CHILDHOOD BEHAVIORAL PREDICTORS OF SMOKING IN ADOLESCENCE

by

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TABLE OF CONTENTS

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Abstract

Cigarette smoking is a major preventable cause of premature morbidity and mortality in the United States. The relation of smoking to heart disease and lung cancer, as well as many other adverse health outcomes, has been widely demonstrated. Of great concern is the fact that approximately 90% of all initiation of tobacco use occurs among individuals less than 18 years of age and the prevalence of tobacco use among adolescents is increasing.

A secondary analysis of the National Longitudinal Studies Youth data set was used to assess childhood behavioral problems and subsequent smoking initiation in adolescence. The central hypothesis of this study was that specific behavioral problems in childhood, measured repeatedly over time, predict smoking in adolescence. The following specific behavioral problems were examined: antisocial, anxious/depressed, headstrong, hyperactivity, dependency, and conflict. Behavior problems were assessed every two years, beginning at age 4 years. Smoking initiation questions were self-reported and also measured every two years. Data were available from six survey years, 1986, 1988, 1990, 1992, 1994, 1996. Specific aims were as follows:

1. To determine the strength of association between repeated measures of six different behavior problems in childhood and smoking initiation in adolescence.
2. To evaluate age-specific risks of smoking initiation.
3. To evaluate the influence of respondent demographic characteristics, including race, gender, and socioeconomic status on adolescent smoking initiation

Separate multiple logistic regression models were developed by gender for each age group, with smoking status as the dependent variable. All independent variables were entered in the model at the same time.

Among males, childhood behavior problems that subsequently predicted smoking in the teen years included antisocial, anxious/depressed, and headstrong. The association was positive for antisocial (OR = 1.88 to 2.10) and anxious/depressed (OR = 2.01 – 2.18) and negative for headstrong (OR = .26) for selected years. Blacks and Hispanics, as compared to non-Black/non-Hispanics, reported being more likely to smoke for ages 17 and older and less likely to smoke up to age 17.

Among females, childhood behavior problems that subsequently predicted smoking in adolescence include antisocial and headstrong. Antisocial respondents were more likely to smoke (OR = 1.52 – 2.48), whereas dependent respondents were less likely to smoke (OR = .26 - .53) for selected years. Similar to the pattern for males, Blacks and Hispanics were more likely to smoke in later years and less likely to smoke up to age 17 years.

These findings, along with the literature, suggest that children and adolescents with these behavioral characteristics may represent a large group of youth who are at high risk for cigarette smoking, and possible subsequent drug abuse, medical morbidity and mortality. Thus, it is critical to aim smoking prevention programs, which have proven to be effective, at high-risk children and adolescents such as those with significant behavioral problems including antisocial for males and females and anxious/depressed for males, as defined by the Behavior Problems Index (BPI) variables in this study.

Introduction

Cigarette smoking is a major preventable cause of premature morbidity and mortality in the United States. The relation of smoking to heart disease and lung cancer, as well as many other adverse health outcomes, has been widely demonstrated (US HHS 1989). Of great concern is the fact that approximately 90% of all initiation of tobacco use occurs among individuals less than 18 years of age and the prevalence of tobacco use among adolescents is increasing (MMWR 1996). Approximately 95% of regular smokers begin smoking before the age of 20 (Williams et al) and those who start to smoke as adolescents are among the heaviest tobacco users during adulthood, and thus experience higher mortality from smoking-related diseases (Zhu et al).

Approximately 33-50% of persons who try smoking cigarettes eventually become regular smokers. The 1990-92 National Comorbidity Survey estimated that 23.6% of persons who ever used cigarettes progressed to nicotine dependence, which is the final stage in the smoking behavior continuum. This estimate compares with conversion proportion of 24.5% for cocaine and 20.1% for heroin (MMWR 1998). A recent survey of high school students revealed that nearly 70% of students had tried cigarette smoking in their lifetime and one-third of the students were currently smoking (Milberger et al). Fourteen percent of these students used cigarettes frequently (smoked cigarettes on at least 20 of the 30 days preceding the survey). Of those students who smoked daily, 44% believed that in 5 years they would not be smoking; however, at follow up 5-6 years later, 73% of those who smoked daily actually remained regular smokers.

Given the trend towards experimental smokers becoming regular smokers, more emphasis must be placed on preventing individuals from initiating smoking. A better understanding of a range of specific risk factors is necessary to accomplish this task. With that objective in mind, this study attempted to determine if alternatives exist to the well-established risk factors of smoking initiation in teens.

Annual trend analyses on initiation of cigarette smoking in adolescents provides important data to identify specific groups who are at particularly high risk. Adolescent smoking prevalence varies widely between socioeconomic groups, as well as between groups defined by race and gender.

In a recent study by Robinson et al (1997), gender and ethnic differences were explored in the prevalence of risk factors for smoking onset. Limited to seventh graders in an urban school setting with a mean age of 13 years, the study reported that regular smoking was more prevalent among males than females and among European-Americans than African-Americans. The authors suggested ethnic differences could be attributed to stronger social support among African-Americans and the fact that rebelliousness and risk-taking is less common in African-American than European-American adolescents. Another study of seventh and eighth graders conducted as part of the Youth Risk Behavioral Study (Wiecha 1996) revealed that Vietnamese and Caucasian males had higher smoking rates than Hispanic and African-American males. However, the Vietnamese males started smoking later (after age 12 years). The authors found that Vietnamese and African-American females rarely smoke compared to Caucasian and Hispanic females. In another study using the Youth Risk Behavioral Survey data, Escobedo et al (1993) evaluated smoking initiation, as defined by the age when the first

full cigarette was smoked, and regular smoking, as defined by smoking 5-15+ days in the last 30, among students in grades 9-12. They found that African-Americans were more likely than others to be experimental smokers and that white adolescents were more likely to become regular smokers. Older students, white students, and students with low academic performance were more likely to be heavy smokers.

While previous studies have shown that race is a risk factor for smoking initiation in teens, none have surveyed a sample that is truly representative of the population at large. The current study surveyed a group of individuals that contained an over-representation of the major minority groups, specifically Blacks and Hispanics, and thereby should produce results that could be generalized to the entire United States population. The strength of such a heterogeneous race mix would greatly add to the existing body of knowledge on the subject.

Socioeconomic factors also influence adolescent smoking behavior. Headen et al (1991) reported on the difference in smoking initiation among Caucasian males and females from low versus higher socioeconomic (SES) backgrounds. The interaction between gender and parent education (as a measure of SES) indicated that when neither parent graduated from high school, males were 3.53 times as likely as females to initiate smoking. When one parent completed high school or college, males were only .58 times as likely to initiate smoking compared to females.

Researchers have also investigated non-demographic factors that contribute to the decision to smoke. For example, Robinson et al (1997) identified several factors as consistent predictors of smoking initiation. They found that exposure to smoking models, particularly peer models, reliably predicted cigarette use among adolescents and that

adolescents' perceptions of the prevalence of cigarette smoking appeared important. They also demonstrated that children perceive smoking as an effective way to impress their peers. Adolescents who view cigarettes as a way to appear mature have been found to be significantly more likely to smoke. Furthermore, teenagers who have ready access to tobacco are at greater risk for smoking initiation. Other factors found to influence patterns of initiation include cigarette advertising and promotion, smoking by adults and older siblings, price of cigarettes, peer pressure, and the degree of exposure to effective counter-advertising and school-based prevention programs (MMWR 1996).

In an analysis of the onset of smoking, Ary et al (1988) indicated that social influences and prior experience with cigarettes and other substances were associated with young people beginning to smoke. However, the roles of these factors differed depending on the developmental level of the child. Middle-school students were more likely to begin smoking if their friends were smokers, if they were receiving offers of cigarettes, if they had some prior experience with cigarettes (i.e. being with friends who smoked), and if they had been using other drugs. Analysis of the high school sample suggested that social contextual influences on smoking onset may be even stronger during high school than in middle school. Peer influences predicted smoking onset better among the high school subjects than among the middle school subjects.

Less established in the literature is the notion of behavioral predictors of smoking initiation in adolescents. One such factor is the child's tendency towards risk-taking and rebellious behavior. Robinson et al (1997) reported that rebellious children were found to be significantly more likely to smoke. They found that children also had a tendency to

initiate smoking when they had low self-esteem and felt unsuccessful and unsupported by their parents and friends. Smoking became a coping mechanism for dealing with stress.

Findings from a number of studies suggest the possibility of specific relationships between early behavioral tendencies and cigarette use later in adolescence. Research has shown that disruptive behavior and family environment are linked to smoking and that basic personality dimensions are the underlying link between disruptive behavior and smoking, as well as other substance abuse. In a study of kindergarten boys, Masse et al (1997) tested the hypothesis that high novelty-seeking, low harm avoidance and low reward dependence predicts early onset of cigarette use, alcohol abuse, and other drug use from 10 to 15 years. It was earlier suggested that these three personality dimensions appeared early in the child's development and remained stable over time (Caspi et al., 1996; Tremblay et al., 1994). In the study by Masse et al, childhood behavioral tendencies were assessed by teachers' rating of behaviors at ages 6 and 10 years old. Self-reports of smoking cigarettes, getting drunk, and using other drugs provided the measurement of substance abuse.

Results of the Masse et al study indicated an association between novelty-seeking and harm avoidance dimensions to early onset of getting drunk, using drugs, and smoking cigarettes. Reward dependence was unrelated to substances use. The results indicated that early (6 years of age) and late (10 years of age) childhood personality dimensions had similar powers of prediction and that they both significantly predicted the onset of substance abuse in adolescents. However, the study is limited in that the sample was culturally homogenous, consisting of all white, French-speaking, non-immigrant school boys living in a low socioeconomic area of a large urban city.

With a focus on behavioral problems, rather than simply behavioral descriptors, Lynskey and Fergusson (1995) examined the relation between conduct problems and attention deficit behaviors at age 8 years and the subsequent use of tobacco, alcohol, and drug use at 15 years. They studied a birth cohort of 900 children from New Zealand based on previous studies showing a positive association between disruptive, troublesome, or inattentive behaviors in childhood and the later use and misuse of other substances. Data were collected using a variety of techniques including maternal interviews, child interviews, teacher reports and official sources of information, including hospital and police records. At age 8, the children were measured on conduct/oppositional and attention deficit/hyperactivity behaviors using maternal and teacher reports. At age 15, the adolescents were asked about a series of issues relating to their use of tobacco during the period from 14 to 15 years.

Results of Lynskey and Fergusson's study indicated a significant association between level of conduct problems and subsequent substance use behaviors. After controlling for gender, family social background, and parental substance use, high conduct problem scores were associated with higher rates of daily tobacco use. The study was limited in that it classified a young person as a regular smoker only if he/she reported smoking on a daily basis. The study did not investigate less regular smoking habits or age at initiation. It may also be that children predisposed to substance use had not expressed this tendency by the age of 15 years. Additionally, child behavior was assessed at age 8 in this study and it is unknown if the behavior problems measured remain stable over time. A study examining behavioral problems repeatedly and continuously throughout childhood, as demonstrated in the present study, would address

this question of stability of the measures, thereby enhancing the understanding of risk factors leading to teen smoking.

