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Early Childhood Misbehavior and the Estimated Risk of Becoming Tobacco Dependent

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Abstract

This study focuses on signs of early childhood misbehavior that might be linked to risk of becoming tobacco dependent. Standardized teacher ratings of misbehavior were obtained for an epidemiological sample of first graders entering an urban mid-Atlantic public school system in 1985 and 1986. Fifteen years later, 1,692 were re-assessed (75% of the original sample). As adults, 962 indicated they had tried tobacco at least once; 66% of the 962 had become daily users. Latent class analysis of the Fagerström Test for Nicotine Dependence items gave evidence of three classes pertinent to the tobacco dependence syndrome in smokers by young adulthood: one non-dependent class of smokers (50% of smokers), a class of smokers experiencing a moderate number of dependence features (31%), and a third class more severely affected (19%), as manifest in needing to smoke right after waking, and smoking when ill. With or without covariate adjustments, higher levels of teacher-rated childhood misbehavior at entry to primary school are associated with modestly excess risk of becoming tobacco dependent by young adulthood (risk ratio = 1.6, 95% CI: 1.1, 2.5). Interventions that seek to improve childhood misbehavior might reduce early onset tobacco smoking and risk of tobacco dependence among smokers.

Keywords

behaviors; cohort study; longitudinal studies; risk; smoking; tobacco dependence

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

MATERIALS AND METHODS

Population, sample, and non-response

In 1985-86, 2,311 pupils entered first grade classrooms within 19 primary schools selected from an urban public school system of a mid-Atlantic state of the USA (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% of the sample was located, but 142 young adults chose not to be interviewed and 133 were not interviewed because of logistical problems (e.g., 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 the 32 decedents (verified by National Death Index searches through 2002), there were independent associations between smoking with being male and non-minority, but not with year of first grade entry ('cohort'), receiving subsidized lunch, or levels of childhood misbehavior (alpha set at 0.05). Mean age at follow-up interview was 21 years (range 19-24 years old). 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 (TOCA-R) (8) near the end of the Fall quarter for 1,925 pupils (roughly 89 percent of first graders enrolled in these schools). Test-retest correlations were above 0.60 for each TOCA-R subscale (Cronbach alpha > 0.80). The childhood misbehavior subscale consisted of 10 six-point Likert items on behaviors such as starting fights, breaking rules, taking other's property, lying, teasing classmates, being stubborn, yelling at and hurting others, and having trouble accepting authority. In accord 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 during young adulthood. Participants were classified as a smoker if they indicated 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 of 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?". Current smokers (n= 595) reported on the most recent interval of smoking. Former smokers (not smoking in the month prior to assessment) were asked about the interval during which they were smoking the most (n=367).

Analysis

After initial cross-classification analysis, the relative odds of tobacco involvement associated with levels of childhood misbehavior was estimated by logistic regression models that held other covariates constant. Latent class analysis identified subgroups of smokers on the basis of their patterns of responses to the FTND items (12-15). Alternative forms of the unobserved latent class variable were fit to the data using *Latent GOLD* version 2.0 (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 non-dependent class of smokers, a class of smokers experiencing a moderate number of dependence features, and a third class more severely affected. A multinomial logistic regression model yielded estimates of associations linking earlier childhood misbehavior with risk of becoming tobacco dependent among those who had smoked at least once, before and after covariate adjustment (e.g., for age, sex, and minority group status).

In a post-analysis 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, a variant of the Huber-White sandwich estimator of variance was used to obtain robust standard errors and variance estimates (19).

RESULTS

In young adulthood, 962 respondents 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 fit to the Fagerström test item responses for those who had smoked at least once. A three class model fit best, with the classification accuracy proportion 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 prevalence of items from class to class). Class 1 included one-half of our ever-smokers, those reporting very few dependence features (mean was a value between zero and one). 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 2 included 31 percent of the ever-smokers, who appear to have developed a less severe form of tobacco dependence (mean number of features = 2.2). Alternately, Class 2 may be a prodrome class more susceptible to a future shift toward Class 3, or a class more likely to quit 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 regression analysis is supportive but the association is no more than modest (table 2). Estimates based upon a model with a product-term to estimate separate slopes for males and females, indicated 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 compared to females in the lowest tertile. Smaller differences, some opposite, were found contrasting Class 2 with Class 1 smokers. Males with higher misbehavior ratings were more likely to be in both tobacco dependence syndrome classes (table 2).

DISCUSSION

The study provides 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 starting first grade in primary school is predictive.

