Early Childhood Misbehavior and the Estimated Risk of Becoming Tobacco-dependent

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In this study, the authors focused on signs of early childhood misbehavior that might be linked to the risk of becoming tobacco-dependent. Standardized teacher ratings of misbehavior were obtained for an epidemiologic sample of first graders entering an urban mid-Atlantic public school system in 1985 and 1986. Fifteen years later, 1,692 of the students were reassessed (nearly 75% of the original sample). As adults, 962 participants indicated that they had tried tobacco at least once; 66% of the 962 had become daily users. Latent class analysis of items on the Fagerström Test for Nicotine Dependence gave evidence of three classes pertinent to tobacco dependence syndrome in smokers by young adulthood: one nondependent class of smokers (50% of smokers), a class of smokers experiencing a moderate number of dependence features (31%), and a third class that was more severely affected (19%), as manifest in the need to smoke immediately after waking and smoking when ill.

With or without adjustment for covariates, higher levels of teacher-rated childhood misbehavior at entry into primary school were associated with a modest excess risk of becoming tobacco-dependent by young adulthood (risk ratio = 1.6, 95% confidence interval: 1.1, 2.5). Interventions that seek to improve childhood behavior might reduce early onset tobacco smoking and risk of tobacco dependence among smokers.

behavior; child; cohort studies; longitudinal studies; risk; smoking; tobacco use disorder

Abbreviation: FTND, Fagerström Test for Nicotine Dependence.

Many tobacco smokers experience a dependence syndrome with co-occurring mental disturbances (obsession-like cravings or urges), disturbances of behavior (compulsion-like repetitions of smoking), and sometimes observable features of neuroadaptation, such as pharmacologic tolerance to nicotine (1). Tobacco dependence may be rooted in an underlying diathesis (e.g., genetic vulnerability shaped by later experience). We studied early childhood signs of misbehavior that might be linked to a risk of becoming tobacco-dependent (2–4).

MATERIALS AND METHODS

Population, sample, and nonresponse

In 1985–1986, 2,311 pupils entered first-grade classrooms in 19 primary schools selected from an urban public school system in a mid-Atlantic US state (5–7). Over 15 years later, nearly 75 percent of the surviving pupils were traced and consented to an interview (n = 1,692), including 154 incarcerated participants. Another 12 percent of the sample was located, but 142 young adults chose not to be interviewed and 133 were not interviewed because of logistic problems (e.g., living out of state with no telephone number, military postings overseas).

A central computerized school database provided data on each child’s sex, birth date, eligibility for a subsidized lunch program, and race/ethnicity (table 1). After exclusion of 32 decedents (verified by National Death Index searches through 2002), there were independent associations of smoking with being male and being nonminority but not with year of entry into first grade (“cohort”), receipt of subsidized lunches, or level of childhood misbehavior (α = 0.05). Mean age at follow-up interview was 21 years (range, 19–24 years). Protocols were approved by cognizant institutional
review boards. Signed consent was obtained from parents initially and from participants at the adult interview.

**Assessment of early childhood misbehavior**

First-grade teachers completed the Teacher Observation of Classroom Adaptation—Revised (8) near the end of the fall quarter for 1,925 pupils (approximately 89 percent of first graders enrolled in these schools). Test-retest correlations were above 0.60 for each subscale of the test (Cronbach’s $\alpha > 0.80$). The childhood misbehavior subscale consisted of 10 six-point Likert items on behaviors such as starting fights, breaking rules, taking others’ property, lying, teasing classmates, being stubborn, yelling at or hurting others, and having trouble accepting authority. In accordance with prior research, we sorted participants into subgroups based on tertiles of the summary score (8).

