Arria first for allowing me the opportunity to use some of her precious data and secondly for her enthusiasm and encouraging words that have helped in the completion of this project. In addition, thanks to Dr. Kevin O'Grady for his patience and guidance (and numerous emails) in helping to provide the statistical and methodological framework for the current paper.

I am also grateful to Dr. John Laub for his time and guidance reviewing earlier thesis topics and literature reviews which never seemed to culminate for a number of different reasons.

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Introduction:

Statement of Problem

Substance use, especially the use of marijuana, is a problem among the nation's youth. Annual rates of use among college students have been found to be similar to annual rates of use by young adults of a similar age that do not attend college (30% versus 35%; Monitoring the Future, 2007). Furthermore, marijuana has been suggested to be a "gateway" drug, leading to further substance use and other antisocial problems (Kandel, 2002). While there has been a large amount of research that links conduct problems with substance use, including marijuana; this research generally has focused only on special types of populations such as juvenile delinquents or other clinically committed youth with psychiatric problems (Kratzer and Hodgins, 1997; Robins and McEvoy, 1990). The prior research has also emphasized the importance of the age of onset of conduct problems to the use of marijuana.

The current study will examine the age of onset of conduct problems and their association with early marijuana use, which may subsequently lead to further problems later in life. The study will do so by looking at a different sample of young adults, one in which there is little known in this specific area of research due to a large gap, college students, (Elliott, 1994; Ellickson, Tucker, Klein, and Saner, 2004; Pope et al., 2003). The study is unique because generally people who initiate early conduct problems tend to be academically challenged or become increasingly delinquent, reducing their chances for success in school and attending college (APA, 1994). However, this study will assess whether problem behaviors that occur earlier in life are associated with the early use of marijuana in a population of college students.

Overview of Paper-

Chapter 1 provides a discussion of early substance use and its association with subsequent problems including further drug involvement, other deviant behaviors, criminal acts and arrests. A more comprehensive look at early marijuana use and the consequences of such use follows, which examines studies of the association between early marijuana use and subsequent cognitive and behavioral problems. This section provides the rationale for the importance of studying the early use of marijuana.

It continues by presenting information on the risks which have been found to be associated with marijuana use and especially, early marijuana use. After the risks have been briefly discussed, research is presented on conduct problems and their association with substance use and explicitly with early marijuana use. Background information on the conduct problems that make up the clinical disorder known as conduct disorder follows, including a discussion on the sub-types and the role that early conduct problems play in subsequent problem areas later in life.

The next section describes the ways that early marijuana use has been defined and studied in previous research related to this topic. This section also emphasizes the important nature of the sample being studied. It stresses the gap in the literature that exists, caused by so few studies focusing their research on the specific area of early conduct problems and early marijuana use in college students.

In Chapter 2, the proposed research questions are laid out and hypotheses are developed based on the reviewed literature highlighting why students with early conduct problems (CPs) are thought to be more likely to be early marijuana users.

Chapter 3 begins by describing the sample and how it was created. Next the data are discussed followed by a section on methods of analyses. The rationale for choosing the specific scale for early CPs in the specific sample is then noted, after it is determined that a new scale may be better suited for the population of college students than scales used in other general or deviant populations. Next is a brief discussion of why multinomial logistic regression was chosen for the method of analysis with the present data, followed by a discussion of the sample's statistical power and its importance to the results.

Subsequently, Chapter 4 lays out the findings and the results of analysis, including a comparison of the newly developed scale and one of the previously used scales of CPs found in the current literature. Finally, in Chapter 5 the results are discussed along with the limitations of the current study. Implications for future research are then proposed and concluding remarks are made.

Chapter 1: Review of the Literature

Early Drug Use and Subsequent Behavior

In her studies of adolescents, Kandel (1982) found that the early use of any drug increases the chance of involvement with other drugs later in life. Additional research has suggested that the age at first drug use is a strong predictor of the extent of later involvement with different substances and involvement in other deviant activities (Brill and Christie, 1974; DEWS, 2004; Kandel, 1982; Kleinman, 1978; Robins, 1978). Other studies have revealed that the early use of any type of drug increases the likelihood of continued and increased involvement in conduct problems and delinquent acts (Brunswick and Boyle, 1979; Kleinman, 1978; O'Donnell and Clayton, 1979). Similarly, research has found early substance use to be associated with substance dependence, antisocial personality disorder, and arrests (Franken and Hendriks, 2000; McGue, Iacono, Legrand, Malone, and Elkins, 2001). A substantial body of research has focused on early marijuana use and problems later in life as well.

Early Marijuana Use and Subsequent Problems

Many studies have focused on early marijuana use and its association with the continued marijuana use, other illicit drug use, and other cognitive and behavioral problems. *Table 1.* shows some of the problems that have been found to be associated with early marijuana use. One of the most consistent findings is the earlier that youth begin using marijuana the more likely they are to use other illegal drugs (Agrawal, Neal, Prescott, and Kendler, 2004; DEWS, 2004; Ellickson et al., 2004; Fergusson, Lynskey, and Horwood, 1993, 1996; Fergusson & Horwood, 1997; Lynskey et al., 2003;

SAMHSA, 2002). Similarly, early marijuana users are more likely to develop other serious drug and alcohol related problems compared to youth who begin using marijuana later in life and non-users (DEWS, 2004; Lynskey et al., 2003; Ellickson et al., 2004).

Early marijuana users are more likely to have dropped out of school and have other academic related problems than later users and non-marijuana users (Ellickson et al., 2004; Lynskey & Hall, 2000; Fergusson et al., 1993, 1996), have cognitive related problems (Pope et al., 2003), physical (Ehrenreich et al., 1999; Wilson et al., 2000) and psychological problems (Fergusson et al., 1993, 1996; Fergusson & Horwood, 1997; Lynskey et al., 2003; Lynskey et al., 2004) in comparison to both late and nonusers. Early marijuana users are also more likely to initiate crime at an earlier age as well as become generally more delinquent than later and non-marijuana users (Fergusson et al., 1993, 1996; Fergusson & Horwood, 1997; Elliott, 1994; Elliott, Huizinga, & Menard, 1989).

All of these studies as well as numerous others have focused on early marijuana use and the risk of subsequent problems associated with early marijuana use. General population studies have found that early marijuana users initiate crimes at earlier ages compared to persons who do not initiate marijuana use at an early age (Elliott, 1994; Elliott et al., 1989). Studies using data from the National Household Survey on Drug Abuse report that 7 percent of adults aged 18 years or older who first used marijuana before age 14 were dependent on illicit drugs in 2000. This was more than twice the rate among adults who first used marijuana between age 15 to 17 years, and over 5 times the rate among those who first used marijuana after 18. Early marijuana users were also more

likely to have used cocaine and heroin compared to people who began using marijuana later in life (SAMHSA, 2002).

Ellickson and colleagues (Ellickson et al., 2004), in a high school-based sample, found earlier marijuana users (students who initiated use in grade 7) were more likely than later users (students who initiated use in grade 10) to exhibit problem-related marijuana use, hard drug use, and poly drug use. Moreover, Pope and colleagues (Pope et al., 2003) in a recent study of adults who were heavy marijuana users found that those who initiated marijuana use early (before 17) exhibited poorer cognitive performance than later marijuana users and non-users.

Table 1. Summary of Studies Investigating Early Marijuana (MJ) Use and Subsequent Problems

Study/Authors	Definition of "Early MJ Use" used in the study	Population Studied	Findings
SAMHSA, 2002	< 14 Years	U.S. Adult Population	-Early MJ users were 2 to 5 times more likely to be dependent on illicit drugs than later MJ users -Early MJ users were more likely to have used cocaine and heroin than later MJ users
DEWS, 2004	< 15 Years	Public High School Students	-The earlier that students began using alcohol, cigarettes, and/or marijuana, the more likely they were to use other illegal drugs and develop related problems -Early MJ users had the highest risk of using other illegal drugs and developing serious drug- and alcohol- related problems
Lynskey & Hall, 2000	< 15 Years	Public High School Students	-Early MJ use is associated with the adoption of anti-conventional lifestyles characterized by affiliations with delinquent and substance using peers, and the adoption of adult roles including dropping out of school early, leaving the parental home early and early parenthood.
Fergusson, Lynskey, & Horwood, 1993; 1996	< 15 Years	New Zealand Birth Cohort	-Early MJ users were at increased risks of later substance use behaviors, conduct/oppositional disorders, juvenile offending, severe truancy, school dropout, anxiety, depression, and suicidal ideation. -Early MJ users had odds of these outcomes ranging from 2.7 to 30.8 times higher than the odds for those that did not use cannabis prior to 15.
Fergusson & Horwood, 1997	< 16 Years	New Zealand Birth Cohort	-Early MJ use was related to later substance abuse, juvenile offending, poor mental health, and unemployment.
Pope et al., 2003	< 17 Years	Adult MJ Users	-Adult heavy MJ users who initiated MJ use early exhibited poorer cognitive performance than later MJ users and non-users.
Ehrenreich et al., 1999	< 17 Years	Adult MJ Users	-48 early MJ users, but not 51 late onset users, exhibited significantly longer reaction times than controls in a visual scanning task suggesting early MJ use is more toxic than later use.
Lynskey et al., 2003	< 17 Years	Same Sex Twin Pairs	-Individuals who use MJ by age 17 had odds of other drug use, alcohol dependence, and drug abuse/dependence that were 2.1 to 5.2 times higher than those of their co-twin, who did not use MJ before age 17 years, when controlling for known risk factors (early-onset alcohol or tobacco use, parental conflict/separation, childhood sexual abuse, conduct disorder, and major depression)
Lynskey et al., 2004	< 17 Years	Same Sex Twin Pairs	-Those who initiated MJ use before age 17 had elevated rates of subsequent suicide attempts, but not major depressive disorder or suicidal ideation.
Agrawal et al., 2004	<18 Years	General Population Twin Pairs	-Early MJ use was strongly associated with other illicit drug use and abuse/dependence.
Elliott, 1994; Elliott, Huizinga, & Menard, 1989	**	National Probability Sample of Youth age 11-17	-Early MJ users initiate crimes at earlier ages than people who begin using MJ at later ages
Ellickson et al., 2004	Grades 7 to 8 (about 13 to 14 years old)	Middle School Students	-Early MJ users were more likely to exhibit problem-related marijuana use, hard drug use, polydrug use, poor grades, and low academic intentions than later MJ users

** Did not use an age range, just compared earlier MJ users to later users

Defining Early Marijuana Use

Prior research has used a variety of different ages to classify “early marijuana use,” as can be seen also in *Table 1*. Two studies using samples of public school students, (DEWS, 2004; Lynskey and Hall, 2000) distinguish early marijuana use as the use of marijuana prior to reaching the age of 15 years. Lynskey and Fergusson (1993; 1996) used the same age (15) as a distinction of early marijuana use in their study of a New Zealand birth cohort. In a later study of the same New Zealand birth cohort, Fergusson and Horwood (1997) classified early marijuana use, as use that occurs prior to reaching the age of 16 years. Pedersen and colleagues (Pedersen, Mastekaasa, and Wichstrom, 2001) used the same age (prior to 16) in their study of a school-based sample of Norwegian high-school students to distinguish early marijuana use.

