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Marijuana Use Patterns among African-American Middle-School Students:

A Longitudinal Latent Class Regression Analysis

Beth A. Reboussin[1], **Scott Hubbard**[2], and **Nicholas S. Ialongo**[2]

1*Department of Biostatistical Sciences, Division of Public Health Sciences, Wake Forest University School of Medicine, Winston-Salem, NC, USA*

2*Department of Mental Health, Johns Hopkins University, Bloomberg School of Public Health, Baltimore, MD, USA*

Abstract

The aim of this paper was to describe patterns of marijuana involvement during the middle-school years from the first chance to try marijuana down through the early stages of experiencing health and social problems from marijuana use in a sample of African-American adolescents. A total of 488 urban-dwelling African-American middle-school students were interviewed in sixth, seventh and eighth grades as part of a longitudinal field study. Longitudinal latent class models were used to identify subgroups (classes) of adolescents with similar patterns of marijuana involvement. Three classes were identified; little or no involvement (prevalence 85%, 71%, 55% in sixth, seventh and eighth grade, respectively), marijuana exposure opportunity (12%, 19%, 26%), and marijuana use and problems (2%, 9%, 19%). High levels of aggressive/disruptive behavior exhibited as early as first grade and moderate to high levels of deviant peer affiliation were associated with an increased risk of marijuana exposure opportunities in middle school. Moderate to high levels of aggressive/disruptive behavior and deviant peer affiliation, moderate to low levels of parent monitoring and high levels of perceived neighborhood disadvantage were associated with an increased risk of marijuana use and problems. Significant interactions with grade provided evidence that the influences of parent monitoring and neighborhood disadvantage decrease through the middle-school years. Although not statistically significant, the magnitude of the effects of deviant peer affiliation on marijuana use and problems increased two fold from sixth to eighth grade. These findings highlight the importance of marijuana exposure opportunities in the pathway to marijuana use and problems and the potential to intervene on behaviors exhibited as early as first grade. It also underscores the importance of developing interventions that are sensitive to the strong influence of parents at entry into middle school and the shift to peer influences by the end of middle school.

Keywords

Adolescent; African-American; Aggressive/disruptive behavior; Deviant peer affiliation; Epidemiology; Latent class analysis; Marijuana; Neighborhood; Parent monitoring

Correspondence concerning this article should be addressed to: Beth A. Reboussin, PhD, Department of Biostatistical Sciences, Division of Public Health Sciences, Wake Forest University School of Medicine, Medical Center Boulevard, Winston-Salem, NC 27157. Tel (336)-713-5213, Fax (336)-713-5308, e-mail: brebouss@wfubmc.edu

1. Introduction

Marijuana is the most commonly used illicit drug in the United States. According to the most recent National Survey on Drug Use and Health (SAMHSA, 2006), 74% of current illicit drug users use marijuana with 55% using marijuana exclusively. Of the 2.1 million Americans who used marijuana for the first time in 2005, the majority were less than 18 years old (SAMHSA, 2006). In fact, as early as age 14, marijuana is the most commonly used illicit drug (SAMHSA, 2006). While marijuana use among eighth graders has seen long-term improvements since its peak in 1996, the decline seems to have halted (Johnston et al., 2006b). Currently, almost 45% of teens have tried marijuana at least once before they finish high school (CDC, 2006). Prior research estimates that within one year of an adolescent's first chance to try marijuana, two thirds will start to use the drug (Van Etten et al., 1997,1999). This suggests a narrow window of opportunity for the prevention of marijuana use. Marijuana treatment admission rates also peak between the ages of 15 and 17 (SAMHSA, 2002) and clinical dependence between the ages of 17 and 18 (Wagner and Anthony, 2002). The increased risk of marijuana dependence during the high-school years coupled with the insidious onset of marijuana dependence, highlights the importance of focusing on marijuana use in the middle-school years for understanding the processes underlying the transition to marijuana use and dependence.

The health and social consequences of marijuana use and dependence is a serious concern for developing adolescents. Inability to take on educational and psychological tasks because of the cognitive and psychological impairments resulting from marijuana use may affect an adolescent's ability to successfully transition from childhood to adulthood. Increased risk of school dropout (Lynskey et al., 2003;Green and Ensminger, 2006), poorer achievement (Brook et al., 1989a;Donovan, 1996) unplanned pregnancy (Kandel, 1984;Green and Ensminger, 2006), and job instability (Kandel et al., 1986;Green and Ensminger, 2006) are all associated with marijuana use. Early onset marijuana use is also associated with increased opportunities to use cocaine (Wagner and Anthony, 2002), hallucinogens (Wilcox et al., 2002) and other illicit drugs (Lynskey et al., 2003;Lynskey et al., 2006) later in life.

The objective of this study is to describe patterns of marijuana involvement during the middle-school years from the first chance to try marijuana down through the early stages of experiencing health and social problems from marijuana use in a sample of African-American adolescents attending middle school in an urban area. Little research exists on the patterns of marijuana use among African-American adolescents. Most research has focused on the basic epidemiology of alcohol (Blum et al., 2000) and tobacco (Kann et al., 1996;Felton et al., 1999) use among African-Americans as compared to Whites. This is particularly disturbing given that African-American students generally exhibit lower rates than Whites for all drugs but marijuana. In eighth grade, African-American students have higher rates of lifetime, annual and past-30-day marijuana use (20.5%, 13.6%, and 8.2% versus 14.6%, 11.1% and 5.8% for Whites, respectively) (Johnston et al., 2006a). Data from the Youth Risk Behavior Surveillance (YRBS) System consistently show that the prevalence of lifetime and past-30-day marijuana use is higher among African-American male (43.8 and 22.1 percent, respectively) compared to White male (40.0 and 21.3 percent, respectively) high-school students (CDC, 2006). Marijuana is also the primary substance of abuse among African-American youth admitted for substance abuse treatment services representing 66% of all admissions compared to 42% for Whites (SAMHSA, 2002). Another concern is that much of the data on African-Americans is from national surveys and may not accurately reflect the drug taking experiences of these youth who might be less willing to participate in surveys or to provide accurate information about their drug-using histories. A strength of the current study is that it was specifically designed to be sensitive to ethnic minority populations in order to maximize participation and minimize underreporting of drug-using behaviors and so may more accurately reflect the true nature and extent of drug use problems in this population.

Researchers are also beginning to question whether individual, family and peer variables that predict marijuana involvement among Whites can generalize to African-Americans (Gottfredson and Koper,1996;Wallace and Muroff, 2002;Brown et al., 2004) and whether potentially important contextual factors like neighborhood environment have been ignored (Lambert et al., 2004). In this study, we will examine the potential influences of neighborhood disadvantage as well as a model of early antisocial behavior on middle-school marijuana involvement. In the United States, first grade typically represents a child's first legally required full-day educational experience. Thus, first grade may represent for many children their initial encounter with the challenge of prolonged separation from their caregivers, concomitant with the social, cognitive, and behavioral demands of their teachers and classmates. Not surprisingly, failure to adapt to these demands has been shown to predict later academic failure, antisocial behavior, criminality, and heavy substance use/abuse (Robins, 1978;Kellam et al., 1983;Farrington and Gunn, 1985;Ensminger, Kellam, and Rubin, 1983;McCord and Ensminger, 1997; Crum et al., 1998,2006; Fothergiil and Ensminger, 2006). Patterson et al. (1992) theorize that aggressive and socially-maladaptive behaviors exhibited in first grade may lead to rejection by parents, teachers and well-adjusted peers in the elementary and middle school years. This rejection may lead to inadequate parent supervision and monitoring and 'drift' into a deviant peer group where an adolescent is likely to be offered the opportunity to engage in a wide array of antisocial and delinquent behavior, including alcohol and drug use (Hirschi, 1969;Jessor and Jessor, 1978;Brook et al, 1989b;Patterson et al., 1992). Consistent with this conceptual model, we will examine the influence of early aggressive/disruptive behavior, and poor parent monitoring and affiliation with deviant peers in middle school as well as neighborhood disadvantage on marijuana involvement in our study population.

