Parental Smoking Exposure and Adolescent Smoking Trajectories

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KEY WORDS

cigarette smoking, nicotine dependence, parental smoking, intergenerational smoking

ABBREVIATIONS

CI—confidence interval
CIDI—Composite International Diagnostic Interview
LCGA—latent class growth analysis
NEFS—New England Family Study
OR—odds ratio

Dr Mays contributed to the conceptualization of the study idea, led statistical analyses and interpretation of the data, and drafted the paper; Dr Gilman contributed to the conception and design of the original study, acquisition of data, conceptualization of the study idea, and revision of the paper for important intellectual content; Dr Rende contributed to the conception and design of the original study, acquisition of data, and revision of the paper for important intellectual content; Dr Luta contributed the statistical analysis and revision of the paper for important intellectual content; Dr Tercyak contributed to the revision of the paper for important intellectual content; and Dr Niaura contributed to the conception and design of the original study, acquisition of data, statistical analysis and interpretation, conceptualization of the study idea, and revision of the paper for important intellectual content.

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WHAT'S KNOWN ON THIS SUBJECT: It is well-established that parental smoking is associated with adolescent smoking initiation and regular tobacco use. However, we know less about how exposure to specific types of parental smoking affect adolescent smoking and progression to regular smoking in young adulthood.

WHAT THIS STUDY ADDS: Among adolescents with parents who are nicotine dependent, each previous year of parental smoking increases the likelihood they will be in a heavy smoking trajectory. Parental smoking cessation early in their children's life is critical to prevent smoking in families.

abstract

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OBJECTIVE: In a multigenerational study of smoking risk, the objective was to investigate the intergenerational transmission of smoking by examining if exposure to parental smoking and nicotine dependence predicts prospective smoking trajectories among adolescent offspring.

METHODS: Adolescents (n = 406) ages 12 to 17 and a parent completed baseline interviews (2001–2004), and adolescents completed up to 2 follow-up interviews 1 and 5 years later. Baseline interviews gathered detailed information on parental smoking history, including timing and duration, current smoking, and nicotine dependence. Adolescent smoking and nicotine dependence were assessed at each time point. Latent Class Growth Analysis identified prospective smoking trajectory classes from adolescence into young adulthood. Logistic regression was used to examine relationships between parental smoking and adolescent smoking trajectories.

RESULTS: Four adolescent smoking trajectory classes were identified: early regular smokers (6%), early experimenters (23%), late experimenters (41%), and nonsmokers (30%). Adolescents with parents who were nicotine-dependent smokers at baseline were more likely to be early regular smokers (odds ratio 1.18, 95% confidence interval 1.05–1.33) and early experimenters (odds ratio 1.04, 95% confidence interval 1.04–1.25) with each additional year of previous exposure to parental smoking. Parents' current non-nicotine–dependent and former smoking were not associated with adolescent smoking trajectories.

CONCLUSIONS: Exposure to parental nicotine dependence is a critical factor influencing intergenerational transmission of smoking. Adolescents with nicotine-dependent parents are susceptible to more intense smoking patterns and this risk increases with longer duration of exposure. Research is needed to optimize interventions to help nicotine-dependent parents quit smoking early in their children's lifetime to reduce these risks. *Pediatrics* 2014;133:983–991

Parental smoking is associated with adolescent smoking uptake and regular smoking, suggesting intergenerational transmission of smoking behavior within families.[1] Research demonstrates that adolescents whose parents smoke are more likely to begin smoking[2,3] and that parental smoking predicts future smoking initiation and regular smoking among adolescents.[4–8] Research also suggests that offspring of parents who quit smoking are less likely to begin smoking and those who already smoke are more likely to quit.[9–12] The intergenerational transmission of smoking within families is likely influenced by multiple factors, such as genetics, observed parental behavior, and the home environment (eg, rules about smoking).[8]

Although many studies have used brief measures that define smoking behavior by using broad categories (eg, any past-month smoking),[2,4,6,8–10] these measures constrain our understanding of how specific types of parental smoking (eg, current versus former) affect adolescent smoking behavior. Few studies have used measures to shed light on how nicotine dependence unfolds within families. Although research suggests intergenerational transmission of nicotine dependence occurs,[13–15] findings of research on the influence of parental nicotine dependence and adolescent smoking remain equivocal.[3,16]