**Assessment of tobacco involvement and dependence**

Trained interviewers assessed tobacco experiences as part of a 90-minute interview conducted in young adulthood. Participants were classified as smokers if they indicated that they had ever smoked a tobacco product, even just a puff. Tobacco dependence was based on the young adult’s responses to six standardized items on the Fagerström Test for Nicotine Dependence (FTND) (9), which has been validated against biochemical indices (10, 11). Dependence features assessed by the FTND are: 1) “How soon after waking up do you smoke your first cigarette?”; 2) “Do you find it difficult to refrain from smoking in places where it is forbidden?”; 3) “Which cigarette would you hate to give up?”; 4) “How many cigarettes a day do you smoke?”; 5) “Do you smoke more frequently during the first hours after waking than during the rest of the day?”; and 6) “Do you smoke if you are so ill that you are in bed most of the day?”.

**Analysis**

After initial cross-classification analysis, the relative odds of tobacco involvement associated with levels of childhood misbehavior were estimated by means of logistic regression models in which other covariates were held constant. Latent

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**TABLE 1.** Characteristics of the baseline and follow-up samples in relation to occurrence of tobacco smoking among students in an urban public school system, 1985–2002

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Total</th>
<th>Female</th>
<th>Male</th>
<th>Lowest tertile</th>
<th>Middle tertile</th>
<th>Highest tertile</th>
<th>Missing data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Minority</td>
<td>1,550</td>
<td>67.1</td>
<td>1,218</td>
<td>72.0</td>
<td>619</td>
<td>64.3</td>
<td>343</td>
</tr>
<tr>
<td>Nonminority</td>
<td>761</td>
<td>32.9</td>
<td>474</td>
<td>28.0</td>
<td>343</td>
<td>35.7</td>
<td>343</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Receipt of subsidized lunch in the first grade§</th>
<th>No</th>
<th>Yes (free or reduced-cost lunch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-grade cohort</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (1985)</td>
<td>1,196</td>
<td>51.8</td>
</tr>
<tr>
<td>2 (1986)</td>
<td>1,115</td>
<td>48.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Childhood misbehavior rating¶</th>
<th>Lowest tertile</th>
<th>Middle tertile</th>
<th>Highest tertile</th>
<th>Missing data#</th>
</tr>
</thead>
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<tr>
<td></td>
<td>712</td>
<td>688</td>
<td>655</td>
<td>256</td>
</tr>
<tr>
<td></td>
<td>30.8</td>
<td>29.8</td>
<td>28.3</td>
<td>11.1</td>
</tr>
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<td></td>
<td>254</td>
<td>290</td>
<td>300</td>
<td>185</td>
</tr>
<tr>
<td></td>
<td>25.6</td>
<td>30.1</td>
<td>31.2</td>
<td>10.9</td>
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<tr>
<td></td>
<td>51.0</td>
<td>56.5</td>
<td>61.5</td>
<td>63.2</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>1.3</td>
<td>1.5</td>
<td>1.7</td>
</tr>
</tbody>
</table>

* Data were obtained from 1,692 participants originally recruited in 1985–1986 at the time of entry into first grade. Students were followed up in 2000–2002.
† For the adjusted relative odds estimates, the model included all listed covariates and took classroom-level clustering design effects into account. For the unadjusted estimates, classroom-level clustering was taken into account, but no covariate terms were included in the regression equation.
‡ RO, relative odds; CI, confidence interval.
§ Data on the subsidized-lunch status of six children were missing at baseline.
¶ Childhood misbehavior was rated in the fall of first grade according to the Teacher Observation of Classroom Adaptation—Revised (8).
# Ratings of misbehavior were missing because of students transferring to other schools and circumstances in which the teacher could not complete the ratings.
class analysis was used to identify subgroups of smokers on the basis of their patterns of response to the FTND items (12–15). Alternative forms of the unobserved latent class variable were fitted to the data using Latent GOLD, version 2.0 (Statistical Innovations, Inc., Belmont, Massachusetts) (16). Conventional goodness-of-fit statistics were used in the model choice process, with probes for the standard assumption of local independence between observed variables, once the latent classes had been specified (17, 18).

Respondents were assigned to a specific tobacco dependence class based on modal class membership probabilities: a nondependent class of smokers, a class of smokers experiencing a moderate number of dependence features, and a third class of persons more severely affected. A multinomial logistic regression model yielded estimates of association linking earlier childhood misbehavior with risk of becoming tobacco-dependent among persons who had smoked at least once, before and after adjustment for covariates (e.g., age, sex, and minority group status).