Additional studies, which have looked at the early use of marijuana, have used the age of 17 years as a cutoff point in distinguishing early marijuana use from later use. Pope and colleagues (2004), as well as other researchers have used this division (prior to 17 years of age) of early use in their retrospective studies of adults selected based on their previous use of marijuana (Pope et al., 2004; Ehrenreich et al., 1999; Wilson, Turkington, Hawk, Coleman, and Provenzale, 2000). Two other studies (Lynskey et al., 2003; Lynskey et al., 2004) examining same-sex twin pairs also differentiate early use of marijuana as use prior to the age of 17 years. One other population-based study, which used twin pairs, defined early marijuana use as use occurring before or at the age of 18 years (Agrawal et al., 2004).

While there are a variety of different ages used to define “early marijuana use” ranging from < 14 years of age to < 18 years of age, it does not appear to matter what age

in this range is chosen to distinguish “early MJ use” because the results seem similar across definitions. All definitions spanning this range seem to find an anticipated negative relationship between early marijuana use and subsequent problems. Therefore it should not matter what age distinction is used between 14 and 18 when defining early marijuana use for purposes of this study.

Risks of Early Marijuana Use

On the next page, *Table 2.* presents an overview of the literature that has been written on the risks that have been found to be associated with early marijuana use. Low peer achievement, peer delinquency, peer and sibling drug use (Kandel, Kessler, and Margulies, 1978; Kosterman, Hawkins, Guo, Catalano, and Abbott, 2000; Yamaguchi, 1990), and the youth’s own legal drug use (Kosterman et al., 2000) have all been found to be associated with early marijuana use. The age at which a person first drinks alcohol or tries other substances has also been found to be associated with later problem use behaviors, such as early marijuana use; the earlier the use begins, the greater the risk for later abuse (Hawkins and Catalano, 1992; Kandel and Yamaguchi, 1993; Yu and Williford, 1992).

Table 2. Studies Investigating Correlates for Early Marijuana Use

Study/Authors	Population Studied	Findings
Kandel, Kessler, & Margulies, 1977	New York State public secondary school students	-Adolescents beliefs and values favorable to the use of marijuana and association with marijuana-using peers are strongly associated with initiation to marijuana use -Frequency of use of drugs lower in sequence of drug involvement (beer, wine, cigarettes, or hard liquor), minor delinquent acts, cutting classes, and low grades are important predictors of marijuana initiation
Kandel & Yamaguchi, 1993	Representative sample of New York state 12 th grade students	-Age at onset of alcohol use is a strong predictor of progression to other drugs
Yu & Williford, 1992	16 to 24 year old young adults in New York state	-Alcohol use increases the risk of cigarettes and marijuana -Alcohol-cigarette use significantly increases the use of marijuana
Fleming, Kellam, & Brown, 1982	1 st grade children in poor black Chicago communities	-Boys used all substances (including marijuana) at an earlier age than girls
Hammer & Vaglum, 1990	Nationally representative sample of young adults age 17-20 years	-Young men were more likely than young women to use marijuana
Pokolainen, Tuulio-Henriksson, Aalto-Setälä, Marttunen, Anttila, & Lonnqvist, 2001	High school students in Finland followed up at young adulthood	-Males were more likely to initiate marijuana use than females
Kosterman, Hawkins, Guo, Catalano, & Abbott, 2000	5 th grade students from 18 Seattle elementary schools	-Young people exposed to others who use substances are at higher risk for early use of alcohol and marijuana
Okwumabua & Duryea, 1987	Sample of Native American students grades 7 to 12	-Early adolescence (as early as 10) is a particularly risky period for initiation Native Americans to initiate smoking cigarettes, marijuana, and drinking
Okwumabua, J., Okwumabua, T., Winston, & Walker, 1989	Sample of black students grades 7 to 12 in rural Alabama	-The ages between 10 and 14 years is a particularly risky period for initiation to marijuana use for black youth
Clark, Cornelius, Kirisci, & Tarter, 2005	560 children from high and low risk homes	-Childhood neurobehavioral disinhibition (dysregulation) predicted later substance use disorder in late adolescence
Tarter, Kirisci, Habeych, Reynolds, & Vanyukov, 2004	170 boys; 1/3 of which had fathers with substance use disorders	-The neurobehavioral disinhibition (dysregulation) score predicted substance use disorders between ages 10-12 and 19

In addition to youth's exposure to others who use substances, which increases youth's risk for early marijuana use, Kosterman and colleagues (2000) also found that boys (Fleming, Kellam, and Brown, 1982; Hammer and Vaglum, 1990; Poikolainen et al., 2001) and Native and African Americans were all at significantly higher risks for early marijuana use compared to girls and members of other races. Additionally, they (Kosterman et al., 2000) note that low parental monitoring and low levels of attachment to parents increased the youth's risk of marijuana use at earlier ages. Similarly, Brook and colleagues (Brook, Kessler, and Cohen, 1999) found that close attachment to parents

lowered the risk of use, while those who attended church with their parents were less likely to use marijuana at each stage in their life.

Neurobehavioral disinhibition, defined as the delayed or deficient development of behavioral, emotional, and cognitive regulation (Clark et al., 2005) and also known as dysregulation, has predicted later substance use disorders in both early (Tarter et al., 2003; Tarter et al., 2004) and late adolescence (Clark et al., 2005), in samples of both high and low risk children. Additionally, dysregulation may also play a role in the early age of onset of substance use in general, including the early use of marijuana.

Previous research, though limited, has also shown a relationship between socioeconomic status (SES) and early marijuana use. Some prospective studies on adolescents (Baumrind, 1985; Kandel et al., 1978; Kaplan, Martin, and Robbins, 1985) have found that early marijuana use is related to SES. These studies find that youth from higher SES families are at a greater risk of marijuana use than youth from lower SES families. This suggests that youth from higher SES families have the financial ability to obtain marijuana while the lower SES youth do not.

Little is know about risk factors for early marijuana use among college students, SES and the other risk factors previously mentioned may have different associations with early marijuana use among college students. Likewise, grades or academic status might not vary to the same extent in college students and may not have the same effect as in other samples. There is a great need to study conduct problems and marijuana use in college students.

Early Conduct Problems and Substance Use

While *Table 2.* covers a variety of different risk factors associated with early marijuana use, another risk that has been repeatedly found to be associated with both substance use and early marijuana use, are early conduct problems. Conduct problems are generally deviant and antisocial behaviors, committed by youth. Further discussion of the specifics of conduct problems will follow later in the current paper. *Table 3.* reveals literature that has found associations between early conduct problems and general substance use. The amount of literature that is directly related to early conduct problems (CPs) and the early use of marijuana is scarce, and almost non-existent when focusing specifically on a college population, as is evident in *Table 4.*

Robins and McEvoy (1990) state “Abuse is extremely rare for those free of (early) conduct problems, no matter how early substance use begins,” (p. 196, 1990).

Robins and McEvoy, in a general population study, found that substance abuse problems are twice as common in adults who had histories of childhood conduct problems (Robins and McEvoy, 1990). In research by Loeber and Le Blanc (1990), the early onset of CPs were found to be predictive of high rates of later offending and serious substance abuse later in life.

Table 3. Summary of Studies Investigating Conduct Problems and Substance Use

Study/Authors	Population Studied	Findings
Kratzer & Hodgins, 1997	Stockholm birth cohort followed to age 30	-76% of males and 30% of females with childhood conduct problems had either a criminal record, a mental disorder, or both -Almost all of the mental disorders were severe substance abuse
Robins & McEvoy, 1990	Household survey	-More adult drug users (26%) than non-users (11%) reported a history of childhood conduct problems
Kellam, Brown, Rubin, & Ensminger, 1983	Prospective study of poor Chicago first graders and their families	-Childhood aggression is associated with drug use later in life
Chilcoat, Dishion, & Anthony, 1995	Epidemiological study of 8-10 year old Baltimore, MD children	-Found association between early antisocial behavior (conduct problems) and later risk of drug use
Johnson, Arria, Borges, Jalongo, & Anthony, 1995	Epidemiological sample of urban students in the public schools in mid-Atlantic U.S.	-High levels of conduct problem behaviors by age 10-12 years are associated with early alcohol use without parent permission
Neurmark & Anthony, 1997	Household survey of adults in Baltimore, MD	-Youth who exhibit problem behaviors are at increased risk of injecting drug use. The estimated risk of injecting drug use increased with the number of reported conduct problems.
Gordon, Kinlock, and Battjes, 2004	Adolescents entering substance abuse treatment programs	-Early onset of substance use was associated with greater levels of bullying and cruelty to people and animals

Robins and McEvoy (1990) using data from the Epidemiological Catchment Area Program (a household survey) also found a connection between conduct problems and drug use in general. They found more adult drug users (26%) than non-users (11%) reported a history of childhood conduct problems (Robins and McEvoy, 1990). Similar studies using parent and teacher reports of conduct problems found a similar relationship between childhood conduct problems and adolescent drug use (Boyle et al., 1993; Brook, Whiteman, Cohen, & Tanka, 1992). Kratzer and Hodgins (1997) found comparable results in their study of a Stockholm birth cohort. In this study both males and females who were identified with childhood conduct problems, compared to those that did not have childhood conduct problems, were at an increased risk for both crime and substance abuse in adulthood.

Additional research by Kellam and colleagues (Kellam, Brown, Rubin, and Ensminger, 1983) in the prospective Woodlawn study, found an association between early aggression (some of these behaviors are similar to conduct problems) and subsequent drug use. In another prospective study, Chilcoat and colleagues (Chilcoat, Dishion, and Anthony, 1995) found a relationship between early conduct problems and an increased risk for later substance use. Johnson and colleagues (Johnson, Arria, Borges, Jalongo, and Anthony, 1995), in a study of childhood CPs, found that higher levels of childhood CPs were associated with early alcohol use without parental permission. Moreover, two retrospective studies of adult intravenous and heavy drug users reported a strong link between early childhood problems and their later subsequent problems (Anthony, 1985; Tomas, Vlahov, and Anthony, 1990). Neumark and Anthony (1997), in a follow-up study of Baltimore households, determined that for every one-point increase in their nine-point misbehavior scale (which include several types of conduct problems), the risk of becoming an injecting drug user increased by an estimated 70%. Even though results weakened after adjusting for demographic characteristics, statistical significance remained.

Numerous other studies have found that both conduct disorder, a diagnosis that includes a number of different conduct problems, and conduct problems are associated with an elevated risk of drug use disorders in both population-based and clinical samples (Biederman, Wilens, Mick and Faraone, 1997; Bukstein, Glancy, and Kaminer, 1992; Greenbaum, Prange, Friedman, and Silver, 1991; Stowell and Estroff, 1992). In addition, research by Gordon and colleagues (Gordon, Kinlock, and Battjes, 2004) found that the age of substance use onset was significantly associated with some of the symptoms found

in the conduct disorder diagnosis including, bullying others, being cruel to people, being cruel to animals, and aggressive behavior. While each of these studies refer to the more general topic of substance use, research exists, though limited, supporting an association between early conduct problems and early marijuana use as can be seen in *Table 4*.