Other evidence demonstrates distinct trajectories of adolescent smoking behavior can be identified.[5,17–21] Few studies, however, have used prospective data to track influences of parental smoking on offspring's smoking behavior from adolescence into young adulthood, a period of risk for developing nicotine dependence.[22] Nicotine-dependent smokers are less successful at quitting and are more likely to quit with intensive cessation interventions.[23] Examining if exposure to parental smoking and nicotine dependence differentially influence offspring's smoking trajectories could help identify adolescents and families in need of more intensive intervention to reduce risks.

Our goal was to investigate the associations between adolescents' exposure to their parents' smoking and prospective trajectories of adolescent smoking into young adulthood. This study builds on a previous investigation of intergenerational smoking from the New England Family Study (NEFS), a multigeneration study of smoking risk within families.[3] The NEFS was designed to understand intergenerational transmission of cigarette smoking by capturing detailed information on parental smoking history and nicotine dependence, and assessing offspring's smoking behavior prospectively. The prior NEFS investigation demonstrated that adolescents' cumulative exposure to active parental smoking, but not former parental smoking, increases the likelihood of adolescent smoking initiation.[3] Prospective NEFS data provide a unique opportunity to gain new knowledge of how offspring's exposure to parental smoking and nicotine dependence early in life influences smoking trajectories.

METHODS

Participants and Procedure

This analysis included data from second- and third-generation NEFS participants.[3,24–26] The NEFS was established to interview adult offspring of pregnant women enrolled between 1959 and 1964 at the Boston, Massachusetts, and Providence, Rhode Island, sites of the National Collaborative Perinatal Project, a birth cohort study of the effects of in utero and early childhood environment on child health.[27] Adult offspring of National Collaborative Perinatal Project participants (second-generation) were selected for participation by using a multistage sampling procedure and contacted by mail at age 40 to enroll in the NEFS.[3] Among NEFS adults residing within 100 miles of the Providence site, adolescent offspring (third-generation) between 12 and 17 years of age were invited to participate in a prospective study on the intergenerational transmission of smoking conducted from 2001 to 2009.[3] Second- and third-generation participants were provided with a modest incentive (eg, $5–$10 cash equivalent) for completing study interviews.

In total, 726 eligible third-generation adolescents were invited to participate; 559 (72%) completed a baseline interview with data on smoking behavior. A complete description of the baseline sample was published previously.[3] Adolescents and, separately, their parents completed a baseline interview in person. Adolescents were contacted for a second interview 1 year later (mean 1.3 years, SD 0.28), and those who were age 18 and older at the 5-year follow-up were contacted for a third interview (mean 5.2 years, SD 0.64). The Brown University Institutional Review Board approved the protocol. Parent consent and adolescent assent were obtained at baseline and reestablished at each follow-up.

The sample for the current study comprised 406 adolescents with data available for 2 or more time points to analyze changes in smoking behavior. Characteristics of the baseline and analytic samples are shown in Table 1. Adolescents in the analytic sample were significantly older than those in the original baseline sample ($P < .001$) because of the age restrictions for the third interview. There were no other statistically significant differences between the samples.

Measures

Adolescent Smoking

Adolescent smoking was captured by using the Lifetime Inventory of Smoking Trajectories, a valid instrument that

