Influences of behavior and academic problems at school entry on marijuana use transitions during adolescence in an African American sample

Beth A. Reboussin[a], **Nicholas S. Ialongo**[b], and **Kerry M. Green**[c]

[a]Department of Biostatistical Sciences and Department of Social Sciences and Health Policy, Wake Forest School of Medicine, Winston-Salem, NC 27157

[b]Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205

[c]Department of Behavioral and Community Health, University of Maryland School of Public Health, College Park, MD 20742

Abstract

Background: The aim of this study was to examine how patterns of academic and behavior problems in first grade relate to longitudinal transitions in marijuana use from middle school through entry into high school among African Americans.

Methods: Latent class and latent transition analyses were conducted on a community sample of 458 low-income, urban-dwelling African-Americans.

Results: Two behavior problem classes emerged at school entry; externalizing and attention/concentration. Academic problems co-occurred with both problem behavior classes although more strongly with attention/concentration. Youth in the attention/ concentration problem class were more likely to transition from no marijuana involvement to use and problems beginning in 7th grade and to use and problems given the opportunity to use marijuana early in high school compared to youth with no problems. Youth in the externalizing behavior problem class were significantly more likely to transition from no involvement to having a marijuana opportunity during the transition to high school compared to youth in the attention/concentration problems class.

Conclusions: These findings highlight the importance of developing prevention programs and providing school services that address the co-occurrence of academic and behavior problems, as

well as their subtype specific risks for marijuana involvement, particularly for low-income minority youth who may be entering school less ready than their non-minority peers. These findings also provide evidence for a need to continue to deliver interventions in middle and high school focused on factors that may protect youth during these critical transition periods when they may be especially vulnerable to opportunities to use marijuana based on their academic and behavioral risk profile.

Keywords

academic difficulties; African-American; behavior problems; latent class analysis; latent transition analysis; marijuana

1. Introduction

Marijuana use now exceeds the rate of cigarette use among adolescents; rates of past 30 day cigarette smoking are 4.9%, 10.8% and 17.1%, respectively for 8th, 10th and 12th graders compared to 6.5%, 17.0% and 22.9% for marijuana use (Johnston et al., 2013). While rates of marijuana use have historically been higher in Whites than African Americans, increases in African American marijuana use and abuse in the 1990s, particularly among younger African Americans, began to narrow this difference (Compton et al., 2004). Recent data show that rates are now slightly higher for African Americans aged 12 and older than Whites (Substance Abuse and Mental Health Services Administration, 2013). According to the most recent Youth Risk Behavior Surveillance System (YRBSS) survey of high school students, African American males have the highest rate of current marijuana use compared to all other racial, ethnic and gender groups (Centers for Disease Control and Prevention, 2012). Despite these increases over the past 20 years, little researched has examined the longitudinal patterns and antecedents of African American marijuana use (Brown et al., 2004).

Life course social field theory provides one framework for understanding the role that early academic, social and behavioral competencies play in the development of marijuana use that may be particularly salient to low-income African American children (Patterson et al., 1992). According to this theory, early elementary school is a critical transition period that requires successful adaption to social task demands (e.g., making friends, learning classroom expectations, acquiring academic skills, and complying with adult directions). Children, however, arrive at school with diverse experiences. Children from middle-class, educated families are likely to have attended educationally-oriented preschools, have traveled, visited libraries and museums and to have been read to by their parents and teachers. They have been prepared to enter school since toddlerhood in contrast to poor, minority, inner-city children who are prepared to manage an entirely different set of experiences (e.g., assuming responsibilities in the household, caring for younger siblings), which may not be compatible with school expectations (Wilson, 1989).

While early academic and behavior problems in the classroom have independently been associated with later risk for substance use and dependence (e.g. Colder et al., 2013; Storr et al., 2011; Clark et al., 2008), there is little research focused on the impact of a child

experiencing both academic and behavior problems despite research documenting that they co-occur in children at rates greater than expected by chance (e.g., Bradshaw et al., 2008). In an effort to understand these relationships, Reinke et al. (2008) used latent class analysis to identify subgroups of children based on their observed patterns of academic and behavior problems at school entry. They found that children with co-occurring academic and behavior problems in first grade had the highest likelihood of negative outcomes, specifically special education placement, deviant peer affiliation, suspension from school, and conduct problems.