In this paper, we use longitudinal latent class analysis (LCA) to identify subgroups (classes) of African-American adolescents with similar patterns of marijuana involvement and to estimate their prevalence through the middle-school years. In addition to being an empirically-based approach, LCA accounts for the measurement error often found in self-reported substance use data (Maisto et al., 1990;Cox et al., 1992;Harrison and Hughes, 1997;Golub et al., 2000) by assuming that each response is an imperfect measure of marijuana involvement. We then model the influences of early aggressive/disruptive behavior and middle-school levels of parent monitoring, deviant peer affiliation, and neighborhood disadvantage on membership in the resultant classes using longitudinal latent class multinomial regression analysis (Reboussin and Anthony, 2001). This information can then be used to inform the targets of future preventive intervention efforts. Specifically, the aims of this paper are (1) to use empirical data to characterize patterns of marijuana involvement in a large urban sample of African-American middle-school students, (2) to estimate the prevalence of these patterns of marijuana involvement over time, and (3) to better understand the variation in marijuana involvement patterns through the middle-school years with a focus on individual, peer, family and neighborhood influences.

2. Methods

2.1 Population and Sample

Data were drawn from a longitudinal study conducted by the Baltimore Prevention Research Center (BPRC) at Johns Hopkins University. The original study population consisted of a total of 798 children and families, representative of students entering first grade in nine Baltimore City public elementary schools in 1993. The children were recruited for participation in two school-based, preventive, intervention trials targeting early learning and aggressive/disruptive behavior (Ialongo et al., 1999). Written consent was obtained from parents and verbal assent from youth in accord with the requirements of the Johns Hopkins Bloomberg School of Public Health Committee on Human Research. Three first-grade classrooms in each of the nine

elementary schools were randomly assigned to one of the two intervention conditions or a control condition. The interventions were provided over the first-grade year, following a pretest assessment in the early fall. Of the 798 children available for participation in the fall of first-grade assessments, 678 (85%) were African-American. Approximately 72% (N=488) had data available on the first-grade study measures of interest as well as for at least one assessment between sixth and eighth grade. These 488 youth comprised the sample of interest for this study; 259 (53%) were males and 229 (47%) were females as shown in Table 1. Approximately seventy-two percent of the sample received free or reduced lunches according to parent report at the first-grade assessment. The mean score on the teacher-rated scale of aggressive/disruptive behavior indicated that on average youths almost never or rarely exhibited aggressive or disruptive behaviors in first grade. At the time of the sixth-grade assessment, youth were on average 11.77 years (range 10.62 to 13.12 years). The majority of the 488 youth involved in the follow-up assessments completed all assessments. Four hundred and thirty-six youths (89%) completed all three waves of data collection, 38 completed two waves and 14 completed only one wave. Six youths completed only the sixth-grade assessment, i.e. 99% had either a seventh or eighth grade assessment.

Chi-square tests revealed no differences in terms of gender or free-lunch status between the 488 African-American students participating in this study and the 190 African-American students not included in this study. T-tests revealed no differences between these groups in terms of age at entry into the study, first-grade self-reports of anxious and depressive symptoms or teacher ratings of first-grade aggressive/disruptive behavior. However, those included in this study were significantly more likely to be in the intervention group compared to those not included in this study ($X^2 = 10.43$, p = 0.001). The 436 students completing all assessments and the 52 students completing one or two waves of data collection did not differ in terms of gender, intervention status, free-lunch status, and first-grade self-reports of anxious and depressive symptoms. The 436 students completing all assessments were slightly older ($t = 2.46$, p=0.014) and had lower first-grade teacher ratings of aggressive/disruptive behavior ($t = 2.27$, p=0.023). Descriptions of the measures and methods used to assess first-grade variables may be found in Ialongo et al. (1999).

2.2 Assessments

Interviews were conducted using the audio computer-assisted self interview (ACASI) method. The ACASI method involved each participant sitting down with a laptop computer, putting on headphones, and both listening and seeing standardized questions and responses as they were streamed in audio and visual displays. The federal government's evaluation of its mass media anti-drug campaign and the National Survey on Drug Use and Health (NSDUH) that is conducted each year for a 'national report card' on the nation's drug experiences also use ACASI methods (OAS, 2001). Others have shown the superiority and more complete reporting of sensitive behaviors when ACASI methods are used in place of standard questionnaire and interview methods of assessing youth drug involvement (Turner et al., 1998;Murphy et al., 2000).

In order to promote honest reporting, the staff interviewer sat down across from the youth in a private location within the school (e.g., vacant office or classroom). The first part of the session was devoted to developing trust and rapport via informal conversation, followed by an explanation of the ACASI method and completing the formal youth assent process in accord with a protocol approved by the cognizant Institutional Review Board. The interviewer provided assurances that the information would be recorded and treated in a confidential manner. After answering all of the youth's questions, the ACASI program was started and the laptop was turned to face the youth. Each youth answered the questions without observation of their choices by anyone. The sequence of questions within the ACASI session was designed

to promote accurate and complete responding. The interview began with questions on social adaptation, feelings of psychological well being and perception of control. The questions tapping the constructs measured in the present study occurred about midway into the 90 minute duration of the ACASI session. A small number of students were not present in school (e.g., home schooled, absent or expelled). These youth were interviewed at a private location including libraries or children's homes.

2.3 Measures

For characterizing marijuana involvement we considered responses to five questions about marijuana exposure opportunities, extent of marijuana use and problems associated with marijuana use gathered in the spring of sixth, seventh and eighth grades. These items are contained in the Appendix. Opportunity to use marijuana involved asking whether a youth had 'ever been offered' marijuana as described by Crum et al. (1996). We assume that if a youth uses marijuana they have been actively offered marijuana by someone else or they have seized the opportunity to use marijuana without the agency of someone else. Adolescent reports of marijuana use were based on asking 'Have you ever used marijuana?" Frequency of marijuana use was measured based on questions from the Monitoring the Future survey (Johnston et al., 1995). In this study, the prevalence of continuing marijuana use beyond the first use was quite low (i.e., 1%, 5% and 8% used marijuana more than once by sixth, seventh, and eighth grades, respectively). Hence, frequent marijuana use was defined as ever using marijuana more than a couple of times, i.e. on three or more occasions. This low threshold for frequent marijuana use was chosen to be meaningful for this sample of young adolescents. It also gave us the opportunity to explore whether this level of use is problematic in young adolescents. For this reason, we also looked at health and social problems associated with marijuana use. Health and social problems were assessed by asking if they ever experienced any health problems or social problems from using marijuana. The specific problems comprising these two questions are listed in the Appendix. If a youth reported a behavior at one interview and not subsequent interviews, lifetime history values were based on the earliest report.

Early aggressive/disruptive behavior, parent monitoring, deviant peer affiliation and neighborhood disadvantage were examined as potential influences on marijuana involvement consistent with Patterson et al.'s (1992) conceptual model and based on reviews of the literature indicating their possible association with substance use in White but not necessarily ethnic-minority populations (Patterson et al., 1992;Gottfredson and Koper,1996;Wallace and Muroff, 2002;Brown et al., 2004;Lambert et al., 2004). These factors were measured, as described in more detail below, by means of multi-item assessments adapted from prior scales and were divided into tertiles (low, moderate, high) for statistical analyses to deal with skewness in the distributions. Gender, receiving free or reduced lunch and intervention group were obtained from first-grade records.