TABLE 1 Characteristics of the Baseline and Analytic Samples

	Baseline Sample	Analytic Sample
Adolescent demographics	*n* = 559	*n* = 406
Gender		
Male	267 (47.8)	194 (47.8)
Female	292 (52.2)	212 (52.2)
Race		
Non-Hispanic white	474 (84.8)	350 (86.2)
Nonwhite	85 (15.2)	56 (13.8)
Baseline age, mean (SD)	14.0 (1.7)	14.2 (1.6)
Parent demographics		
Gender		
Male	124 (22.2)	85 (20.9)
Female	435 (77.8)	321 (79.1)
Race		
Non-Hispanic white	474 (84.8)	351 (86.4)
Nonwhite	85 (15.2)	55 (13.6)
Baseline age, mean (SD)	39.6 (1.9)	39.6 (1.9)
Marital status		
Married	402 (71.9)	298 (73.4)
Unmarried	157 (28.1)	108 (26.6)
Educational attainment		
≥College degree	105 (18.8)	70 (17.2)
<College education	454 (81.2)	336 (82.8)
Household income		
<$60 000/y	255 (45.6)	183 (45.1)
≥$60 000/y	304 (54.4)	223 (54.9)
Parental smoking		
Nonsmoker	220 (40.0)	167 (41.7)
Former daily or weekly smoker	176 (31.9)	126 (31.5)
Current, nondependent	71 (12.9)	47 (11.8)
Current, dependent	84 (15.2)	60 (15.0)

Some cells do not at up to the total sample size due to sporadic missing data for <5% of participants for individual variables. Values are *n* (%) unless otherwise noted.

gathers detailed information on smoking initiation, past and current smoking, and susceptibility.[28] Nicotine dependence was assessed based on *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition,* criteria by using the adapted Composite International Diagnostic Interview (CIDI).[29,30] The CIDI was selected over brief dependence screeners (eg, Fagerström Tolerance Questionnaire) to gather detailed information on clinical dependence symptoms for the NEFS. Smoking status was operationalized to reflect developmentally appropriate transitions from nonsmoking and susceptibility to regular, dependent use.[31] For trajectory analyses, smoking status at each interview used a score with the following values: committed nonsmokers never smoked and indicated they would never try smoking (0); susceptible nonsmokers never smoked but indicated they may try in the future (1); triers smoked only once in their life (2); experimenters smoked more than once, but never daily (3); regular smokers without nicotine dependence smoked daily but did not meet *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition,* dependence criteria (4); and regular smokers with nicotine dependence smoked daily and met dependence criteria (5).

Parental Smoking

Parental smoking and nicotine dependence also were assessed at baseline by using the Lifetime Inventory of Smoking Trajectories (LIST)[28] and CIDI.[29,30] One parent completed a baseline interview for the study. For analyses, we examined parental smoking in 2 ways. A categorical variable was created based on parents' baseline smoking status: current (daily or weekly) nicotine-dependent smoker, current non-nicotine–dependent smoker, former daily or weekly smoker, or nonsmoker.

The Lifetime Inventory of Smoking Trajectories gathers data on current and prior periods of smoking, including timing and duration, which allowed us to determine adolescents' cumulative years of exposure to parental smoking.[28] We created continuous predictor variables for adolescents' total years of exposure to parental smoking before baseline based on whether their parents were current dependent smokers, current smokers without dependence, or former smokers at baseline.

Covariates

Parent (gender, race/ethnicity, age, educational attainment, household income, marital status) and adolescent (gender, age, race/ethnicity) demographics ascertained at baseline were examined as covariates.

Statistical Analysis

We conducted Latent Class Growth Analysis (LCGA)[32] by using MPlus 7.1 (Muthén & Muthén, Los Angeles, CA) to construct adolescent smoking trajectory classes based on prospective behavior patterns.[19] LCGA has been widely used in studies of adolescent smoking[19,33,34] and similar behaviors.[35] Adolescents who were committed nonsmokers at all time points (*n* = 123, 30%) were defined a priori as a trajectory class.[17,33,34] For the remainder (*n* =283, 70%), LCGA models examined 1 to 4 class solutions. The optimal number of classes was determined based on solutions having a lower Bayesian Information Criteria, higher estimated proportion of participants correctly classified (entropy), and a statistically significant Lo-Mendall-Rubin likelihood ratio χ^2 test comparing fit for a model with K classes

compared with K-1 classes.[32,36,37] Missing data were accommodated using full-information robust maximum likelihood estimation, which uses all available data for analyses.[38]

We examined whether exposure to parental smoking was associated with adolescent smoking trajectories through bivariate analyses (eg, χ^2 tests) and multinomial logistic regression.[39] The NEFS included siblings to investigate aims surrounding smoking risk within families. The sample included 197 singletons (49%), 91 sibling pairs (n = 182, 45%), and 9 sibling triads (n = 27, 7%). Analyses accounted for clustering using survey procedures in SAS 9.3 (SAS Institute, Inc, Cary, NC).