The purpose of the current study is to expand upon these findings, focusing solely on African Americans to yield insight into the co-occurrence of behavioral and academic problems displayed by this racial subgroup at school entry. We then use latent transition analysis (LTA) to examine the influence of latent classes of behavior and academic problems in first grade on transitions between latent stages of marijuana involvement during early adolescence. Specifically, the objectives of this study are to: (1) identify classes of academic and behavior problems in first grade in an urban, African American sample and estimate their prevalence; (2) identify stages of marijuana involvement from 6th through 9th grade; (3) examine the probability of transitions between stages; and (4) investigate the influence of the classes of academic and behavior problems at school entry on transitions in marijuana involvement during early adolescence.

2. Methods

2.1 Participants

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 a school-based, randomized preventive trial targeting early learning and aggressive/disruptive behavior (Ialongo et al., 1999). Interventions were provided throughout first grade. Information on drug use was collected annually beginning in 6th grade. 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.

Of the 798 children available for participation in the fall of first-grade assessments, 678 (85%) were African-American. Approximately 67% of the African American students (N=458) had data available on the first-grade study measures of interest as well as data for the 6th and 7th grade assessments in 1999 and 2000 to examine at least the first transition in marijuana involvement. These 458 youth comprised the sample of interest for this study; 240 (52%) were males and 218 (48%) were females. Approximately seventy-two percent of the sample received free or reduced lunches at the first-grade assessment. At the time of the sixth-grade assessment, youth were on average 11.77 years (range 10.62 to 13.12 years). Chi-square tests revealed no differences in terms of gender (χ^2=1.17, p=0.280) and intervention group assignment (χ^2=2.11, p=0.146) between the 458 African-American students participating in this study and the 220 not included. T-tests revealed no differences

between these groups in terms of age at entry into the study (T=−1.75, p=0.081). However, those included in the study were significantly more likely to receive free or reduced lunch (χ^2=6.78, p=0.009). Among those not included in the study because of missing sixth or seventh grade assessments but with data available on first grade measures (N=167 of the 220), they did not differ significantly from the 458 included in the study on first grade measures of aggressive and disruptive behavior, attention and concentration problems, oppositional behavior, academic performance, or achievement. The sample of 458 youth with data available in 6th and 7th grade in addition to the first grade measures of interest decreased slightly to 450 youth in 8th grade, and 432 in 9th grade.

2.2 Measures

Early behavior problems. Teacher ratings of behavior were obtained in first grade and are based on the Teacher Observation for Classroom Adaptation -- Revised (TOCA-R) (Werthamer-Larsson et al., 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, oppositional behavior, and attention-concentration problems subscales of the TOCA-R were used as indicators for behavior problems in first grade. The Aggressive/Disruptive Behavior subscale is the mean of 11 items (e.g. "breaks rules", "fights") and has a reported alpha of 0.96. The Oppositional Behavior Subscale with a reported alpha of 0.77 is the mean of 4 items (e.g. "talks back to teachers", "disobeys teachers"). Finally, the Attention-Concentration Problems subscale is the mean of 9 items (e.g. "pays attention", "easily distracted") and has a reported alpha of 0.91. These scales were divided into binary items to indicate those children with the most problems in our sample (e.g., top 25% for aggressive behavior) relative to their peers with fewer or no problems.

Early academic problems—Academic performance was measured by the Comprehensive Test of Basic Skills 4 (4th ed.; CTBS, 1990); a standardized achievement battery. Internal consistency coefficients for the Total Math and Total Reading scores are greater than 0.80. We computed the average of the CTBS Total Math and Total Reading normal curve equivalent scores for each child in first grade to create a composite academic achievement variable. The average was then dichotomized to indicate those children with the most achievement difficulties (i.e. bottom 25% on achievement). In addition to this standardized achievement measure, we included the teacher report of the child's overall progress in the fall of first grade. This item was rated on a 6-point scale (1=excellent to 6=extremely poor) and dichotomized for analyses to indicate those with poor to extremely poor progress versus those with good to excellent progress.

