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Elementary School Age Children's Future Intentions and Use of Substances

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Abstract

This study describes the lifetime prevalence and future intentions related to trying cigarettes, chewing tobacco, alcohol, marijuana, and inhalants of students in the 1st through 7th grade. This article also describes the identification of these substances by children in the 1st through 3rd grade. Participants were 1,075 1st through 5th graders within a school district in western Oregon who were followed for 3 years. Across most substances, prevalence and intentions increased with grade, with a moderate increase between 3rd and 4th grade and a larger increase between 5th and 6th grade. Boys were more likely than girls to identify alcohol and cigarettes and were more likely than girls to report trying chewing tobacco. In addition, 3rd-grade boys were more likely to identify marijuana and, in the early grades, alcohol. Boys were also more likely than girls to intend to use tobacco and drink alcohol when older. For alcohol and cigarettes, intention was related to subsequent trying of the substance, suggesting that intention may be an early warning sign of subsequent substance use.

Several studies suggest that substance use at a young age is a primary risk factor for continued use and dependence (Breslau & Peterson, 1996; Chassin, Presson, Sherman, & Edwards, 1990) and for subsequent problem substance use later in adolescence or adulthood (Kandel & Davies, 1992; Kaplan, Martin, Johnson, & Robbins, 1986; Newcomb & Bentler, 1988). In a 20-year longitudinal study, early use of alcohol and cigarettes was the strongest predictor of progression to marijuana and other illicit drugs (Kandel, Yamaguchi, & Chen, 1992). Early initiators of substances are also less likely to reduce their use of substances following the receipt of intervention or prevention programs in adolescence (Ellickson, Bell, & McGuigan, 1993; Murray, Pirie, Luepker, & Pallonen, 1989).

Although early experimentation is a known risk factor, few studies have systematically examined the use of substances in children younger than 10 or 11. The gap in research with this age group is most likely due to the low prevalence of substance use among young children. However, although these children may have not yet tried a substance, they may have developed intentions regarding the future use of each substance. Drawing on the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 1988, 1991), future intentions to use a substance are related to subsequent behavior. The primary purpose of this study, therefore, is to examine the lifetime prevalence of trying cigarettes, chewing tobacco, alcohol, marijuana, and inhalants and the intentions to use each substance in children who are in the first through the seventh grade.

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The few studies conducted with children younger than 10 years of age show that some children have tried substances, but the prevalence varies across communities. For example, a small proportion of first graders in Pittsburgh reported using substances without parental knowledge (7.7% had tried beer, 0.4% had tried marijuana, and 1.2% had inhaled glue; Van Kammen, Loeber, & Stouthamer-Loeber, 1991). In contrast, a fairly high proportion of 7- to 9-year-olds in Queensland, Australia, reported trying alcohol (27%; Oei & Burton, 1990). Intention to use substances among young children also varies across communities. In a study conducted in Israel, 30% of first graders expressed their intention to smoke in the future (Brook, Mendelberg, Galili, Priel, & Bujanover, 1999).

Studies examining the substance use of children 10 or older show a developmental increase in trying substances with considerable regional variability across studies. For example, a large proportion of children by fourth grade have used alcohol (43% [New Hampshire Study], Stevens, Youells, Whaley, & Linsey, 1991; 23% [western Canada], Porter-Serviss, Orpheim, & Hindmarsh, 1994), many without parental knowledge (15% of all children; Bush & Iannotti, 1992; Van Kammen et al., 1991), about 20% have tried cigarettes (19%, Bush & Iannotti, 1992; 27% [Queensland, Australia], Oei, & Burton, 1990; 8% [western Canada], Porter-Serviss et al., 1994), and 2% have tried marijuana (Bush & Iannotti, 1992). A survey of four rural northeast Texas school districts showed that among fifth graders, 17% reported currently using alcohol, 23% tobacco, and 10% marijuana (Fournet, Estes, Martin, Robertson, & McCrary, 1990). By sixth grade, 65% of a sample from a New England town had used alcohol, 46% tobacco, 11% marijuana, and 6% inhalants (Grady, Gersick, Snow, & Kessen, 1986). Our population-based study reports on the prevalence of trying substances in a working-class community in western Oregon and examines differences by grade.

Prior to or concurrent with intention to use substances or trying substances, it is reasonable to assume that children have acquired some knowledge about them. Knowledge regarding substances is a necessary precursor to attitude and beliefs (Fossey, 1993), which in turn are predictive of intentions to use substances (Ajzen & Fishbein, 1980). Research suggests that children have acquired knowledge regarding alcohol and cigarettes by age 3 (Jahoda, Davies, & Tagg, 1980; Spiegler, 1983). Bloom and Greenwald (1984) reported that all second graders knew what alcohol was, 47% had heard of marijuana, and 42% had heard of glue sniffing. In this study, we report on the pictorial recognition of alcohol, cigarettes, chewing tobacco, marijuana, and inhalants of first through third graders. This further exploration of the early precursors of intention and use will further understanding of the etiological pathways to use and abuse.

Studies conducted with adolescents show a link between intention to use a substance and subsequent initiation of smoking or an increase in smoking (Maher & Rickwood, 1997; Norman & Tedeschi, 1989) and alcohol use (Marcoux & Shope, 1997; Webb, Baer, Getz, & McKelvey, 1996). Choi, Gilpin, Farkas, and Pierce (2001) showed a prospective association between intentions to smoke and established smoking 3 to 4 years later. To our knowledge, previous studies have not investigated the relation between future intention to use substances and subsequent use of the respective substance with elementary school age children. Therefore, in this study we examined the relation between intention measured in elementary school and the subsequent report of trying each respective substance 2 years later.