Table 4. Summary of Studies Investigating Conduct Problems and Marijuana Use

Study/Authors	Population Studied	Findings
Anthony, 1985; Tomas, Vlahov, & Anthony, 1990	Retrospective study of adult intravenous and heavy marijuana users	-Found an association between both intravenous and heavy marijuana users and early childhood misbehavior
Pedersen, Mastekaasa, & Wichstrom, 2001	Norwegian High School Students	-Conduct problems are important precursors of early MJ use. In particular there was a strong association between early onset conduct problems and MJ initiation.
Fergusson, Lynskey, & Horwood, 1993; 1996	New Zealand Birth Cohort	--Children who showed tendencies to conduct disorder behavior in middle childhood were between 2.1 to 2.7 times more likely to engage in early cannabis use than children not prone to conduct problems even when controlling for family social background, parental separation and parental conflict.
Brook, Kessler, & Cohen, 1999	Nonusers of illegal drugs, followed from 9 years of age to their early 20s	- Unconventional behavior and low ego integration from preadolescence through young adulthood predicted subsequent marijuana use

Conduct Problems and Early Marijuana Use

Brook, Kessler, and Cohen’s (1999) longitudinal study of youth from age 9 to 20 years, found that unconventional behavior and low ego integration from preadolescence through young adulthood increased the risk of subsequent marijuana use, however they do not note whether it is specifically “early marijuana use.” Conversely, Fergusson and Lynskey (1993) in their study of a New Zealand birth cohort showed that conduct problems during childhood were significantly associated with early marijuana use. In this study, children who showed conduct problems early, during middle childhood, were estimated to be 2.1 to 2.7 times more likely to engage in early marijuana use, before age 15, than children who did not exhibit early conduct problems. Similarly, Pedersen and

colleagues (2001) in a prospective longitudinal study of adolescents found a strong association between early conduct problems and the subsequent initiation of marijuana use, before 16 years.

What are Early Conduct Problems?

Conduct problems themselves are derived from the 15 criteria that make up the clinical diagnosis known as conduct disorder (see the *American Psychiatric Association's Diagnostic and Statistical Manual* for a complete description of the disorder (4th edition, 1994)). The 15 behaviors included in conduct disorder follow:

(1) often bullies, threatens, or intimidates others; (2) often initiates physical fights; (3) has used a weapon that can cause serious physical harm to others (e.g., a bat, brick, broken bottle, knife, gun); (4) has been physically cruel to people; (5) has been physically cruel to animals; (6) has stolen while confronting a victim (e.g., mugging, purse snatching, extortion, armed robbery); (7) has forced someone into sexual activity. Destruction of proportion—(8) has deliberately engaged in fire setting with the intention of causing serious damage; (9) has deliberately destroyed others' property (other than by fire setting). Deceitfulness or theft—(10) has broken into someone else's house, building, or car; (11) often lies to obtain goods or favors or to avoid obligations (i.e., "cons" others); (12) has stolen items of nontrivial value without confronting a victim (e.g., shoplifting, but without breaking and entering; forgery). Serious violations of rules—(13) often stays out at night despite parental prohibitions, beginning before age 13 years; (14) has run away from home overnight at least twice while living in parental or parental surrogate home (or once without returning for a lengthy period); (15) is often truant from school, beginning before age 13 years.

The clinical disorder has certain regulations on the number of times that a youth must commit a number of the previously listed conduct problems, during a certain period of time, for diagnosis. Much research however, has focused not on the clinical diagnosis, but only on the presence of youth exhibiting any number of these conduct problems for analysis purposes depending on the study (McCabe, Hough, Wood, and Yet, 2001; Ruchkin, Kuposov, Vermeiran, and Schwab-Stone, 2003, Nurco, Blatchley, Hanlon, and O'Grady, 1999; Johnson et al., 1995). These studies, like the current paper, do so in an

effort to better understand the developmental course of conduct disorder by better understanding early conduct problems.

Subtypes of the disorder are also distinguished in the DSM-IV; childhood onset (early) in which the onset of CPs start before the age of 10 years and adolescent onset (late) where the onset of CPs start after the youth has reached the age of 10. The DSM-IV also notes that the prognosis for early onset conduct disorder is not good, compared to a more favorable prognosis for late onset (APA, 1994). Extensive research by Moffitt (1993) and others (Blumstein, Cohen, Roth, and Visher, 1986; Farrington et al., 1990; LeBlanc and Loeber, 1998; Loeber and Farrington, 1998; Tolan, 1987) has shown that the age of onset of CPs play a large role in the extent and seriousness of further problems that a youth may be involved in later in life. This research also shows that the earlier the onset of CPs the greater the likelihood that an individual will commit further acts of antisocial behavior. Even early research by the Gluecks (Glueck and Glueck, 1950) discussed the importance of the age of onset to problem behaviors and the implications that the age of onset had on the duration and extent of future problem behaviors (Land and Nagin, 1996; Sampson and Laub, 1993).

Earlier Versus Later Conduct Problems

Fergusson and Lynskey's (1998) prospective study of a birth cohort in New Zealand showed that even after controlling for confounding factors, children with earlier CPs were at increased risk for juvenile offending, substance use behaviors, and mental health problems. Additionally, Hawkins and colleagues (Hawkins, Kosterman, Maguin, Catalano, and Arthur, 1997) report a pattern of persistent CPs in multiple settings in

childhood as an early behavioral predictor of substance abuse. They go on to say that aggressive behavior as early as age 5 years has been found to predict frequent drug use in adolescence and drug problems in adulthood.

Young and colleagues (Young et al., 1995) found that the age of onset of the first CP did not correlate significantly with the age of first trying a substance nor with the mean number of drugs which they had used regularly. However, they did not test to see if an increased number of early conduct problems, and not just the first symptom, were correlated significantly with the age of first marijuana use. Nor did they determine if the severity of the type of early conduct problems were associated with the age of first marijuana use, both of which will be explored in this current paper while looking at a population of college students. The term early in regards to CPs throughout the course of the rest of this paper will be in reference to CPs that occur earlier rather than later.

Number and Severity of Early Conduct Problems and Early Marijuana Use

While it is beneficial to determine whether early conduct problems increase the risk of early marijuana use, it may be more valuable to determine specifically whether it is the number of different types of early conduct problems or the nature of the severity of these early problem behaviors that has a stronger association with early marijuana use. Robins and Wish (1977) write, “The more varied, serious, and frequent the deviance of childhood, the greater the risk of its predicting later maladjustment” (p. 448). Their study of normal urban black men, found that the probability of committing a new type of deviance is in part a function of the variety of acts previously committed and in part the

result of having committed one particular type of deviant act making it more probable to initiate another particular type of deviant act thereafter.

Robins and McEvoy (1990), based on work with the ECA project, later concluded that no specific one CP behavior item could be identified as more predictive of general substance use than others could. They did not determine whether a larger number of conduct symptoms were associated with the earlier onset of substance use.

Conversely, Nurco and colleagues (Nurco et al., 1999) created both a deviance variety and a deviance severity index in their study on children of narcotics addicts. The variety index simply totaled the number of acts that the youth had reported engaging in by the age of 11, while the severity index was determined by assigning a value of 0 to 4 to each of the behaviors in question (0 = no offense, 1 = minor deviance, 2 = moderate deviance, 3 = moderately serious deviance including chargeable offenses, 4 = serious offense). They found that both variety and severity were associated with adolescent drug use. Yet again, there is a hole in the literature as to whether a similar relationship will exist in a sample of college students comparable to youth of general and deviant populations.

Do Early Conduct Problems Precede Early Marijuana Use?

Research on the progression of early conduct problems and early marijuana initiation is limited. However, research by Pedersen and colleagues (Pedersen et al., 2001), based on prior findings believe “the association and temporal ordering between conduct problems, conduct disorder, and later substance use and abuse seem well established” (p. 417, 2001). They state, “Numerous studies have concluded that CPs

(conduct problems) have a high prevalence among adolescent populations, and consequently the prevention of subclinical forms of conduct disorder could have a far more dramatic impact on later substance use than targeting only those with disorders,” which emphasizes the importance of studying conduct problems, in an effort to prevent later substance use (p. 417, 2001). They went on to report a strong association between CPs and the early use of marijuana in their sample of Norwegian high-school students. More notably, they found “early-onset CP increases individual vulnerability to later cannabis use” (p. 425, 2001) also accentuating the need for continued research on the association between early CPs and early marijuana use, especially among a sample in which little research has been conducted, college students.

Huizinga and Elliott (1981) in a community-based sample found that the most frequent temporal order was first minor delinquency (conduct problems), next alcohol use, then marijuana use, and last polydrug use. Young and colleagues, (Young et al., 1995) write that most of the boys in their study, a sample of 13-19 year old boys referred to an unlocked residential program by social or juvenile justice services, “reported that their [the boys] disruptive behavior began before their substance use...” (p. 160, 1995). The authors continue by noting a subsequent reciprocal effect in which their data suggests, “substance involvement may exacerbate some symptoms of conduct disorder” (p. 160, 1995). In a broader sense, delinquency (CPs) has been found in other studies to take place prior to general drug use (Elliott, Huizinga, and Ageton, 1982; Johnston, O’Malley, and Eveland, 1978).

College Students: A Unique Sample for Studying Early Conduct Problems and Early Marijuana Use

Analyzing college students, their early conduct problems and their association with early marijuana use is unique in several ways. First, while college students may carry the stigma of being “party animals” who drink a lot and use drugs, they are also perceived to be motivated and trying to further their educations in order to become successful in life. This perception is in contrast to the traditional view of a drug user living in a socio-economically deprived environment. Likewise, it may be the case that many people think that young adults who do not aspire to become college students are more likely to fail and have a greater likelihood to be drug users than college student. Conversely, according to national data from the 2006 Monitoring the Future survey, it seems that college students are just as likely to use marijuana and other illicit drugs as young adults who are 1-4 years out of high school. Annual and 30-day prevalence rates for any illicit drug use are similar when comparing college students (annual=33.9%, 30-day=19.2%) with others who are 1-4 years out of high school (annual=39.7%, 30-day=21.8%). Similarly, the prevalence of annual and 30-day marijuana use of college students and others who are 1-4 years out of high school are also comparable (college student annual= 30.2% vs. others annual=35.2% and college student 30-day=16.7 vs. others 30-day=18.6%; Johnston, O'Malley, Bachman, & Schulenberg, 2007).

The DSM-IV states when referring to conduct disorder, “the disturbance in behavior cause clinically significant impairment in social, academic, or occupational functioning,” (APA, 1994). Therefore, a sample of college students is not considered a typical sample for exploring conduct problems, especially early conduct problems which tend to lead to more serious impairments. Youths with conduct problems often have

academic difficulties which make it unlikely for them to attend college. They are at high risk of becoming delinquent and being involved in crimes, reducing the chances for them to attend college. Similarly, youths with earlier conduct problems are at an even greater risk for substance use problems and juvenile offending than youth with late onset conduct problems (Fergusson and Lynskey, 1998), making it seem even more difficult for them to achieve academic success. However, while youths with clinically diagnosed conduct disorder may have a difficult time academically, those youth with subclinical levels, for some reason may differ and be able to succeed academically, like those youth in the present sample.