1. *Early Aggressive/Disruptive Behavior*. Teacher ratings of aggressive and disruptive behavior were obtained in first grade and are based on the Teacher Observation for Classroom Adaptation -- Revised (TOCA-R) (Werthamer-Larsson, Kellam, and Wheeler, 1991). The TOCA-R is a structured interview with the teacher, which was administered by a trained assessor. Teachers responded to 36 items pertaining to the child's adaptation to classroom task demands over the last 3 weeks. Adaptation was rated by teachers on a six-point frequency scale (1=almost never to 6=almost always). The aggressive/disruptive behavior subscale was the mean of the following TOCA-R items: (a) breaks rules, (b) harms or hurts others physically, (c) harms or damages property on purpose (d) breaks things, (e) takes others property, (f) fights, (g) lies, (h) trouble accepting authority, (i) yells at others, (j) stubborn, and (k) teases classmates. Higher scores mean more aggressive/disruptive behavior. Cronbach's alpha was 0.96 for this scale.

2. *Parent Monitoring*. Youth report of parent monitoring was assessed in the spring of sixth, seventh and eighth grades. It was based on a seven-item scale adapted from the Structured Interview of Parent Management Skills and Practices - Youth Version (SIPMSP, Capaldi and Patterson, 1989). This interview was developed by Patterson and his colleagues as a counterpart to their parent interview. The youth version assesses the parenting constructs integral to the Patterson et al. (1992) model of antisocial and survival skills. It includes six items measuring such things as how often youth tell their parents when they will be back or leave a note about their whereabouts when they go out and how often someone is at home within an hour of getting home from school. This scale was the sum of six items scaled on a six-point frequency scale (1=all of the time to 6=never). Higher scores indicate less parent monitoring. Cronbach's alphas were 0.62, 0.69 and 0.69, respectively in sixth, seventh and eighth grades for this scale.

3. *Deviant Peer Affiliation*. We used a subset of items from Capaldi and Patterson's (1989) youth self-report scale to measure deviant peer affiliation in sixth, seventh and eighth grades. Youths are asked in forced choice format to indicate how many of their friends (1=none to 5=all of them) have engaged in antisocial behavior, such as hitting or threatening someone, stealing, and damaging others' property and how many of their friends have used marijuana. This scale was the sum of seven items with higher scores indicating more deviant peer affiliation. Cronbach's alphas were 0.76, 0.84, and 0.85, respectively in sixth, seventh and eighth grades for this scale.

4. *Neighborhood Disadvantage*. Youth report of neighborhood disadvantage was measured in sixth, seventh and eighth grades with ten items from the Neighborhood Environment Scale (NES; Elliott, Huizinga, and Ageton, 1985) assessing exposure to deviant behavior in the neighborhood, including violent crime, drug use and drug sales. The scale was the sum of the ten items rated on a four-point frequency scale (1=not at all to 4=very true). Higher scores indicate a more disadvantaged neighborhood. Cronbach's alphas were 0.81, 0.85 and 0.85, respectively in sixth, seventh and eighth grades for this scale.

2.4 Statistical Analyses

Longitudinal latent class analysis (LCA) was applied to examine the structure underlying the five marijuana involvement behaviors in sixth, seventh and eighth grades. The basic premise of latent class analysis is that within classes, behaviors are locally independent (Lazarsfeld, 1950;McCutcheon, 1987). For our application this means the co-occurrence of behaviors can be explained by an underlying classification of youth into subgroups (classes) with similar patterns of behavior. The goal of LCA is to identify the smallest number of classes that adequately describes the association among the behaviors. Information about the resultant class structure is conveyed through two sets of parameters; the probability of reporting a behavior within a particular class (response probabilities) and the proportion of youth in each class (latent class prevalences). While in principle it is possible to allow the response probabilities, and hence class structure, to vary over time, this implies that the definition of marijuana involvement is changing, which would substantially complicate the interpretation of a longitudinal model. Therefore, we constrained the response probabilities to be constant over time, i.e. the probability of reporting a behavior within a latent class was the same in each grade. For example, if p_{ijk} is the probability of reporting behavior i given membership in class j at in grade k, then we assume $p_{ijk} = p_{ijm}$ for $m \neq k$. This is analogous to constraining the factor loadings to be equal over time in a longitudinal factor analysis model (sometimes referred to as factor invariance). Exploratory analyses by grade provided support that the class structure was time invariant (data not shown). The latent class prevalences, however, were allowed to vary over time, i.e. the proportion of youth in each class could change over time. Model

parameters were estimated simultaneously using the generalized estimating equations (GEE) approach of Reboussin and Anthony (2001) for longitudinal latent class models. Software can be obtained from the first author.

Our model building strategy involved starting with the most parsimonious one-class model ("all marijuana involvement the same") and fitting successive models with an increasing number of latent classes in order to determine the most parsimonious model that provided an adequate fit to the data. Following the work of Bandeen-Roche et al. (1997), we inferred the number of latent classes ignoring covariates to reduce the complexity of the problem. The goodness-of-fit of various models was evaluated with an emphasis upon Akaike's Information Criteria (AIC), a global fit index which combines goodness-of-fit and parsimony. We use a modified version of the AIC proposed by Reboussin et al. (2006a) for models estimated using the GEE approach in which a likelihood is not available. In comparing different models with the same set of data, models with lower values are preferred. While Lin and Dayton (1997) argue for the use of the AIC for complex latent class models, others argue it is overly liberal (McLachlan and Peel, 2000). We therefore report results for both the AIC and BIC (Bayesian Information Criteria). For latent class models, there are considerations other than global goodness-of-fit indices. In particular, an examination of the validity of the local independence assumption which is the hallmark of LCA is critical. We used a modified version of Garrett and Zeger's (2000) Log-Odds Ratio Check. This method involves calculating the log odds ratio in both the observed and expected two-way tables for pairs of behaviors. The observed data log-odds ratio is then expressed as a z-score relative to the expected data log-odds ratio. The z-value is then used as a guide to detect items that are locally dependent. A threshold of ± 1.5 was conservatively chosen as suggestive of local dependence.

Once determining the appropriate number of latent classes, we incorporated covariates into the latent class model. When introducing covariates into the latent class model, the notion of local independence was extended by assuming that the probability of engaging in a behavior was the same for all individuals within a given latent class regardless of the value of their covariates. This concept of 'marginalization', as it is often referred in the literature, further defines the way in which latent classes serve as summary constructs. We modeled the latent class prevalences as in a cross-sectional study using a multinomial regression model but included indicators for grade and the covariates of interest. This model allowed us to describe the association between the LCA-derived marijuana involvement classes and their suspected influences while allowing the prevalences to vary by grade. By including an interaction between grade and the covariates of interest, we explored whether: (1) early aggressive/disruptive behavior influenced marijuana involvement through the middle-school years, and (2) whether the relationship of the time-varying measures of parent monitoring, deviant peer affiliation and neighborhood disadvantage with marijuana involvement changed over the course of middle school. The results of analyses are presented in the form of odds ratios. In all analyses, standard errors were corrected to reflect the fact that children are clustered within classes within schools (Reboussin et al., 2006a)

3. Results

Presented in Table 2 are the middle-school characteristics and marijuana involvement behaviors. Levels of parent monitoring were stable across the study period. On average, youth reported high levels of parent monitoring most of the time. Affiliation with deviant peers and perceptions of neighborhood disadvantage decreased slightly from sixth to seventh grade. In sixth grade, 14% of youth reported being offered marijuana and 4% reported ever using marijuana. By seventh grade, almost a third had been offered marijuana and approximately 12% had used marijuana. Approximately 4% had used marijuana more than 2 times by seventh grade and almost 10% experienced social problems from marijuana use. Almost half had been

offered marijuana by eighth grade, 20% had used marijuana and almost 10% had used marijuana more than two times. Social problems from marijuana use were reported by 17% of eighth graders while 7% reported health problems.