Results from regional studies (Grady et al., 1986; Johnson, Arria, Borges, Ialongo, & Anthony, 1995) suggest a higher prevalence of alcohol, smokeless tobacco, and marijuana use among elementary school age boys as compared to girls. However, results from the National Household Survey on Drug Abuse (U.S. Department of Health and Human Services [USDHHS], 2001) did not show sex differences in the use of alcohol or marijuana for children 12 to 17 years of age, suggesting that girls' use may increase faster over time relative to boys.

Boys who are high school age and older have a higher prevalence of heavy drinking and illicit drug use (other than marijuana) throughout adolescence than girls (Johnston, O'Malley, & Bachman, 2000). Perhaps this higher, more problematic drug use among boys is the result of the higher prevalence of early use among boys. Clearly, describing the prevalence of substance use and a cognitive antecedent of substance use, intention, by sex is necessary.

The purpose of this article is to describe the prevalence of trying five substances—cigarettes, chewing tobacco, alcohol, marijuana, and inhalants—across first through seventh grade using data collected within a cohort-sequential design, wherein five grade cohorts (in the first through fifth grade at the initial assessment) are followed for 3 years (until they are in the third through seventh grade). We also report on first through third graders' recognition of cigarettes, alcohol, chewing tobacco, marijuana, and inhalants and first through seventh graders' future intention regarding using each substance. In addition, we test for cohort effects and for developmental and sex differences. Further, we examine the relation between intention and subsequent substance use 2 years later. This research constitutes part of the Oregon Youth Substance Use Project, an ongoing longitudinal investigation of predictors of children's substance use, including assessments of children, their parents, and teachers (Severson, Andrews, & Walker, 2003). This article presents data reported by children in the first 3 years of the study.

Method

Overview of Design

This study uses a cohort-sequential design (Schaie, 1965, 1970) wherein five grade cohorts (first assessment = T1) are assessed at annual intervals over a 3-year period. A cohort-sequential design combines both cross-sectional (i.e., grade cohort) and longitudinal (three assessments) designs into one sequential design. The grade of the child is defined as the grade at which the assessment occurred. Cohort represents the number of individuals in each grade (first through fifth) at the first assessment. A third term is the time of measurement. A cohort-sequential design, in contrast to cross-sectional and longitudinal designs, allows an examination of all three sources of variance within one study: the cohort, the age or grade of the child, and the assessment time. A disadvantage of this design is that these three components are not independent. Thus, age is always confounded with either differences between cohorts or differences between assessments. In this study, an investigation of age differences controls for time of measurement but is confounded with cohort differences. Therefore, to investigate developmental differences due to the age or grade of the child, it was first necessary to examine cohort effects. Table 1 gives the number of participants in each grade cohort across the three assessments.

Sampling Design, Recruitment, and Participation

Sampling design and recruitment—The population recruited from was the total enrollment in Grades 1 through 5 of 15 elementary schools in one school district, consisting of approximately 5,600 students. The western Oregon community served by the district is a working-class community of approximately 50,000, largely comprised of middle- and lower-middle class citizenry. A few schools, however, serve primarily upper-middle class households, and three schools serve a rural population. Using stratified random sampling (by school, grade, and sex), parents of 2,127 students in 15 elementary schools were sent a letter followed by a phone call describing the project and soliciting participation. We made a particular effort to recruit participants from the growing Hispanic American population. Recruitment and assessment materials were in both Spanish and English, and a Latina recruited Hispanic American parents and conducted assessments in Spanish.

Parents of 1,075 students consented to their child's participation (50.7%). Parents of 875 (40.8%) refused to allow their child to participate, and parents of 177 (8.5%) either did not make a commitment or verbally consented over the phone but did not provide a written consent. Reasons for refusal included the following: consent returned with a "No" checked (34.7%), the family was too busy and the study was for too many years (9.5%), the parent did not want the child exposed to drug information (1.6%), the child was too shy or it was too stressful on the child (25.5%), the parent had legal concerns (3.1%), and the parent was not interested in hearing about the study (25.6%). Although this participation rate was less than desirable, it was not much lower than that of other epidemiological community-based studies (e.g., 60.1% [the Oregon Adolescent Depression Project], Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993; 52% [the Socialization of Problem Behavior in Youth Project], Jessor & Jessor, 1977) in which informed active consent is required.

Participants

Participants at T1—Of the 1,075 T1 students for whom we obtained parental consents, 1,070 children completed the first assessment. The remaining five students were absent on the assessment day. An average of 215 students per grade (first through fifth) participated in the study at T1 with an even distribution by sex (50.3% female, $N = 538$). At the time of the first assessment (T1), participants were an average of 9.0 years old ($SD = 1.45$), 71% of mothers and 66% of fathers had more than a high school education, and 7% of mothers and 11% of fathers had not graduated from high school. The sample was primarily European American (85.8%), with 7.1% Hispanic American, 1.1% African American, 2.2% Asian American, 2.4% American Indian or Alaskan Native, and 1.7% other or of mixed race or ethnicity. Forty percent of the sample was eligible for a free or reduced lunch under Title 1.