The primary predictor in regression analyses was exposure to parental smoking at baseline. Demographics associated with smoking trajectory classes in bivariate analyses ($P < .05$) were considered as covariates. Two separate models were created. In Model 1, we used the categorical parental smoking status predictor variable, with nonsmokers as the reference group. In Model 2, parental smoking was operationalized as adolescents' total years of exposure to their parents' smoking stratified by parents' baseline smoking status.

RESULTS

Study Sample

Sample characteristics are shown in Table 1. Participants (n = 406) were nearly half girls (52%), and most were white (86%) and averaged 14.2 years (SD 1.6) of age at baseline. The mean (SD) smoking status scores at baseline and each follow-up were 0.93 (1.42), 1.20 (1.53), and 2.41 (1.83), respectively. In total, 15.0% of parents were current dependent smokers, 11.8% were current nondependent smokers, 31.5% were former smokers, and 41.7% were nonsmokers. Parents who were current or former smokers (n = 233) smoked an average of 19.0 (SD 12.5) cigarettes per day. The number of cigarettes smoked per day did not differ significantly by parental smoking status (P = .469). Adolescents of parents who were current dependent smokers were exposed to an average of 1.19 (SD 3.66) years of smoking before baseline, whereas offspring of current nondependent smokers were exposed for 0.89 (SD 2.99) years, and offspring of former smokers were exposed for 1.26 (SD 3.29) years.

Adolescent Smoking Trajectories

Table 2 displays fit statistics for LCGA models. The 3-class solution was optimal based on the joint evaluation of the fit indices and the likelihood ratio χ^2 test compared with the 2-class solution. Combined with the a priori class of nonsmokers, this created a 4-level trajectory class outcome variable.

To describe adolescent trajectory classes, we calculated average smoking status scores over time by class (Fig 1). Classes were labeled as nonsmokers (30%), early experimenters (23%), late experimenters (41%), and early regular smokers (6%). Nonsmokers abstained across all 5 years. Early experimenters tried or smoked nondaily at baseline and year 2, and nearly half (50%) were regular smokers by year 5. Late experimenters typically tried smoking later, and almost 25% were regular smokers by year 5. Early regular smokers smoked regularly at baseline and most (80%) were nicotine-dependent smokers by year 5 or earlier.

TABLE 2 Latent Class Growth Analysis Fit Statistics

K Classes	BIC	Entropy	χ^2 P value
1	2620.7	—	—
2	2374.5	0.846	.005
3	2192.2	0.989	<.001
4	2132.6	0.951	.015

P value based on Lo-Mendall-Rubin likelihood ratio χ^2 test comparing model with K classes to model with K-1 classes. BIC, Bayesian Information Criteria.

Table 3 displays bivariate associations between demographics, parental smoking, and adolescent smoking trajectories. Baseline demographic characteristics associated with adolescents' trajectory class ($P < .05$) that were considered as covariates in logistic models included adolescents' and parents' age, and parents' race, education, marital status, and household income. When both parents' and adolescents' ages were included in the logistic models, only adolescents' age was significant and the results were similar regardless of which age variable was used. Only adolescents' age was included in the models for parsimony. Parents' cigarettes smoked per day did not differ significantly by adolescents' trajectory classes in pairwise comparisons (Table 3), so it was excluded from multivariable analyses.

Parental Smoking and Adolescent Smoking Trajectories

Table 4 displays results of the logistic regression models. Model 1 examined parents' baseline smoking status using a categorical predictor. Adolescents with parents who were current dependent smokers at baseline were significantly more likely to be in the 2 heaviest smoking trajectories: early experimenters (odds ratio [OR] 4.61, 95% confidence interval [CI] 1.52–13.96) and early regular smokers (OR 9.67, 95% CI 1.66–50.67). Adolescents whose parents were current nondependent smokers at baseline were also significantly more likely to be early regular smokers (OR 9.96, 95% CI 1.67–59.44), early experimenters (OR 4.52, 95% CI 1.32–15.42), and late experimenters (OR 2.89, 95% CI 1.16–7.17). Parents' former smoking was not associated with adolescents' trajectory class.