Longitudinal latent class models were fit to the data on marijuana involvement behaviors starting with the most parsimonious one-class model ("all marijuana involvement the same') with progression to a less parsimonious model with three classes of marijuana involvement. The AIC favored a two-class model (2C) of marijuana involvement relative to three-class (3C) and four-class (4C) models (2C_AIC = 393546 versus 3C_AIC = 502950 and 4C_AIC = 554224 where smaller is better). Results were similar for the BIC. Presented in Figure 1 are the z-values contrasting the observed and expected log odds ratios between pairs of marijuana behaviors in sixth, seventh and eighth grade for the two, three and four class models. Under the two-class model, there were a number of detectable local dependencies (i.e., z-values greater than 1.5) between pairs of marijuana involvement behaviors. The addition of a third class generally reduced the local dependencies (i.e., z-values decreased) most notably between being offered marijuana and using marijuana. Dependencies remained between ever using marijuana and experiencing social problems from marijuana use at all three time points and between frequent use and health problems at one time point. The addition of a fourth class resulted in a model with no evidence of local dependence. However, the prevalence of this fourth class was less than 1% in sixth and seventh grades and only 4% in eighth grade hindering our ability to obtain stable parameter estimates when including covariates in the longitudinal regression models.

To probe further whether introduction of a third class yielded a model that was clinically meaningful in addition to its ability to improve the local independence assumption over the two class model, we examined the resultant latent class structure to evaluate its interpretability and clinical meaningfulness. The estimated probability of reporting each marijuana involvement behavior within each class is displayed in Figure 2. Middle-school students in Class 1 reported virtually no marijuana exposure opportunities or marijuana use. We refer to this class as the "*Little* or *No involvement*" class. The estimated prevalence of this class was 85% in sixth grade, 71% in seventh grade and 55% in eighth grade. Among middle-school students in Class 2, more than 95% had been offered marijuana but less than 15% had used marijuana. We refer to this pattern of marijuana involvement as "*Marijuana exposure opportunity*"; the estimated prevalence of Class 2 was 12% in sixth grade, 19% in seventh grade and 26% in eighth grade. Class 3 with an estimated prevalence of 2%, 9% and 19%, respectively in sixth, seventh and eighth grades, was characterized by marijuana use (> 95%). In addition, 45% of middle-school students in Class 3 had used marijuana more than 2 times and more than 85% had experienced social problems as a result of marijuana use. Health problems were less prevalent but were still reported by almost 40% of youth in Class 3. We refer to Class 3 as "*Marijuana Use and Problems.*" In contrast, the two-class model (data not shown) subdivided middle school youth into a class in which youth had not used marijuana and less than 20% had been offered marijuana and a class which included youth who had been offered and used marijuana. Despite the fact that the two-class model has a smaller AIC, the ability of the three-class model to reduce the number of local dependencies and the potential clinical meaningfulness of its recognition of marijuana exposure opportunity as a distinct stage of marijuana involvement on the path to marijuana use and problems led us to support the three-class model over the two-class model.

Table 3 summarizes odds ratios estimates (OR) for marijuana class membership in relation to early aggressive/disruptive behavior and suspected middle-school influences (parent monitoring, deviant peer affiliation, neighborhood disadvantage) as derived with longitudinal latent class multinomial regression models. The addition of covariates into the models did not change the response probabilities significantly to affect interpretation of the underlying classes

suggesting the marginalization property holds. In what follows, OR_{Exp} indicates the estimated odds ratio for the marijuana exposure opportunity class (Class 2) relative to the little or no involvement class (Class 1); OR_{Use} indicates the odds ratio for the marijuana use and problems class (Class 3) relative to the little or no involvement class (Class 1). Before adjustment for potential confounding effects (Model 1), middle-school youth exhibiting moderate levels of aggressive/disruptive behavior (middle tertile) in first grade were almost three times more likely to be in the marijuana use and problems class compared to youth exhibiting the lowest levels of aggressive/disruptive behavior (lowest tertile) (OR_{Use} = 2.9, 95% CI = 1.1, 8.1). Both moderate and low levels of parent monitoring were associated with an increased likelihood of marijuana use and problems compared to high levels of parent monitoring (OR_{Use} = 3.4; 95% CI = 1.9, 5.9 OR_{Use} = 3.9; 95% CI = 2.4, 6.5, respectively). Middle-school youth with moderate and high levels of deviant peer affiliation were two and four times more likely, respectively to be in the marijuana exposure opportunity class compared to youth with the lowest levels of deviant peer affiliation (OR_{Exp} = 1.8; 95% CI = 1.3, 2.5 and OR_{Exp} = 3.7; 95% CI = 2.4, 5.8, respectively). Moderate and high levels of deviant peer affiliation were also associated with a two-fold and eleven-fold increased likelihood, respectively of marijuana use and problems compared to youth with the lowest level of deviant peer affiliation, (OR_{Use} = 2.1; 95% CI = 1.2, 3.6 and OR_{Use} = 10.9; 95% CI = 5.8, 20.6, respectively). Youth that perceived their neighborhood to be highly disadvantaged were 80% more likely to be in the marijuana exposure opportunity class and almost four times more likely to be in the marijuana use and problems class compared to youth who perceived their neighborhood to have the lowest level of neighborhood disadvantage (OR_{Exp} = 1.8; 95% CI = 1.1, 3.1 and OR_{Use} = 3.6; 95% CI = 1.9, 7.0). Moderate levels of neighborhood disadvantage were significantly associated with a 50% increased likelihood of marijuana exposure opportunity (OR_{Exp} = 1.5; 95% CI = 1.0, 2.1) compared to youth with the lowest perceived level of neighborhood disadvantage.

The estimated associations remained quite stable as we made statistical adjustments for gender, subsidized-lunch status and intervention group (data not shown). When effects were estimated simultaneously (Model 2) in addition to statistical adjustments for gender, subsidized-lunch status and intervention group, the odds ratios for parent monitoring and marijuana use and problems (Class 3) were attenuated but retained statistical significance for both moderate (OR_{Use} = 2.6; 95% CI = 1.3, 5.0) and low levels of parent monitoring (OR_{Use} = 1.9; 95% CI = 1.1, 3.5). Similarly, results were attenuated but retained significance for the highest levels of deviant peer affiliation and marijuana exposure opportunity (OR_{Exp} = 2.8; 95% CI = 1.9, 4.1) and marijuana use and problems (OR_{Use} = 5.6; 95% CI = 3.0, 10.3). Little attenuation was observed for moderate levels of deviant peer affiliation. Results were no longer statistically significant for neighborhood disadvantage and marijuana exposure opportunities and were attenuated for high levels of neighborhood disadvantage and marijuana use and problems (OR_{Use} = 2.1; 95% CI = 1.1, 4.0). Finally, high levels of early aggressive/disruptive behavior not previously associated with marijuana exposure opportunities and marijuana use and problems attained statistical significance (OR_{Exo} = 1.9; 95% CI = 1.1, 3.3 and OR_{Use} = 2.7; 95% CI = 1.0, 6.9) in the full model.

To test the hypothesis that the associations of early aggressive/disruptive behavior, parent monitoring, deviant peer affiliation and neighborhood disadvantage with marijuana involvement might vary over the middle school years, we included an interaction between each of these suspected influences and grade in the full model (Model 2). These results are presented in Table 4. There were no statistically significant interactions between early aggressive/ disruptive behavior and grade although there was some evidence that influences on marijuana exposure opportunities waned over time and increased for marijuana use and problems.

