Predicting Experimentation with Cigarettes: The Childhood Antecedents of Smoking Study (CASS)

MAURICE B. MITTELMARK, PHD, DAVID M. MURRAY, PHD, RUSSELL V. LUEPKER, MD, TERRY F. PECHACEK, PHD, PHYLLIS L. PIRIE, PHD, AND UNTO E. PALLONEN, PHD

Abstract: In a two-year investigation of cigarette smoking incidence in a population of Minnesota adolescents, the perceived smoking behavior of friends at baseline was a strong predictor of smoking onset. Additional predictors included: siblings' smoking behavior, parents' education level, and seven psychosocial scales including independence and rebelliousness. Smoking prevention strategies which teach youth to cope with social influences are well founded. Results also indicate that younger adolescents may yet be dissuaded from beginning smoking by knowledge of the health consequences of smoking. (*Am J Public Health* 1987; 77:206–208.)

Introduction

Although numerous studies have related a host of sociodemographic and psychosocial factors to adolescent smoking, much remains to be learned about causal relationships.[1–4] Most investigators believe that role models who smoke (e.g., peers, siblings, and parents) increase the probability of smoking onset, yet this pattern has been observed in only slightly more than half of the few prospective analyses undertaken.[5–16] Few investigations have used biochemical measures of smoking or employed procedures to increase the validity of smoking self-reports, and prospective studies of smoking onset have rarely included more than a single follow-up survey of smoking status to trace individuals' movements through the stages of smoking initiation and cessation.

The Childhood Antecedents of Smoking Study (CASS) was undertaken to help clarify factors predictive of smoking onset. Four surveys of an adolescent population in grades seven through 11 were conducted at six-month intervals. The surveys included biochemical measures of smoking and used special procedures to increase the validity of self-reports of smoking.

Methods

The CASS was carried out in a suburban school district in the Minneapolis/St. Paul area. Seventh through 11th grade students were asked to participate in surveys conducted each fall and spring during the two-year study period (a total of four surveys).

Identical procedures were used in the four surveys; these have previously been published in detail.[17,18] Participants produced a saliva specimen for thiocyanate analysis and completed a questionnaire about their smoking behavior, aspects of the home and school environment, the smoking behavior of significant others, and the students' values, attitudes and beliefs about smoking.[18] Expired air samples were obtained for carbon monoxide analysis.

A telephone survey of parents of children in the study schools was conducted (93 per cent participation rate). Attitudes towards smoking, opinions about teenagers' independence, relations between the parent and teenage children were assessed as were the parents' smoking history, current smoking behavior, income, and education.

Results

The study population consisted of 2,284 seventh through 11th grade students present in school at the first survey. Of these, 96.7 per cent agreed to participate and completed all procedures (n = 2,209). Survey results have been reported elsewhere.[18]

For the current analysis, a cohort was identified that participated fully in all four surveys. In the three follow-up surveys of the eligible population of 2,209 students, a total of 26 per cent were absent from school, 15 per cent refused at some point to participate, and the cigarette smoking status of 7 per cent could not be determined because of conflicting self-reports; 2 per cent left the school district. A cohort of 1,101 students participated in all surveys and completed all procedures.

Using data obtained in the initial survey of the analysis cohort (n = 1,101), factor analysis[19] identified eight factors which accounted for 57 per cent of the variance in the variables analyzed (Table 1). A similar analysis was performed on the data of the parent questionnaire, yielding six factors (Table 2).

From the analysis cohort of 1,101 students, a cohort was defined consisting of all participants who reported *nonsmoking* at the time of the initial survey (n = 887). Discriminant models were developed using the stepwise procedure of BMDP.[19] These models predicted membership in one of two groups: those who reported in all four surveys to have never smoked cigarettes or to have tried them only once or twice (n = 644); and those who reported at the time of the initial survey to have never smoked (or to have smoked only a few cigarettes) but reported a greater amount of smoking on at least one of the subsequent surveys (n = 243).

Four subgroup analyses were performed: males, females, seventh and eighth grades combined, and ninth through 11th grades combined.

Randomly designated samples of approximately half of each group were used as function derivation samples; remaining participants were held out for use in validating the function. Variables examined were the factors derived from student and parent data, parents' smoking behavior, perceived smoking behavior of siblings and friends, and parents' education level.