Chapter 2: Questions and Hypotheses

Proposed Research Questions

Previous research studies that have employed general population, school, clinical and juvenile detention populations have observed a strong association between early conduct problems and early marijuana use. Few studies have examined this association among college students. The lack of research is most likely attributable to a common perception that academically-achieving college students are not likely to exhibit serious conduct problems. Children with conduct problems in disadvantaged environments may be likely to have poor academic performance and might not be likely to attend college. Given that recent studies have highlighted the extent of problematic marijuana and other drug use among college students (Caldeira, et al., in press; Johnston et al., 2007), it is important to question these assumptions and examine whether or not evidence of early conduct problems exist among college students, and if so, whether these conduct problems are important predictors of early marijuana use.

Hypotheses

H1: Early conduct problems are a significant predictor of early marijuana use in college students.

Previous research with samples other than college students have found that the number of CPs are more predictive than the specific type of conduct problems in predicting risk for substance use, including marijuana (Robins & Wish, 1977; Robins & McEvoy, 1990; Nurco et al., 1999). Therefore, it is reasonable to assume that this association would hold true among a sample of college students.

Conduct problems have been measured in a variety of ways. Johnson et al (1995) used a scale in which less serious conduct problems (e.g., took property belonging to others, damaged other people's property on purpose, lied, started physical fights with youths, broke rules) were acknowledged as a problem only if they had occurred three or more times in the past year, and more serious problems (e.g., hurt others physically, skipped school, ran away from home overnight, used a weapon in a fight, broke into someone's house, building or car, and set fires) were acknowledged as problematic if they had occurred at least twice in the past year.

Nurco et al. (1999) used two different methods of assessing conduct problems. First, a variety index was computed which was derived from summing the number of problems that occurred before age 11. Second, a severity index was constructed by assigning a value of 0-4 for each of the problems (i.e., 0 = no offense; 1 = minor deviance, 2 = moderate deviance, 3 = moderately severe deviance, and 4 = severe deviance) and then summing the weighted total. Both methods of conduct problem assessment proved to be significantly associated with youth substance use. The present study will attempt to develop a unique method of measuring early conduct problems among college students that builds on prior research.

H2: Early conduct problems remain a significant predictor of early marijuana use in college students after controlling for race, gender, SES, academic achievement, religious participation, the early use of alcohol, the age when first offered marijuana and cognitive, affective, and behavioral dysregulation.

Prior research has identified a number of different risk factors other than early conduct problems that are associated with early marijuana use, such as race, gender, socioeconomic status, academic achievement, religious participation, early use of alcohol, and age when first offered marijuana. In the current study, multivariate models will be developed to estimate the degree to which conduct problems are associated with early marijuana use, after holding constant the potential confounding risk factors mentioned above.

Chapter 3: Data and Methods

Sample

The sample for the current study consist of freshman college students from a large, public, mid-Atlantic university participating in a prospective longitudinal study funded by the National Institute on Drug Abuse known as *The College Life Study* (CLS). The study was reviewed and approved by the University Institutional Review Board, and a federal Certificate of Confidentiality was obtained.

The overall goals of the CLS include: 1) understanding how high school patterns of drug use are predictive of drug use during college; 2) developing models to explain the complex associations between drug use and the following four outcomes: a) high risk sexual activity; b) academic experiences, including achievement of goals and dropout; c) drug dependence; and d) mental health, namely anxiety and depression; and 3) describing how drug use patterns fit into college experiences and satisfaction with those experiences across time.

Data for the current study was taken from the private and confidential baseline interviews, which consisted of both a face-to-face interview and several self-administered questionnaires. Research assistants, consisting of graduate students and undergraduates who were at least in their third year of college, facilitated most of the baseline interviews, while senior staff administered the remaining few. Each research assistant received extensive training on administering the interviews and the importance of maintaining confidentiality.

Selecting the Sample

To reduce any bias associated with college exposure, incoming freshman enrolled in the fall semester of 2004, were screened during freshman orientation in the summer of 2004. Students either completed a web-based or paper version of the screener which asked about demographics, the age of onset of drug use, frequency and recentness of drug use, and parental monitoring. Students were informed of the nature of the study, the consent forms were reviewed, and the schedule of incentive payments were all explained prior to students signing informed consent. Students received five dollars for completing the screener.

In addition to consent to the screener, students were given the opportunity to consent to be contacted for longitudinal follow-up and to obtain data on academic performance, demographics, and other domains for the university's Data Warehouse. Students who wished to participate in future interviews provided their names and contact information on Locator Sheets, which were kept separate from the students' interviews. Identification numbers on both the Locator Sheet and the screening interview are linked through an encryption algorithm which is known only to the principal investigator and her designee, reassuring confidentiality to screening participants. A total of 3413 screening responses were collected. After the conclusion of the fall semester's (2004) add-drop period, a dataset of all students classified as freshmen who were still registered for classes was obtained to serve as the study's ultimate denominator (i.e., the freshmen class population; see Arria et al., 2006 (in press) for a comparison of the screening sample and the overall freshman class).

The target population was defined as the 4160 students who were classified as freshman by the university, aged 17 to 19 years old, and were still registered for classes at the conclusion of add-drop period in the fall semester of 2004. In an effort to exclude respondents who may have over-reported substance use from the sampling frame, students were excluded who reported using a fictitious drug, “cadrina,” on the screener. Five students were excluded for citing such use. A total of 3401 screening respondents met all the criteria for the target population. This group of screening respondents represented 81.8% of the target population. Students who did not consent to follow-up or drug use data were inadequate for sampling assignment were also excluded resulting in a final sampling frame of 3191 students, or 79.1% of the target population.

Based on responses of lifetime illicit drug use in the screener, three sampling groups were defined and selected for the longitudinal sample. “Prevalent cases” were those students who had already used some illicit substance other than marijuana (14.3% of the screened sample). “High risk cases” were defined as those students who had used marijuana at least once in their lifetime but did not use any other illicit drug (25.7% of the screened sample). “Low risk cases” were students who had not used either marijuana or any other illicit drug even once in their lifetime (60.0% of the screened sample). Missing data on the screener for an individual substance was treated as non-use of that substance in order to retain as many students as possible in the sampling frame, knowing that confirmation of this information could be completed during the baseline interview.

Prevalent and high-risk cases were sampled with 100% probability. A 40% random sample of low-risk cases were selected after stratifying by gender and race. The

sampling design required a sample large enough to confer sufficient statistical power to analyze data on incident substance use.

Of the 2106 students selected for longitudinal follow-up, 68.8% (n=1449) were available for recruitment. Baseline interviews were completed for 86.4% (n=1253) of the available students, while 13.6% (n=197) of the students refused to participate. The additional 657 (31.2% of the sample) students were unavailable for recruitment due to resources running out before sufficient contact was made with them. Students were recruited over the course of the entire 2004-2005 academic year through locator information that they had provided during the screener and information from the university directory (for a detailed explanation of recruitment processes, see Arria et al., in press, 2006). Pertaining specifically to the current paper, missing one question on the dysregulation questionnaire excluded another 177 students because dysregulation subscale scores could not be calculated, ending up with a final sample of 1,076 students. The excluded students did not seem to differ demographically or on the key variables of interest, from the 1,076 students retained in the final sample.

Measures

Early Marijuana Use. The dependent variable, early marijuana use, is measured based on students' self-reports on the Alcohol and Drug Use section of the *Core Module* for the CLS baseline interview. Students were asked to respond to the question, "How old were you the first time you used any type of marijuana?" While past research has used a variety of different ages to classify "early marijuana use," ranging from before 15 to 18 years, previous research mentioned earlier in this paper found similar results across the

range of ages so the age chosen should be arbitrary. Since this college sample is most similar to those studies which used samples of public high school students and a distinction of “early marijuana use” being before turning 15 years of age (DEWS, 2004; Lynskey and Hall, 2000) this study will also use the same age distinction (before 15 years). Students who first began using marijuana after turning 15 are considered late users for study purposes, while the third group of students would be those that had never used marijuana at the time of the baseline interview. While the majority of students (88.2%) had not tried marijuana before they reached the age of 15, one in ten college students had tried marijuana prior to turning 15 (11.6%) as is evident by *Table 5*. below. By combining the early and late users, the data show that 67.9% of the college students had used marijuana, at some point, prior to their baseline interview for this study. It should be noted that 75% of the students interviewed were 18 years of age or younger at the time of the baseline interview, which may lead to the small number (10) of students who first used marijuana at 19 years of age in the current sample or it may reflect the idea that most students who were going to use MJ would have done so prior to turning 19 years of age.

Table 5. College Students’ Age When First Smoked Marijuana (n=1,076)

	Age	f	%	
	8	1	.1	
	11	4	.3	Total
EARLY	12	11	1.0	11.6%
	13	32	3.0	
	14	78	7.2	
	15	137	12.7	
	16	171	15.9	
LATE	17	188	17.5	Total
	18	101	9.4	56.3%
	19	10	.8	
NEVER	Never smoked	343	31.9	
TOTALS		1,076	100%	

Early Conduct Problems The independent variable of interest, early CPs, were self-reported by students on their participation in the 15 different DSM-IV Conduct Disorder symptoms, (APA, 1994) prior to the turning 18 years of age. Students were asked how many times (0 = never, 1 = once, 2 = twice, three = three times, four = more than three times) they participated in each of the different behaviors. Additionally, each participant was asked to report how old he/she was the first time they participated in a specific CP behavior. A description of how the scale was developed and the scores were calculated follows in the methods section.

Gender. Much research in the field of early marijuana initiation has shown that boys in general are at a much greater risk for early marijuana initiation than girls (Fleming et al., 1982; Hammer and Vaglum, 1990; Poikolainen et al., 2001). Conversely, research by Pedersen and colleagues (Pedersen et al., 2001) has shown that the relationship between early CPs and marijuana use is stronger among girls than boys. Therefore, a dichotomous measure of gender has been included in the analysis (0=female; 1=male). The sample is evenly distributed with regard to gender (51% female).

Race. Research by Kosterman and colleagues (2000) has found that African Americans are at an increased risk for early marijuana initiation than other races. Consequently, students were asked to report their race under the following categories for analysis (1=white; 2=black/African American; 4=Asian; 8=other/unknown).

Table 6. Participant's Race (n = 1,076)

Race	f	%
White	776	72.1
Asian	95	8.8
Black/African American	93	8.6
Other/Unknown	112	10.4
Total	1,076	100%

Socioeconomic Status (SES). While the literature on SES and its association to marijuana use is conflicting, (Baumrind, 1985; Kandel et al., 1978; Kaplan et al., 1985; Block et al., 1988, Brook, Brook, Gordon, Whieman, and Cohen, 1990; Jessor, Donovan, and Costa1991; Kandel, 1989) children from higher SES families may have a greater ability to acquire marijuana and thus increase the risk for early use. A measure of SES has been created to control for such an effect based on the median Adjusted Gross Income of each students' self-reported home zip codes. There is a wide range of SESes, ranging from \$31,215-\$298,653. About 50% live in areas with average SESes less than \$66,838, while an equal amount of participants live in areas that make more than that on average (data not shown).