Marijuana involvement in 6th, 7th, 8th and 9th grades—We considered responses to five questions about marijuana involvement gathered in the spring of sixth, seventh, eighth and ninth grades. Opportunity to use marijuana involved asking whether a youth had "ever been offered" marijuana as described by Crum et al. (1996). 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) and 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.

Demographic information—The school district provided information on the students' sex and ethnicity. School records indicating each student's free or reduced-cost meal status were collapsed into a dichotomous variable of free or reduced lunch versus self-paid lunch as an indicator of student socioeconomic status.

2.3 Statistical Analyses

A cross-sectional latent class analysis (LCA) was applied to examine the structure underlying the five indicators of academic and behavior problems in first grade. The basic premise of LCA is that within classes, behaviors are locally independent (Lazarsfeld, 1950). The goal 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 having high levels of academic and/or behavior problems within a particular class (item probabilities) and the proportion of youth in each class (class prevalences).

A longitudinal latent class model (or latent stage model) was then applied to examine the structure underlying the five items comprising the marijuana involvement profile over time. While in principle it is possible to allow the item probabilities, and hence latent structure, to vary over time for the 6th to 9th grade marijuana indicators, this implies that the definition of marijuana involvement is changing, which would substantially complicate the interpretation of a longitudinal model. Therefore, we constrained the item probabilities to be constant over time, i.e. the probability of reporting a behavior within a latent stage was the same in each grade. 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). The latent stage prevalences, however, were allowed to vary over time, i.e. the proportion of youth in each stage could change over time.

Our model building strategy for the two sets of latent class models involved starting with the most parsimonious one-class (or one-stage) model and fitting successive models with an increasing number of latent classes (or stages) in order to determine the most parsimonious model that provided an adequate fit to the data. The goodness-of-fit of various models was evaluated using the Akaike's Information Criteria (AIC), a global fit index that combines goodness-of-fit and parsimony. Because we were concerned that the statistical power in this study may be limited by the sample size, we chose to rely on the AIC over other global fit indices as it is known to favor more complex models (Lin and Dayton, 1997). Entropy was

calculated to provide an indication of the overall degree of classification uncertainty in the solution (Celeux and Soromenho, 1996). Lower values of AIC are preferable whereas higher values (or values closer to 1) are better for entropy. 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.

Next, we estimated the probability of transitioning between the latent stages of marijuana involvement from 6th through 9th grade and the influence of academic and behavior problem subtypes on transition rates using latent transition analysis (LTA). LTA is an extension of latent class analysis to the longitudinal framework which expresses change over time in terms of transition probabilities and models the impact of covariates on transitions using a multinomial logistic regression formulation. It has been used extensively to estimate stage-sequential models of drug use over time (e.g. Lee et al., 2013; LaFlair et al., 2013; Chung et al., 2013; Lanza and Bray 2010). We controlled for student-level covariates of gender, free or reduced cost lunch status, and intervention status in the LTA model. A robust estimate of the LTA parameter variance that accounts for the variation due to the estimation of the two sets of LCA parameters is applied. This approach is described in greater technical detail in Reboussin and Ialongo (2010).

3. Results

3.1 Subtypes of early academic and behavior problems: latent class analysis

The AIC suggested a best-fitting model based on three classes (1-class=9219; 2-class=8548; 3-class=8452; 4-class=8482). The entropy for the three class model was 0.97 indicating high certainty in classification. The introduction of a fourth class resulted in an entropy of 0.86 suggesting less class separation. A check of the local independence assumption via the log odds ratio residuals for the three class model indicated there were no residual dependencies. Under the three-class model that is displayed in Figure 1, 61% of youth do not have academic or behavior problems in first grade based on teacher report and standardized achievement scores. Approximately 27% of youth have high probabilities of falling into the top quartile for oppositional/defiant and aggressive/ disruptive behavior, as well as having moderate probabilities of having attention/ concentration and academic problems. We refer to this class as the "externalizing behavior problems" class because it is primarily dominated by externalizing problems. The least prevalent class (12%) was a class of children with high probabilities of being in the top quartile for attention/concentration problems and lowest quartile for both academic achievement and teacher-reported overall progress. We refer to this class as the "academic and attention/concentration problems" class.