Representativeness of students—The T1 participants were comparable to elementary students in the district on race or ethnicity (including European American, Hispanic American, and other, $\chi^2(2, N = 1,070) = .303, ns$, and on participation in the free or reduced lunch program under Title 1, $\chi^2(2, N = 881) = 3.73, ns$. According to test scores on required achievement tests given to third and fifth graders, participants had significantly higher achievement scores in both reading and math than all students in the school district, third-grade reading: 214 vs. 210 (district), $t(179) = 3.93, p < .001$; math: 210 vs. 206 (district), $t(190) = 4.37, p < .001$; fifth-grade reading: 220 vs. 218, $t(190) = 2.33, p < .05$; fifth-grade math: 220 vs. 217, $t(186) = 4.32, p < .001$. This difference is not surprising as parent involvement is a primary predictor of academic achievement (Hess & Holloway, 1984; Wentzel, 1994) and in this study, parents, as well as children, were asked to complete questionnaires. T1 participants were also comparable to those children sampled but who did not participate on sex and grade.

We also compared the prevalence of use of all five substances in the past 30 days among sixth graders at the second assessment (T2) to data collected in the year 2000 (the same year as the T2 assessment) from public school students in the same region in Oregon (Oregon Alcohol and Drug Abuse Program of the Department of Human Services in the State of Oregon, 2000). The T2 sixth graders in this study were comparable to sixth graders from the Oregon study on the 30-day prevalence of cigarette use, alcohol use, use of smokeless tobacco, and use of marijuana. However, a significantly higher proportion of the Oregon sample used inhalants in the past 30 days than did the participants in this study, 5.8% vs. 1.5%; $\chi^2(1, N = 196) = 6.54, p < .05$.

Attrition—Forty-eight children who participated in the T1 assessment, did not participate in the third assessment (T3; 4.5% of the total sample). Among these individuals, parents of 15 children requested that their child be dropped from the study, 8 parents who initially had consented were no longer the custodial parent and we could not obtain consent from the new

custodial parent, 1 family moved to Africa, and 24 families were lost to follow-up. A comparison of the children who participated in the study at T3 with children who did not participate at T3 showed no differences at T1 on report of trying alcohol, marijuana, or inhalants or intention to use alcohol, marijuana, cigarettes, smokeless tobacco, or inhalants in the future. However, those who did not participate at T3 were more likely to report trying cigarettes, 10.4% vs. 1.5%; $\chi^2(1, N = 1,070) = 6.03, p < .01$, and smokeless tobacco, 8.3% vs. 2.4%; $\chi^2(1, N = 1,070) = 6.03, p < .05$, at T1. Participants were similar to nonparticipants in grade or sex. However, those who did not participate at T3 were more likely to receive a free or reduced lunch: participants: 48.2%; nonparticipants: 67.5%; $\chi^2(1, N = 716) = 8.11, p < .01$; and were less likely to be European American: 73.6% vs. 86.1%; $\chi^2(1, N = 1,075) = 8.96, p < .05$. In addition, parents of nonparticipating T3 children were less likely to complete the T1 assessments (47.2%) than parents of participants (95.1%).

Assessment Procedures

At T1, all consenting students were assessed at their school during the school day. If students were absent on the assessment day, they were assessed on a make-up day. At T2 and T3, the assessment location varied depending on where the student currently attended school. If students attended school within the targeted school district, they were assessed at school. If they lived outside the district but within driving range of the Oregon Research Institute, they were assessed at the Institute. If they did not live within driving range, fourth and fifth graders were assessed via the telephone and second and third graders were not assessed until they entered fourth grade.

The first through third grade assessment was an individual interactive structured interview. This interview used a procedure similar to that used by Blinn-Pike et al. (1993) and Jahoda and Cramond (1972), wherein children put pictures of each substance in one of three labeled boxes that correspond to their answers. Fourth through seventh graders answered a written questionnaire in group sessions. For fourth and fifth graders, a trained monitor read the questions aloud to the group and another monitor answered questions on an individual basis; for sixth and seventh graders, children read the questions to themselves and a trained monitor was available to answer questions. If children in the sixth or seventh grade could not read the questionnaire to themselves, the monitor read it to them. Items asked were similar across grades.

Measures—First through third graders were shown a series of pictures depicting cigarettes, smokeless tobacco (an open tin and tobacco), alcohol (wine, beer, hard liquor), inhalants (glue, gasoline, whippets), and marijuana (a pipe, a joint, a baggie). The children were asked if they could identify the item in each picture and knew its use. Each child was scored as identifying the substance if he or she could name it or describe its effects. If the child indicated that he or she could identify a specific drug, he or she was asked “Have you ever tried it?” and if answered affirmatively, “Have you ever tried it without your parents knowing?” Each child indicated his or her response by putting the picture of the substance in one of three boxes, labeled “yes,” “no,” and “maybe.” If he or she identified the drug, the child’s intention regarding future use of the drug was also assessed in this manner, using the items described later. If the child did not identify the drug, he or she was not asked further questions about it. The responses of these children were scored as not trying the drug and not intending to try the drug in the future. To assess prevalence of trying each substance, children in the fourth through seventh grade were asked if they had ever tried a cigarette or cigar, chewing tobacco, alcohol, inhalants, or marijuana.

To assess future intentions, all children were asked the following: “Do you think you would (smoke, drink alcohol, etc.) when you are grown-up?” and “when you are a teenager?” A “yes”

or “maybe” answer to either of these two questions was considered an intention to use in the future. For first through third graders, the correlation (ϕ) between these two items ranged from .42 to .61; for fourth and fifth graders, from .41 to .63; and for sixth and seventh graders, from .43 to .70.