In another study of behavior problems and smoking, Milberger et al (1997) showed that attention-deficit hyperactivity disorder had both a quantitative and a qualitative impact on cigarette smoking in a population of psychiatric and pediatric referrals between the ages of 6 and 17 years. Using both maternal and child interviews, the children were assessed at baseline and reassessed one and four years later. Attention-deficit hyperactivity disorder in childhood predicted higher rates of cigarette smoking four years later in mid-adolescence along with a significantly younger age of smoking initiation. The data analysis controlled for socioeconomic status, IQ, and comorbidity with conduct disorder, major depression, and multiple anxiety disorders. Conduct disorder as a predictor of cigarette smoking, independent of attention-deficit hyperactivity disorder, further highlights the connection between conduct disorder and substance abuse.

In summary, well-established predictors of adolescent smoking include peer pressure, low self-esteem, and stress. However, the data are less conclusive in the area of personality traits and, specifically, childhood behavior problems as predictors of initiation of smoking in adolescence. The bulk of literature examining cigarette smoking and personality was conducted in adults or examines the personality dimensions of the adolescent at the time of smoking. Although a few studies suggest a predictive relationship between early childhood behavior patterns and adolescent smoking, this relationship requires further exploration. Most important, previous studies have lacked ethnic and socioeconomic diversity, thereby producing results that cannot be applied to the general

population. No studies have adequately represented minorities such as Blacks and Hispanics and often only one socioeconomic sector is represented. Furthermore, no studies have repeated measures for behavior or smoking outcomes more than twice. Stability of these measures over time would be confirmed with more than two measures of the outcome. Previous studies also have not employed proven, reliable measures for behavior problems.

To elucidate the association between early childhood behavior patterns and subsequent adolescent smoking, and in order to obtain generalizable results, a study with over-representation of Blacks and Hispanics, and one that includes individuals both in and out of school, is needed. The sample in the present study included a broad range of ages, with continuous measures of both behavioral predictors throughout childhood and smoking outcomes throughout adolescence. Behavioral problems were assessed with a tested and reliable instrument. An analysis of age at initiation, coupled with repeated measurements of early childhood behaviors in a diverse population (race/ethnicity, socioeconomic status, not limited to children in school), addressed the weaknesses of prior studies and demonstrated the stability of these predictions over time for the onset of smoking in adolescence.

Objectives

The central hypothesis of this study was that specific behavioral problems in childhood, measured repeatedly over time, predicted smoking in adolescence. The following specific behavioral problems were examined: antisocial, anxious/depressed, headstrong, hyperactivity, dependency, and conflict. Using the NLSY Child Data, behavior problems were assessed every two years, beginning at age 4 years. Smoking

initiation questions were self-reported and also measured every two years. Results were available from six survey years, including 1986, 1988, 1990, 1992, 1994, 1996. Specific aims were as follows:

1. to determine the strength of association between repeated measures of six different behavior problems in childhood and smoking initiation in adolescence;
2. to evaluate age trends in smoking initiation; and
3. to evaluate the influence of respondent demographic characteristics, including race, gender, and socioeconomic status.

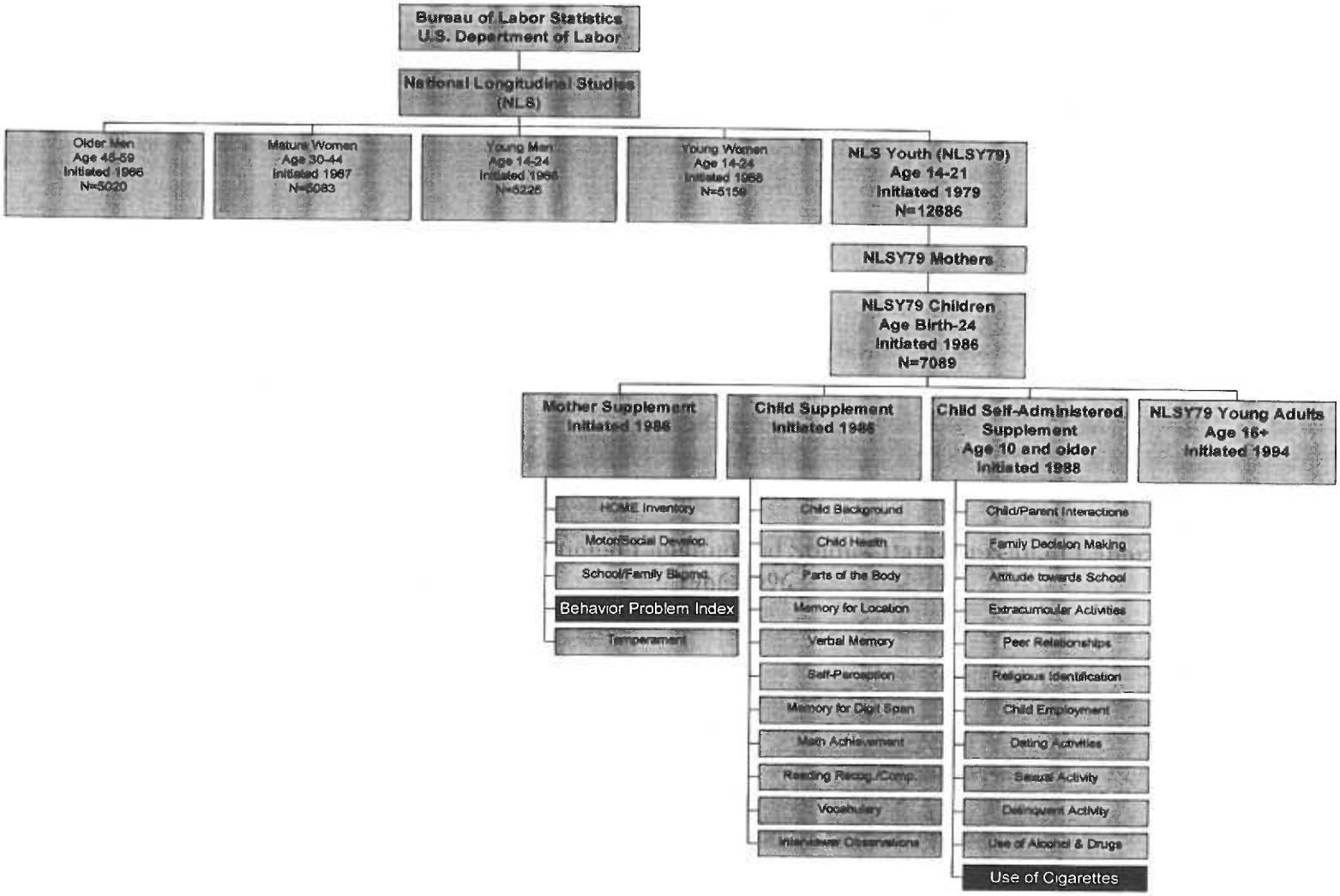
Methods

Population Sample

The National Longitudinal Studies (NLS) are a set of surveys designed to gather information at multiple points in time on the labor market experience of five groups of men and women. The Bureau of Labor Statistics, U.S. Department of Labor, sponsors the studies. Each cohort was selected to be representative of all Americans born during a given time. In the mid-1960's, NLS began surveying four population cohorts including older men, mature women, young men and young women (Figure 1).

The primary purpose of the NLS was the collection of data on the labor force experience of adults and young adults. In addition, the NLS has gathered information on a regular basis about a range of factors including investments in education and training, geographic region of residence, local labor market conditions, the formative influence of parents, marital status and family responsibilities, socioeconomic status, work-related attitudes and aspirations, health problems, and job discrimination.

Figure 1: Organization of National Longitudinal Studies Data, Bureau of Labor Statistics 1966-1996



In 1979, the NLS drew a national probability sample of young women and men between the ages of 14-21 years with overrepresentation of blacks, Hispanics, and economically disadvantaged whites. The sample also included young persons serving in the Armed Forces. Members of this sample, referred to as the National Longitudinal Survey of Youth (NLSY79), were first interviewed in 1979 and have been re-interviewed annually through 1996. However, due to funding constraints, interviewing ceased after the 1984 surveys for 1,079 members of the military subsample. From that point on, 201 respondents were randomly selected from the entire military sample. As of the 1991 survey, 1,643 economically disadvantaged white respondents from the supplemental sample were no longer interviewed. Beginning in 1996, the NLSY79 cohort is interviewed on a biennial basis.

The NLSY79 sample design selected as respondents all individuals ages 14-21 years who resided in a surveyed household during 1978. As a result, the 12,686 civilian and military respondents interviewed in 1979 originated from 8,770 unique households; 2,862 households included more than one NSLY79 respondent.

The original interview schedule, calling for personally administered interviews, was maintained until 1987, when budget constraints dictated a more limited telephone interview. Personal interviews resumed in 1988. The traditional paper and pencil interview instruments used during the 1979-92 interviews were replaced in 1993 with computer-assisted personal interviewing. Retention rates for those NLSY79 respondents still eligible for interview have remained close to 90% during the 16 years of interviews.

In 1986, the NLS began supplementing the data on mothers and children collected during the regular youth surveys by collecting detailed information on the development

of children born to women in the NLSY79 sample. These biennial surveys included a battery of child cognitive-socioemotional-physiological assessments administered to NLSY79 mothers and their children.

The child sample consisted of all children born to NLSY79 women respondents who completed an interview during the biennial interviews, which began in 1986. "Interviewed" means that some information was obtained from either the mother, child, or young adult using at least one of the field instruments. Figure 1 shows the organization of all the NLSY child data sets, including a sampling of the categories of questions asked of mothers of the NLSY79 survey and their children.

In summary, the NLSY child sample is representative of the American population. With representative sampling of Blacks and Hispanics, as well as age groups ranging from birth to young adult, findings resulting from this data set should be easily generalizable to the U.S. population at large. The data set includes children both in and out of school, thereby capturing more of the childhood population. Only the economically disadvantaged are not adequately represented in the latter three survey years.

Data Collection

NLSY Child data collection was primarily carried out using personal home interviews. This approach, effective in maintaining long-term cooperation with respondent families, was compatible with the interviewing mode used with the children's mothers and results from the fact that several of the child assessments were designed for face-to-face administration. Experienced interviewers received extensive special training

in the administration of a collection of instruments selected for use by non-specialists in child development and adapted for in-home settings.

Instrumentation

Four instruments were administered to each child including the Mother Supplement, the Child Supplement, the Child Self-Administered Supplement and, beginning in 1994, the Young Adult Self-Administered Instrument. Using a variety of sources and methods, these tools collected information on the child's background, development, attitudes, home environment, schooling, health, behavior patterns, and motor-social skills (see Appendix A for additional details on these instruments).

The two self-report instruments, the Child Self-Administered Supplement and the Young Adult Field Instrument, assessed the personal feelings and attitudes of the participants. Beginning in 1994, the Child Self-Administered Supplement was given to children ages 10-14 years only, at which point the Young Adult Field Instrument was initiated for children who were at least 15 years of age by the end of the interview period.

Gender and Race

Gender and race variables were used as reported by the mother in the NLSY Child data. Race for the overall NLSY Child sample was categorized as Hispanic, black, and non-black/non-Hispanic.

Income

The NLSY79 dataset reported a summary variable entitled "Net Family Income" to reflect all income received in the household in the calendar year preceding the survey year. Each year the NLSY79 used a slightly different program to compute net family income, however all programs have a similar structure of combining approximately 19 different income categories. Some of these categories include military income, wages/salary/tips, net business income, farm income, unemployment compensation, receive/pay child support or alimony, food stamps, and/or disability/VA benefit.

Behavior Problem Index

Table 1 shows a detailed list of the various childhood assessments. Not all instruments were fielded in each child survey year, and select assessments were administered only to those children for whom no valid score had been obtained during a previous survey.