In a postanalysis exploratory stage, we explored male-female differences in the strength of the observed association. We found that models with covariate terms for primary school intervention status did not yield appreciably different estimates. To accommodate the clustering of students within schools, we used a variant of the Huber-White sandwich estimator of variance to obtain robust standard errors and variance estimates (19).

### RESULTS

In young adulthood, 962 respondents reported that they had smoked tobacco (at least a puff), and 66 percent of them smoked tobacco daily. A higher level of childhood misbehavior was modestly associated with cumulative occurrence of tobacco use by young adulthood (table 1).

Latent class models were fitted to the FTND responses for persons who had smoked at least once. A three-class model fitted the data best, with the classification accuracy proportion being acceptably high for each class: 0.93 for class 1, 0.86 for class 2, and 0.85 for class 3. Classes differed mainly in relation to a severity dimension (increase in the prevalence of items from class to class). Class 1 included one half of our ever smokers, those reporting very few dependence features (the mean value was between 0 and 1). The mean number of dependence features reported by smokers in class 3 (an estimated 19 percent of the ever smokers in this sample) was 3.5. The intermediate class, class 2, included 31 percent of the ever smokers, who appeared to have developed a less severe form of tobacco dependence (mean number of features = 2.2). Alternately, class 2 may be a prodromal class of persons who are more susceptible to a future shift toward class 3 or are more likely to quit smoking than class 3.

With respect to the primary study hypothesis about early childhood misbehavior relative to later risk of becoming tobacco-dependent, the evidence from multinomial regres-
sion analysis was supportive, but the association was no more than modest (table 2). Estimates based on a model including a product term for sex indicated that females with teacher ratings in the highest tertile of misbehavior were almost twice as likely to have developed the more severe tobacco dependence syndrome as females in the lowest tertile. Smaller differences, some opposite, were found when class 2 smokers were contrasted with class 1 smokers. Males with higher misbehavior ratings were more likely to be in both tobacco dependence syndrome classes (table 2).

**DISCUSSION**

The results of this study provide modest support for a link between early childhood misbehavior and risk of tobacco dependence by young adulthood. It seems remarkable that a 10-item teacher rating of misbehavior obtained soon after the start of first grade is predictive.

Strengths of this study included a predefined study base, standardized ratings of childhood misbehavior by the first-grade teacher, and independent standardized assessment of tobacco dependence in young adulthood. Our latent class approach required no arbitrary specification of cutoff scores for designating tobacco-dependent cases versus noncases.

Major limitations were the incomplete participation in young adulthood, possible unmeasured underlying susceptibility factors (e.g., familial influences), and concerns about the FTND. Although the FTND is widely respected for clinical use, its psychometric properties may not hold up in community samples (20, 21). Future work would benefit from qualitative research (22, 23) and refinements encompassing other features of nicotine dependence (24–27).

Previous studies have consistently reported an increased risk of subsequent drug use and dependence associated with conduct problems and antisocial behavior in childhood (28–31), and an association of nicotine dependence with conduct problems was found in a cross-sectional survey of young adults (24). Long-term relations between aggressive, unconventional, and impulsive behaviors and drug involvement have also been found (32–34). However, different pathways between early childhood misbehavior and tobacco involvement may exist. Psychiatric symptoms and cognitive disabilities may be manifest as aggressive behaviors, and smoking may be a response to impulsive tendencies that often co-occur with aggression or misbehavior. Distress and failure to adopt responsible conventional roles and behaviors may be important mediators linking childhood misbehavior to later tobacco dependence (34, 35).

In conclusion, this study supports the notion that early childhood misbehavior can help predict who will become a tobacco smoker and develop tobacco dependence by young adulthood. Evidence from several randomized trials now suggests that programs designed to reduce childhood misbehavior may delay the onset of tobacco use (5, 36).

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**REFERENCES**