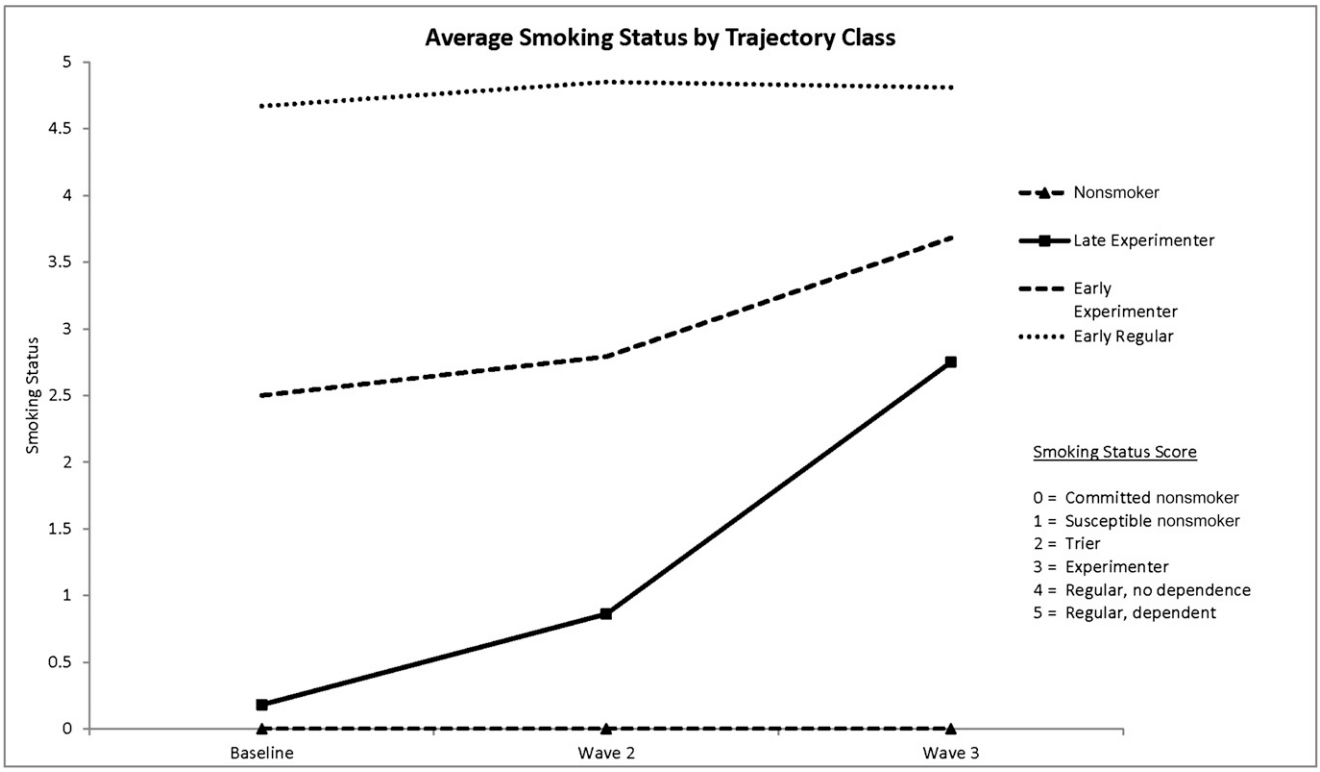

FIGURE 1
Average adolescent smoking status by trajectory class.