Although parent monitoring was not significantly associated with marijuana exposure opportunities in any grade, there were significant differences in the direction of the effects over

time. Moderate and low levels of parent monitoring were associated with an increased likelihood of marijuana exposure opportunities in sixth grade (OR_{Exp} = 1.6; 95% CI = 0.9, 2.9 and OR_{Exp} = 1.7; 95% CI = 0.9, 3.5) but a decreased likelihood in seventh grade (OR_{Exp} = 0.6; 95% CI = 0.3, 1.1 and OR_{Exp} = 0.7; 95% CI = 0.4, 1.3). Similarly, low levels of parent monitoring were associated with a decreased likelihood of marijuana exposure opportunities in eighth grade (OR_{Exp} = 0.6; 95% CI = 0.3, 1.3). The association of parent monitoring and marijuana use and problems decreased significantly through the middle-school years. In sixth grade, moderate and low levels of parent monitoring were associated with an increased likelihood of marijuana use and problems (OR_{Use} = 50.0; 95% CI = 7.3, 342.8 and OR_{Use} = 25.3; 95% CI = 4.7, 135.6). By eighth grade, parent monitoring was no longer significantly associated with marijuana use and problems (OR_{Use} = 1.4; 95% CI = 0.6, 3.7 and OR_{Use} = 1.5; 95% CI = 0.6, 3.6).

The association between deviant peer affiliation and marijuana exposure opportunities decreased from sixth to eighth grade but the difference was only statistically significant when comparing the highest and lowest levels of deviant peer affiliation in seventh compared to sixth grade. The relationship between deviant peer affiliation and marijuana use and problems increased with grade, but this trend was not statistically significant.

Finally, the relationship between neighborhood disadvantage and both marijuana exposure opportunity and marijuana use and problems was significantly higher in sixth compared to eighth grade. Youth reporting the highest levels of neighborhood disadvantage in sixth grade were almost four times more likely to be in the marijuana exposure opportunity class compared to youth reporting the lowest levels of disadvantage (OR_{Exp} = 3.7; 95% CI = 1.6, 8.4) whereas there was no association by eighth grade (OR_{Exo} = 0.9; 95% CI = 0.5, 1.6). Similarly, youth reporting moderate levels of neighborhood disadvantage in sixth grade were almost five times more likely to be in the marijuana use and problems class compared to youth reporting the lowest levels of disadvantage (OR_{Use} = 4.8; 95% CI = 1.3, 17.8) whereas there was no association by eighth grade (OR_{Use} = 1.0; 95% CI = 0.4, 2.1).

4. Discussion

We found evidence for three classes of marijuana involvement among an African-American sample of urban middle-school students: little or no involvement, marijuana exposure opportunity, and marijuana use and problems. Early in their middle school career (spring of sixth grade), an overwhelming majority of youth in this sample had not had an opportunity to use marijuana (85%; prevalence of Class 1). However, by seventh grade almost one third had the opportunity to use marijuana (28%; combined prevalence of Classes 2 and 3) and almost 10% had engaged in marijuana use and were likely to exhibit problems associated with use (Class 3). By the end of middle school (spring of eighth grade), almost half had the opportunity to use marijuana (Classes 2 and 3) and almost 20% had tried marijuana (Class 3). Despite the sensitivity of our survey to ethnic-minority populations, our findings in this urban African-American sample are consistent with the most recent national data from the Monitoring the Future Study where approximately 20% of African-American eighth graders report ever using marijuana (Johnston et al., 2006a). This is comparable to the proportion of eighth graders represented by Class 3 (19%).

It is worth pointing out that while almost 20% of middle-school students had used marijuana by eighth grade, less than half of these youth reported using marijuana more than two times. This finding is also consistent with the most recent data from the Monitoring the Future Study (Johnston et al., 2006a) in which only 1% of African-American eighth graders reported daily use of marijuana. While less than half of our marijuana users have used marijuana more than a couple of times, we found this pattern of use to be associated with both social (89%) and

health problems (38%). Considering that most of the health consequences from marijuana use (e.g. respiratory illness, cancer) are the result of daily and long term use (Tashkin, 1990; Zhang et al., 1999) the prominence of social problems over health problems is not surprising. It is also consistent with the notion that an inability to handle educational, social or psychological tasks during the transition from childhood to adolescence may have more prominent effects in this age group than do health issues resulting from more frequent or long-term use. The widespread prevalence of social problems among adolescent marijuana users may also suggest that health problems are more clinically significant among this age group.

The study findings also include an assessment of variation in the risk of exhibiting empirically-derived marijuana involvement patterns based on individual, peer, family and neighborhood factors. Interestingly, the highest levels of aggressive/disruptive behavior exhibited as early as first grade were significantly associated with an increased risk of marijuana exposure opportunities and marijuana use and problems in middle school even after adjustment for middle-school predictors (Model 2). This finding of a possible developmental link between early childhood misbehavior and later risk of drug exposure opportunities and use is supported by earlier research in which boys assigned at random to a two-year behavior-improving classroom environment were about one third to one half as likely to start smoking tobacco cigarettes by the early years of adolescence, as compared with a control group of boys assigned to usual and customary classroom environments (Kellam and Anthony, 1998). Although not statistically significant, these data also suggest that the effect of early childhood aggressive/disruptive behavior on marijuana use may not manifest itself until seventh and eighth grades. This finding is similar to results showing that teacher ratings of first grade aggressive/disruptive behavior were strong predictors of later violence but were of limited utility in the early identification of youth at risk (Petras et al., 2004,2005). Despite the lack of association with marijuana use and problems until seventh and eighth grades, higher levels of aggressive/disruptive behavior were predictive of marijuana exposure opportunities in sixth grade and may prove to be an important target early in the pathway to marijuana use.

The strongest influence on the risk of both marijuana exposure opportunity and marijuana use and problems was affiliation with deviant peers in middle school. Consistent with the theory of Patterson et al. (1992), it is in deviant peer groups that adolescents are likely to be offered the opportunity to engage in drug use as well as to have this behavior reinforced. Evidence is also accumulating that peers have a greater influence on adolescent drug use than do parents (Beal et al., 2001;Guo et al., 2002;Kuther, 2002;van den Bree and Pickworth, 2005;Reboussin et al., 2006b). Despite these recent findings, there is evidence to suggest parents remain important through the teen years. There is a large body of research suggesting that higher levels of parenting monitoring may reduce the incidence of drug use (Chassin et al.,1993;Chilcoat et al., 1995;Chilcoat and Anthony, 1996;DiClemente et al., 2001). Few researchers have considered the relationship between parent monitoring and earlier stages of drug involvement, e.g. the first chance to try a drug. Based on data from the National Household Survey of Drug Abuse 1979-1994, we know that two thirds of individuals will transition to marijuana use within the first year of exposure to the drug (VanEtten and Anthony, 1997). This highlights the importance of drug exposure in the pathway to future drug use and the narrow window of opportunity to intervene once an exposure opportunity occurs. Recently, Chen et al. (2005) investigated whether parenting practices which included parent monitoring might reduce the risk of first opportunity to try marijuana. They found that after adjustment for other covariates, higher levels of parent monitoring did not reduce the risk of exposure to try marijuana. Similarly, we found no relationship between marijuana exposure opportunity (Class 2) and lower levels of parent monitoring. Interestingly, we did find that in seventh and eighth grades, lower levels of parent monitoring among African-American youth were associated with a decreased risk of marijuana exposure opportunity. Although the magnitude of these effects were not statistically significant, they were significantly different than the effect in sixth grade

which suggested that lower levels of monitoring were associated with an increased risk of marijuana exposure opportunity. One explanation for this finding may be that parent monitoring increases following knowledge of affiliation with deviant peers. Hence, low levels of parent monitoring among older youth (seventh and eighth graders) may indicate little or no affiliation with deviant peers. However, in secondary analyses (data not shown), there was no evidence that increases in deviant peer affiliation were associated with increases in parent monitoring. Hence, this finding may lend support to the idea that the influence of parents decreases over time and that despite high levels of monitoring, exposure opportunities increase through middle school.