The instrument selected for this study was the Behavior Problem Index (BPI). The BPI was completed by the child's mother for children four years of age and older. This scale was created by Zill and Peterson (1986) to measure the frequency, range, and type of childhood behavior problems. Many items were derived from the Achenbach Behavior Problems Checklist and other child behavior scales.

Table 1: NLSY79 Child Assessment Instruments
Survey Years 1986 - 1996

	Age-eligible Children	1986	1988	1990	1992	1994	1996
HOME Inventory	All ages	*	*	*	*	*	*
Behavior Problem Index	4 years and older	*	*	*	*	*	*
Motor & Social Development Scale	< 4 years	*	*	*	*	*	*
Temperament Scale	< 7 years	*	*	*	*	*	*
Parts of the Body	1 through 2 years	*	*	-	-	-	-
Memory for Location	8 months through 3 years	*	AE	-	-	-	-
McCarthy Verbal Memory Subscale	3 to 6 years (except 1990: 4 to 6 yrs)	*	AE	AE	AE	AE	-
Self-perception Profile	8 years and older	*	*	*	*	*	≥12 beg '9
WISC-R Digit Span Subscale	7 years and older	*	AE	AE	AE	AE	Age 7-11
PIAT Math & Reading	5 years and older	*	*	*	*	*	*
PPVT-R	3 or 4 years and older	*	AE	AE	*	AE	AE

* = **All age-eligible children**
AE = **All age-eligible children without a previous valid score**

Parental respondents to the 1981 Child Health Supplement of the National Health Interview Survey were asked an extensive series of structured questions concerning the child's problem behaviors and use of mental health services (NCHS 1982). The specific questions varied somewhat depending on the age of the child. The behavior problem index utilized in the NLSY were developed from these items. The Behavior Problem summary score was based on the mothers' responses to 28 questions dealing with specific behaviors their child may have exhibited in the previous three months. Responses to the individual items were dichotomized and summed to produce an index score for each child. Based on factor analysis of these 28 questions, the six behavior subscales were

developed (Table 2) and represented some of the more common syndromes of problem behavior found in children and adolescents: antisocial, anxious-depressed, hyperactive, headstrong, immature dependency, and peer-conflict/social withdrawal. Summary scores ranged from 0-5 for all subscales except conflict, which ranged from 0-3. Higher scores on these indexes indicate a greater level of behavior problems.

Table 2: NLSY79 Child Behavior Problems Index Subscales

Subscale	Components
Anxious/Depressed	Sudden changes in mood/feeling; feels/complains no one loves him/her; is too fearful or anxious; feels worthless or inferior; is unhappy, sad, or depressed.
Antisocial	Cheats or tells lies; bullies or is cruel, mean to others; does not feel sorry after misbehaving; breaks things deliberately; is disobedient at school; has trouble getting along with teachers.
Headstrong	Is rather high strung, tense, nervous; argues too much; is disobedient at home; is stubborn, sullen, or irritable; has strong temper and loses it easily.
Hyperactive	Has difficulty concentrating/paying attention; is easily confused; is impulsive/acts without thinking; has trouble with obsessions; is restless and over active.
Peer Conflict/Social Withdrawal	Has trouble getting along with others; is not liked by other children; is withdrawn and not involved with others.
Immature Dependency	Clings to adults; cries too much; demands a lot of attention; is too dependent on others.

Zill and his associates (1986) at Child Trends performed comprehensive factor analysis procedures on the 1981 NCHS data in defining the most appropriate items for inclusion in the overall scale and the various subscale. Principal components analyses were used by Child Trends to verify that the items in the scale could be considered to be tapping common underlying dimensions.

A test-retest study of certain Child Health Supplement items was conducted and analyzed by the Bureau of the Census (Schreiner, 1983). Six of the Behavior Problems items were included in the re-interview questionnaire. Schreiner found that the parental reporting of individual items of problem behavior was unstable over a two-week period

(i.e., of those parents who reported on either the original interview or the re-interview that their child had difficulty concentrating, only 46% reported such difficulty on both interviews). However, Zill found that when the individual items were combined into a scale, the test-retest reliabilities obtained were quite comparable to the internal consistency reliabilities calculated from the Child Health Supplement public use file. Specifically, four items from the hyperactive subscale were included in the re-interview study. When a scale was formed by combining responses to these items from the binary scoring method described above, the test-retest reliability of the resulting scale score was equal to .63. Thus, even though the two surveys were carried out on substantially disparate samples with different interviewing procedures and environments, the close comparability in the coefficients was thought to lend support to the notion that the BPI assessment can be used with some confidence (Zill et al 1986).

The NLSY Behavior Problems scales have been used quite extensively by researchers, typically as outcome measures in research examining a variety of familial and maternal predictors of subsequent child behavior. These research efforts have contributed substantially to the knowledge base regarding the reliability and face validity of the overall scale and subscales.

As evidence of construct validity, Parcel et al (1988a, 1988b) demonstrated the strong relation between the BPI and a variety of social and demographic variables. For example, children in households with higher incomes or where mothers have higher hourly rates of pay exhibited fewer behavior problems. Conversely, children living in poverty exhibited more behavioral problems. Mothers who were older, more intelligent, and had more education also reported fewer behavior problems for their children. Child

characteristics were also related to the BPI, with older children showing higher levels of behavior problems in almost all areas. Parcel et al also found some important gender differences, with boys scoring higher on the externalizing scale and its component subscales and girls scoring higher on the internalizing scale. There were no significant effects for ethnicity on the total, externalizing or internalizing scales, whereas there were significant interactions among age, gender, and the experience of marital disruption on all three scales.

The Behavior Problem Index has proven to be an important indicator of socioemotional development and has been used in a variety of research contexts to explore issues such as the effects of maternal employment, daycare, divorce, father absence, family poverty and crowding, and maternal smoking. Baydar et al (1991) found that maternal employment in the first year of life was related to higher (i.e. poorer) BPI scores for three- and four-year old children, even when controlling for factors such as gender, number of siblings, mother's intelligence and poverty status. Greenstein (1992), however, found no consistent relationship between maternal employment in infancy and behavior problems at ages 4 to 6 years, once mediating factors, such as home environment and income, and interactive effects, between income and type of care, were controlled. Vandell et al (1991) found interactions between family characteristics and type of after-school care were more important indicators of behavior problems than type of care per se; specifically, they found that children living in poverty (whether experiencing latch-key or mother care after school) were particularly at risk for having high scores on the BPI.

In assessing the impact of father absence, Mott (1992) found that, for all children except African-American girls, there were some negative affects of father absence on BPI scores, although these effects were relatively weak once maternal and other relevant characteristics were controlled. Caucasian boys were particularly affected by father absence. In examining the effects of divorce on young children, Morrison et al (1992a) focused on changes in the BPI from 1986 to 1988. They found an initial association between increases in behavior problems and marital disruption for both boys and girls but a wide variety of controls (such as maternal and child characteristics, income and assets, and home environment) reduced this effect to near zero for girls although it remained statistically significant for boys. In examining living patterns after marital disruption, Hawkins et al (1991) used a metascale combining subscales from both the BPI and Temperament assessments. They found only one significant difference in psychosocial functioning among a variety of father (or father-figure) present or absent conditions once gender, ethnicity, maternal characteristics, resources, and household size were controlled.

Research using the BPI has also explored the longer-term effects of maternal behavior on children's behavior problems. Morrison et al (1992b) found that children of teenage mothers had more behavior problems; however, maternal age at first birth affected behavior problems indirectly through mother's educational attainment, the home environment and the amount of time spent in poverty. Martin et al (1992) found that the mother's self-reported severity of non-drug offenses in 1980 had a significant positive effect on subsequent (1986) BPI scores, controlling for race, gender, poverty status, mother's age, marital status, and child's age. Controlling for a wide variety of health (birth weight, prenatal exposure to alcohol, chronic asthma) and socio-demographic

variables (age, race, sex, family structure, income, maternal characteristics, home environment), Weitzman et al (1992) found a statistically significant, dose-related effect of maternal smoking on children's behavior problems, with mothers who smoked a pack or more a day both during and after pregnancy having children at particularly high risk of having extremely high scores on the BPI. Thus, there is a substantial body of published literature that has used the NLSY Behavior Problems scale to explore the determinants of behavior problems at one point in time as well as changes in child behavior over time.

Smoking Status

Data on the dependent variable, smoking status, were collected both in the Child Self-Administered Supplement (age 10+ years; 10-14 years beginning in 1994), and, beginning in 1994, the Young Adult Survey (age 15+ years). Self-report questions included the following:

- in your lifetime, on how many different occasions have you smoked cigarettes?
- if you have ever smoked, how old were you when you first smoked a cigarette?
- if you have ever smoked, when was the most recent time you smoked a cigarette?
- during the last 30 days, how often, if ever, have you smoked cigarettes on average?
- on the days that you smoked in the last 30 days, how many cigarettes per day did you smoke?

Analysis

Source

Data were obtained from the Bureau of Labor Statistics, U.S. Department of Labor on CD-ROM for the following NLSY79 cohorts: children 1986-1996 and young adults 1994-1996. Selected demographic, childhood behavioral problems, and adolescent smoking variables were downloaded to SPSS 9.0 for analysis.

Data Management

The original data for this study sample contained a large amount of missing data across the interview years (1986 through 1996), thereby rendering the majority of cases unusable in the analysis. The missing data was largely a factor of non-eligibility of certain age groups for specific instruments. Additionally, some missing data was attributed to loss to follow up or lapse in participation for particular survey year(s).

This issue of missing data became a significant issue for certain variables, specifically behavior problems, smoking status, and income. In this section, the methods employed to work around the limitations inherent in the original data are described (Table 3).

Table 3: Data Management Measures

VARIABLE	*ORIGINAL NLSY79 CHILD CLASSIFICATION*	*TRANSFORMED CLASSIFICATION FOR ANALYSIS*
Smoking	Six dichotomous variables by survey year	Six dichotomous variables by age group
Household Income	Six continuous variables by survey year	One categorical variable averaged across all survey years
BPI: Antisocial Anxious/Depressed Headstrong Hyperactive Dependency Conflict	For each behavior, 0-5 for each of 6 survey years 0-3 for each of 6 survey years	For each behavior, one dichotomous variable across all study years

DEPENDENT VARIABLE

The smoking status of adolescents surveyed in the sample was the dependent variable for this study. In each of the six survey years (1986, 1988, 1990, 1992, 1994, 1996), the questions "have you ever smoked a cigarette?" and "age started smoking" was asked of every child participant. Due to limited number of responses to the question "have you ever smoked a cigarette?" for any given survey year, it was first necessary to consolidate responses across all survey years, thereby creating a new dichotomous variable that recorded whether or not a respondent had ever smoked between 1986 and 1996.

Due to limited number of responses to the question "age started smoking" for any given survey year, it was also necessary to consolidate responses across all survey years for this variable, thereby creating a new variable that recorded the respondent's age when he first smoked a cigarette. Once the respondent reported having smoked, he/she was counted in the sample as a smoker. If the respondent reported never having smoked, the respondent's age in the last survey year was noted.

The last step in creating the dependent variable for this study was to combine the two new variables described above (dichotomous variable recording if respondent had ever smoked and continuous variable recording age respondent first started to smoke). This step was necessary to obtain age-based variables that were dichotomous for smoking status. With these data transformations, age-based dichotomous variables from 8 through 24 years of age were available for the analysis, rather than the interview-year data as provided in the original data. Finally, six age-based groups were established from

the age-based variables according to sample clustering. The final groups included: ten years and under, 11-12 years, 13-14 years, 15-16 years, 17-18 years, and 19-24 years.