Results

Intraclass Correlation of Substance Use Variables Within School

In the primary study, students were originally recruited from 15 elementary schools. A standard assumption of most analytic methods is that the data are obtained from a random sample from a given population (in this case the school district) with independence of observations. If there is substantial intragroup dependence within schools, the assumption of independent observations is violated, resulting in a decrease in the standard error and an increase in the probability of a Type I error. Thus, our preliminary analyses included an examination of the intraclass correlation (ICC) within school at the T1 assessment for intention and substance use. The ICC within school for trying alcohol was .005; for cigarettes it was .014, for chewing tobacco it was .004, for marijuana it was .005, and for inhalants it was $-.003$. For intention to use alcohol as a teen, the ICC was .014; for cigarettes it was .005, for smokeless tobacco it was .003, for marijuana it was $-.003$, and for inhalants it was $-.004$. The ICC within schools for intention to use alcohol as an adult was .011; for cigarettes it was .020, for smokeless tobacco it was .004, for marijuana it was $-.002$, and for inhalants it was $-.001$. The size of these ICCs suggests little clustering within school and only a small effect of the ICC on the standard error of the estimate in analyses collapsing across schools.

Examination of Cohort Effects

As shown in Table 1, there were two overlapping cohorts (based on grade at T1) in the second and sixth grade and three cohorts in the third through fifth grade. We used the chi-square statistic to examine differences in prevalence and intention between T1 grade cohorts at each grade level by sex. Similarities in proportions across cohorts provide evidence for the validity of the prevalence estimates. We sought to minimize the probability of Type II errors by increasing our alpha level to .10 for these analyses. Analyses suggest a few differences between cohorts on prevalence of trying each substance or intention across grade levels for both boys and girls. Boys who were in the first grade at T1 were more likely to report trying alcohol when in the second grade (22.1%) than boys in the second grade (9.3%) at T1, $\chi^2(1, N = 201) = 6.5$, $p < .05$. These same boys (first graders at T1) were also more likely to report trying alcohol when in the third grade (21.7%) than boys in second grade (12.5%) or third grade (11.3%) at T1, $\chi^2(2, N = 293) = 4.8$, $p < .10$. As first graders at T1, these boys also reported a relatively high rate of alcohol use at T1 (see Table 3). Boys who were in the fourth grade at T1 were more likely to report trying chewing tobacco (5.5%) in the fourth grade than boys in the second grade (1.0%) or third grade (0.5%) at T1, $\chi^2(2, N = 308) = 8.1$, $p < .05$. These same boys (fourth graders at T1) were also significantly more likely to report that they had tried inhalants (16.5%) in the fourth grade than boys who were in the second grade (12.6%) or third grade (3.2%) at T1, $\chi^2(1, N = 307) = 9.57$, $p < .01$. These boys (fourth graders at T1) were also more likely to report trying inhalants in the fifth grade (8.2%) than the other two cohorts (third graders at T1, 3.1%; fifth graders at T1, 1.8%), $\chi^2(1, N = 316) = 5.82$, $p < .10$.

Boys who were in the fourth grade at T1 were also more likely to report trying inhalants without parents' knowledge (8.3%) in the fourth grade than boys in the third grade at T1 (0%) or boys in the second grade (4.9%) at T1, $\chi^2(2, N = 307) = 8.0$, $p < .05$. These same boys, in the fifth grade were also more likely to report trying inhalants without parents' knowledge than the other two cohorts (3.6% vs. 1.0% and 0.0% for third and fifth graders at T1, respectively), $\chi^2(2, N = 316) = 4.9$, $p < .10$.

Girls in the third grade at T1 were more likely to report trying chewing tobacco at the fifth grade assessment (4.9%) than girls in the fourth or fifth grade at T1 (0.0% for both cohorts), $\chi^2(2, N = 297) = 9.6, p < .01$. Girls who were in the third grade at T1 were more likely to report intention to use cigarettes (12.7%) when in the third grade than those in the second grade (10.3%) or first grade (12.7%) at T1, $\chi^2(2, N = 318) = 8.49, p < .05$. Girls who were in the fifth grade at T1 were more likely to report intention to use alcohol (58.1%) in the fifth grade than girls in the fourth grade (45.3%) at T1, $\chi^2(1, N = 188) = 3.08, p < .10$.

Thus, cohort effects were specific for each sex and for specific substances. Boys in the first grade at T1 were more likely to report trying alcohol across all assessments than were the other cohorts, and boys in the fourth grade at T1 were more likely to report trying chewing tobacco in the fourth grade and inhalants in both the fourth and fifth grade than the other cohorts. Girls in the third grade at T1 were more likely to report intention to smoke in the third grade and trying chewing tobacco than the other cohorts. Girls in the fifth grade at T1 were more likely to report intention to use alcohol in the fifth grade than the other cohorts.

Consistency of Responses Across Time

For responses to be consistent, if students reported trying at T1, they should have also reported trying at subsequent assessments. If students reported trying at T1, inconsistent responses at subsequent assessments were not changed, as the accuracy of the report at each assessment was unknown. However, the proportion of respondents who reported that they had tried using the substance at T1 but reported that they had not tried using the substance at either T2 or T3 was of interest. Consistent reporting across assessments was less than ideal but was higher for the substances with the higher prevalence, alcohol and cigarettes. Among those who reported trying the respective substance at T1, 85% of each sex reported trying alcohol, and 73% of the girls and 57% of the boys reported trying cigarettes at T2 or T3. For substances with lower initial prevalence, consistency between responses across time was much lower. Among those who reported trying the substance at T1, 50% of the girls and 32% of the boys reported trying chewing tobacco, 50% of both boys and girls reported trying marijuana, and 12% of the girls and 42% of the boys reported trying inhalants at T2 or T3.