Academic Achievement A number of different measures of academic performance during high school were self-reported by the students. While grade point average (GPA) is normally a reliable measure of a student's academic performance, many schools are now weighting their GPAs, while others are not. Therefore, without a way of determining which GPAs were weighted and those that were not, students' Scholastic Assessment Test (SAT) scores are used as a measure of academic achievement for purposes of analysis in this study. SAT scores were treated as a continuous variable during analysis. SAT scores ranged from 820 to 1600. The mean score was 1274. Nearly half (48%) of the sample scored 1280 or higher on the SATs (data not shown).

High School Religious Participation. Previous research has shown that youths' who participated or were involved in church were less likely to initiate use of marijuana at each stage in life (Brook et al., 1999; Burkett and White, 1974). Involvement in religious or church groups during high school was reported by the students in a series of

questions that asked about students' involvement in extracurricular activities. Students responded with their rate of involvement in religious or church groups (none=0; irregular=1; regular=2). Nearly 1 in 3 (29%) students reported participating in religious or church groups regularly while in high school (data not shown).

Early Use of Alcohol. One warning sign for early marijuana use (before the age of 15 years) is the early use of alcohol (before 15 years also; DEWS, 2004). Additionally, other studies have found the early use of alcohol to be associated with the early use of marijuana (Hawkins and Catalano, 1992; Kandel and Yamaguchi, 1993; Yu and Williford, 1992). Students were asked to report the age at which they first drank any type of drink with alcohol in it. Alcohol use prior to the age of 15 years is considered early use for analysis purposes. Approximately 39% of the sample had drunk alcohol for the first time prior to reaching 15 years of age.

Age When First Offered Marijuana. Drug availability has been found to be significantly related to the use of marijuana and other illegal drugs (Maddahaian, Newcomb, and Bentler, 1988). It is likely that the earlier marijuana is made available to a youth, the earlier that a youth will use marijuana. In the current study, students were asked to report the age at which they were first offered any type of marijuana. Nearly 1 out of every 4 students (23%) students reported that they had been offered marijuana prior to turning 15 years of age.

Dysregulation. The Dysregulation Inventory Scale (Mezzich, Tarter, Giancola, and Kirisci, 2001) was used to capture information on neurobehavioral disinhibitions. As previously stated in the review of the literature, dysregulation has predicted later substance use disorders in both early (Tarter et al., 2003; Tarter et al., 2004) and late

adolescence (Clark et al., 2005) and may also play a role in the early age of onset of marijuana use. The 92 question Dysregulation Inventory scale was self-administered with guidance from the interviewer. Students were instructed to answer questions relating to affective dysregulation, behavioral dysregulation, and cognitive dysregulation by choosing the appropriate answer to the statements listed. The same four answers were provided for the students to choose from for each question. The choices were as follows: 0.) Never true 1.) Occasionally true 2.) Mostly true 3.) Always true. Scores were summed for each of the sub-scales based on the affective, behavioral or cognitive nature of the question according to Mezzich and colleagues, 2001. The three sub-scale scores are included as continuous variables in analysis as suspected covariates of early marijuana use.

Methods of Analysis

The dependent variable, early marijuana use, is a trichotomous variable, indicating whether the student smoked marijuana prior to turning 15 years of age, after 15 years of age, or never smoked. Therefore, multinomial logistic regression has been selected to determine whether there is an association between the independent variable of interest, early conduct problems, and early marijuana use. Once this has been determined other control variables and risk factors for early marijuana use including gender, race, socioeconomic status (SES), academic achievement, high school religious participation, early use of alcohol, and the three dysregulation subscale scores, were included in the model to determine whether the association between early conduct problems and early marijuana use remains significant.

Multinomial logistic regression utilizes maximum likelihood estimation to examine the dependent variable as a logit variable (the natural log of the odds of the dependent variable occurring or not). Using the logit it is possible to estimate the probability of an event happening; in this case the probability of a college student having become an early marijuana user based on whether he or she had early conduct problems.

An issue that needed to be addressed before any regression was conducted was which scale to use to classify early conduct problems. There were three options based on previous literature on similar topics in other populations. The first scale, based on the study by Johnson et al. (1995), students who reported their participation of any one of the less serious CPs three times or more in the past year and also reported participating in that same behavior prior to reaching the age of ten years were considered to have early conduct problems. Additionally, if they committed any one of the more serious CPs two or more times in the past year, doing so for the first time also prior to reaching the age of 10 years, they were considered to have early conduct problems (APA, 1994, McCabe et al., 2001; Ruchkin et al., 2003).

Two other scales to choose from come from work by Nurco and colleagues (1999). They use two different scales in their work on early conduct problems including both a variety and a severity scale. The variety scale is calculated by totaling the number of conduct problem behaviors that each youth committed one or more times, having committed that specific behavior for the first time prior to turning 11 years old. Likewise, a conduct problem severity scale was created by assigning a value of 1, 2, or 3 to each of the 15 behaviors that were practiced one or more times, with the first time committing

that behavior prior to reaching the age of 11 years, with 1 = minor CP, 2 = moderate CP, 3 = severe CP. A final weighted severity score was then totaled for each participant.

While each of these scales proved useful in previous literature with different populations than the current one, it is unclear whether they would work the same way in the current sample of college students. In addition, Johnson and colleagues' scale was designed for school-aged students between the ages of 10 and 12 while Nurco and colleagues' scale was developed for children (12-17) of narcotic addicts. The current sample may not exhibit the behaviors quite as early as the most delinquent samples or even the general population, therefore committing the behaviors prior to the age of 10 or even 11 years may not be well suited for the current sample. Additionally, upon closer examination of the data it is not possible to exactly replicate any of the three scales. As has been previously mentioned the current study has a unique sample, and although conduct problems do exist among this sample they should exist at a rate much smaller than delinquent or general population samples. Therefore, since it is not possible to exactly replicate either the Nurco or Johnson scales, and that this is a unique population, it was determined to create a new scale that is thought to be better suited for the college sample.

The new College Early CP Scale was created by first running the frequencies of the age at which each of the conduct problems was first reported by each of the students demonstrating that specific behavior. Next, the median age was determined for each specific behavior. If a behavior did not have a specific median, the next youngest age was used as the median to gauge the age of behaviors in a more conservative manner, since it is believed that fewer college students would display earlier CPs. The total number of

early CPs were then added up for each participant to get a scale score, resembling something similar to Nurco's variety index.

On the next page, *Table 7*. shows the number and percentage of total students who exhibited each CP behavior. It also shows the specific median age for each of the individual behaviors. Finally, it shows the frequency and percentage of students who displayed each specific behavior prior to the individual cutoff. "Forced someone into sexual acts," was excluded from the table due to the infrequency of the behavior (3) and the inability to calculate a median age. The median age cutoff, varies by behavior and range from "prior to 10 years of age" to "prior to 16 years." Additionally, the table is broken into categories; mild, moderate, and severe based on ideas from Nurco and colleagues on weighting each behavior according to its severity.

Some points of interest from *Table 7*. reveal that the more severe behaviors were exhibited by a far smaller number of students than the less severe behaviors, especially those severe behaviors that were committed early by the students, such as "broke into someone else's house, building, or car" and "used a weapon in a fight.," which would be expected. One behavior that was categorized as mild, "often stay out at night without parental permission (before the age of 13)" was one behavior which may need to be moved to a more severe category in regards to the current population of college students. It may be for this population that parents have a better idea of where their children are and this may not play as significant of a role in the lives of the students due to greater parental control, unlike lower income and delinquent populations where this may be more of a problem.

**Table 7. Number and Percentage of College Students Who Exhibited Conduct Problems Total and Early Based on Each Behaviors Median Age When First Exhibited
(N = 1,076)**

Conduct Problem Behavior	Number of Total Students Who Exhibited Behavior f	Percentage of Total Students Who Exhibited Behavior %	Median Age Cutoff For Early Behavior (prior to the age listed below)	Number of Total Students Who Exhibited Behavior Early f	Percentage of Total Students Who Exhibited Behavior Early %
Mild					
Break the rules	939	87	10	437	41
Lie to get something or avoid responsibility	914	85	10	356	33
Take property belonging to others	550	51	13	271	25
Damage property on purpose	341	32	14	133	12
Often stay out at night w/o parental permission (before age of 13)	102	9	12	40	4
Moderate					
Hurt others physically	420	39	10	172	16
Bullied, threatened, or intimidated another person	358	33	12	150	14
Shoplifted	351	33	14	160	15
Steal something from someone	320	30	12	136	13
Start fights w/ other people	271	25	12	128	12
Set fires on purpose	151	14	13	72	7
Caused physical harm to and animal	74	6	11	33	3
Skip school before age of 13	60	6	12	29	3
Ran away from home (overnight) at least twice while living at home or once w/o returning for lengthy period	53	5	15	20	2
Severe					
Broke into someone else's house, building, or car	60	6	16	27	3
Used a weapon in a fight	19	2	14	9	1

Next weights were applied to each of the behaviors exhibited early, similarly to those of Nurco in his severity scale. Below, *Table 8*. shows the raw scale score and the weighted scale score.

Table 8. Distribution of Early Conduct Problems in the Sample
Based on Median Split in the College Early Conduct Problem Scale; Raw and Weighted Scores
(N = 1,076)

<u>Raw Scale Score</u>	<u>f</u>	<u>%</u>	<u>Weighted Scale Score</u>	<u>f</u>	<u>%</u>
0	391	36.30	0	391	36.30
1	193	17.90	1	148	13.80
2	147	13.70	2	123	11.40
3	111	10.30	3	82	7.60
4	69	6.40	4	60	5.60
5	60	4.80	5	62	4.90
6	46	4.30	6	44	4.10
7	30	2.80	7	36	3.30
8	12	1.10	8	34	3.20
9	11	1.00	9	27	2.50
10	4	.40	10	23	2.10
11	3	.30	11	18	1.70
12	3	.30	12	11	1.00
Totals	1,076	100%	13	5	.50
			14	7	.70
			15	4	.40
			16	2	.20
			17	1	.10
			18	2	.20
			19	3	.20
			20	2	.20
			Totals	1,076	100%

Before, continuing any further however, the two scales were compared to see how well they were correlated to see if the weighting was really necessary. As would be anticipated, both scales are skewed in the sense that there are more students who had fewer early CP problems and as the scale score increases the number of students with that score decreases. *Table 9*. also reveals that the weighted and unweighted scales were correlated .99 (significant at a $p < 0.01$ level (2-tailed)). Therefore, it is believed that the two scales are measuring approximately the same construct. Additionally, the other three scales, created as closely to Nurco and Johnson's scales have been included in the

correlation matrix and reveal that they are highly correlated among each other. Although the Nurco and Johnson scales were not created exactly the way that Nurco and colleagues and Johnson and colleagues developed their scales, they were replicated as closely as possible to these scales and will be referred to as the Johnson Scale and the Nurco Scale throughout the course of the rest of the paper. These three scales do not show a similar correlation to either of the new College Early CP scales, thus suggesting that the new College Early CP scales are measuring something different than the previous three scales used. This could indicate that a new scale is needed for this population or it could suggest that the other three scales are a good measure of early CPs and there is no need for a new measure, which this paper intends to determine.