We did find that higher levels of parent monitoring play a role in reducing the risk of marijuana use and problems (Class 3) even after adjustment for affiliation with deviant peers and neighborhood disadvantage. This association, however, decreases through the middle-school years and is no longer statistically significant by eighth grade (OR_{Use} =1.4, 95% CI=0.6, 3.7 and OR_{Use} =1.5, 95% CI=0.6, 3.6 for moderate and low levels of parent monitoring, respectively) also supporting the notion that parent influence decreases in middle school. Consistent with this finding, although not statistically significant, we found evidence that affiliation with deviant peers becomes more strongly associated with marijuana use and problems over time. In particular, youth reporting the highest levels of deviant peer affiliation in sixth grade are three times more likely to be in the marijuana use and problems class compared to youth with the lowest level of deviant peer affiliation. By eighth grade, youth with the highest affiliation with deviant peers are six times more likely to be in the marijuana use and problems class.

Existing research suggests that neighborhood characteristics may predict alcohol use among ethnic minorities (Gruenewald et al., 2000;Treno et al., 2000). Recently, Lambert et al. (2004) found that perceptions of neighborhood disadvantage in seventh grade were associated with increased tobacco, alcohol and marijuana use in grade 9 among urban African-Americans. Crum et al. (1996) focused on the very early stages of drug use and demonstrated a significant relationship between cocaine exposure opportunity and neighborhood disadvantage in a predominantly African-American sample of middle-school students and weaker, but statistically significant, associations with tobacco and alcohol exposure opportunities. Consistent with these findings we also find significant associations between the highest levels of neighborhood disadvantage and both marijuana exposure opportunities and marijuana use and problems in this African-American sample. However, after adjustment for first grade aggressive/disruptive behavior, parent monitoring and deviant peer affiliation, these findings are attenuated and no longer statistically significant in seventh and eighth grades. This finding may suggest that more proximal measures of a child's day to day environment like peers, parents and child behavior are more predictive of marijuana involvement because they reflect conditions directly experienced by the child. Neighborhood disadvantage and other demographics that are considered more distal measures may lose their predictive ability once more proximal measures are taken into account because their effects on a child's marijuana involvement are indirect.

A significant strength of the present study is the focus on a large sample of urban-dwelling African-Americans participating in a prospective study designed to be sensitive to ethnic-minority populations. With the intent of maximizing participation and minimizing underreporting of drug-using behaviors, these data may more accurately reflect the true nature and extent of marijuana use in this under-studied population. Besides the focus on African-Americans, another significant strength of this study is that it is only one of a handful that examines the major tenets of Patterson et al (1992)'s model of the influence of early antisocial behavior on later drug use within the context of a prospective longitudinal design, spanning from entrance to elementary school through the middle-school years. The findings from this

study are further strengthened by the use of an innovative analytic technique that allowed for the detection of sub-populations based on observed patterns of marijuana use and accounted for the measurement error often found in self-reported substance use data.

In terms of limitations, we largely relied on a single method (participant report) and reporter (child report) for the data used in this study. Multiple methods (e.g., biological assays) and reporters (e.g., peer report of participant drug use) would have strengthened the study design. Internal consistency for youth reports of parental monitoring were relatively low (Cronbach's alpha = 0.62, 0.69, and 0.69 for sixth, seventh, and eighth grades, respectively) compared to youth reports of deviant peer affiliation (0.76, 0.84, 0.85) and neighborhood disadvantage (0.81, 0.85, 0.85). Although there is not a generally agreed upon cut-off, usually 0.70 and above is considered acceptable (Nunnally, 1978). The marginal consistency of the parent monitoring scale may be a function of the narrow reporting range with most youth in the sample reporting high levels of parent monitoring and few reporting at the extremes of parent monitoring. Implications of this lower variability are also evident in the wider confidence intervals, particularly in sixth grade, for parent monitoring effects (see Table 4). Despite the lower alpha, this measure has been shown to be associated with initiation of early drug use providing evidence of its validity (e.g. Chilcoat et al., 1995;Chilcoat and Anthony, 1996).

A larger and more diverse sample may have allowed for identifying more subgroups, longitudinal trends and ethnic comparisons. In particular, the small number of Whites in the original sample (N=120) and participating in the middle-school assessments (N=74) precluded our ability to make any meaningful (or statistically stable) comparisons between Whites and African-Americans. Given this limitation, we restricted analyses to African-Americans so that we could make stronger statements about patterns of marijuana use that were specific to this population. Finally, as is the case in most longitudinal studies, approximately 28% (190/678) of the original African-American study population was lost to follow-up, i.e. participated in the first-grade but not the middle-school assessments. Although those youth assigned to the control group in first grade were more likely to be lost to follow-up, they did not differ on first-grade behavioral measures such as self-reports of anxious and depressive symptoms and teacher ratings aggressive/disruptive behavior. To account for the potential bias that could arise from the imbalance in intervention status in the follow-up sample, intervention status was included as a covariate in statistical models. The GEE estimation procedure was developed for the analysis of multivariate categorical data when non-response is classified as missing completely at random (MCAR) (see Liang and Zeger, 1986 for details) according to the criterion defined by Rubin (Rubin, 1976). If the reason for non-response depends on covariates or outcomes either observed or missing, the estimating equations approach might provided biased results. For those youth participating in the sixth to eighth grade assessments, we used all available waves of data collection for individuals which resulted in intermittent missing data. Those with complete data for all three assessments are slightly older at study entry and exhibit less aggressive/disruptive behavior in first grade than those with fewer assessments. However, the number of youth with missing data for at least one time point is minimal (N=52) and is unlikely to affect results. In fact, only 14 youth completed only one assessment and even fewer (n=6) completed only the initial sixth grade assessment.

In terms of implications for prevention, our findings lend further support to the key tenets of Patterson et al. (1992)'s model of the relationship between early antisocial behavior and later substance use and to the targeting of early aggressive/disruptive behavior as a means of reducing the risk for marijuana use. Indeed, we found a sub-population of children who exhibit problem marijuana use in the middle-school years and that membership in this class was predicted by aggressive/disruptive behavior. We are not suggesting, however, that preventive efforts be confined to the targeting of early aggressive/disruptive behavior as there is evidence of sub-populations whose pathway to problem marijuana use begins in the adolescent years.

There was clear evidence in the present study that covariates measured in the middle-school years were strong predictors of membership in the marijuana problem use class, which points to them as potential targets for intervention in the middle-school years. It also highlights the importance of parents at entry into middle school in terms of marijuana use and problems but the need to shift the focus of interventions to peer groups in middle-school populations both to reduce risk of marijuana exposure opportunities as well as marijuana use and problems.

The focus of the current study was on characterizing patterns of marijuana use in African-Americans at the population level and examining whether variation in these patterns exist between populations subgroups, e.g. youth with high versus low levels of early aggressive/disruptive behavior. The findings from this epidemiologic analysis suggest a progression in marijuana involvement from little or no involvement to exposure opportunities and then to use and problems. With regard to implications for future research, these findings provide motivation for investigating at the individual level factors that might influence progression in marijuana involvement using techniques for modeling individual change, e.g. latent transition analysis (Collins and Wugalter, 1992). We are also continuing to follow the study population through high school and into young adulthood. Consequently, we will have the opportunity to examine the relationship between middle-school marijuana use and later marijuana and other substance abuse and dependence. We also have the opportunity to study the predictors of within-class variation in later outcomes. For example, we can explore what factors might explain why some members of the problem use class in middle school do not go on to abuse marijuana or other drugs in the high-school or young-adult years.