In further analyses we examined consistency by cohort (the grade of the respondent at T1). Because the number of students who tried each substance was small, we increased our alpha to .10 for these analyses. Among girls who initially reported trying, there were no differences in the proportion responding consistently by cohort for any of the substances. Among boys, for cigarette use, consistency increased with the grade of the child at T1, $\chi^2(1, N = 21) = 8.78, p < .10$. For example, among boys who reported trying cigarettes at T1, none of the first- and second-grade cohorts reported trying at T2 or T3, whereas 85% of the fifth-grade cohort reported trying at T2 or T3. For alcohol, consistency also varied with cohort, $\chi^2(1, N = 92) = 11.48, p < .05$. Consistency was again highest for the fifth grade cohort (97%) and was lowest for the third grade cohort (56%). There were no differences in the proportion responding consistently by grade for the other substances. The lower consistency among the less prevalent substances affects our confidence in the estimates of prevalence of the use of these substances in the elementary years.

Overview of Analysis of Prevalence

Prevalence estimates by grade and sex are presented in Tables 2 through 5. We used logistic regression to investigate the effects of sex and age and their interaction on the recognition of substances and prevalence of trying and intention toward using each substance. Significant interactions were further investigated using techniques recommended by Aiken and West (1991). If the interaction with sex or age was not significant, it was removed from the equation using backwards elimination ($p < .05$). Only significant effects are reported.

Identification of each substance—The proportion of first through third graders correctly identifying each substance from a picture shown to them is given in Table 2. The proportion identifying cigarettes (odds ratio [OR] = 1.56, 95% confidence interval [CI] = 1.07, 2.28; $p < .05$), alcohol (OR = 1.52, 95% CI = 1.19, 1.95, $p < .01$), smokeless tobacco (OR = 1.56, 95% CI = 1.33, 1.83, $p < .001$), and inhalants (OR = 2.64, 95% CI = 1.32, 5.31, $p < .01$) increased significantly with grade. More boys than girls identified alcohol (boys: 94.2%; girls: 83.2%; OR = 2.20, 95% CI = 1.44, 3.34; $p < .001$) and inhalants (boys: 3.6%; girls: 0.9%; OR = 4.12, 95% CI = 1.65, 10.23, $p < .01$). For the identification of marijuana, there was a significant interaction of sex and grade, $\chi^2_{\text{difference}}(1, N = 1258) = 7.48, p < .01$. Further investigation of this interaction showed no sex differences in identification among first and second graders, but third-grade boys were significantly more likely to identify marijuana than third-grade girls (25.2% vs. 16.4%; OR = 1.69, 95% CI = 1.15, 2.46, $p < .01$).

Prevalence of trying each substance—The proportion of students reporting that they had tried each substance by sex and by grade is given in Table 3. Across sexes, the prevalence of trying cigarettes (OR = 1.79, 95% CI = 1.60, 2.00, $p < .001$), trying marijuana (OR = 2.30, 95% CI = 1.74, 3.06, $p < .001$), and trying inhalants (OR = 1.33, 95% CI = 1.18, 1.50, $p < .001$) increased significantly with grade. As shown in Table 3, across all substances, the largest increases in prevalence occurred between the third and fourth grades and between the fifth and sixth grade. Across grades, the odds of trying smokeless tobacco were significantly higher among boys than girls (2.9% vs. 0.7%; OR = 2.11, 95% CI = 1.29, 3.45, $p < .01$). The results of logistic regression analyses showed a significant interaction of sex with grade for trying alcohol, $\chi^2_{\text{difference}}(1, N = 3091), 11.72, p < .001$. Investigation of this grade by sex interaction showed that the odds of boys trying alcohol in the early grades were significantly higher than the odds for girls (first grade: 19.3% vs. 4.3%; OR = 2.65, 95% CI = 1.69, 4.17, $p < .001$; second grade: 15.3% vs. 7.8%, OR = 2.16, 95% CI = 1.53, 3.06, $p < .001$; third grade: 15.0% vs. 8.8%, OR = 1.76, 95% CI = 1.37, 2.28, $p < .001$). There were no sex differences for trying alcohol for older children.

As shown in Table 3, there was an apparent decrease in the report of lifetime use (trying) among boys between the first and second grade for cigarettes, alcohol, and chewing tobacco. This decrease was primarily due to a cohort effect. A greater proportion of boys who were in the first grade reported trying at T1 and continued to report trying substances at T2 and T3. Cohorts who were in the second and third grade at T1 reported trying at lower rates at T2 and T3. The difference between cohorts at these assessments was significant only for alcohol. Also apparent in Table 3 was the increase in inhalant use in the fourth grade only. This single high point could be due to both a cohort effect for boys and inconsistency in responding for both boys and girls. As noted earlier, report of inhalant use was the least consistent of all of the substances. Children in fourth grade may not have fully understood what “huffing” meant, but by fifth grade children may have learned about this substance in drug education classes.

Across sexes, the prevalence of trying cigarettes (OR = 2.00, 95% CI = 1.72, 2.34, $p < .001$), marijuana (OR = 2.85, 95% CI = 2.00, 4.06, $p < .001$) and inhalants (OR = 1.50, 95% CI = 1.24, 1.82, $p < .001$) without parents’ knowledge varied significantly with grade (see Table 4). More boys than girls tried smokeless tobacco without parents’ knowledge (OR = 3.24, 95% CI = 1.05, 9.95, $p < .05$). The interaction of grade with sex was significant for trying alcohol without parents’ knowledge, $\chi^2_{\text{difference}}(1, N = 3091) = 10.21, p < .001$. The prevalence of trying alcohol without parents’ knowledge was higher for boys than girls in first grade (OR = 19.26, 95% CI = 3.33, 111.5, $p < .01$), second grade (OR = 11.00, 95% CI = 2.67, 45.12, $p < .001$), third grade (OR = 6.29, 95% CI = 2.14, 18.46, $p < .001$), fourth grade (OR = 3.60, 95% CI = 1.67, 7.73, $p < .01$), and fifth grade (OR = 2.05, 95% CI = 1.22, 3.45, $p < .01$). There were no sex differences among older students. Similar to the report of trying, Table 3 shows a slight decrease in report of trying cigarettes, alcohol, and chewing tobacco without parents’

knowledge across the early grades. Again, this decrease can be attributed to the higher prevalence of use for boys in the first grade at T1.