It is recognized that these data management methods may dilute the time-dependent measures for smoking status contained in the original data. While the repeated measures of NLSY survey data in its original format would have allowed examining changing smoking behaviors over time, obtaining an appropriate sample size was required to complete the analyses in this study.

INDEPENDENT VARIABLES

Annual Household Income

To create the independent variable measuring annual household income, several data manipulations were performed on the original NLSY data. While that original data was reported as a continuous variable by survey year, large amounts of missing data rendered the original data unusable for any relevant analysis, particularly from the perspective of sample size. To work around these issues, the data was consolidated for all survey years and a new variable was created that calculated average household income across all survey years for which data was reported. This new variable was then recoded to create three ranges based on sample clustering: $1-$19,999; $20,000-$39,999; and $40,000-$100,000+.

It is recognized that accurate self-reported income is commonly difficult to obtain in survey analysis. While the data management methods employed to obtain an average household income detracted from the study's ability to examine effects of trends and changes in income in individual families over time on smoking status, they allowed for an adequate sample size to be obtained for analysis.

Behavior Problem Index

Data transformations were necessary to create the six independent variables measuring behavior problems in childhood (antisocial, anxious/depressed, headstrong, hyperactive, dependent, and conflict) employed in this analysis. The original NLSY data recorded each behavior problem variable by survey year (1986, 1988, 1990, 1992, 1994, 1996). Due to limited number of responses to the BPI questions for any given survey year, it was difficult to obtain appropriate sample size or determine trends within the data.

In order to obtain one dichotomous measure for each behavior problem and increase the strength of the sample, responses were consolidated across all survey years and recoded from their original scale of 0-5 (except conflict, which was 0-3) to a dichotomous variable. With the exception of the score for conflict, if an individual reported a 3 or higher in any survey year, they were recoded to a 1, indicating a more pronounced degree of the behavior. If the score was between 0 and 2, they were recoded to a 0, indicating no to moderate signs of the behavior. Similarly, the conflict measure was recoded to a 1 if the score was 2 or 3 and a 0 if the score was between 0 and 1.

It is recognized that these data management methods may dilute the time-dependent measures for the six behavior problems contained in the original data. While the repeated measures of NLSY survey data in its original format would have allowed examining trends and changes in behavior problems over time and subsequent effects on smoking status, obtaining an appropriate sample size was required to complete the analysis in this study.

Statistical Analysis

Univariate Analysis

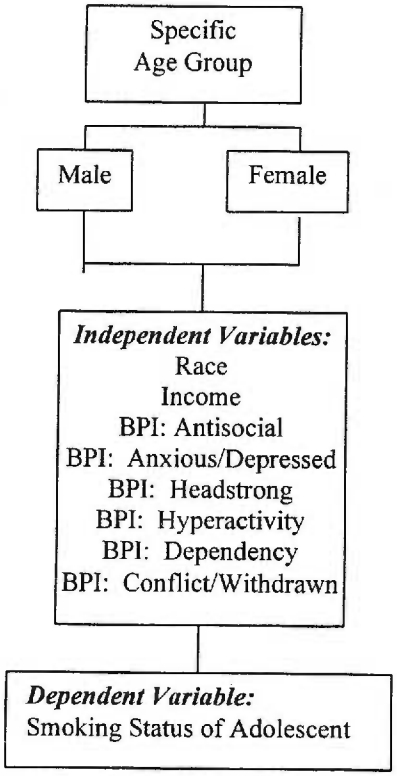
Initial analysis began with exploration of the demographic variables of the sample including age, race, and income. The data were stratified by gender. The first step in the analysis was an investigation of the frequency distribution of each demographic variable.

Multiple Logistic Regression Models

Separate multiple logistic regression models were developed by gender for each of the six age groups, with smoking status as the dependent variable. All independent variables were entered in the model at the same time. Both race and income were treated as categorical variables. For the race variable, the non-Black/non-Hispanic group was the reference category. For average annual income, the reference category was the $1-19,999 range. Figure 2 illustrates the basic model employed in the analysis for each age group.

Inclusion criteria for each of the independent variables in the model were based on significant findings in a survival analysis, as well as univariate analysis. The survival analysis showed all six behavioral variables to be significant predictors of smoking initiation in adolescence. Specifically, the probability for each of the six behavioral variables was 0.0000, with the exception of dependency, where the probability was 0.0023. In the univariate analysis, the majority of the variables were significant, with selected measures dropping out of each gender of the model.

Figure 2: Multiple Logistic Regression Models Predicting Adolescent Smoking Patterns: Sample from NLSY79 Child Population



Odds ratios were obtained as a measure of relative risk and interpreted based on 95% confidence intervals.

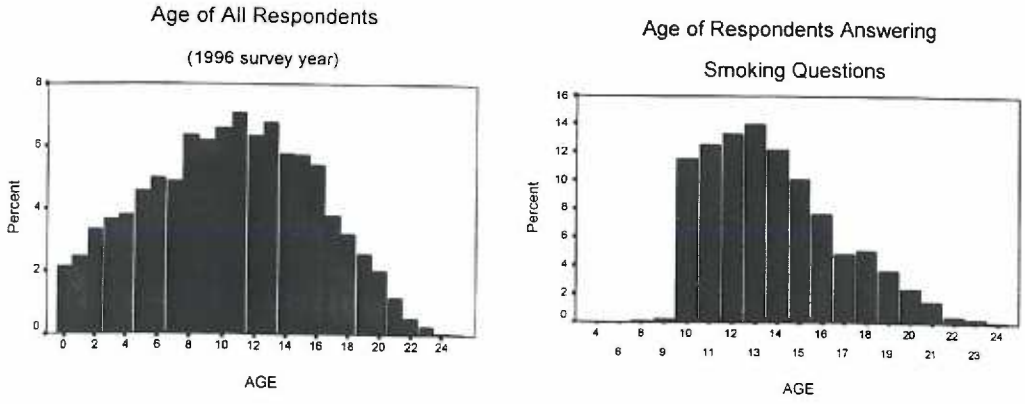
Additionally, an analysis was performed to test whether the regression coefficients (betas) for each independent variable, both significant and non-significant, were similar to the beta in other models. Z scores, and their associated p-values, were calculated by combining betas and their standard errors from each regression model. Using normal distribution theory, the null hypothesis was rejected if a p-value of .05 was found.

Results

Demographic Characteristics: Age, Gender, Race, Income

Out of the 10,507 valid surveys in this study, 3,990 adolescents recorded responses to questions regarding smoking behavior. Figure 3 shows the percentage of respondents by age for all 10,507 surveyed, as well as for the 3,990 respondents answering questions regarding smoking behavior. Approximately 40% of all respondents surveyed were under the age of 10 years. The percent of non-respondents to the smoking questions is not as high as it initially seems when looking simply at the survey versus the sample numbers. Basically, respondents up to age 10 in the original survey were not asked questions regarding smoking, thus eliminating approximately 40% of the initial 10,507 surveyed from the study sample.

Figure 3: Percentage of Respondents by Age: Total NLSY79 Child Sample Respondents (1996) vs. Study Sample with Smoking Data



By comparison to the study sample, Table 4 shows the age mix of the original NLSY79 child sample from 1986 through 1996. The number of children aged ten years and over increased from 295 in 1986 to 3623 in 1996, even though the 1996 estimate excluded older economically disadvantaged white children who were deleted from the fielded sample in 1990. In 1986, six percent of the children in the sample were age 10 years and over. In 1996, for the first time a majority (51%) of the NLSY child sample were ages 10 years and over. This "aging" largely reflects the declining number of births to women in the NLSY79 cohort in recent years. Additionally, some of the increase is due to the repeated nature of the survey, which attempted to re-interview respondents every other year while also enrolling new respondents. In 1996, almost one out of four children were considered a "young adult".

Table 4: NLSY79 Child Sample Sizes by Age: 1986-1996

SAMPLE GROUPS	*1986*	*1988*	*1990*	*1992*	*1994*	*1996*
Total Interviews	**4,971**	**6,266**	**5,803**	**6,509**	**7,089**	**7,103**
By Age						
Birth to 9 years	4,676	5,380	4,508	4,430	4,154	3,480
10-14 years	294	851	1,158	1,700	1,955	1,951
15 years and older	1	35	137	379	980	1,672

As shown in Table 5, the percent of the original NLSY survey that was black was maintained at about 33%; however the percent of children who were non-black/non-Hispanic increased somewhat, whereas the Hispanic sample declined. The sample in the current study revealed similar representation of all ethnic groups.

Table 5: NLSY79 Child Sample Sizes by Race/Ethnicity: 1986-1996

SAMPLE GROUPS	*1986*	*1988*	*1990*	*1992*	*1994*	*1996*
Total Interviews	**4,971**	**6,266**	**5,803**	**6,509**	**7,089**	**7,103**
By Race and Ethnicity						
Hispanic	937	1,158	1,304	1,483	1,546	1,520
Black	1,604	1,895	1,994	2,133	2,350	2,330
Non-black/Non-Hispanic	2,430	3,213	2,505	2,893	3,193	3,253

The demographic characteristics of the sample examined in this study by gender are presented in Table 6.

Table 6: Demographic Characteristics of Respondents Reporting Smoking Information 1986-1996

		Males N=1993	Females N=1997	Pearson Chi Square: (df; p-value)
		%	%	
AGE	≤10	12	12	4.91 (1df; p<.03)
	11-12	26	26	1.16 (1df; p<.28)
	13-14	24	28	3.35 (1df; p<.07)
	15-16	19	17	0.07 (1df; p<.79)
	17-18	10	10	4.91 (1df; p<.03)
	19-24	9	7	0.76 (1df; p<.39)
RACE	Non-Black/Non-Hispanic	41	41	1.31 (2df; p<.52)
	Black	36	38	
	Hispanic	23	21	
AVGE. ANNUAL	0-$19,999	45	46	0.12 (2df; p<.94)
INCOME	$20K-39,999	36	35	
	≥$40K	19	19	

For both males and females, the distribution of the sample by race was fairly even between Non-Black/Non-Hispanic and Black, with the Hispanic category only slightly more than 20% of the sample. Income was also fairly evenly distributed between males

and females, with over 80% of the sample reporting an average annual net household income of under $40,000.

Table 7 shows the distribution of smoking status by gender and age in the study sample. Gender distribution was approximately equal, as it was reported in the original NLSY data, however the age distribution of adolescents who reported information on smoking was skewed toward age eleven years and older. Of the 3,990 sampled, 35% of males and 33% of females responded yes to having smoked ever in their lifetime, with age 11-16 years being the most common time period for an adolescent to begin smoking.

Table 7: Smoking Status of Study Sample by Age and Gender 1986-1996

	Males			Females		
	N	% YES	% NO	N	% YES	% NO
Age ≤10 years	246	28	72	231	19	81
Age 11-12 years	519	33	67	518	30	70
Age 13-14 years	484	42	58	560	45	55
Age 15-16 years	373	43	57	337	44	56
Age 17-18 years	197	34	66	197	24	76
Age 19-24 years	174	18	82	154	14	86

Behavior Problem Index

Table 8 summarizes the distribution, by gender, of the six behavior problem variables in the analysis: antisocial; anxious/depressed; headstrong; hyperactive; dependency; and conflict/withdrawn, including Chi-Square analysis.