Model 2 examined associations between adolescents' years of exposure to parental smoking separated by their parents' smoking status at baseline and smoking trajectory classes. ORs reflect the increase in adolescents' odds of being in a higher smoking trajectory class relative to being a committed nonsmoker with each additional year of exposure to parental smoking before baseline. After adjusting for demographics, each prior year of exposure to parental smoking among adolescents whose parents were nicotine-dependent smokers significantly increased the odds of an adolescent being an early regular smoker (OR 1.18, 95% CI 1.05–1.33) and an early experimenter (OR 1.14, 95% CI 1.04–1.25). Each additional year of exposure among adolescents whose parents were current nondependent smokers also increased the odds of adolescents being an early regular smoker (OR 1.23, 95% CI 1.01–1.50); however, the overall effect of exposure among those whose parents were nondependent current smokers was not significant ($P = .17$).

DISCUSSION

This study adds to the research on intergenerational transmission of smoking by demonstrating that when parents are current, nicotine-dependent smokers, a longer duration of exposure to parental smoking increases the odds that adolescents will be in heavier smoking trajectories. Parents' categorical smoking status proved to be a blunt indicator of risk: exposure to any form of current parental smoking at baseline increased the likelihood that adolescent offspring would be in a heavier smoking trajectory class. Examining adolescents' previous years of exposure to parental smoking stratified by parents' baseline smoking status yielded a more fine-gained assessment of risk. A longer duration of exposure to parental smoking among adolescents whose parents were nicotine dependent increased the odds that adolescents would be in heavier smoking trajectories. These findings indicate that cessation among nicotine-dependent parents early in their offspring's lifetime is critical to reduce the risk of smoking within families.

Using NEFS data, Gilman and colleagues[3] reported that exposure to current parental smoking predicts adolescent smoking initiation at baseline, whereas parental nicotine dependence and former parental smoking were not associated with smoking initiation. Although this study suggests that parental nicotine dependence may not be the most important risk factor for adolescent smoking initiation, our results demonstrate that assessing parental nicotine dependence remains critical

TABLE 3 Bivariate Associations With Adolescents' Smoking Trajectory Class

	Never Smoker *n* = 123	Early Regular *n* = 24	Early Experimenter *n* = 94	Late Experimenter *n* = 165	*P*
Adolescent demographics					
Gender, *n* (%)					.871
Male	55 (44.7)	12 (50.0)	47 (50.0)	80 (48.5)	
Female	68 (55.3)	12 (50.0)	47 (50.0)	85 (51.5)	
Race, *n* (%)					.100
Non-Hispanic white	107 (87.0)	23 (95.8)	74 (78.7)	146 (88.5)	
Nonwhite	16 (13.0)	1 (4.2)	20 (21.3)	19 (11.5)	
Baseline age, mean (SD)	13.6 (1.5)	16.2 (1.1)	14.9 (1.4)	14.0 (1.5)	<.001
Parent demographics					
Gender, *n* (%)					.665
Male	29 (23.6)	4 (17.7)	16 (17.1)	36 (21.8)	
Female	94 (76.4)	20 (83.3)	78 (82.9)	129 (78.2)	
Race, *n* (%)					.050
White	104 (84.6)	23 (95.8)	75 (79.8)	149 (88.5)	
Nonwhite	19 (15.4)	1 (4.2)	19 (20.2)	16 (11.5)	
Baseline age, mean (SD)	40.0 (1.8)	39.3 (1.8)	39.1 (2.0)	39.7 (1.9)	.005
Marital status, *n* (%)					<.001
Married	99 (80.5)	10 (41.7)	51 (54.2)	134 (81.2)	
Unmarried	24 (19.5)	14 (58.3)	43 (45.7)	31 (18.8)	
Educational attainment, *n* (%)					.003
≥College	30 (24.4)	1 (4.2)	7 (7.4)	32 (19.4)	
<College	93 (75.6)	23 (95.8)	87 (92.6)	133 (80.6)	
Household income, *n* (%)					.008
<$60 000/y	57 (46.3)	15 (62.5)	52 (55.3)	59 (35.8)	
≥$60 000/y	66 (53.7)	9 (37.5)	42 (44.7)	106 (64.2)	
Parental smoking					
Smoking status, *n* (%)					<.001
Current, dependent	9 (7.4)	10 (41.7)	24 (26.1)	17 (10.4)	
Current, nondependent	7 (5.7)	6 (25.0)	14 (15.2)	20 (12.3)	
Former daily or weekly smoker	36 (29.5)	3 (12.5)	28 (30.4)	59 (36.2)	
Nonsmoker	69 (57.0)	5 (20.8)	26 (28.3)	67 (41.1)	
Cigarettes/d, mean (SD)[a]	8.4 (12.0)	15.7 (13.5)	13.0 (11.0)	11.2 (15.2)	.012
Years of exposure before baseline by parents' baseline smoking status, mean (SD)					
Current, dependent	0.46 (2.2)	4.8 (6.6)	2.1 (4.7)	0.7 (2.8)	.047
Current, nondependent	0.34 (1.8)	1.8 (3.9)	1.1 (3.2)	1.0 (3.2)	.030
Former daily or weekly	1.0 (2.9)	0.2 (1.0)	1.7 (4.0)	1.3 (3.3)	.314