Strengths of this study include a pre-defined study base, standardized ratings of childhood misbehavior by the first-grade teacher, as well as independent standardized assessment of tobacco dependence in young adulthood. Our latent class approach required no arbitrary specification of cut-off scores to designate tobacco dependent cases versus non-cases.

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

Previous studies have consistently reported increased risk of subsequent drug use and dependence associated with conduct problems 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). Furthermore, long-term relationships between aggressive, unconventional, and impulsive behaviors have also been found with drug use involvement (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 becomes a tobacco smoker and develops tobacco dependence by young adulthood. Evidence from several randomized trials now suggests that programs to reduce childhood misbehavior may delay onset of tobacco use (5,36).

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Abbreviations

FTND, Fagerström Test for Nicotine Dependence; TOCA-R, Teacher Observation of Classroom Adaptation—Revised.

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TABLE 1

Description of the baseline and follow-up samples in relation to occurrence of tobacco smoking. Data from 1,692 participants originally recruited in 1985/86 at the time of entry into first grade classrooms of an urban mid-Atlantic public school system and followed-up in 2000/2.

[[[]]]	Baseline sample in first grade, 1985/86			Assessed in young adulthood, 2000/2		Subset of tobacco users		Tobacco use by young adulthood						
	[[No.]]		[[%]]	[[No.]]		[[%]]	[[No.]]		[[%]]	Occurrence of tobacco use (%)		Adjusted*		
	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[RO]] [†]	[[95% CI]]	[[RO]] [†]	[[95% CI]]	[[p-value]]
[[Total overall]]	[[2,311]]	[[[]]]	[[[]]]	[[1,692]]	[[[]]]	[[[]]]	[[962]]	[[[]]]	[[57.1]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[Sex]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[Female]]	[[1160]]	[[50.2]]	[[[]]]	[[902]]	[[53.3]]	[[442]]	[[45.9]]	[[49.2]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.5, 2.3]]	[[<0.001]]
[[Male]]	[[1151]]	[[49.8]]	[[[]]]	[[790]]	[[46.7]]	[[520]]	[[54.1]]	[[66.0]]	[[2.0]]	[[2.0]]	[[1.9]]	[[1.5, 2.3]]	[[[]]]	[[[]]]
[[Race]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[Minority]]	[[1550]]	[[65.5]]	[[[]]]	[[1218]]	[[72.0]]	[[619]]	[[64.3]]	[[51.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[[]]]
[[Non-minority]]	[[761]]	[[34.5]]	[[[]]]	[[474]]	[[28.0]]	[[343]]	[[35.7]]	[[72.5]]	[[2.5]]	[[2.0, 3.2]]	[[2.8]]	[[2.0, 3.9]]	[[<0.001]]	[[[]]]
Subsidized lunch in first grade [‡]	[[1093]]	[[47.4]]	[[[]]]	[[761]]	[[45.1]]	[[463]]	[[48.2]]	[[61.2]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[[]]]
Yes,	[[1212]]	[[52.6]]	[[[]]]	[[927]]	[[54.9]]	[[498]]	[[51.8]]	[[53.8]]	[[0.7]]	[[0.6, 0.9]]	[[1.0]]	[[0.9, 1.2]]	[[0.55]]	[[[]]]
free or reduced	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]	[[[]]]
[[First grade cohort]]	[[1196]]	[[51.8]]	[[[]]]	[[856]]	[[50.6]]	[[492]]	[[51.1]]	[[57.8]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[[]]]
[[1985]]	[[1115]]	[[48.2]]	[[[]]]	[[836]]	[[49.4]]	[[470]]	[[48.9]]	[[56.3]]	[[0.9]]	[[0.8, 1.1]]	[[0.9]]	[[0.7, 1.0]]	[[0.15]]	[[[]]]
Childhood misbehavior rated in Fall of first grade	[[712]]	[[30.8]]	[[[]]]	[[504]]	[[29.8]]	[[255]]	[[26.5]]	[[51.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[[]]]
Lowest tertile	[[688]]	[[29.8]]	[[[]]]	[[514]]	[[30.4]]	[[290]]	[[30.1]]	[[56.5]]	[[1.3]]	[[1.0, 1.6]]	[[1.4]]	[[1.1, 1.8]]	[[0.01]]	[[[]]]
Middle tertile	[[655]]	[[28.3]]	[[[]]]	[[489]]	[[28.9]]	[[300]]	[[31.2]]	[[61.5]]	[[1.5]]	[[1.2, 2.0]]	[[1.7]]	[[1.3, 2.1]]	[[<0.001]]	[[[]]]
Highest tertile	[[256]]	[[11.1]]	[[[]]]	[[185]]	[[10.9]]	[[117]]	[[12.2]]	[[63.2]]	[[1.7]]	[[1.2, 2.4]]	[[1.4]]	[[1.1, 1.9]]	[[0.02]]	[[[]]]
Missing rating [§]														

* For the adjusted relative odds estimates, the model includes all listed covariates, and takes classroom-level clustering design effects into account. For the unadjusted estimates, classroom-level clustering is taken into account but no covariate terms are in the regression equation.