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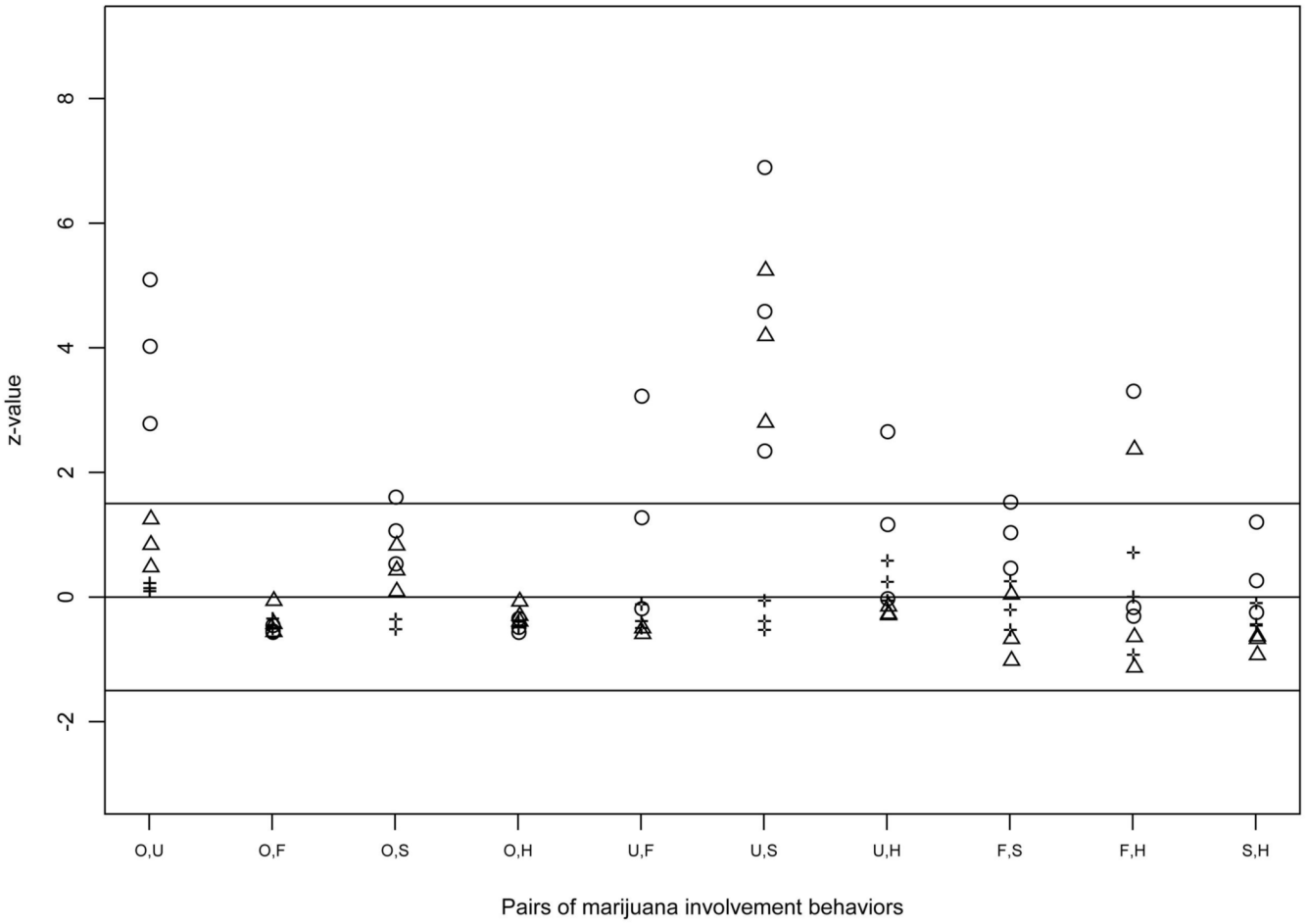

Figure 1.
Z-values for the observed log odds ratios relative to the expected log-odds ratios for two (○), three (△) and four (+) class models of marijuana involvement. O=ever offered marijuana, E=ever used marijuana, F=ever used marijuana more than two times, S=ever have social problems from marijuana use, H=ever have health problems from marijuana use.

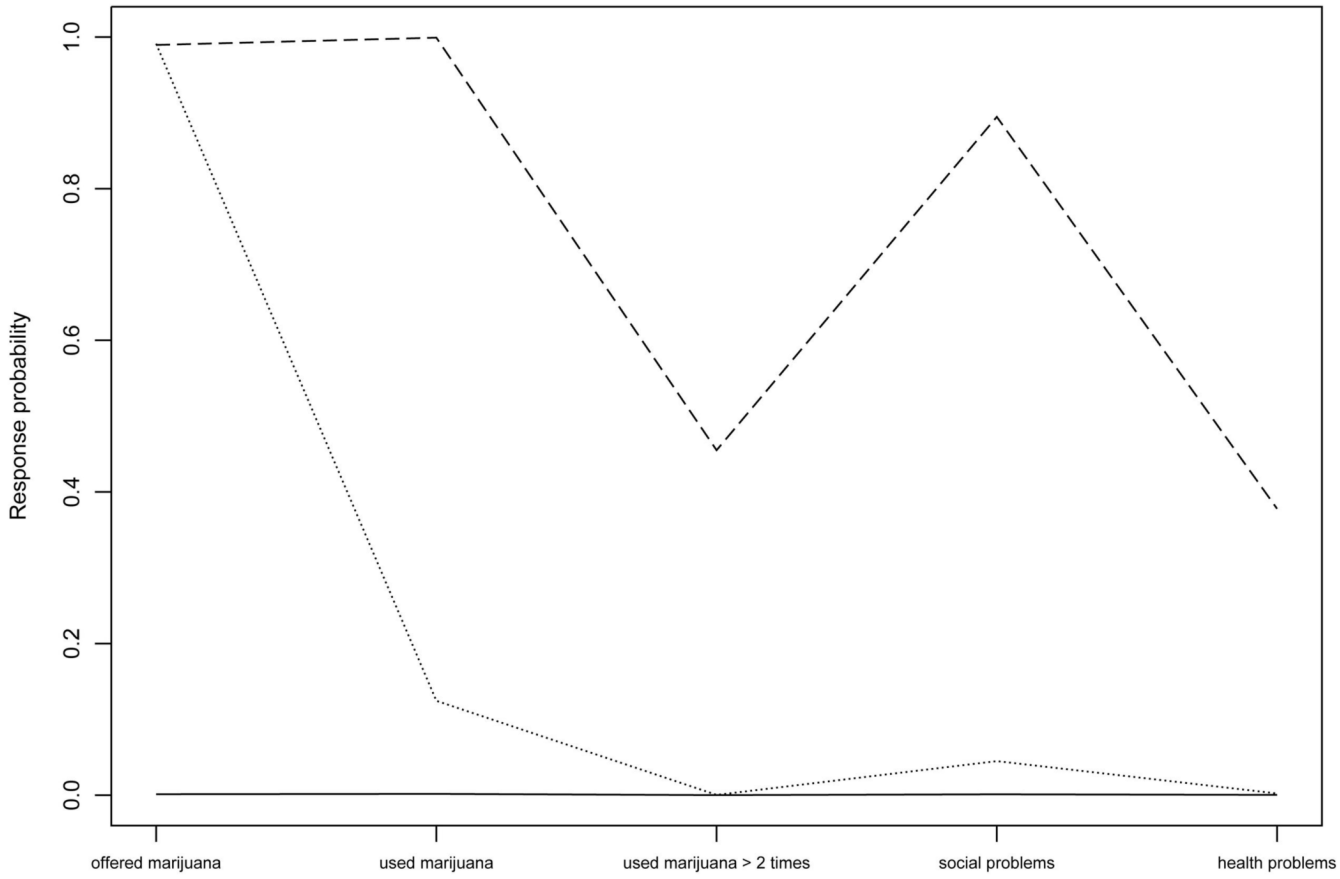

Figure 2.
Estimated patterns of marijuana involvement among sixth to eighth grade students based on a longitudinal latent class analysis. Solid line=Class 1, dotted line=Class 2, dashed line=Class 3.

Table 1

Means (standard deviations) and prevalences (number) of sample characteristics measured in first grade. Data are from the Baltimore Prevention Research Center at Johns Hopkins University, 1993.