Table 3 presents the results of the four discriminant analyses. Compared to continuing nonsmokers, both males and females who began smoking during the study were far more likely to have friends who smoked at baseline. Males who smoked were also more independent, less concerned with health consequences of smoking, and lived in families reporting less involvement of the children in family decision-making. Females who smoked were also more likely to have

From the Division of Epidemiology, School of Public Health, University of Minnesota. Address reprint requests to Maurice B. Mittelmark, PhD, Division of Epidemiology, School of Public Health, University of Minnesota, 611 Beacon Street, SE, Minneapolis, MN 55455. This paper, submitted to the Journal March 3, 1986, was revised and accepted for publication July 30, 1986.

TABLE 1—Student Survey Factor Analysis

Factor	Highest Loading Item	Number of Items	Loadings' Range	Cronbach's Alpha*
Independence	If I want to smoke, that is my business.	3	.71–.67	.69
Smoking Consequences	Cigarette smoking might give me serious illness.	6	.68–.57	.77
Rebelliousness	I have often gone against my parents' wishes.	4	.74–.61	.72
Exemplars	People in the health professions should set a good example by not smoking cigarettes.	3	.84–.38	.71
Smokers' Image	Smoking cigarettes can make you look good.	3	.77–.57	.75
Disease Consequences	Most doctors believe smoking causes cancer.	4	.76–.40	.68
Exhibition	People smoke in order to show off.	3	.65–.57	.54
Addiction	You can get a real gnawing hunger for cigarettes when you have smoked for a while.	3	.72–.58	.48

*Index of internal consistency of item responses within each factor.

TABLE 2—Parent Survey Factor Analysis

Factor	Highest Loading Item	Number of Items	Loadings' Range	Cronbach's Alpha*
Family Detachment	Teenagers are old enough to make their own decisions about things like smoking cigarettes.	5	.69–.39	.54
Family Involvement	How frequently do you and your teenagers discuss school work?	4	.72–.50	.54
Parental Control	Have you been strict in setting rules about where your teenagers may go with their friends?	2	.84–.81	.51**
Nonsmoking Preference	If I had a teenage son, I'd prefer he didn't smoke.	5	.74–.62	.72
Choice	No one should try to prevent someone else from smoking.	3	.70–.53	.43
Egalitarian Home Environment	When parents are faced with a major decision such as whether to move to a new city, they should consider their teenage children's opinion.	5	.58–.53	.61

*Index of the internal consistency of item responses within each factor.
**Pearson R; Alpha cannot be computed for factors with less than three items.

siblings who smoked at baseline, viewed the smoker's image as positive, believed less that adults should be positive role models regarding smoking, and had less educated parents.

Beginning smokers among seventh and eighth graders, compared to continuing nonsmokers, were far more likely to be less concerned with the health consequences of smoking.

The discriminant functions were used to classify the hold out samples. The hit rates (per 100) were 75 for males, 66 for females, 77 for younger students, and 76 for older students. Hit rates were somewhat higher for classification of continuing nonsmokers (79 to 86) compared to classification of experimenters (50 to 60).

Discussion

The most pervasive predictor of experimentation with cigarettes was whether or not a best friend (or several friends) smoked. The influence of smoking by siblings was apparently exerted mainly on females and younger students. This finding is consistent with observations from other longitudinal studies of smoking onset.[6,9,14] Parents' smoking did not contribute to the discriminant models. This is consistent with the majority of prospective analyses that have examined the influence of parents' smoking behavior on future smoking status of children.[5–8,9,12,14]

The *Independence* scale contributed to the discriminant functions derived for males and older students. Chassin, *et al*,[9] also examined the influence of independence in similar analyses and concluded that it was not a predictor of smoking onset. However, their measure of independence was "generalized" while the Minnesota Smoking Survey scale is focused on independence related specifically to cigarette smoking. It has been suggested that only attitudes and beliefs specific to a behavior are important in forming behavioral intentions,[20] an idea supported by the pattern of findings of Chassin, *et al*,[9] and the current study.

The finding that the continuing nonsmokers among the younger students were distinguished from those who began smoking by the degree of their belief in the negative health consequences of smoking is of particular interest. These data suggest that in education programs for younger students there may yet be value in communicating messages about the health consequences of smoking.

The extrapolation of the present results to the general population is unknown. Absenteeism and refusal to participate accounted for three-fourths of the loss to follow-up; it is assumed that the prevalence of smoking in the dropout group was higher than in the cohort. Nevertheless, the study illustrates the probable complexity of the etiology of smoking onset. The age and gender differences observed are consistent with a view of adolescent development stressing that transition behaviors (e.g., onset of smoking, onset of sexual activity) are an integral aspect of adolescent development. Thus, it is to be expected that patterns of influence on smoking behavior vary as a function of gender, age and grade, psychosocial development, and culture.