Some cells do not at up to the total sample size due to sporadic missing data for <5% of participants for individual variables.

[a] Although the main effect for parental cigarettes smoked per day was statistically significant, no pairwise mean comparisons of adolescent smoking trajectories differed at $P < .05$.

to identify adolescents at risk for heavier smoking over time. In line with the findings of Gilman and colleagues,[3] our results showed that exposure to parental smoking when parents had quit before baseline was not associated with adolescent smoking. These data support the hypothesis that intergenerational smoking transmission occurs, in part, through social learning where adolescent smoking is influenced by observation of parental smoking.[3,8]

Our analysis yielded smoking trajectory classes consistent with previous studies using similar methods, supporting the validity of our findings.[18,19,40,41] An important contribution of our study is the attention to nicotine dependence in identifying adolescent smoking trajectories. One study examined how nicotine-dependence symptoms develop among adolescent smokers, concluding that parental smoking increases the risk of early-onset dependence.[13] Our results were similar, and, taken together, sharpen the focus on using trajectory-based definitions of adolescent smoking that incorporate nicotine dependence to identify adolescents at risk rather than relying only on brief measures, such as those used in prior studies.[2,4,6,9,10] Trajectory-based approaches using measures of nicotine dependence yield more fine-grained information to understand how intergenerational transmission of smoking occurs, timing and duration, and what aspects of parental smoking predict high-risk adolescent smoking behavior.[13]

Screening and counseling adolescents and their parents in pediatric clinical settings for tobacco use is a recommended strategy to reduce youth

TABLE 4 Multinomial Logistic Regression Analysis of Adolescent Smoking Trajectories Based on Exposure to Parental Smoking at Baseline, Defined as a Category or Duration of Adolescents' Previous Years of Exposure to Parental Smoking

	Model 1: Parents' Baseline Smoking Status Category				Model 2: Years of Exposure to Parental Smoking Before Baseline by Parents' Baseline Smoking Status			
	Trajectory Group				Trajectory Group			
	Early Regular *n* = 24	Early Experimenter *n* = 94	Late Experimenter *n* = 165	*P* Value	Early Regular *n* = 24	Early Experimenter *n* = 94	Late Experimenter *n* = 165	*P* Value
Demographics								
Adolescent baseline age	3.86	1.75	1.20	<.001	3.68	1.71	1.20	<.001
	2.44–6.10	1.43–2.14	1.00–1.45		2.41–5.62	1.40–2.09	0.99–1.44	
Parent white race	7.82	1.04	1.60	.163	10.18	0.38	1.80	.149
	0.90–66.24	0.44–2.47	0.76–3.38		0.91–114.54	0.16–0.87	0.86–3.76	
Parent college education	0.32	0.42	0.77	.162	0.34	0.38	0.71	.103
	0.06–1.91	0.18–0.98	0.41–1.42		0.51–2.25	0.16–0.87	0.38–1.33	
Parents married	0.46	0.32	0.88	.034	0.36	0.28	0.84	.015
	0.10–2.14	0.13–0.77	0.41–1.86		0.08–1.63	0.11–0.69	0.40–1.78	
Income >$60 000/y	1.42	1.95	1.81	.148	1.41	0.84	1.94	.119
	0.37–5.50	0.89–4.28	1.04–3.16		0.37–5.34	0.40–1.78	0.89–4.25	
Parental smoking								
Current, dependent	9.16	4.61	1.94	.016	1.18	1.14	1.06	.010
	1.66–50.67	1.52–13.96	0.68–5.56		1.05–1.33	1.04–1.25	0.96–1.17	
Current, nondependent	9.96	4.52	2.89	.034	1.23	1.15	1.14	.174
	1.67–59.44	1.32–15.42	1.16–7.17		1.01–1.50	0.98–1.34	0.99–1.30	
Former daily/weekly	0.76	1.84	1.57	.256	0.80	1.05	1.03	.426
	0.13–4.45	0.83–4.06	0.90–2.73		0.56–1.14	0.94–1.18	0.96–1.12	