Intention to use substances in the future—As shown in Table 4, intention to smoke cigarettes (OR = 1.10, 95% CI = 1.04, 1.18, $p < .01$), use marijuana (OR = 1.45, 95% CI = 1.26, 1.66, $p < .001$), and use inhalants (OR = 1.22, 95% CI = 1.06, 1.41, $p < .01$) as a teen or as an adult varied significantly with grade. Significantly more boys than girls said they would smoke cigarettes (OR = 1.43, 95% CI = 1.17, 1.76, $p < .001$) and chew tobacco (OR = 2.32, 95% CI = 1.59, 3.39, $p < .001$) when older. The interaction of grade with sex was significant for intention to use alcohol, $\chi^2_{\text{difference}}(1, N = 3091) = 12.34, p < .001$. More boys than girls intended to use alcohol in the lower grades, including first grade (OR = 2.26, 95% CI = 1.63, 3.15, $p < .001$), second grade (OR = 1.92, 95% CI = 1.49, 2.46, $p < .001$), third grade (OR = 1.62, 95% CI = 1.35, 1.95, $p < .001$), and fourth grade (OR = 1.37, 95% CI = 1.18, 1.59, $p < .001$). There were no sex differences among students in intention to use alcohol in the higher grades.

The Relation Between Intention and Trying

A visual comparison of the proportions who reported trying and the proportions who reported intention shows that across substances intention clearly exceeds trying in the early years, but the differences between proportions become smaller as the children age, becoming nearly identical in seventh grade. We used logistic regression to investigate the effects of intent at T1 on trying at T3. For this analysis, intent to use in the future was considered positive if children responded “yes” or “maybe” to either question assessing intent to use as a teen or intent to use as an adult. All analyses controlled for age and sex and investigated the interaction between intent and age and sex. Significant interactions were further investigated using techniques recommended by Aiken and West (1991). If the interaction with sex or age was not significant, it was removed from the equation using backwards elimination ($p < .05$).

Intention to try cigarettes at T1 significantly predicted trying cigarettes at T3 (OR = 1.51, 95% CI = 1.09, 2.08, $p < .05$), across grades and for both sexes. In the prediction of alcohol use, the intention by age interaction was significant, $\chi^2_{\text{difference}}(1, N = 3091) = 12.11, p < .01$. Intention predicted subsequent trying of alcohol for those in the second grade or higher for both sexes (second grade: OR = 1.46, 95% CI = 1.21, 1.76, $p < .001$; third grade: OR = 1.79, 95% CI = 1.51, 2.12, $p < .001$; fourth grade: OR = 2.20, 95% CI = 1.76, 2.75, $p < .001$; fifth grade: OR = 2.70, 95% CI = 1.96, 3.72, $p < .001$). Intention to use the respective substance did not significantly predict trying smokeless tobacco, marijuana, or inhalants. Perhaps the lower prevalence of trying these substances among these children limited the predictability of intention.

Comparison of Methods in a Separate Sample

One methodological limitation in the primary data collection was the use of both questionnaires and interviews. To determine the effects of these two methods, data were collected using both methods from a second sample of 60 students in three 4th-grade classes in a nearby rural school district. A passive consent procedure was used to attain parents' permission for their child to participate because all responses were anonymous. Parents of 4 of the 64 children in the classrooms asked that their child not participate. All study participants answered the same questions measuring trying each substance and intention to use the substance in the future using both an interview and a questionnaire, administered in separate sessions 2 weeks apart, counterbalanced to control for a potential order effect. Responses on the questionnaire from the second sample were compared to responses from the primary sample. Participants in the second sample were similar to participants in the primary sample on intention to use cigarettes, alcohol, chewing tobacco, and marijuana in the future. However, participants in the second

sample were significantly more likely to report trying inhalants, 12.5% versus 3.3%; $\chi^2(1, N = 1133) = 14.08, p < .001$; trying inhalants without parents' permission, 4.7% versus 1.1%; $\chi^2(1, N = 1133) = 5.87, p < .05$; and intention to use inhalants when older, 10.9% versus 1.6%; $\chi^2(1, N = 1133) = 25.45, p < .001$.

As shown in Table 5, with the exception of inhalants, there were no significant differences in report of trying substances or in children's intention to use substances when older between those who answered using the questionnaire as compared to the interview. Children were significantly more likely to report that they had tried inhalants, $\chi^2(1, N = 125) = 5.51, p < .05$, and intended to use inhalants in the future, $\chi^2(1, N = 125) = 7.07, p < .01$, on the questionnaire than in the interview. Two weeks following the second session, a discussion group was held with the students. They reported that they felt more comfortable reporting their use and intention on the questionnaire than in the interview.

Discussion

This is one of the first systematic longitudinal studies to examine the use of cigarettes, smokeless tobacco, alcohol, marijuana, and inhalants identification of these substances and intention to use these substances in the future in children in the first through seventh grade. Although the study has several strengths, including a cohort-sequential design and low attrition, it is limited in several ways. The finding of cohort effects for some substances and inconsistencies in responding for other substances affects our ability to rely fully on the estimates reported herein. Despite these limitations, the overall trends are informative.