Table 8: Distribution of Dichotomous Behavior Problems by Gender
Test of Significance for Deviation from Equal Distribution

		Males	Females	Males	Females
		%	%	N	N
Antisocial	Lower degree of behavior	42	58	838	1155
	Higher degree of behavior	58	42	1167	851
	Pearson Chi Square with 1 df = 135.06 (p<.0001)				
Anxious/Depressed	Lower degree of behavior	43	44	861	879
	Higher degree of behavior	57	56	1144	1127
	Pearson Chi Square with 1 df = 0.44 (p<.44)				
Headstrong	Lower degree of behavior	20	26	405	529
	Higher degree of behavior	80	74	1601	1477
	Pearson Chi Square with 1 df = 26.08 (p<.0001)				
Hyperactive	Lower degree of behavior	27	41	535	815
	Higher degree of behavior	73	59	1471	1191
	Pearson Chi Square with 1 df = 129.29 (p<.0001)				
Dependency	Lower degree of behavior	58	52	1170	1048
	Higher degree of behavior	42	48	835	958
	Pearson Chi Square with 1 df = 28.39 (p<.0001)				
Conflict/Withdrawn	Lower degree of behavior	63	68	1263	1359
	Higher degree of behavior	37	32	743	647
	Pearson Chi Square with 1 df = 11.83 (p<.001)				

Maternal respondents reported somewhat more pronounced behavior for females in the areas of anxious/depressed, headstrong, and hyperactive, whereas fewer signs of behavior problems were reported in the areas of antisocial, dependent and conflict/withdrawn. Some behaviors, like headstrong and conflict/withdrawn, showed larger differences between females reporting low versus high degrees of the behavior. For the headstrong category, only 26% of female respondents reported low degrees,

(75%) scored low in this behavior, with only 25% reporting strong patterns of this behavior.

For males, the pattern is somewhat similar, with a few exceptions. Namely, males showed more of a tendency to be antisocial, with the majority of males (58%) reported having higher degrees of this behavior. Males showed stronger tendencies than females towards hyperactivity, with 73% of males reporting high degrees and only 27% reporting low degrees.

Multiple Logistic Regression

Tables 9 and 10 summarize the results of the regression analyses for males and females, respectively, and show the associated odds ratios. Significant findings are highlighted in bold. Graphs of odds ratios and the associated 95% confidence intervals for both significant and non-significant findings are shown in Table 11.

Table 9: Risk of Smoking Initiation by Age, Race, Income And Behavioral Characteristics Males

(Significant findings highlighted in bold)

Age Group (yrs)	Measure Of Risk	Race*		Avg Income**		BPI Antisocial	BPI Anxious	BPI Headstrong	BPI Hyperactivity	BPI Dependency	BPI Conflict
		Black:	Hispanic:	$20-39999K:	$40K +:						
<=10 yrs	OR	.88	.62	**2.24**	.51	1.93	.96	.88	2.19	1.06	1.13
N=246	(95% CI)	(.41 - 1.87)	(.30 - 1.31)	**(1.13 – 4.43)**	(.18 – 1.45)	(.93 – 4.00)	(.45 - 2.06)	(.35 - 2.20)	(.92 - 5.22)	(.53 - 2.11)	(.48 - 2.68)
11-12 yrs	OR	.68	.84	**.49**	**.36**	**2.04**	**2.01**	1.03	.67	.69	1.60
N=519	(95% CI)	(.42 – 1.10)	(.50 – 1.41)	**(.31 - .77)**	**(.21 – .64)**	**(1.27 - 3.28)**	**(1.24 - 3.28)**	(.56 - 1.92)	(.39 - 1.16)	(.45 - 1.07)	(.94 - 2.73)
13-14 yrs	OR	.67	.87	1.02	.62	**2.10**	.86	1.55	.99	.67	1.58
N=484	(95% CI)	(.41 – 1.09)	(.53 – 1.42)	(.65 – 1.68)	(.34 – 1.11)	**(1.33 - 3.31)**	(.55 - 1.33)	(.85 - 2.80)	(.60 - 1.62)	(.44 - 1.01)	(.91 - 2.72)
15-16 yrs	OR	**.52**	.73	.74	.80	**1.88**	.80	1.11	.85	.89	.83
N=373	(95% CI)	**(.30 - .90)**	(.41 – 1.29)	(.45 – 1.22)	(.43 – 1.49)	**(1.10 - 3.21)**	(.47 - 1.35)	(.59 - 2.09)	(.49 - 1.46)	(.54 - 1.45)	(.45 - 1.52)
17-18 yrs	OR	**3.13**	**4.09**	**3.30**	2.53	1.03	**2.18**	.87	1.35	1.11	1.08
N=197	(95% CI)	**(1.39 – 7.02)**	**(1.58 – 10.59)**	**(1.51 – 7.26)**	(.86 – 7.45)	(.44 - 2.44)	**(1.02 - 4.67)**	(.35 - 2.13)	(.56 - 3.25)	(.54 - 2.26)	(.40 - 2.91)
19-24 yrs	OR	2.96	**14.65**	.58	1.22	.96	2.72	**.26**	3.18	1.24	.19
N=174	(95% CI)	(.86 – 10.15)	**(3.56 – 60.23)**	(.19 – 1.78)	(.30 – 4.92)	(.34 - 2.71)	(.89 - 8.32)	**(.08 - .84)**	(.88 - 11.53)	(.41 - 3.71)	(.03 - 1.10)
TOTAL	**1993**										

Multiple Logistic Regression, Full Model
* Reference group: Non-black/non-Hispanic
** Reference group: $1-19,999/year

Table 10: Risk of Smoking Initiation by Age, Race, Income And Behavioral Characteristics Females

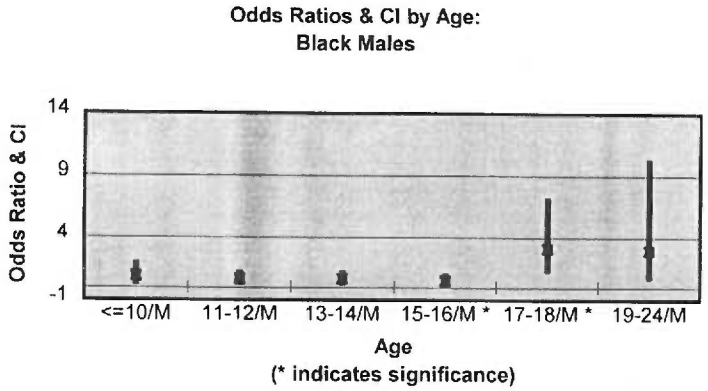
(Significant findings highlighted in bold)

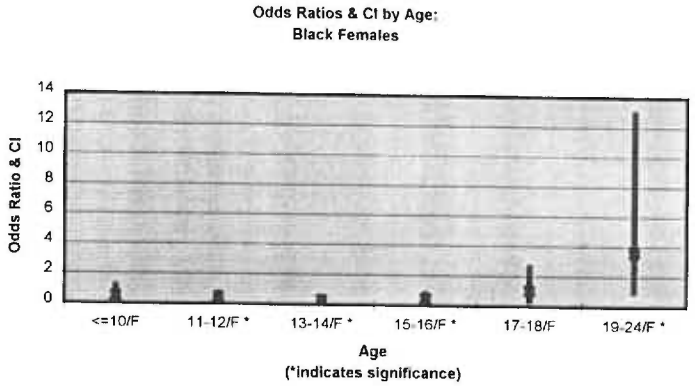
Age Group (yrs)	Measure Of Risk	Race*		Avg Income**		BPI Antisocial	BPI Anxious	BPI Headstrong	BPI Hyperactivity	BPI Dependency	BPI Conflict
		Black:	Hispanic:	$20-39999K:	$40K +:						
<=10 yrs	OR	.48	**.34**	.76	**.24**	1.29	1.54	2.31	1.01	**.33**	.99
N=231	(95% CI)	(.20 – 1.16)	**(.11 – 1.02)**	(.35 – 1.65)	**(.08 - .77)**	(.56 – 3.01)	(.65 - 3.66)	(.81 - 6.64)	(.43 - 2.41)	**(.14 - .76)**	(.27 - 3.66)
11-12 yrs	OR	**.44**	**.45**	**.61**	**.35**	**2.48**	1.30	1.33	1.41	**.53**	1.44
N=518	(95% CI)	**(.27 - .73)**	**(.25 - .80)**	**(.38 - .98)**	**(.19 - .67)**	**(1.52 - 4.06)**	(.80 - 2.10)	(.72 - 2.46)	(.85 - 2.31)	**(.34 - .85)**	(.79 - 2.63)
13-14 yrs	OR	**.34**	**.50**	.69	**.47**	**1.52**	.83	1.51	1.26	.82	1.22
N=560	(95% CI)	**(.21 - .53)**	**(.32 - .78)**	(.46 – 1.04)	**(.28 - .80)**	**(1.01 - 2.29)**	(.55 - 1.25)	(.93 - 2.45)	(.83 - 1.92)	(.56 - 1.20)	(.71 - 2.12)
15-16 yrs	OR	**.45**	1.26	.88	.96	**1.79**	.94	1.11	.82	.64	1.28
N=337	(95% CI)	**(.25 - .79)**	(.68 – 2.36)	(.52 – 1.50)	(.51 – 1.80)	**(1.01 - 3.16)**	(.56 - 1.60)	(.60 - 2.04)	(.47 - 1.42)	(.38 - 1.05)	(.60 - 2.70)
17-18 yrs	OR	1.05	2.49	1.44	**3.44**	**2.37**	1.24	1.02	1.52	.62	2.17
N=197	(95% CI)	(.43 – 2.57)	(.95 – 6.51)	(.61 – 3.41)	**(1.16 – 10.22)**	**(1.01 - 5.56)**	(.55 - 2.80)	(.41 - 2.52)	(.62 - 3.74)	(.27 - 1.41)	(.66 - 7.11)
19-24 yrs	OR	**3.62**	**8.27**	1.95	.48	1.30	2.93	.66	1.40	**.26**	1.58
N=154	(95% CI)	**(1.01 – 12.93)**	**(1.70 – 40.24)**	(.65 – 5.84)	(.05 – 4.74)	(.40 - 4.24)	(.81 - 10.66)	(.16 - 2.74)	(.36 - 5.46)	**(.07 - 1.03)**	(.31 - 8.13)
TOTAL	**1997**										

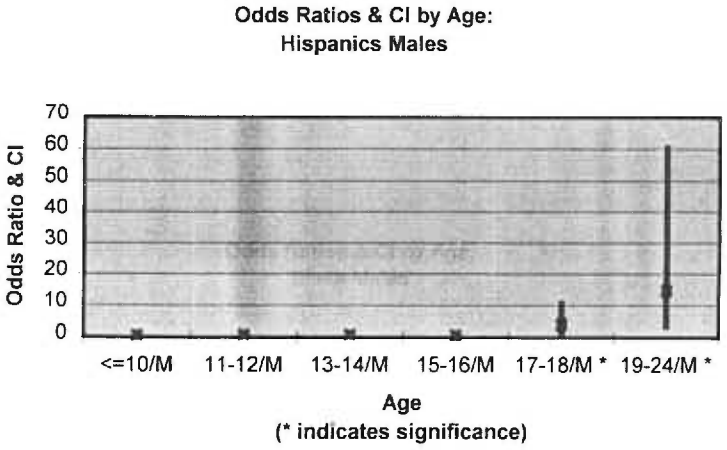
Multiple Logistic Regression, Full Model
* Reference group: Non-black/non-Hispanic
** Reference group: $1-19,999/year