In Model 1, parental smoking is defined categorically based on parents' baseline smoking status. In Model 2, parental smoking is defined as adolescents' total years of exposure to parental smoking before baseline separated by their parents' smoking status at baseline. ORs and 95% CIs displayed. The reference group for ORs is adolescents who were never smokers (*n* = 123).

smoking risk.[42,43] This study adds to evidence supporting the need to address smoking among both adolescents and their parents in pediatric clinical settings.[42,43] Although some studies have shown that offspring of parents who had quit smoking are less likely to smoke,[9–12] to our knowledge there has been no clinical trial to determine whether interventions for parental smoking cessation have a downstream impact on their adolescent offspring. Although there are obvious benefits to eliminating secondhand smoke exposure by helping parents quit,[44] this is an important topic of investigation for future studies.

Recent reviews indicate tobacco control interventions administered in the clinical setting can be impactful for preventing youth smoking[45] and advocate for strategies, such as the 5 A's (Ask, Advise, Assess, Assist, Arrange), to identify parents who smoke and deliver cessation advice.[43] Parental cessation counseling interventions administered in pediatric settings have had a modest impact,[46] and despite such interventions, most parents do not quit.[44] Our data suggest this could be because counseling interventions do not fully attend to parental nicotine dependence. Dependence symptoms are a strong predictor of quitting smoking above other known factors (eg, motivation to quit),[23] and pharmacotherapies are often critical to increase the likelihood of successfully quitting among dependent smokers.[47]

Our findings highlight the importance of screening parents for nicotine dependence in pediatric settings and referring them to evidence-based cessation resources. An efficient approach to put these findings into practice could be for pediatric providers to use brief nicotine-dependence screening instruments that have well-established validity to identify dependent parents.[48] These brief screening instruments could be dovetailed with parent-directed counseling interventions emphasizing quitting for the health of their children to motivate cessation[44] and pharmacotherapy to treat dependence. Another approach that deserves additional research is Ask, Advise, Connect, where clinicians ask parents about smoking, provide brief cessation advice, and refer parents who smoke to evidence-based cessation resources, such as telephone quit lines.[49] An approach integrating nicotine-dependence screening, provider advice that parents quit for their children's health, and referral for cessation support and dependence treatment may be optimal and should be examined in future research.

Our findings should be interpreted in light of important limitations. Baseline interviews were conducted with only 1 parent, limiting our ability to investigate differences based on maternal and paternal smoking. Parental smoking was assessed at baseline only, therefore we could not examine how prospective patterns of parental smoking influence adolescent smoking. We did not examine smokeless or other noncigarette tobacco use, which could

be an important avenue for future research to understand the role of nicotine dependence given the increasing use of newer tobacco products (eg, snus, electronic cigarettes). All measures were self-report, smoking was not verified biochemically, and we did not control for other risk factors for smoking (eg, peer smoking).

CONCLUSIONS

This study demonstrates that among adolescents with parents who are nicotine dependent, each previous year of exposure to parental smoking increases the likelihood that adolescents will be in a higher-risk smoking trajectory and progress to regular smoking. Adolescents' cumulative exposure to parental smoking may provide a clearer indicator of risk than often-used categorical indicators of parental smoking alone. Interventions to identify nicotine-dependent parents and link them with evidence-based cessation resources to quit smoking early in the life of their offspring may help reduce the risk of smoking within families.

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