Almost all first through third graders identified alcohol and cigarettes, suggesting that they have had either direct exposure to these substances or have learned about them through the media. Reflecting the lower prevalence of the use of smokeless tobacco than cigarettes, only about one fourth of first graders identified this substance, with the proportion recognizing it increasing to about half by third grade. Very few young children identified marijuana and even fewer identified inhalants, but again, the proportion identifying these substances increased with grade. Because only those who correctly identified a substance were asked further questions about the substance, the design of this study prevented an investigation of the association between recognition and intentions. This is unfortunate, as recognition is most likely an initial step in the etiological process.

With few exceptions, the proportion trying substances, trying without parents knowing about it, and reporting intention to try substances in the future increased with age, with a notable increase between the third and fourth grade and a higher increase between the fifth and sixth grade. The increase between fifth and sixth grade is easy to explain from both a contextual and developmental viewpoint. This grade transition reflects a transition from elementary to middle school, where substance use, in general, is more prevalent. In sixth grade, children enter early adolescence, which is the developmental phase characterized by individuation and separation from parents. Substance use may be one mode to establish the preadolescent's identity.

In this Oregon-based sample, we found a prevalence of trying cigarettes, alcohol, and marijuana among fourth and fifth graders that was similar to that of a western Canadian sample (Porter-Serviss et al., 1994) but less than that of Texas (Fournet et al., 1990) and New England (Grady et al., 1986; Stevens et al., 1991) samples. Similar regional differences in alcohol and cigarette use are evident in the 1999 Monitoring the Future Study among eighth graders (the same year this data was collected). The Monitoring the Future Study reported a lower prevalence of use of cigarettes and alcohol among students in the western region of the United States than among students in the northeastern or southern regions (Johnston et al., 2000). However, in contrast, marijuana use was higher in both the western and northeastern parts of the country. Children

in Oregon may initiate marijuana when older, rather than as early as sixth grade, as shown in the New England studies. The reasons for this regional variation in use are unknown. National studies (Johnston, O'Malley, & Bachman, 2002; USDHHS, 2000) show differences in prevalence of use as a function of race or ethnicity, population density, socioeconomic level, employment status, college plans, and educational attainment. One could conjecture that these factors play a role in explaining this regional variation, but, as noted by Johnston et al., the interrelations among these factors are complex.

Boys, in general, were more likely than girls to report trying alcohol and smokeless tobacco at an early age, trying alcohol without parents' knowledge, and intending to try both alcohol and cigarettes when older. The sex difference in use of smokeless tobacco is reflective of the gender difference in use of this substance in the general population (USDHHS, 2001). The sex differences in alcohol use are consistent with previous research showing a sex difference favoring boys in heavier alcohol use in adolescence (USDHHS, 2001) and in early alcohol use (in elementary school) without parental permission (Johnson et al., 1995). Johnson et al. showed that early alcohol users tend to have higher levels of conduct problem behaviors and are at more risk for an increase in problem behaviors throughout childhood and as they transition into early adolescence. Thus, the sex difference in prevalence, as well as intention, found in our sample may have important prevention implications.

The prediction of trying alcohol and cigarettes from intention and the decreasing disparity in trying and intention across the elementary years shown in our analyses imply that, as suggested by Pierce, Choi, Gilpin, Farkas, and Merritt (1996), intention may be a first step in the initiation and maintenance of substance use. Thus, intention can be viewed as an early warning sign, particularly in the early elementary years, of subsequent initiation of substances. Intention may also be useful as an outcome measure in the design of substance use prevention programs targeting elementary school children.

The large increase in intention and the smaller increase in trying between the third and fourth grade led us to question whether these changes across grade were partially due to the assessment method. Thus, data from a second sample investigated the effect of assessment method on responding. Although the change in assessment methods can partially explain the increase in inhalant use and intention between the third and fourth grade, the results suggest that the change in assessment methods does not explain the increase in trying other substances or intention to use other substances in the future between the third and the fourth grade.

The inconsistency in responses for the less prevalent substances is somewhat disturbing. It is unknown whether the child answered incorrectly when he or she was younger, perhaps not understanding it the question, or answered it incorrectly when he or she was older. Thompson's (1990) review suggested that the self-report of older children may be less reliable than younger children due to demand characteristics and an increased need for privacy. That inconsistency occurred most often for the less normative and acceptable substances supports this contention. In contrast, for the more prevalent substances, alcohol and cigarettes, responses of the older cohorts were more consistent, suggesting that for these substances children could have erred in their report in the earlier assessment when they were younger. Research is needed to further explore the reliability of children's self-reports of substance use and the reasons for inconsistencies across time.

Several limitations relating to the methodology of the study are worth noting. First, although we felt it necessary to use an interactive interview with young children, the change in assessment method from an interview in the third grade to a questionnaire in the fourth grade could affect the children's responses. Our test of the effects of this change in methodology suggested that, with one exception, reports of trying and intention were similar across

assessment methods. Second, if children did not recognize a substance, they were asked no further questions about it. This restriction limited our ability to assess intention and trying among these young children and to investigate the relation between identification of a substance and trying and intention. Perhaps children would have tried or intended to try a substance, even though they did not recognize it. Third, substance use was based on self-report with no biochemical verification. Fourth, the proportion of students recruited to the study was relatively low (51%), and recruited students had higher scores on achievement test scores than other students in the district. Fifth, although attrition was low, those who left the study had more risk factors (had tried tobacco, low family income, less involved parents) and therefore may be more likely to use substances as they get older.