Table 9. Correlation of Different Earlier Conduct Problem Scales

	Johnson et al. (1995)	Nurco Variety Scale (1999)	Nurco Severity Scale (1999)	College Median Raw Scale	College Median Weighted Scale
Johnson et al. (1995)	--	.85**	.84**	.67**	.68**
Nurco Variety Scale (1999)	--	--	.99**	.69**	.70**
Nurco Severity Scale (1999)	--	---	--	.69**	.71**
College Early Conduct Problem Raw Scale	--	--	--	--	.99**
College Early Conduct Problem Weighted Scale	--	--	--	--	--

** Correlation is significant at the 0.01 level (2-tailed)

Before discarding the idea of weighting the new College Early CP Scale and using only the raw scale score, each early CP was examined a little closer. This was done by determining the mean number of other early conduct problems that each student had displayed based on exhibiting or not exhibiting each specific earlier CP. The results are shown in *Table 10*, again, broken down by categories based on ideas from Nurco et al.'s (1999) weighted scale. Two things seem evident from these results. The first is that the raw score is naturally weighted. The more severe of an early CP behavior that a student exhibited the more likely they were to have participated in a higher number of other earlier CP behaviors. For example, if a student used a weapon in a fight at an early age, on average they would have exhibited 6.6 other earlier CP behaviors. The same is true for the less severe behaviors, such as breaking the rules "early." These students on average exhibited 2.8 other CP behaviors "early."

The second thing that seems apparent from this table is that three of the behaviors that Nurco and colleagues had classified as moderate "steal something from someone else," "caused physical harm to an animal," and "skip school before the age of 13" each have a higher mean number of other early CP behaviors than "breaking into someone else's house, building or car." This suggests that either the three moderate behaviors be weighted similar to the severe behaviors and that the severe behavior of "breaking in" should be weighted less, similar to the moderate behaviors. Nonetheless, it does not matter for purposes of this paper as a natural weighting is occurring and there is such a high correlation between the weighted and unweighted scales that the simpler, unweighted scale utilizing only the raw College Early CP Scale has been chosen for purposes of analysis.

**Table 10 Mean Number of Other Early Conduct Problems:
Based on Exhibiting or Not Exhibiting Each Specific Early Conduct Problem**

Early Conduct Problem	Mean Number of Other Early Conduct Problems Based on Having Each Specific Early CP	
	YES	NO
Mild		
Break rules	2.8	0.8
Lie to get something or avoid responsibility	3.0	1.1
Take property belonging to others	3.6	1.5
Damage property on purpose	4.5	2.0
Often stay out at night w/o parental permission (before age of 13)	4.6	2.8
Moderate	YES	NO
Shoplifted	3.8	1.6
Ran away from home (overnight) at least twice while living at home or once w/o returning for lengthy period	3.9	2.2
Hurt others physically	4.2	2.3
Bullied, threatened, or intimidated others	4.3	1.9
Start fights with others	4.3	2.2
Set fires on purpose	4.4	2.9
Steal something from someone	4.9	2.0
Skip school before age of 13	5.0	2.6
Caused physical harm to animals	5.0	3.6
SEVERE	YES	NO
Break into someone else's house, building, or car	4.6	2.6
Used a weapon in a fight	6.6	4.1

Temporal Order

Another area examined was the order in which the early CP behaviors and early MJ use occurred. This will help when discussing the results of the logistic regression in terms of the odds ratios and whether there is just an association between the early CPs and early MJ use or whether there is some type of predictive power in which the early CPs precede the early MJ use. The results of the discovery are shown in *Table 11*. Those students who had both each specific early CP behavior and were also an early MJ user were first selected from the data. Next, the age at which the behavior started and the age at which the early MJ use started were crosstabulated to find the percentage of behaviors that precipitated early MJ use. Overall, 90% of the early CPs were exhibited prior to the

use of MJ, which is compelling evidence. In eleven of the sixteen categories, all of the early CPs came before the early use of MJ. The only CP where it was more likely that the early MJ use came prior to the CP was for the behavior “broke into someone else’s house, building or car,” which is a more severe problem and is anticipated to be a behavior committed by an older student than a younger student. Thus these results allow for the associations between early CPs and early MJ be more than just associations, they show that in most cases the early CPs occur before the early MJ use, suggesting the early CPs are predictive of early MJ use, and not just associated. There are the rare instances in which early MJ use may occur before the early CP problem, but overall, nine of ten times the early CP is exhibited prior to the early use of MJ. Therefore, throughout the results section when associations are discussed between early CPs and early MJ use, these associations can be described as the early CPs being predictive of the early MJ use.

Table 11. Number of Students With Early Conduct Problem Behavior and Early Marijuana Use and the Percentage of Students' Early Conduct Problem Behaviors Occurring Prior to Their Early Use of Marijuana

Conduct Problem Behavior	Number of Students With Early Conduct Problem Behavior and Early Marijuana Use	Percentage of Students' Early Conduct Problem Behaviors Occurring Prior to Their Early Use of Marijuana
	f	%
Mild		
Break the rules	72	100
Lie to get something or avoid responsibility	51	100
Take property belonging to others	40	83
Damage property on purpose	34	82
Often stay out at night without parental permission (before age of 13)	9	100
Moderate		
Shoplifted	36	67
Hurt others physically	23	100
Steal something from someone else	22	100
Start fights with other people	20	100
Set fires on purpose	16	100
Bullied, threatened, or intimidated another person	15	100
Skip school before age of 13	6	100
Ran away from home (overnight) at least twice while living at home or once without returning for lengthy period	6	67
Caused physical harm to an animal	4	100
Severe		
Broke into someone else's house, building, or car	14	36
Used a weapon in a fight	3	100

Another relationship examined was the percentage of students who used marijuana, early, late, or never based on their score on the College Early Conduct Problem Scale. As seen in *Table 12.*, across the range of scores on the scale approximately one-third of the students had never used marijuana regardless of their score on the scale. Most of students who scored lower (0-9) on the College Early Conduct

Problem Scale seemed to be late users of marijuana. The percentage of students who scored lowest on the College Early Conduct Problem Scale (<4) were those least likely to use marijuana early. Likewise, the percentage of those students who scored highest (10+) on the College Early Conduct Problem Scale were those most likely to have used marijuana early. When looking at the overall percentage for each group of marijuana users, the group that differed most from the overall sample were those students who scored highest (10+) on the College Early Conduct Problem Scale; 11% of the overall sample were early MJ users, but 40% of the students who scored a 10 or higher on the College Early Conduct Problem Scale were early MJ users. These bivariate relationships suggest that the College Early Conduct Problem Scale was most likely to differentiate students who used MJ early.

Table 12. Percentage of Students Who Used Marijuana Early, Late or Not At All Based on The College Early Conduct Problem Scale Score

College Early Conduct Problem Scale Score	n	Percentage of Students Who Used Marijuana Early %	Percentage of Students Who Used Marijuana Late %	Percentage of Students Who Did Not Use Marijuana %
0	391	6	62	32
1	193	12	57	31
2	147	14	55	31
3	111	14	50	36
4	69	25	54	38
5	56	25	46	29
6	46	17	61	22
7	30	17	40	43
8	12	25	50	25
9	11	18	64	9
10+	10	40	30	30
Totals for Sample	1,076	12	56	32

Power Analysis

One goal of the proposed study is to test the null hypothesis that there is no relationship between early conduct problems and early marijuana use. The power was computed to reject the null under the following alternate hypothesis. For conduct problems means value of 2.0 and 4.3, the expected event rates are 0.14 and 0.06, corresponding with an odds ratio of 0.39, a beta (log odds ratio) of -0.41, and a relative risk of 0.43. This effect was selected as the smallest effect that would be important to detect, in the sense that any smaller effect would not be statistically significant. For this computation it was assumed that the mean of conduct problems was 2.0 with a standard deviation of 2.3, and that the event rate at the mean was 0.14.

As was previously mentioned in the section on selecting the sample, the sample size is 1,076 college students. The criteria for significance (α) has been chosen to be .05 and a two-tailed test has been selected, indicating that a significant difference in either direction will be interpreted. For the selected distribution where the conduct problem mean is 2.0, standard deviation of 2.3, the baseline line (event rate of 0.14 at the mean), effect size (log odds ratio of -0.41), sample size (1,076), and α (0.05, 2-tailed), power exceeds .99. This means that close to 100% of studies using this size sample and this α level, given the expected population difference, would be expected to yield a significant effect, rejecting the null hypothesis that the odds ratio is 1.0.

Chapter 4. Results

Results of Multinomial Logistic Regression Predicting Marijuana Use with the College Early Conduct Problem Scale

The first step in determining whether early conduct problems are associated with early marijuana use in college students was to run an unconditional multinomial logistic regression predicting marijuana use (early, late, no use) with the only predictor variable in the model being the primary variable of interest, the College Early CP Scale, in order to determine whether the College Early CP Scale is, in and of itself, a statistically significant predictor of early MJ use. Results revealed that the College Early CP Scale is a statistically significant predictor of marijuana use, $\chi^2 = 21.0$ (df = 2), $p < .01$.

Regression Coefficients, Odds Ratios, and Wald χ^2 s

Once the College Early CP Scale was determined to be a statistically significant predictor of marijuana use, focus turned to the multinomial logistic regression coefficients in the model as well as the odds ratios and Wald χ^2 s, which can be seen in *Table 13*. The regression coefficients, odds ratios and Wald χ^2 s are relative to the referent group identified for each category. If the confidence interval of the Odds ratio spans 1, then the regression coefficient, the corresponding odds ratio and Wald χ^2 s are not statistically significant. We can see that one of the confidence intervals spans 1, for the late MJ use group in comparison to the no MJ use group. Therefore, the two groups do not differ in terms of the predictor variable, the College Early CP Scale score.

In contrast, the other two confidence intervals (College Early CP Scale and early MJ use, in reference to no MJ use and College Early CP Scale and early MJ Use, in

reference to late MJ Use) do not include 1, and therefore their regression coefficients, odds ratios, and Wald χ^2 s are statistically significant.

The odds ratio of 1.16 for the predictor variable College Early CP Scale and the early MJ Use group in comparison to the no MJ use group indicates that were an increase of one unit to occur in the College Early CP Score, the odds of being in the early MJ user group rather than the no MJ use group would increase by 1.16. Additionally, an odds ratio of 1.19 for the College Early CP Scale and the early MJ use group in reference to late MJ use group, indicates that if the College Early CP Score were to increase by one unit, the odds of being in the early MJ user group rather than the late MJ use group would increase by 1.19.

In summary, results of the unconditional multinomial regression indicate that an increase in the score on the College Early CP scale increases the likelihood of being in the early MJ user group rather than in the late or non-MJ user groups. However, it cannot be determined whether an increase in the College Early CP scale would increase the odds of being in the late MJ user group rather than in the non-user group or vice versa.