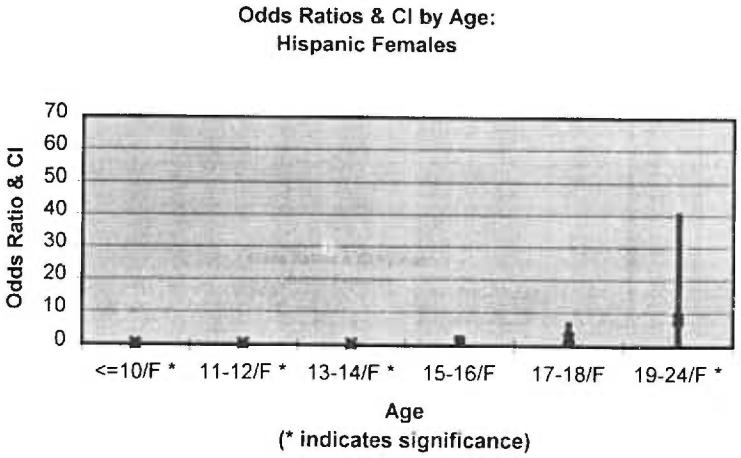
Table 11: Odds Ratios & 95% Confidence Intervals from Multiple Logistic Regression Models by Gender

*(significant finding noted by *)*

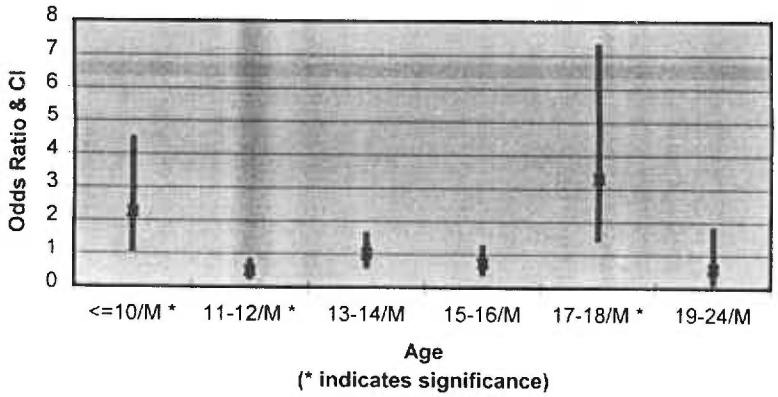




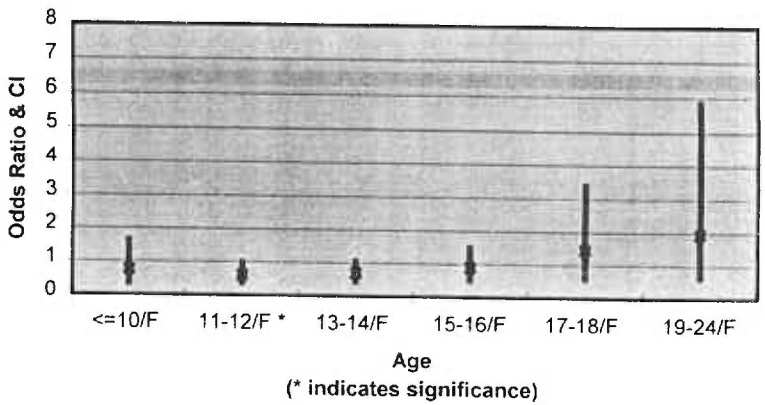




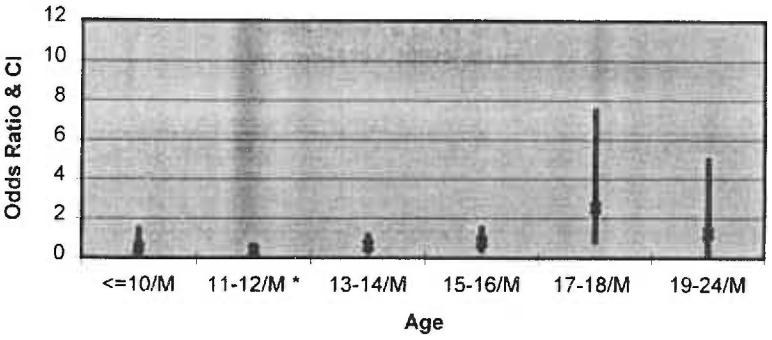
Odds Ratios & CI by Age:
Income ($20K-39999) Males



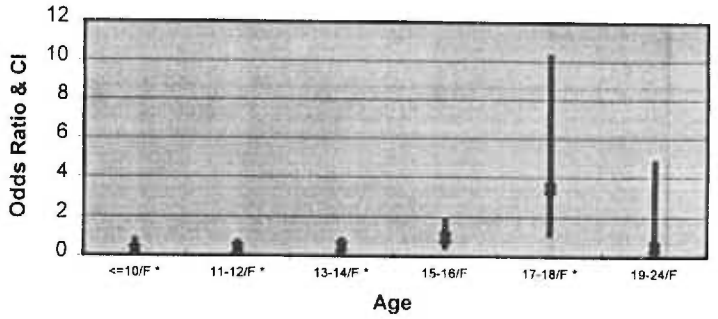
Odds Ratios & CI by Age:
Income ($20K-39999) Females

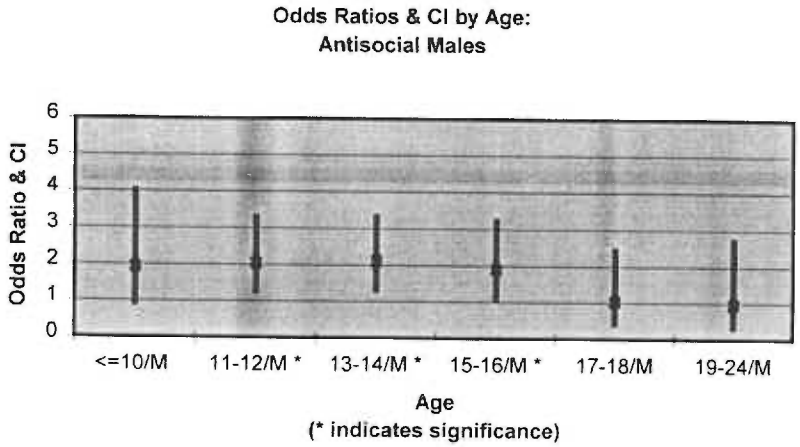


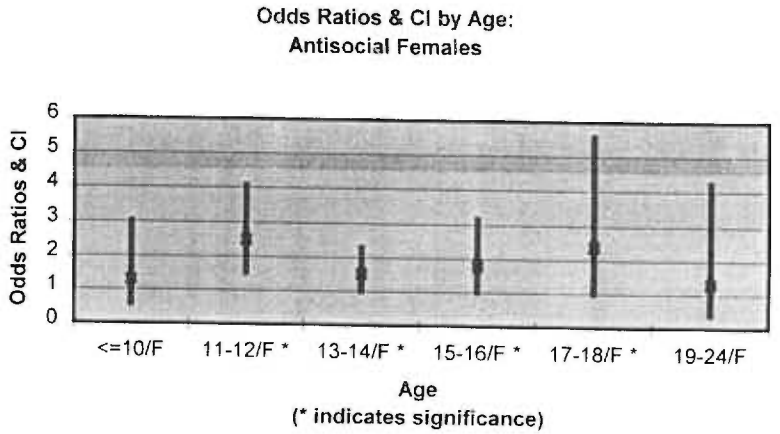
Odds Ratios & CI:
Income ($40K+) Males



Odds Ratios & CI:
Income ($40K+) Females




Odds Ratios & CI by Age:
Antisocial Males
Odds Ratio & CI
6
5
4
3
2
1
0
<=10/M
11-12/M *
13-14/M *
15-16/M *
17-18/M
19-24/M
Age
(* indicates significance)


Odds Ratios & CI by Age:
Antisocial Females
Odds Ratios & CI
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5
4
3
2
1
0
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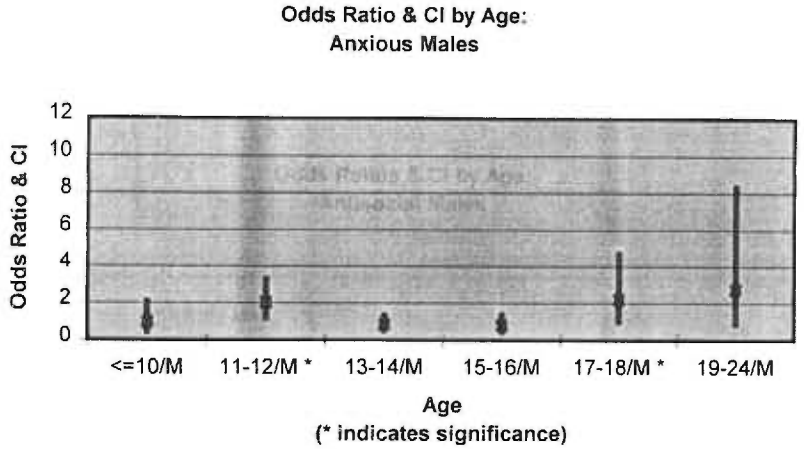
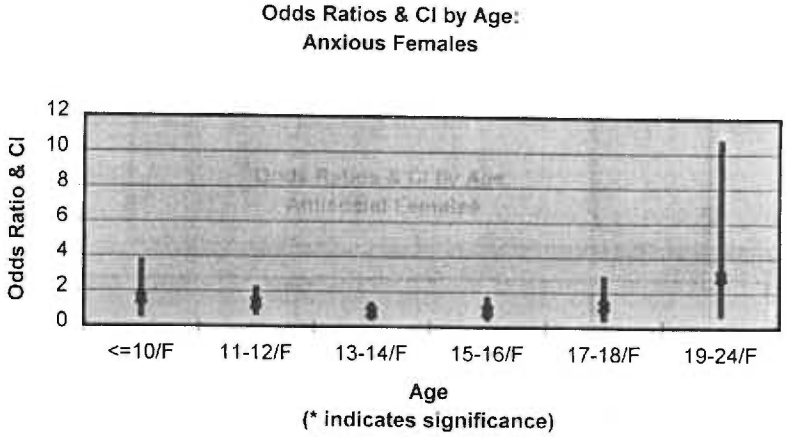
13-14/F *
15-16/F *
17-18/F *
19-24/F
Age
(* indicates significance)


Odds Ratio & CI by Age:
Anxious Males
Odds Ratio & CI
12
10
8
6
4
2
0
<=10/M
11-12/M *
13-14/M
15-16/M
17-18/M *
19-24/M
Age
(* indicates significance)