[†] RO, estimated relative odds; CI, confidence interval.

[‡] The subsidized lunch status of six children is missing at baseline.

Missing ratings of misbehavior due to students transferring to other schools and circumstances where the teacher could not complete ratings.

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TABLE 2

Occurrence and estimated relative risk of developing a tobacco dependence syndrome among smokers in early young adulthood by childhood misbehavior: Data from 1,692 participants originally recruited in 1985/6 at the time of entry into first grade classrooms of an urban mid-Atlantic public school system and followed-up in 2000/2.

	Occurrence (row totals sum to 1.0)			Unadjusted models*			Adjusted models [†]			
	[[Class 1]]	[[Class 2]]	[[Class 3]]	Class 2 vs 1 [[RO]]	Class 3 vs 1 [[RO]]	Class 3 vs 1 [[95% CI]]	Class 2 vs 1 [[RO]]	Class 3 vs 1 [[RO]]	Class 3 vs 1 [[95% CI]]	[[p-value]]
[[Overall]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]
[[Lowest tertile]]	[[255]]	[[0.57]]	[[0.17]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1]]
[[Middle tertile]]	[[290]]	[[0.53]]	[[0.17]]	[[1.2]]	[[1.1]]	[[0.7, 1.8]]	[[1.3]]	[[1.2]]	[[0.7, 1.9]]	[[0.53]]
[[Highest tertile]]	[[300]]	[[0.48]]	[[0.22]]	[[1.3]]	[[1.6]]	[[1.0, 2.4]]	[[1.4]]	[[1.6]]	[[1.1, 2.5]]	[[0.02]]
[[Missing]]	[[117]]	[[0.50]]	[[0.20]]	[[1.3]]	[[1.4]]	[[0.8, 2.1]]	[[1.1]]	[[1.3]]	[[0.8, 2.3]]	[[0.30]]
[[Females]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]
[[Lowest tertile]]	[[138]]	[[0.57]]	[[0.15]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1]]
[[Middle tertile]]	[[150]]	[[0.57]]	[[0.15]]	[[1.0]]	[[1.0]]	[[0.5, 1.9]]	[[1.1]]	[[1.1]]	[[0.6, 2.0]]	[[0.81]]
[[Highest tertile]]	[[103]]	[[0.59]]	[[0.25]]	[[0.5]]	[[1.6]]	[[0.3, 2.9]]	[[0.6]]	[[1.8]]	[[1.0, 3.1]]	[[0.04]]
[[Missing]]	[[51]]	[[0.66]]	[[0.12]]	[[0.7]]	[[0.7]]	[[0.3, 1.6]]	[[0.5]]	[[0.6]]	[[0.4, 1.1]]	[[0.08]]
[[Males]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]	[[1]]
[[Lowest tertile]]	[[117]]	[[0.57]]	[[0.19]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1.0]]	[[1]]
[[Middle tertile]]	[[140]]	[[0.50]]	[[0.19]]	[[1.5]]	[[1.2]]	[[0.6, 2.3]]	[[1.7]]	[[1.3]]	[[0.9, 2.5]]	[[0.42]]
[[Highest tertile]]	[[197]]	[[0.43]]	[[0.21]]	[[2.1]]	[[1.5]]	[[0.9, 3.8]]	[[2.5]]	[[1.7]]	[[1.4, 2.8]]	[[0.03]]
[[Missing]]	[[66]]	[[0.36]]	[[0.27]]	[[2.3]]	[[2.3]]	[[1.1, 4.9]]	[[2.2]]	[[2.3]]	[[1.0, 5.0]]	[[0.04]]

* The estimated relative odds conveys the strength of association between smokers assigned to either class 2 or 3 compared to smokers in class 1 (no dependence) as reference, as estimated under a multinomial regression model taking first grade school clustering design effects into account.

† The estimated relative odds conveys the strength of association between smokers assigned to either class 2 or 3 compared to smokers in class 1 (no dependence) as reference, as estimated under a multinomial regression model with adjustment for minority status; cohort; gender; and subsidized lunch, and taking first grade school clustering design effects into account.