3.2 Stages of marijuana involvement: longitudinal latent class analysis

Even though a longitudinal latent stage model of the five marijuana involvement behaviors suggested a best fitting one stage model based on the AIC (1-class=77395; 2-class=85197; 3-class=115208; 4-class=117893), there was evidence of local dependence under the one, two and three stage models suggesting additional stages were necessary to explain the association among the marijuana behaviors. The addition of a fourth stage removed all local dependencies, however, the prevalence of this fourth stage was only 1% in 6th grade hindering our ability to obtain stable parameter estimates in the latent transition models. Entropy for the four stage model was also relatively low (0.87) suggestive of more classification uncertainty compared to the three stage model with entropy of 0.94. To probe further whether introduction of a third stage yielded a model that was clinically meaningful in addition to its ability to improve the local independence assumption, we examined the resultant latent structure to evaluate its interpretability and clinical meaningfulness and determined this to be the most appropriate model.

As shown in Figure 2, the most prevalent stage is a class with no marijuana exposure opportunities or marijuana use. We refer to this as the "no marijuana involvement" stage. The estimated prevalence of this stage was 84% in 6th grade, 71% in 7th grade, 56% in 8th grade and 38% in 9th grade. The next most prevalent stage is one in which almost everyone has been offered marijuana but the probability of using marijuana is less than 20%. We refer to this as the "offered marijuana" stage; the prevalence was 14% in 6th grade, 20% in 7th grade, 28% in 8th grade and 32% in 9th grade. The third stage is a class of youth who have been offered and used marijuana (> 95%). In addition, almost 60% have used marijuana more than a couple of times, and almost all youth have experienced social problems as a result of their marijuana use. Just more than 40% have experienced health problems. We refer to this as the "marijuana use and problems" stage. The prevalence of this stage was 2% in 6th grade, 9% in 7th grade, 16% in 8th grade and 30% in 9th grade.

3.3 Transitions between stages of marijuana involvement: latent transition analysis

As seen in Table 1, the probability of transitioning from no marijuana involvement to being offered marijuana increases over time and is significantly greater between 8th and 9th compared to 6th and 7th grades (OR=2.10, p<0.001). The likelihood of transitioning from no involvement to use and problems also increases over time and is significantly greater between 8th and 9th grades (OR=2.56, p<0.05) and 7th to 8th grades (OR=2.22, p<0.05) compared to 6th and 7th. The probability of transitioning from being offered marijuana to use and problems, however, is greater between 6th and 7th grades compared to between 7th and 8th grades (OR=3.03, p<0.05).

As seen in Table 2, relative to youth with academic and attention/concentration problems at school entry, youth with externalizing behavior problems are more likely to advance from no involvement to being offered marijuana at entry to high school (i.e. 9th grade) after adjustment for gender, free and reduced lunch status and intervention status (AOR=7.25, p<0.05). They are also more likely to transition from no marijuana involvement to use and problems between 7th and 8th grades relative to youth with no problems (AOR=10.83, p<0.05). Youth with academic and attention/concentration problems were also more likely

to make this transition relative to youth with no problems between 7th and 8th grades (AOR=10.69, p<0.05). Youth with academic and attention/concentration problems were more likely to advance from being offered marijuana to use and problems between 8th and 9th grade relative to youth with no problems (AOR=5.99, p<0.05).