Despite these limitations, the study's findings have direct implications for the timing and design of prevention strategies. The increase in the prevalence of trying substances in the late elementary years suggests that prevention efforts must continue to target the elementary years. Whether prevention should occur prior to the increase in trying or intention (e.g., in fourth or fifth grade) or immediately after the increase is an empirical question. Because intention is related to subsequent use of cigarettes and alcohol, this study suggests intention may serve as an important outcome in early childhood substance use prevention programs, prior to initiation of the substance. Boys appear to be at particularly high risk for alcohol and tobacco use in the early elementary years, suggesting targeted interventions may be needed for them.

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Table 1

Sample Size at Each Grade for Each Cohort

Cohort (Grade at T1)	Current School Grade						
	1	2	3	4	5	6	7
1	224	195	193				
2		223	211	211			
3			208	203	199		
4				210	207	205	
5					207	97	194
Total	224	418	612	624	613	402	194

Note: Students who repeated grades and skipped grades are included with their current cohort except for those students in grades not assessed during that year.

Table 2
Percentage of Students Recognizing Each Substance

Substance	Grade 1		Grade 2		Grade 3	
	Boys	Girls	Boys	Girls	Boys	Girls
Cigarettes	95.4	93.1	96.5	95.9	97.3	97.8
Alcohol	92.7	82.8	92.6	85.4	95.9	92.1
Chewing tobacco	29.4	25.0	30.7	28.8	47.6	41.5
Marijuana	0.4	11.2	12.4	14.6	25.2	16.4
Inhalants	0.9	0	3.0	0	5.1	1.9

Note: Fourth and fifth graders were not asked to identify substances.

Table 3

Percentage of Students Reporting That They Tried Each Substance

Substance	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Grade 7	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Cigarettes	3.7	0.9	1.5	0.9	1.7	1.9	3.9	4.4	5.4	6.4	13.1	15.9	18.1	19.1
Without parent knowledge	0.9	0.9	0	0.5	0.3	1.3	1.6	2.2	3.5	2.7	7.5	11.6	10.0	12.8
Overall	19.3	4.3	15.3	7.8	15.0	8.8	20.3	21.4	27.8	25.6	47.9	42.3	50.0	54.3
Alcohol	2.8	0.9	2.0	0.5	1.7	0.3	1.0	0.6	2.8	0.7	8.5	6.3	15.0	19.1
Without parent knowledge	3.7	0.9	3.0	2.7	1.7	1.6	2.3	0.6	4.1	1.7	4.7	1.6	5.0	2.1
Overall	0.9	0	0.5	1.4	1.0	0.3	0.3	0	0.3	0	1.4	0	3.0	1.1
Chewing tobacco	0	0	0	0	0	0	1.0	1.3	0.9	1.0	3.3	1.1	9.0	3.2
Without parent knowledge	0	0	0	0	0	0	0.6	0.3	0.9	0.7	2.8	1.1	9.0	3.2
Overall	0	0	0	0	0.3	0	10.7	10.1	4.4	3.0	4.7	3.7	4.0	3.2
Marijuana	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2
Without parent knowledge	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2
Overall	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2
Inhalants	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2
Without parent knowledge	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2
Overall	0	0	0	0	0.3	0	4.2	2.5	1.6	1.3	2.3	1.6	4.0	3.2

Note: If students in the first through third grades did not identify the substance, the students were not asked whether they had tried the substance. B = boys; G = girls.

Table 4
Percentage of Students Reporting That They Would Use a Substance When a Teen or an Adult

Substance	Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade 6		Grade 7	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Cigarettes	20.2	15.5	12.4	8.7	8.5	8.5	18.5	13	18.7	12.5	21.6	14.3	17.8	18.1
Alcohol	33.0	22.4	35.1	16.0	33.7	23.9	37.3	39.2	41.5	31.6	52.1	51.3	50.5	57.4
Chewing tobacco	6.4	1.7	4.5	0	5.4	1.9	4.9	7.3	6.6	2.7	6.1	0.5	9.5	1.1
Marijuana	0.9	0	1.5	0.5	1.0	0.6	3.6	7.0	3.2	2.0	6.6	2.1	9.9	5.3
Inhalants	0	0	0	0	0	0	6.5	10.1	1.9	2.4	1.9	1.1	1.0	2.1

Note: *Maybe* and *yes* were both scored as positive responses to this question. If students in the first through third grades did not identify the substance, this question was not asked and was coded as a *no*. B = boys; G = girls.

Table 5
Percentage of Students in the Second Study Reporting Trying and Intention to Use Each Substance for Each Method of Assessment

Substance	Variable	Questionnaire ^a		Interview ^b	
		N	%	N	%
Cigarettes	Tried	3	4.7	2	3.3
	Tried without parents knowing	3	4.7	2	3.3
Alcohol	Intention	9	14.1	10	16.4
	Tried	13	20.3	10	16.4
	Tried without parents knowing	2	3.1	2	3.3
	Intention	29	45.3	29	47.5
Chewing tobacco	Tried	3	4.7	3	4.9
	Tried without parents knowing	2	3.1	0	0
	Intention	5	7.8	5	8.2
	Tried	0	0.0	0	0
Marijuana	Tried without parents knowing	0	0.0	0	0
	Intention	2	3.6	0	0
	Tried	8	11.5	1	1.6*
	Tried without parents knowing	3	4.7	0	0
Inhalants	Intention	7	10.9	0	0.0**

^a $n = 64$.

^b $n = 61$.

* $p < .05$.

** $p < .01$.