Characteristic	1st Grade (N=488)
Gender	
Male	53.1% (259)
Female	46.9% (229)
Free/Reduced Lunch	
No	28.3% (138)
Yes	71.7% (350)
Intervention Group	
Treatment	68.6% (335)
Control	31.4% (153)
Aggressive/Disruptive Behavior[1]	1.62 (0.83)

[1] Based on teacher-rated reports for youth in the Fall of first grade where 1 =almost never, 2=rarely, 3=sometimes, 4=often, 5=very often, 6=always

Table 2

Means (standard deviation) and prevalences (number) of middle school characteristics and marijuana involvement behaviors from 6th through 8th grade. Data are from the Baltimore Prevention Research Center at Johns Hopkins University, 1998-2000.

Characteristic/Behavior	6th Grade N=454	7th Grade N=471	8th Grade N=473
Parent Monitoring[1]	1.99 (0.66)	2.00 (0.72)	2.07 (0.68)
Deviant Peer Affiliation[2]	1.68 (0.61)	1.51 (0.61)	1.59 (0.63)
Neighborhood Disadvantage[3]	1.81 (0.63)	1.71 (0.62)	1.73 (0.63)
Ever offered marijuana			
Yes	14.5% (66)	28.5% (134)	44.0% (208)
No	85.5% (388)	71.5% (337)	56.0% (265)
Ever used marijuana			
Yes	4.0% (18)	11.7% (55)	20.9% (99)
No	96.0% (436)	88.3% (416)	79.1% (374)
Used marijuana > 2 times			
Yes	1.0% (4)	3.8% (18)	8.7% (41)
No	99.0% (450)	96.2% (453)	91.3% (432)
Social problems from marijuana use			
Yes	2.6% (12)	9.1% (43)	16.9% (80)
No	97.4% (442)	90.9% (428)	83.1% (393)
Health problems from marijuana use			
Yes	1.0% (4)	3.4% (16)	7.0% (33)
No	99.0% (450)	96.6% (455)	93.0% (440)

[1] 1=all of the time, 2=most times, 3=sometimes, 4=hardly ever, 5=never

[2] 1=none, 2=very few, 3=some, 4=most of them, 5=all of them

[3] 1=not at all true, 2=a little true, 3=sort of true, 4=very true

Table 3

Estimated odds ratios (OR) of marijuana class membership, in relation to early aggressive/disruptive behavior and suspected middle-school influences based on a longitudinal multinomial latent class regression model.

Variables	Marijuana Exposure Opportunity (Class 2) vs Little or No Involvement (Class 1)		Marijuana Use and Problems (Class 3) vs Little or No Involvement (Class 1)	
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Early Aggressive/ Disruptive Behavior				
Low	1.0	1.0	1.0	1.0
Moderate	0.9 (0.6, 1.4)	1.1 (0.7, 1.8)	**2.9 (1.1, 8.1)**	**3.2 (1.2, 8.5)**
High	1.6 (0.9, 2.7)	**1.9 (1.1, 3.3)**	2.8 (0.9, 8.5)	**2.7 (1.0, 6.9)**
Parent Monitoring				
High	1.0	1.0	1.0	1.0
Moderate	1.3 (0.9, 2.0)	1.0 (0.7, 1.6)	**3.4 (1.9, 5.9)**	**2.6 (1.3, 5.0)**
Low	1.2 (0.8, 1.9)	0.8 (0.5, 1.4)	**3.9 (2.4, 6.5)**	**1.9 (1.1, 3.5)**
Deviant Peer Affiliation				
Low	1.0	1.0	1.0	1.0
Moderate	**1.8 (1.3, 2.5)**	**1.9 (1.4, 2.6)**	**2.1 (1.2, 3.6)**	**1.8 (1.0, 3.3)**
High	**3.7 (2.4, 5.8)**	**2.8 (1.9, 4.1)**	**10.9 (5.8, 20.6)**	**5.6 (3.0, 10.3)**
Neighborhood Disadvantage				
Low	1.0	1.0	1.0	1.0
Moderate	**1.5 (1.0, 2.1)**	1.3 (0.8, 2.3)	1.7 (0.9, 3.0)	1.4 (0.8, 2.6)
High	**1.8 (1.1, 3.1)**	1.4 (0.8, 2.4)	**3.6 (1.9, 7.0)**	**2.1 (1.1, 4.0)**

Model 1: association of early aggressive/disruptive behavior, parent monitoring, deviant peer affiliation, and neighborhood disadvantage with marijuana class membership estimated separately, with adjustment for grade; Model 2: association of early aggressive/disruptive behavior, parent monitoring, deviant peer affiliation, and neighborhood disadvantage with marijuana class membership estimated simultaneously, with adjustment for grade, gender, subsidized-lunch status and intervention group.

Table 4

Estimated odds ratios (OR) of marijuana class membership, in relation to early aggressive/disruptive behavior and suspected middle school influences by grade, based on a longitudinal multinomial latent class regression model.

Variables	Marijuana Exposure Opportunity (Class 2) vs Little or No Involvement (Class 1)			Marijuana Use and Problems (Class 3) vs Little or No Involvement (Class 1)		
	6th Grade OR (95% CI)	7th Grade OR (95% CI)	8th Grade OR (95% CI)	6th Grade OR (95% CI)	7th Grade OR (95% CI)	8th Grade OR (95% CI)
Early Aggressive/ Disruptive Behavior						
Low	1.0	1.0	1.0	1.0	1.0	1.0
Moderate	**2.2 (1.1, 4.4)**	1.1 (0.6, 2.2)	0.9 (0.4, 1.9)	1.5 (0.2, 9.4)	**4.0 (1.4, 11.3)**	**3.1 (1.2, 8.2)**
High	**2.7 (1.2, 6.3)**	**2.4 (1.1, 5.2)**	1.7 (0.9, 3.4)	0.8 (0.1, 6.2)	2.9 (0.9, 9.6)	**3.5 (1.4, 8.3)**
Parent monitoring						
High	1.0	1.0	1.0	1.0	1.0	1.0
Moderate	1.6 (0.9, 2.9)	0.6 (0.3, 1.1)*	0.9 (0.5, 1.6)	**50.0 (7.3, 342.8)**	**3.8 (1.3, 10.9)***	1.4 (0.6, 3.7)*
Low	1.7 (0.9, 3.5)	0.7 (0.4, 1.3)*	0.6 (0.3, 1.3)*	**25.3 (4.7, 135.6)**	2.3 (0.7, 7.4)*	1.5 (0.6, 3.6)*
Deviant peer affiliation						
Low	1.0	1.0	1.0	1.0	1.0	1.0
Moderate	**4.6 (1.7, 12.9)**	1.8 (1.0, 3.2)	**1.9 (1.1, 3.3)**	1.3 (0.1, 14.9)	1.4 (0.5, 3.5)	**2.3 (1.0, 5.3)**
High	**10.0 (3.3, 30.3)**	1.6 (0.7, 3.4)*	**3.0 (1.6, 5.8)**	3.2 (0.3, 37.5)	**5.0 (2.2, 11.4)**	**6.1 (2.9, 13.1)**
Neighborhood disadvantage						
Low	1.0	1.0	1.0	1.0	1.0	1.0
Moderate	1.6 (0.6, 4.3)	1.4 (0.7, 2.8)	1.0 (0.4, 2.2)	**4.8 (1.3, 17.8)**	1.5 (0.5, 4.4)	1.0 (0.4, 2.1)*
High	**3.7 (1.6, 8.4)**	1.4 (0.6, 3.2)	0.9 (0.5, 1.6)*	2.8 (0.4, 18.0)	2.3 (0.8, 6.2)	1.6 (0.7, 4.0)

* Indicates the estimate is significantly different at the 0.05 level from the sixth grade estimate.