4. Discussion

Our results suggest that academic problems occur in combination with both externalizing and attention/concentration problems in African Americans, although to a lesser extent with externalizing problems. In contrast to the work of Reinke et al. (2008) that included both minorities and non-minorities, we did not find a subtype of children that were experiencing academic or behavior problems in isolation. Further, attention and concentration problems were also present with moderate probability in the subtype of children with externalizing behavior problems. This is consistent with reports that African American youth are more likely to have teachers rate them as inattentive (DuPaul and Eckert, 1997) and youth from families with lower socioeconomic status are less likely to be engaged in school (Smerdon, 1999). Our finding that the subtype of children with externalizing behavior problems was the most prevalent problem behavior subtype is also consistent with research that show African Americans are more likely than Whites to receive an educational diagnosis of emotional disturbance (Kaufman, 2005). This study demonstrates the need for future prevention research as well as school services that focus on the co-occurrence of academic achievement and behavior problems. It also emphasizes the need to intervene early in low income African American populations that may be less prepared for school before this lack of readiness becomes intertwined with classroom behavior problems setting children off on a path that places them at risk for marijuana involvement in adolescence.

We found that the greatest risk period for making the transition from no involvement to being offered marijuana was later in middle school and early in high school. This finding is consistent with Storr et al. (2011) in a similar predominantly African American urban sample in which the opportunity to use marijuana rose markedly after the age of 13. Rates of marijuana use and problems are also increasing quickly over this time period suggesting a narrow window of opportunity for prevention during this developmental period. Just as early elementary school is a critical transition period, failure to adapt to the academic and social task demands of middle and high school may precipitate "drift" into a deviant peer group, wherein a wide array of antisocial and delinquent behavior, including alcohol and drug use, may be reinforced (Patterson et al., 1992; Brook et al., 1989; Jessor and Jessor, 1978)

Children in the externalizing behavior class in first grade were at greater risk for transitioning from no involvement to being offered marijuana across all years, and significantly so between 8th and 9th grade compared to youth with attention/concentration problems. This is consistent with the work of Rosenberg and Anthony (2001) who found that aggressive youth are more likely to be approached with offers to buy drugs. This could be the result of an outward persona that makes them targets of drug dealers or a greater affiliation with deviant peers that are using drugs. On the other hand, children with attention/concentration problems were significantly more likely to transition to use given an opportunity between 8th and 9th grade but were not more likely to transition to opportunities.

This lack of opportunities (or offers) may be a reflection of rejection by their peers, however, given an opportunity to use, the impulsivity which often co-occurs with attention/concentration problems may cause them to act without carefully thinking about the consequences of marijuana use. Therefore, interventions for those with externalizing problems may be more peer-focused while interventions for those with attention/concentration problems may be more inwardly focused on strategies for controlling impulsivity. Given that the highest risk period for these transitions is entry into high school, strategies for dealing with the increased academic and social demands of high school is critical in these problem behavior subgroups in which academic problems are co-occurring.

Limitations of the study should be noted. Reliance on self-reported marijuana use could be subject to underreporting bias however this study was designed to be sensitive to ethnic-minority populations with the intent of maximizing participation and minimizing underreporting of drug-using behaviors. The small number of non-minorities in the original sample precluded our ability to make any meaningful (or statistically stable) comparisons between minorities and non-minorities. A larger and more diverse sample may have allowed not only for ethnic comparisons but identification of more subgroups. Limitations in our sample size may have also hindered our ability to detect group differences as evidence by a limited number of statistically significant findings in the LTA modeling. A focus of future work which we did not consider should be other factors know to be associated with substance use such as family, peer and neighborhood factors and how they might modify the influence of academic and problem behavior subtypes on transitions in marijuana use in a low-income ethnic minority population. We also caution the reader that the current study may not be generalizable to non-urban settings in which early academic and behavioral profiles, school readiness and access to and norms around marijuana use may differ.

Despite these limitations, the greatest strength of this study is the availability of a large sample of African Americans participating in a longitudinal study designed to be sensitive to ethnic-minority populations with annual data collection. Prospective studies like this one--featuring a representative cohort of an entire entering class of first graders are relatively rare, particularly bridging the development periods from middle to high school. Even rarer are prospective studies of African-American youth from neighborhoods that are characterized by high levels of community violence, crime, and poverty. An understanding of the "survivors" in such an environment can potentially greatly inform the next stage of preventive intervention efforts. While a larger and more diverse sample may have allowed for identifying more subgroups, cohort differences and ethnic comparisons, a community cohort has the benefit of identifying within-group differences in a highly vulnerable and under-investigated population, not always fully captured in national surveys. Our ability to more accurately reflect the true nature of African American drug use is what makes this a unique contribution to the literature.