Odds Ratios & CI by Age:
Anxious Females
Odds Ratio & CI
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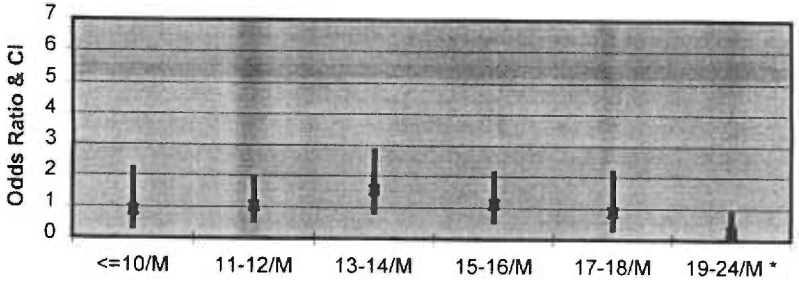
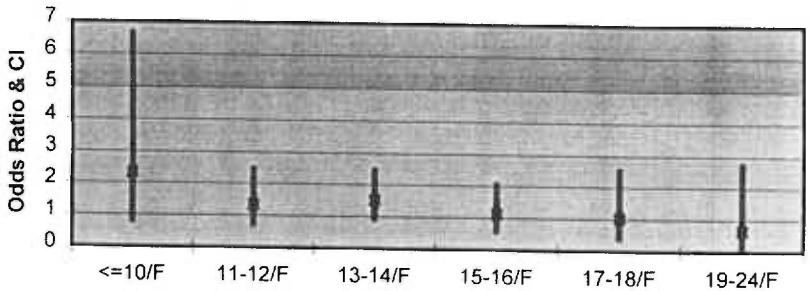
10
8
6
4
2
0
<=10/F
11-12/F
13-14/F
15-16/F
17-18/F
19-24/F
Age
(* indicates significance)

Odds Ratios & CI by Age:
Headstrong Males



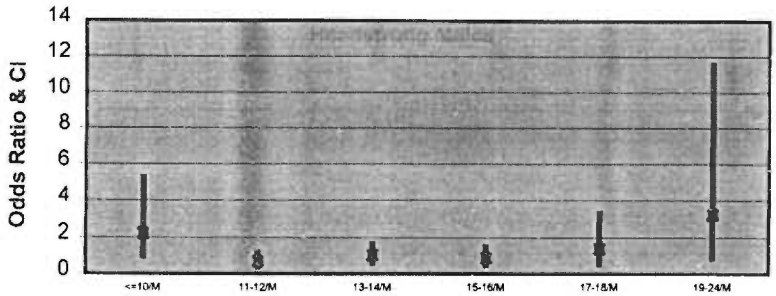
Age
(* indicates significance)

Odds Ratios & CI by Age:
Headstrong Females



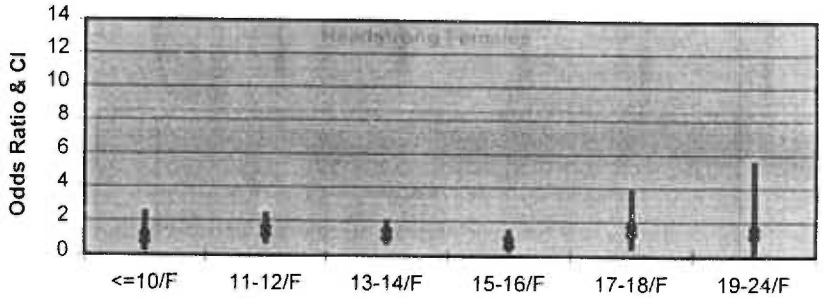
Age
(* indicates significance)

Odds Ratios & CI by Age:
Hyperactive Males



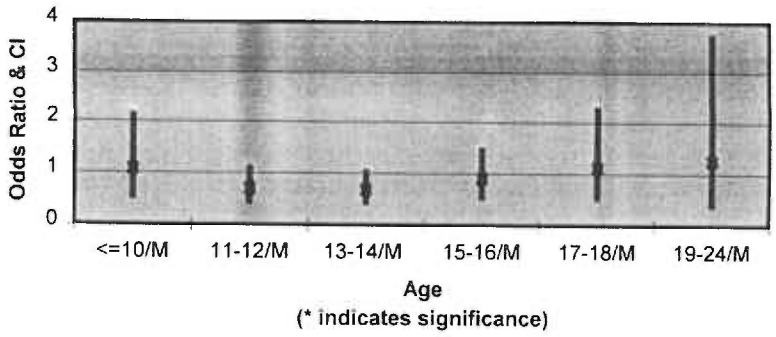
Age
(* indicates significance)

Odds Ratios & CI by Age:
Hyperactive Females

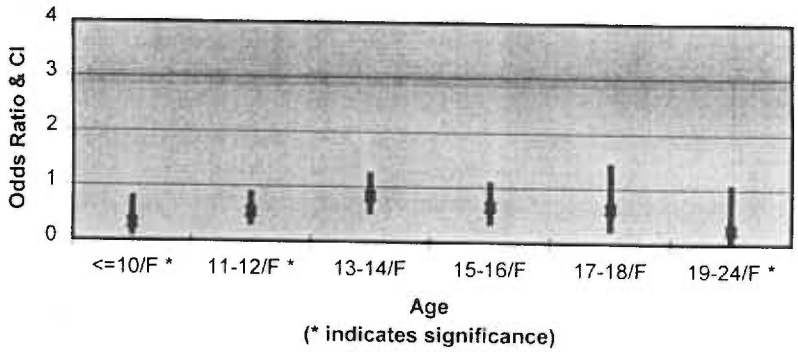


Age
(* indicates significance)

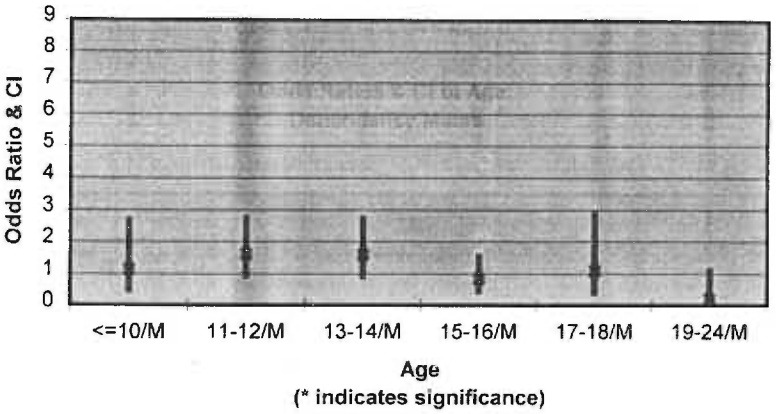
Odds Ratios & CI bt Age:
Dependency Males



Odds Ratios & CI by Age:
Dependency Females



Odds Ratios & CI by Age:
Conflict Males



Odds Ratios & CI by Age:
Conflict Females

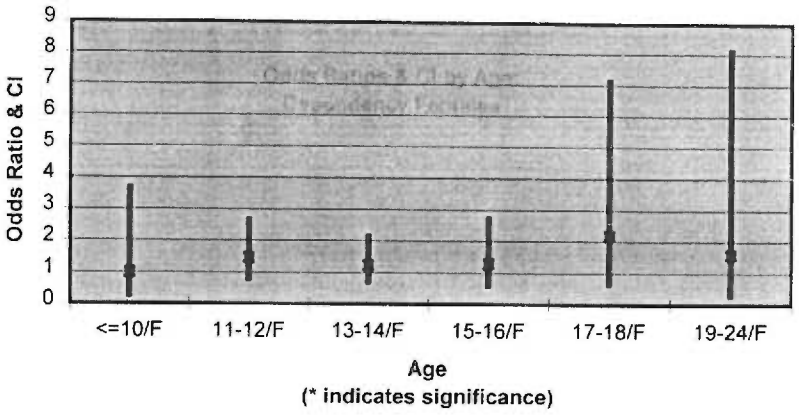


Table 12: Primary Results
Childhood Behavior Characteristics Predicting Subsequent Smoking Status in Adolescents

	GENDER/AGE GROUP	ODDS RATIO
DECREASED RISK OF SMOKING		
Headstrong	Males 19 years & older	.26
Dependency	Females up to age 12 years	.33 - .53
	Females 19 years & older	.26
INCREASED RISK OF SMOKING		
Antisocial	Males age 11-16 years	1.88 – 2.10
	Females age 11-18 years	1.52 – 2.48
Anxious/Depressed	Males age 11-12 years	2.01
	Males age 17-18 years	2.18

Based on all findings, both significant and non-significant, Black and Hispanic male and female respondents, compared to the non-Black/non-Hispanic group, were less likely to smoke based on their ethnicity up through age 16 years of age, with the one exception being Hispanic females 15-16 years of age. However, beginning at age 17 years, the association reversed and Black and Hispanic male and female respondents were more likely to smoke. The significant associations showed black and Hispanic males more likely to smoke with the exception of the 15-16 year group for blacks, which showed a negative association. However, the significant associations among black and Hispanic females predicted respondents were less likely to smoke, except 19-24 years, which showed a positive association.

For males, the $20-39,999 category showed significance for three groups, ages ≤10, 11-12, and 17-18, with income between $20-39,999 predicting smoking for all groups except 11-12 years, which showed a negative association. For females, income

between $20-39,999 was significant for only one group, 11-12 years, and was less likely to predict smoking. In the $40K+ category for males, the findings were significant only for 11-12 year olds and indicated less likelihood of smoking. For females in the $40K+ category, all ages up through 14 years and 17-18 years were significant, with only the latter group showing a predictive factor for smoking. All others showed a negative association.

The Behavior Problem Index variables showed more consistent predictive results for females than for males. For both genders, antisocial behavior was the most consistent predictor of all BPI variables for subsequent smoking. For males, the age groups 11-12 years through 15-16 years yielded positive associations between antisocial behavior and smoking, with odds ratios between 1.88 and 2.10 and small confidence intervals for each. The other age groups were not significant for males, but yielded positive associations between antisocial behavior and smoking with odds ratios less than 2.0. For antisocial behavior in females, age groups between 11 and 18 years were significant in terms of antisocial behavior and smoking, with odds ratios similar to those for males. The remaining two groups, for the youngest and oldest females, also showed a positive association between antisocial behavior and smoking with an average odds ratio of approximately 1.30.

For females ranking high in the category of dependency, the results revealed a negative association for dependent behavior and smoking up to age 12 years and 19-24 years. The association between less dependent behavior and smoking, though not significant, remained negative for the age groups between 13 and 18 years, with an odds ratio of approximately 0.75. No significant associations were reported for males.

For both genders, there was no significant effect for the variable measuring peer conflict, which reflected the degree to which the child has trouble getting along with others or is withdrawn and not involved with others, or hyperactivity, which reflected the degree to which the child has difficulty concentrating/paying attention and is restless/over active.

The significant results for the remaining BPI variables did not yield consistent patterns. Males showed a positive association between the category of anxious/depressed behavior and smoking in the age groups 11-12 years and 17-18 years, whereas there were no significant findings for females with this independent variable. In the category measuring the headstrong behaviors of a child, only the male group 19-24 years revealed an association with smoking.

Comparison of Betas

The results of the tests comparing significant and non-significant beta coefficients across all models for each independent variable differed for males and females. There were no differences for females between any of the coefficients for most of the BPI variables including anxious/depressed, headstrong, hyperactive, dependent, and conflict. Results for the remaining BPI variable, antisocial, showed that the coefficients for ages 12-14 years and 19-24 years differed from the other groups. In general, coefficients for Black, Hispanic, income from $20,000-39,999, and income $40,000+ differed across the models. These differences were generally revealed in the older age groups, with only a few exceptions.

For males, headstrong, dependent, and conflict were the only BPI variables to show no differences between the coefficients for each variable. The other BPI variables showed differences across the betas, but the pattern was not consistent. For the antisocial variable, coefficients differed in the older years (18-24 years). For anxious/depressed, coefficients differed in the younger years (10-16 years). For hyperactive, beta coefficients were different early (≤10 years) and late (19-24 years) across the model. In general for race, both Black and Hispanic, differences across betas were noted in the older years (18-24 years). There were no consistent patterns for the differences in betas for the two variables measuring income for males.