Table 13. Regression Coefficients, Wald χ^2 s, Odds Ratios, and 95% Confidence Intervals for Multinomial Logistic Regression Predicting Marijuana Use With The College Early Conduct Problem Scale

Variable	Late Marijuana Use Versus No Marijuana Use						Early Marijuana Use Versus No Marijuana Use						Early Marijuana Use Versus Late Marijuana Use					
	<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	<i>95% CI for OR</i> <i>LB UB</i>		<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	<i>95% CI for OR</i> <i>LB UB</i>		<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	<i>95% CI for OR</i> <i>LB UB</i>	
College Early Conduct Problem Scale	-.03	.86	.35	.97	.91	1.03	.14*	11.55	<.01	1.16	1.06	1.26	.17*	19.14	<.01	1.19	1.10	1.29

* Significant at $p < .05$

LB = Lower Bound UB = Upper Bound

Crosstabulations of Age When First Offered Marijuana and Marijuana Use, and Early Alcohol Use and Early Marijuana Use

When the multinomial logistic regression model with all of the concomitant variables was attempted, a problem arose fitting the anticipated model. Therefore, the categorical predictor variables were crosstabulated with the criterion variable where a couple of problems were identified. The two problems can be seen in *Table 14* and *Table 15* below. There were no students who were not offered MJ and used MJ early. Similarly, there were no students who did not use alcohol and were also early users of MJ. Zeros in both of these cells caused quasi-complete separation problems in the analyses when fitting the multinomial logistic regression model. Therefore, they were dropped from the regression model.

As would be expected, the 126 students who used MJ early all were offered MJ early. Likewise, the 113 students who used MJ early had also drunk alcohol early. If the students were not offered MJ early or did not use alcohol there was very little, if any, chance that the student was going to use MJ early.

Table 14. Crosstabs of Type of Marijuana Use and Offered Marijuana Early (before 15)

	Not Offered MJ	Offered MJ Early	Offered MJ Late	Total
Early MJ Use	0	126	0	126
Late MJ Use	2	93	512	607
No MJ USE	135	31	177	343
Total	137	250	689	1076

Table 15. Crosstabs of Type Marijuana Use and Early Alcohol Use (before 15)

	No Alcohol Use	Drank Early	Drank Late	Total
Early MJ Use	0	113	13	126
Late MJ Use	1	240	366	607
No MJ USE	54	61	228	343
Total	55	414	607	1076

Results of Multinomial Logistic Regression Predicting Marijuana Use With the College Early Conduct Problem Scale and Other Covariates

Crosstabs did not reveal any further problems with any of the other covariates. Thus, focus turned to the results associated with the conditional multinomial logistic regression model that included the College Early CP Scale score and the following other covariates: race, sex, high school church attendance, SES represented by adjusted gross income, the three Dysregulation Sub-scales (affect, behavior, and cognitive), and SAT score . The results of the Likelihood Ratio Tests' Chi-squares revealed that the College Early CP Scale, as well as the Behavior Dysregulation Scale, SES represented by adjusted gross income, race and high school church attendance are all statistically significant predictors of marijuana use.

Table 16. Chi-Square of Likelihood Ratio Test for College Early Conduct Problem Scale and Type of Marijuana Use; Including Covariates

	χ^2	<i>p</i> (<i>df</i>)
Significant		
College Early Conduct Problem Scale	12.24	<.01 (2)
Dysregulation-Behavior	14.34	<.01 (2)
Adjusted Gross Income	18.31	<.01 (2)
Race	22.64	<.01 (6)
High School Church Attendance	26.22	<.01 (4)
Not Significant		
SAT Score	1.40	.50 (2)
Dysregulation-Affect	2.63	.27 (2)
Dysregulation-Cognitive	2.57	.28 (2)
Sex	2.52	.28 (2)

Late Marijuana Use versus No Marijuana Use With the College Early Conduct Problem Scale

Results from the comparison groups of late MJ use and no MJ use reveal that the College Early CP Scale is not a statistically significant predictor of either group in the regression model when all of the concomitant variables are added to the regression model. This is indicated by the confidence interval in *Table 17* spanning the value of 1. Therefore there cannot be any comparisons made between the late MJ using group and the non-using MJ group about the College Early CP Scale. This was the only time where the College Early CP Scale was not statistically significant when the other concomitant variables were included in the regression model.

Early Marijuana Use versus No Marijuana Use With the College Early Conduct Problem Scale

The College Early CP Scale remains a statistically significant predictor of early marijuana use when other concomitant variables are added to the model, as is indicated by the Wald χ^2 and the confidence interval not spanning 1. The odds ratio indicates that an increase in the College Early CP Scale score increases the odds of being in the early MJ using group rather than in the non-MJ using group by 1.10. Generally speaking, were the score on the College Early CP Scale to increase, it is anticipated that the odds of being a member of the early MJ user group would increase in comparison to the nonuser group. It is also interesting to note that the odds ratios did not change much from the simple bivariate model with only the College Early Conduct Problem Scale and early MJ use in the model (1.16), suggesting that the other concomitant variables in the model are

not sharing much of the variance in the College Early Conduct Problem Scale and are tapping into other aspects of associations with early MJ use.

Early Marijuana Use versus. Late Marijuana Use With the College Early Conduct Problem Scale

Again, the College Early CP Scale is also a significant predictor of early marijuana use in comparison to late marijuana use in the regression model including the covariates. This is indicated by a statistically significant Wald χ^2 value and a confidence interval for the OR that does not span 1. The odds ratio of 1.15, for the College Early CP Scale, indicates a higher score on the College Early CP Scale increases the odds of being in the early MJ user group rather than being in the late MJ user group by 1.15. Again, the OR did not differ much from that of the simple bivariate model not including the other covariates, which had an OR of 1.19, once more suggesting that these other concomitant factors do not share much of the variance in early CPs and its association with early MJ use.

Late Marijuana Use Versus No Marijuana Use; Other Covariates

The Wald χ^2 s that are statistically significant ($p < .05$) when comparing late MJ use to no MJ use, are the Behavior Dysregulation scale, SES represented by adjusted gross income, being Asian compared to being in the other race category, and not attending or attending church irregularly compared to attending church regularly. The Wald χ^2 s in this comparison group (late vs. no MJ use) indicate that each of these independent variables have a statistically significant relationship with the dependent variable, marijuana use, as described below.

The odds ratio of 1.02, which can be seen in *Table 17*, for the Behavior Dysregulation Scale indicates that if the score on the scale increased, the odds of being in the late MJ user group is more likely than being in the non-MJ user group. In addition, the OR for the adjusted gross income variable indicates, that an increase in income increases the chances of being in the late MJ using group in comparison to the non-using MJ group. Likewise, not attending church or attending church irregularly compared to attending church regularly, increases the odds of being in the late MJ user group rather than the non-MJ user group by 1.57 and 2.07 respectively. However, the OR for being Asian versus being classified as “other” actually decreases the odds of being in the late MJ user group by .47 in comparison to the non-MJ using group.

Early Marijuana Use Versus No Marijuana Use; Other Covariates

The Wald χ^2 s that are statistically significant ($p < .05$) when comparing early MJ use to no MJ use, are the Behavior Dysregulation Scale, SES represented by adjusted gross income, and not attending or attending church irregularly compared to attending church regularly.

Referring to the ORs in *Table 17*, an increase in the Behavioral Dysregulation score signifies it is more likely to be in the early MJ user group than in the nonuser group (OR = 1.05). In the same way, an increase in adjusted gross income, increase the chances of being in the early MJ using group compared to the non-using group (OR = 1.01). Similarly, not attending church or attending church irregularly compared to attending church regularly, increases the odds of being in the early MJ using group compared to being in the late MJ using group (ORs of 2.89 and 2.77 respectively).

Early Marijuana Use Versus Late Marijuana Use: Other Covariates

The Wald χ^2 s that are statistically significant ($p < .05$) when comparing early MJ use to late MJ use, are the Behavior Dysregulation Scale score, and not attending church compared to attending church regularly. The ORs in *Table 17* indicate that not attending church regularly in comparison to attending church regularly would increase the odds of being in the early MJ using group rather than the late MJ using group by 1.85.

Additionally, an increase in the Behavioral Dysregulation Scale would increase the odds of being in the early MJ user group rather than the late MJ user group by 1.03.

Table 17. Regression Coefficients, Wald χ^2 , Odds Ratios, and 95% Confidence Intervals for Multinomial Logistic Regression Predicting Early Marijuana Use With The College Early Conduct Problem Scale and Other Covariates

Variable	Late Marijuana Use Versus No Marijuana Use						Early Marijuana Use Versus No Marijuana Use						Early Marijuana Use Versus Late Marijuana Use					
	<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	95% <i>CI for OR</i> LB UB		<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	95% <i>CI for OR</i> LB UB		<i>b</i>	χ^2	<i>p</i>	<i>OR</i>	95% <i>CI for OR</i> LB UB	
College Early Conduct Problem Scale	-.04	1.93	.17	.96	.90	1.02	.10*	5.57	.02	1.10	1.02	1.20	.14*	13.89	<.01	1.15	1.07	1.24
Dysregulation-Behavioral	.02*	6.66	.01	1.02	1.01	1.04	.05*	15.06	<.01	1.05	1.02	1.07	.03*	5.54	.02	1.03	1.01	1.05
Adjust Gross Income	.01*	18.06	<.01	1.01	1.01	1.02	.01*	7.02	.01	1.01	1.01	1.02	.01	.19	.67	1.01	.99	1.01
Race (reference = Other)																		
White	.13	.32	.57	1.13	.73	1.75	.46	1.64	.20	1.59	.78	3.24	.40	1.02	.31	1.40	.73	2.71
Black/African American	-.44	2.08	.15	.64	.35	1.17	.04	.01	.94	1.04	.13	2.90	.48	.92	.34	1.62	.60	4.35
Asian	-.72*	5.92	.02	.47	.27	.87	-.99	3.49	.06	.37	.13	1.05	-.27	.28	.60	.76	.28	2.08
Church Attendance (reference = regular)																		
Not Attend	.45*	8.23	<.01	1.57	1.15	2.13	1.06*	16.21	<.01	2.89	1.72	4.84	.61*	5.92	.02	1.85	1.13	3.02
Attend Irregularly	.73*	17.30	<.01	2.07	1.47	2.92	1.02*	11.87	<.01	2.77	1.55	4.95	.29	1.10	.29	1.34	.78	2.31

* Significant at $p < .05$
LB = Lower Bound UB = Upper Bound

College Early Conduct Problem Scale vs. Adapted Johnson et al. (1995) Scale

Referring back to *Table 9*, which showed the correlations of the different Conduct Problem scales, it is apparent that the adaptations of Nurco et al.'s two scales (variety and severity) and the adapted Johnson et al.'s scale were highly correlated thus suggesting they were generally measuring the same construct. Therefore, only one of these scales was chosen to compare to the new College Early CP Scale. Johnson et al.'s adapted scale was selected for comparison because it seemed to differ most in terms of how the scores were calculated compared to the new College Early CP Scale. It also included in its calculation a prerequisite that a person had to exhibit certain behaviors more than one time; less severe behaviors had to be exhibited at least three times while more severe behaviors had to be practiced at least twice by the youth. This is thought to possibly play a role in the association between earlier CPs and early MJ use, increasing the scale's ability to predict early MJ use.