In summary, our findings highlight the importance of developing prevention programs and providing school services that address the co-occurrence of academic and behavior problems, as well as their subtype specific risks for marijuana involvement, particularly for low-income, urban-dwelling African American youth who may be entering school less ready than their non-minority peers. These findings also provide evidence for a need to continue to

deliver interventions in middle and high school focused on factors that may protect youth during these critical transition periods when they may be especially vulnerable to opportunities to use marijuana based on their academic and behavioral risk profile.

Acknowledgments

Appendix: Social and Health Problems

Some people have bad effects from using marijuana. The next set of questions is about some problems you might have had from using marijuana.

Social problems (Yes or No)

1. Has any friend told you that you shouldn't be using marijuana?

2. Has any member of your family ever told you that you shouldn't be using marijuana?

3. Has any friend ever scolded or fussed at you because you used marijuana?

4. Has any family member ever scolded or fussed at you because you used marijuana?

5. Has any teacher ever scolded or fussed at you because you used marijuana?

6. Have you ever gotten into trouble at school because you used marijuana?

7. Have you ever gotten into trouble at home because you used marijuana?

8. Have you ever gotten into trouble with the police because you used marijuana?

Health Problems (Yes or No)

1. Did you have any health problems like feeling panicky or frightened because you were using marijuana?

2. How about a problem like feeling sad, upset or depressed because you were using marijuana?

3. Did you have a health problem like a lasting cough due to using marijuana?

4. How about a health problem like getting sick to your stomach or an overdose caused by marijuana?

5. Have you ever used marijuana every day or almost every day for two weeks or more?

6. Did you ever wake up and feel something like hunger for marijuana?

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Highlights

- This study included data from 458 African Americans followed from 1st to 9th grade

- Two problem behavior classes emerged; externalizing and attention/concentration

- Academic problems co-occurred with both problem behavior subtypes

- Externalizing problems were associated with an increased risk of being offered marijuana

- Attention/concentration problems were associated with use given an opportunity to use
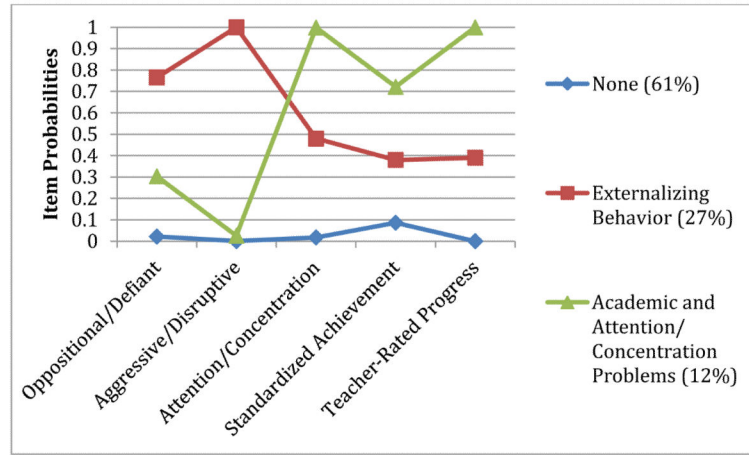
Figure 1.
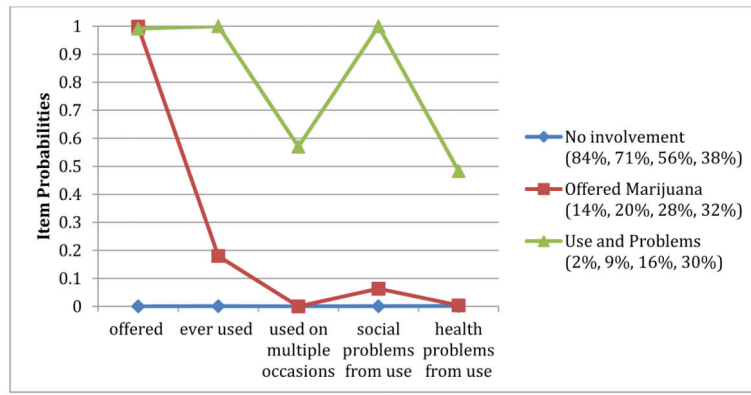Academic and behavior problem item probabilities from the three class model at school entry