Discussion

Adolescent smoking remains an important public health issue today, in spite of the aggressive campaigns in recent years to deter teens from beginning to smoke. To that effect, new methods are needed to identify those teens that may have a tendency, either by personality dimensions or by their environment, to begin smoking. Many of the past studies that have addressed adolescent smoking have focused on behavior dimensions at the time of smoking. The aim of this study was to elucidate the association between adolescent smoking and early childhood behavior patterns. By modeling these factors using logistic regression and controlling for race, age, and income, it was possible to look at the predictive value of these behaviors in childhood for smoking initiation in the adolescent years. By using BPI variables, which are well established and tested in previous studies, the possibility exists to identify a youngster as a potential smoker at an early age and subsequently apply additional interventions during the years leading up to and through adolescence to prevent the possibility of smoking initiation.

This particular sample is especially rich in its heterogeneous mix. Unlike most previous studies, the sample included appropriately diverse representation of individuals from all races and income levels. Specifically, blacks and Hispanics represented approximately 37% and 22% of the sample, respectively. Additionally, children and adolescents were sampled regardless of whether they were enrolled in school. With such a diverse sample, it is easier to generalize the results to the population at large.

One of the study objectives was to look at the influence of demographic variables on an adolescent's progression to smoking. The results of this study with

respect to demographic variables support previous findings to some degree. The main exception is that, across all variables, adolescent females demonstrated a greater risk factor for smoking based on the regression models than the male models, whereas past studies show that smoking initiation is most common in males up to age 18. The unique demographic mix of this sample may explain in part the differences associated with the finding of this study as compared to previous studies. In looking at racial factors, prior research indicates that smoking initiation is more common in male Caucasian adolescents and less common in blacks. This study similarly showed that black and Hispanic adolescents were less likely to have initiated smoking before age 16 years, but that trend reverses for older teens.

Socioeconomic status is another variable that has been studied extensively. In this study, socioeconomic status was measured by average annual net family income self-reported by the mother of the interviewee. Especially for females who initiate smoking before age 14 years, the results suggest that the lower the income, the more likely the adolescent is to begin smoking. This finding is consistent with previous research. However, this study demonstrated that smoking is more likely to occur with females age 17-18 in families with a higher income.

A formidable strength of this study was the repeated measures over time for smoking status of adolescents. Whereas many past studies examine one discreet period of time, for example a child's smoking status at one particular age, this study included repeated measures from up to six interviews over a ten-year period to determine smoking status.

A second objective of the study was to examine the extent to which early childhood behavior, specifically a scale of well-defined behavioral problems, is predictive of smoking initiation in adolescence. While some behaviors have been examined in the past, the exploration of particular BPI variables in relationship to adolescent smoking risk has not previously been investigated. The repeated measures over time of both the behavior and the smoking status variables make this part of the analysis particularly important.

Smoking in adolescence was most strongly associated with antisocial behavior, which the NLSY defined as cheating/lying, bullying, misbehaving without remorse, and difficulty and disobedience at school. For males and females, the more pronounced or severe the antisocial behavior in childhood, the more likely the individual was to smoke in adolescence. The pattern began at age 11 years for males and remains significant through age 16 years. For females, the pattern also started at age 11 years and remained significant through 18 years. Although the BPI variable measuring antisocial tendencies has not previously been examined in association with adolescent smoking, this finding is consistent with those for similarly defiant behaviors as predictors of smoking previously examined in the literature.

For females only, smoking in adolescence was also strongly associated with less dependent behavior. The trend was most evident in the early years (up through age 12 years), and at age 19 years and older. This notion of strongly independent behaviors being a predictor of smoking has also been documented in previous studies. Additionally, one can see similarities between these independent behaviors and the

pronounced antisocial behaviors described above, both of which are predictors of smoking in adolescence.

Supporting the theory that smoking is more commonly associated with adolescent males, several BPI variables were significant for males and not for females in a specific group. One such example is in the category of anxious/depressed, which NLSY defined as feelings of inferiority, fearfulness, and unhappy, sad, or depressed. Male respondents age 11-12 years and 17-18 years who reported more anxious behavior were more likely to smoke as an adolescent. Another significant variable for males only, age 19-24 years, was headstrong, which NLSY defined as high strung, argumentative, disobedient, and strong temper/loses it easily. One would expect, based on the results for antisocial and dependent behaviors, that headstrong behavior in childhood would predict subsequent smoking. However, the groups (ages 11-16 years) reporting a positive association between headstrong behavior and subsequent smoking were not significant.

The BPI variable measuring conflict in childhood was not a predictor of adolescent smoking in any of the models for males or females. This is noteworthy because the characteristics of the conflict measure are not too unlike some of the other variables showing significance (i.e. antisocial, anxious/depressed).

I conclude that smoking in adolescence can be predicted by a combination of demographic and behavioral variables. While it may be more difficult to influence demographic variables, parents, teachers, and care providers should be trained to identify early behavioral predictors in childhood so as to lessen adolescent smoking outcomes in the future.

Limitations

A significant limitation of this study was the large amount of missing data for all variables including demographic, behavioral and smoking status. This may be explained in part by failure of interviewers to capture a response to every question in all six survey years, especially as it relates to self-report surveys. Age requirements for certain questions and naturally occurring loss to follow up were also issues in this regard.

Several important study limitations specifically related to smoking should be noted. In addition to the large amount of missing data noted above, no information was available on peer smoking, which is well established in the literature as a risk factor for smoking in adolescents. Equally well-established in the literature but absent from the NLSY Children dataset was information on smoking patterns of parents or those living in the household of the respondent. Both these factors may have influenced the results of this study. Additionally, missing data made it impossible to look at more detailed aspects of smoking, specifically changes in smoking patterns since initiation, current smoking patterns, and frequency of smoking (number of cigarettes per day). This information would have strengthened the analysis and provided more meaningful results for final interpretation. Lastly, the method used in this study to identify an individual as a smoker was limited to their first "yes" response, thereby eliminating the possibility of changed smoking patterns in later study years.

These limitations are primarily the result of using a secondary dataset.

Conclusions

In spite of the study limitations, the data in this study suggest that selected behavior variables predict the onset of cigarette smoking, even after controlling for age, gender and income. These findings, along with the literature, suggest that children and adolescents with these behavioral characteristics may represent a large group of youth who are at high risk for cigarette smoking, and possible subsequent drug abuse, medical morbidity and mortality. Thus, it is critical to aim smoking prevention programs, which have proven to be effective, at high-risk children and adolescents such as those with significant behavioral problems as defined by the BPI variables in this study.

Specifically, opportunity exists for behavioral intervention in the childhood years to prevent smoking initiation in adolescence. It is recognized that different strategies would be required for various interventions, depending on the specific behavior exhibited. For example, the intervention approach for antisocial behavior would be very different from low dependent behavior. While many issues may be confounders in the outcome, the basic premise of identifying behavioral problems before they become too engrained in a child's personality may be beneficial in curbing teen smoking rates. The behavior problems used in the BPI scale are common disruptors in school and family environments, though teachers, parents, and caregivers may not be aware of the additional risk that such characteristics pose to smoking initiation. With an increased awareness of the long-term detriments, adults encountering such behaviors may be better prepared with appropriate interventions to curb and eventually change such behaviors in children.

Increased awareness would be particularly beneficial when children exhibit aspects of both antisocial and independent behaviors, as defined in this study. The two behaviors have similar characteristics and this study demonstrated that the risk of smoking in adolescence is greater when both behavioral variables are present.

Two main options exist for interventions, depending on the point it is applied in an individual's life. If the significant behavior problems in this study are addressed in childhood, an intervention could be designed to change the behavior early in the child's life. However if the behavior is not addressed in childhood and it carries on into the individual's adolescent years, a more appropriate intervention at that point would be aimed specifically at smoking prevention and education, including attention to peer and parental influences.

Although this study showed slight differences in significant behavioral results for males and females, educators and parents need to address such disruptive behaviors with both genders. Obviously, this needs to be done within the appropriate social/developmental context of the individual for most effective results.

The use of modeling by age group in this study is helpful in practical application of the significant results. Since individual school years are generally defined by age of the individual, appropriate interventions may be altered and designed based on age of the child as well as their gender, race and income.

Due to the high rate of experimenters becoming regular smokers, any measure that can be taken to reduce the risk of teens experimenting with smoking would be of significant public health value. With teen smoking proportions continuing to rise in spite of major educational campaigns and governmental support, alternatives to curbing these

proportions are greatly needed. The results of this study suggest that interventions targeted to certain behaviors should be researched in an attempt to decrease smoking initiation in teens.

This study adds to a body of knowledge about what puts individuals at risk for smoking initiation in adolescence. As strongly suggested in the literature, this study provides further evidence that prevention and understanding the risks is key to influencing outcomes.

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APPENDIX: NLSY79 CHILD INSTRUMENTS

Each child interview included the administration of a number of instruments. They included the Mother Supplement and the Child Supplement. Two self-report assessments were employed; the Child Self-Administered Supplement was administered to children 10 years of age and over (ages 10-14 beginning in 1994) and, beginning in 1994, the Young Adult Field Instrument to children who were at least 15 years of age by the end of the survey year. These documents included items that:

- Elicited maternal reports on the child's background, home environment, schooling, health, temperament, behavioral problems and motor-social skills;
- Directly assessed a child's development using such nationally-normed tests as the Peabody Picture Vocabulary Test-Revised (PPVT-R), the Wechsler Intelligence Scale for Children-Revised (WISC-R), Digit Span Subscale, the Peabody Individual Achievement Test (PIAT): Math, Reading Recognition, and Reading Comprehension assessments, the McCarthy scale of Children's Abilities: Verbal Memory Subscale and Harters Self-Perception Profile for Children (SPPC) and Kagan's Memory for Location and Parts of the Body;
- Recorded the interviewer's observations of each child's home environment and their evaluation of the testing conditions.
- Self-reported information on various issues in the child's life including family interactions, attitude towards school, extracurricular activities, peer relationships, substance abuse, sexual activity, non-normative activities, computer use, and emotional problems.

The Mother Supplement was designed to be completed by the mother or guardian for each child. It covered such topics as HOME (Home Observation for Measurement of the Environment) Inventory, "How My Child Usually Acts/Temperment", Motor and Social Development, Behavior Problems Index, and School and Family Background.

The Child Supplement was used by the interviewer to record general background and health information from the mother of each child, responses from each child to assessment items, evaluations of the testing conditions, and the interviewer observations of the child's home environment. Specific assessments included identification of parts of the body, memory for location, verbal memory, self-perception profile, memory for digit span, and PIAT.

The Child Self-Administered Supplement was a self-report booklet that collects information on a wide-range of topics including child-parent interactions, family decision-making, attitude toward school, extracurricular activities, child employment, peer relationships and dating activities, religious identification and attendance at religious service, sex education, participation in various delinquent activities, use of cigarettes, alcohol, and other illegal substances, and age at initiation of sexual activity. Beginning in 1994, the Child Self-Administered Supplement was given to children ages 10-14 only.

The Young Adult Field Instrument, initiated in the 1994 survey year, included a computer-assisted personal interview with children who were at least 15 years of age by the end of the interview period focusing on their education, employment and family-related behavriors and attitudes. In addition, they filled out a self-administered paper questionnaire that asks about a variety of more personal attitudes and behaviors including substance abuse, sexual activity, and emotional problems.

Not all instruments were fielded in each child survey year, and select assessments were only administered to those children for whom no valid score had been obtained during a previous survey.