Comparisons were made between the Cox and Snell R^2 s of the both the unconditional regression models, with only the MJ use predicted by the CP scale (either the College Early CP Scale or the adapted Johnson Scale) and the more complex models which included the other concomitant variables. The R^2 for the simple model with just the College Early CP scale was .02 while the model with just the Johnson Scale had a R^2 of .09. Likewise, the more complex models report R^2 of .11 for the College Early CP Scale and .16 for Johnson's scale. Although definitive statements in this regard cannot be made, these results would suggest that the Johnson and colleagues' scale might be better at measuring conduct problems. The adapted Johnson scale may be better at measuring early CPs due to the fact that the scale includes a measure of frequency for each behavior,

in which the less severe behaviors had to be exhibited at least three times and the more severe behaviors exhibited at least twice to be counted in the scale. The College Early CP scale however, only required the student to participate in any one behavior once prior to the median age cutoff to be included in the scale score.

Next comparisons were made between the odds ratios of the CP Scales in the regression models that did not include any concomitant variables. In these two models, the odds ratios of the College Early CP scale was 1.16 when comparing early MJ use to non-use and 1.54 for the Johnson scale comparing the same two groups. Likewise, when comparing early MJ users to late users, the odds ratios were 1.19 for the College Early CP Scale and 1.29 for the Johnson scale. Additionally, while the odds ratio for the College Early CP scale when comparing late MJ users to nonusers was not statistically significant, the OR was significant ($p < .05$) in the Johnson scale, indicating that the Johnson Scale was a statistically significant predictor of late MJ use in comparison to no MJ use. Therefore the only conclusion that differs between the two scales is that the Johnson Scale was a significant predictor of late MJ use in comparison to no marijuana use, while the College Early CP Scale was not (data not shown).

Results were similar for the models which added the other covariates. Again, both scales produced statistically significant ORs in the same direction when comparing both early users to non and late users of MJ, so conclusions would be the same using either scale. As in the model with only the CP scale, the Johnson scale was a statistically significant predictor of late MJ use in comparison to non MJ use while the College Early CP Scale remained an insignificant predictor between these two groups (data not shown).

According to these comparisons it is difficult to determine in general whether one

scale is a better predictor of early MJ use than the other scale. One thing that is apparent from the comparisons is that the Johnson and colleagues scale was a significant predictor of late MJ use compared to no MJ use while the College Early CP Scale was not. Another point to note from the regression model containing Johnson's scale was that the Behavior Dysregulation Scale was no longer statistically significant ($p < .05$) for any comparisons between MJ groups in the model as it was in the regression model run with the College Early CP Scale (data not shown). This again may be explained by the adapted Johnson scale including a frequency measure in their scale unlike the College Early CP Scale. When the frequency of the event is measured in order to calculate a scale score this may get at a more severe problem, thus canceling out the effects of the Behavior Dysregulation Scale score.

Chapter 5. Conclusions

Discussion

A major impetus for this study was to examine whether or not the commonly observed association between early conduct problems and early marijuana use held true for academically-achieving college bound adolescents. The results of the study showed that, as expected, early conduct problems are significantly associated with early marijuana use among college students, even after adjustment for a number of potentially confounding covariates. Furthermore, this study demonstrated the robustness of this association with a new retrospective assessment of conduct problems among first-year undergraduates, named the College Early Conduct Problem Scale. Lastly, this study calls into question the perception that college students escape conduct problem behaviors in childhood, since two-thirds of the students exhibited at least one early conduct problem and 25% exhibited more than three early conduct problems.

With respect to other covariates of early marijuana use, consistent with prior research with high-risk adolescents, this study revealed a significant association between one aspect of dysregulation (behavioral as opposed to affective or cognitive) and early marijuana use. Moreover, students who did not attend church or attended church irregularly, compared to those who attended church regularly in high school, were more likely to use marijuana than non-users, with early marijuana use being particularly overrepresented in the non-church attending group. Additionally, those students who grew up in areas with higher SESes, were more likely to use marijuana early and late in comparison to non-users, suggesting access to more money increases the chances of buying marijuana and thus using marijuana.

Once early conduct problems and behavioral dysregulation were included in the model, gender and SAT scores did not significantly add to the explanation of marijuana use. It is difficult to ascertain whether or not the new College Early CP scale was “more effective” than previous scales in explaining early marijuana use. Both the College Early CP Scale and the adapted scale used by Johnson and colleagues showed similar associations with early marijuana use, with R^2 s for the Johnson scale slightly higher than the College Early CP scale. Additionally, odds ratios for the Johnson scale are higher than the College Early CP Scale.

Limitations

Due to the designated sample and purpose of this study, the results are not generalizable to the population at large. Results are believed to be generalizable to other samples of college students who attend large state funded universities; however, being the first to look at early CPs and their association with early MJ use in college students this remains only an assumption.

Additionally, some researchers may argue that retrospective self-reports of both conduct problems and drug use are not accurate, due to recall and self-report bias. Self-reports in the field of both conduct problems and substance abuse have been shown to be both valid and reliable, as well as an accepted manner of collecting data (Johnson et al., 1995; Kosterman et al., 2000; Nurco et al., 1999). Though assertions have been made that college students may over or underestimate the amount of substances they use, studies have concluded that measures of first tobacco, alcohol, and illicit drug use have good test-retest reliability (Brenner, Collins, Kann, Warren, and Williams, 1995; Cottler,

Robins, and Helzer, 1989; Grant, Harford, Dawson, Chou, and Pickering, 1995; Reinisch, Bell, and Ellickson; 1991). Additionally, by trying to validate the students' self-reports with either parent or teacher reports, these reports could be open to similar recall biases and may be less accurate due to behaviors occurring that parents or teachers were unaware of. Moreover, the retrospective nature of this data would not have allowed for this easily and a prospective longitudinal study starting when the youths are young would be both timely and expensive. Likewise, official data would not have been able to provide the type of data needed for this specific type of study.

Additionally, while the retrospective design of this study does not permit causal relationships to be determined, the study does allow for associations to be established in this understudied area of our population, college students. Likewise, the study was able to prove that 90% of the early CPs occurred before the early use of MJ, helping to confirm an already suggested temporal order that early CPs precede early MJ use.

One may question the ability of the questions pertaining to CP behaviors and that they do not provide the opportunity for clinical diagnosis of conduct disorder. However, for the purposes of this study a clinical diagnosis is not required or intended. Moreover, other studies looking at conduct problems have used similar self-report measures (Johnson et al., 1995; Neumark and Anthony, 1997; Nurco et al., 1999; Van Kammen, Loeber, and Stouthamer-Loeber, 1990). The CP questionnaire does allow the ability to gauge the age of first participation in certain CP behaviors and the frequency of that participation. Previous research suggests that even those persons with subclinical levels of CPs are at increased risk for early marijuana use and other problems. Additionally, this study was interested in early CPs and their effects, not clinically diagnosed conduct

disorder. Additionally, more and more research is focusing on identifying early problem behaviors with subjects even as young as 2 years of age (Cummings, Iannotti, & Zahn-Waxler, 1989; Olweus, 1979; Shaw, Gilliom, & Giovannelli, 2000) because serious forms of CP, once established, have been found to be highly resistant to change (Kazdin, 1995).

Additionally, the present study included specific variables that have been found to be associated with and were thought to play a role in the association of early CPs and early MJ use in college students. There may be any number other risk factors or other characteristics of the college students that may play a role in this specific association, allowing for future research to determine. Additionally, while sex itself was not a significant predictor, interactions between sex and other variables were not included in the model and may play a role in the association with early MJ use. Such interactions, if significant, would suggest that conduct problems may play a different role in early MJ use in males than females.

Implications for Future Research

As was previously mentioned in the limitations section, this study needs to be replicated in order to confirm generalizable results across similar samples of students attending large state funded universities. We assume that the results should be generalizable as the sample of students should be similar but without replication, we can only assume. Additionally, research at small private colleges could be conducted to see if similar results also exist.

While the current study looked at a certain number of risk and protective factors that play a role in early CPs and early MJ use, expanding the scope of these factors may shed more light on understanding the association of both early CPs and early MJ use. Based on the current research, it may be interesting to look at whether there were earlier identifiers that precipitated the early CPs among this group of college students. Another area to explore may be the parenting styles that were present in each of the students' homes when the students were young. Alternatively, there may be a comorbidity of early depression or anxiety disorders among the students that accompany their early CPs, leading students to use marijuana early in their lives as a way to escape how they feel. Future research could examine any number of these topics in the understudied population of college students and CPs.

In addition, it would be interesting to see whether attending church regularly versus irregularly or not at all is truly a significant predictor of early MJ use, or whether regular church attendance is standing in for some other factor. It may be the case that if an item such as parental monitoring were added to the model as another factor, church attendance would drop out as being a significant predictor of MJ use.

Additionally, while this study has looked at the scale score of early CPs and their association with early MJ use, it has not looked at individual CPs to see if one problem may be more predictive than another may. Previous research in other types of populations have suggested that no one CP behavior is more predictive than another (Robins and McEvoy 1990); however, results may differ in our unique sample of college students.

One other thing to consider is the fact that these students have all been able to excel enough academically in their lives to graduate high school and be accepted to

college, unlike those youth who are typically thought to have CPs. Maybe it is the lack of the clinically diagnosed conduct disorder which has spared these youth of labeling which may hinder further acceleration, socially or academically. Or possibly these youths all fell below the clinical diagnostic level for conduct disorder, which it is unable to determine from this studies data, allowing them to be able to achieve academic success. Future research may want to look at these ideas and see if there is a difference for college students. It may be something totally different that has not been identified that has allowed the students to continue on to academic success and attend college. Was it parental interventions at some point along the way or possibly a teacher or a counselor who pulled a student aside early in their middle or high school years that helped to change their behaviors? Is it the fact that even though marijuana is thought of as a gateway drug, early CPs are not predictive of more serious substance use in college students? While unlikely, college students with earlier CPs may only be experimenting with less severe substances like marijuana. Only future research can determine if earlier CPs in college students also increase the likelihood of heroin, cocaine or polydrug use.

Concluding Remarks

Despite the fact that college students have been understudied in relation to CPs, probably because it was thought that CPs, especially early CPs, did not exist among this specific population; it has been concluded that college students are not devoid of early conduct problems. Just as general and deviant populations that have been studied before, early conduct problem do exist in college students, maybe not at the same prevalence or incidence. As with the other populations, early CPs increase the risk of early MJ use.

Likewise increased scores on the newly developed College Early CP Scale increase the likelihood that a student will be in the early MJ using group rather than the late or nonuser group. While it is difficult to determine whether the new College Early CP scale is any better or worse at predicting early MJ use than the adapted Johnson and colleagues' scale, it has shown in this paper that it is effective in showing that students with increased scores on the College Early CP Scale are more likely to be early MJ users rather than later or nonusers.

These results have important implications for prevention and suggest the importance of early interventions to reduce the risk for early marijuana use. Educating both parents and teachers in an effort to try to prevent early CP behaviors would be of primary importance. Education for parents and teachers on how to identify early CPs is also necessary so that they may reduce any further behavioral problems that may develop and reduce the risk for early MJ use.

Finally, a clinical diagnosis of conduct disorder is not necessary to confirm that there is an association between early CPs and early MJ use. This study shows that simply an increase in the number of early CPs increases the chance of early MJ use, which in previous research has also shown an increased risk for subsequent problems later in life. Although these college students are able to pursue a higher education at this stage in their lives, there may be some underlying problems that may arise later in life as a result of the early CPs and their early use of MJ. Only time and continued longitudinal research on college students can provide these answers.

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