Figure 2.
Marijuana involvement item probabilities from the three class model for 6th, 7th, 8th and 9th grades

Table 1

Estimated probabilities and odds ratios of transitioning by grade

	Estimated Transition Probability			OR (95% CI) p-value		
	6th to 7th	7th to 8th	8th to 9th	7th to 8th vs 6th to 7th	8th to 9th vs 6th to 7th	8th to 9th vs 7th to 8th
No involvement to offered marijuana	0.12	0.17	0.22	1.50 (0.99, 2.27) p=0.053	2.10 (1.36, 3.22) p<0.001	1.39 (0.91, 2.12) p=0.123
No involvement to use and problems	0.03	0.04	0.07	1.15 (0.52, 2.55) p=0.381	2.56 (1.22, 5.41) p=0.013	2.22 (1.05, 4.69) p=0.036
Offered marijuana to use and problems	0.22	0.09	0.16	0.33 (0.12, 0.90) p=0.030	0.64 (0.28, 1.48) p=0.230	1.96 (0.75, 5.14) p=0.168

Table 2

Estimated transition probabilities and adjusted odds by grade and subtype of academic and behavior problems

	Estimated Transition Probability			AOR (95% CI)[a] p-value		
	No problems	Externalizing Behavior Problems	Academic and Attention/ Concentration Problems	Externalizing vs. No problems	Academic and Attention/ Concentration Problems vs. No Problems	Externalizing vs. Academic and Attention/ Concentration Problems
No involvement to offered marijuana						
6th to 7th	0.11	0.15	0.10	1.33 (0.66, 2.67) p=0.422	0.90 (0.28, 2.83) p=0.857	1.48 (0.43, 5.10) p=0.534
7th to 8th	0.20	0.15	0.10	0.72 (0.35, 1.49) p=0.376	0.44 (0.13, 1.54) p=0.199	1.63 (0.42, 6.37) p=0.482
8th to 9th	0.21	0.31	0.05	1.63 (0.79, 3.37) p=0.187	0.22 (0.04, 1.21) p=0.082	7.25 (1.25, 41.92) p=0.027
No involvement to use and problems						
6th to 7th	0.02	0.05	0.07	2.37 (0.65, 8.59) p=0.189	3.40 (0.78, 14.81) p=0.103	0.70 (0.14, 3.41) p=0.659
7th to 8th	0.01	0.09	0.08	10.83 (2.16, 54.39) p=0.004	10.69 (1.73, 66.13) p=0.011	1.01 (0.23, 4.39) p=0.989
8th to 9th	0.04	0.09	0.19	1.96 (0.53, 7.18) p=0.310	3.55 (0.99, 12.76) p=0.052	0.55 (0.12, 2.60) p=0.451
Offered marijuana to use and problems						
6th to 7th	0.27	0.18	0.17	0.65 (0.15, 2.79) p=0.562	0.70 (0.10, 9.00) p=0.784	0.95 (0.09, 10.49) p=0.967
7th to 8th	0.11	0.06	0.00	0.34 (0.06, 1.86) p=0.213	[b] --	[b] --
8th to 9th	0.11	0.18	0.50	1.27 (0.18, 8.80) p=0.809	5.99 (1.37, 26.12) p=0.017	0.21 (0.04, 1.06) p=0.059

[a] Models adjusted for gender, intervention status, and free or reduced lunch status

[b] Youth with academic and attention/concentration problems had a zero probability of transitioning from being offered marijuana to marijuana use and problems in 7th to 8th grades.