TABLE 3—Discriminant Analyses

Variable	Discriminant Weight	Partial F*
Males (n = 227)		
Friends' Smoking	−1.44	29.9
Independence	0.14	13.6
Smoking Consequences	−0.11	6.2
Egalitarian Home Environment	−0.15	4.7
Females (n = 235)		
Friends' Smoking	−1.17	57.1
Siblings' Smoking	−0.40	9.8
Parents' Education Level	0.29	5.8
Smokers' Image	0.22	7.8
Exemplars	−0.12	6.3
7–8 Grade (n = 188)		
Friends' Smoking	−1.42	6.4
Rebelliousness	0.12	10.4
Siblings' Smoking	−0.62	13.5
Smoking Consequences	−0.10	23.6
9–11 Grade (n = 274)		
Friends' Smoking	−1.40	57.5
Independence	0.12	12.9
Parents' Education Level	0.42	21.2
Smokers' Image	0.13	7.3
Addiction	−0.11	5.1

*Partial F values are indices of the relative discriminating power of each variable.

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REFERENCES

1. US Public Health Service: Smoking and Health: A report of the Surgeon General. Washington, DC: US Department of Health, Education, and Welfare, 1979.
2. Botvin G, McAlister A: Cigarette smoking among children and adolescents: Causes and prevention. *In:* Arnold C (ed): Annual Review of Disease Prevention. New York: Springer, 1981.
3. Flay BR, d'Avernas JR, Best JA, Kersell MW, Ryan KB: Cigarette smoking: Why young people do it and ways of preventing it. *In:* Firestone P, McGrath P (eds): Pediatric Behavioral Medicine. New York: Springer-Verlag, 1983.
4. Kozlowski LT: Psychosocial influences on cigarette smoking. *In:* The Behavioral Aspects of Smoking. NIDA Research Monograph 26. Washington, DC: National Institute on Drug Abuse, 1979.
5. Ahlgren A, Norem AA, Hochhauser M, Garvin J: Antecedents of smoking among adolescents. J Drug Educ 1982; 12:325–340.
6. Alexander HM, Callcott R, Dobson AJ, Hardes GR, Lloyd DM, O'Connell DL, Leeder SR: Cigarette smoking and drug use in schoolchildren: IV—Factors associated with changes in smoking behavior. Int J Epidemiol 1983; 12:59–66.
7. Allegrante JP, O'Rourke TW, Tuncalp S: A Multivariate analysis of selected psychosocial variables on the development of subsequent youth smoking behavior. J Drug Educ 1977; 7:237–247.
8. Ary DV, Biglan P, Gallison CL, Weissman W, Severson H: Longitudinal prediction of the onset and change of adolescent smoking. *In:* Forbes WF, Frecker RC, Nostbakken D (eds): Proceedings of the 5th World Conference on Smoking and Health, Vol. 1. Ottawa: Canadian Council on Smoking and Health, 1983.
9. Chassin L, Presson CC, Sherman SJ, Cortz E, Olshavsky RW: Predicting the onset of cigarette smoking in adolescents: A Longitudinal study. J Appl Soc Psychol 1984; 14:225–243.
10. Cherry N, Kiernan K: Personality scores and smoking behavior: A longitudinal study. Br J Prev Soc Med 1976; 30:123–131.
11. Downey AM, O'Rourke TW: The utilization of attitudes and beliefs as indicators of future smoking behavior. J Drug Educ 1976; 6:283–295.
12. Hansen WB, Johnson CA, Collins LM: Cigarette Smoking Onset among High School Students. Paper presented to the 91st Annual Convention of the American Psychology Association, 1983. Mimeograph. Los Angeles: Behavioral Research Institute, University of Southern California, 1983.
13. Kellam SG, Stevenson DL, Rubin BR: How specific are the early predictors of teenage drug use? *In:* Harris (ed): Problems of Drug Dependence. NIDA Research Monograph Series 43. Washington DC: Govt Printing Office, 1982.
14. McCaul K, Glasgow R, O'Neill HK, Freeborn V, Rump BS: Predicting adolescent smoking. J School Health 1982; 52:342–346.
15. Salber EJ: Smoking among teenagers. Bull NY Acad Med 1968; 44:1521–1525.
16. Croft JB, Hunter SMacD, Webber GS, Watson RB, Berenson GS: Cigarette smoking behavioral distinctions between experimental nonadopters and adopters in children and adolescents—a consideration of transitional smoking experience: The Bogalusa Heart Study. Prev Med 1985; 14:109–122.
17. Luepker RV, Pechacek TP, Murray DM, Johnson CA, Hund F, Jacobs DR: Saliva thiocyanate: A chemical indicator of cigarette smoking in adolescents. Am J Public Health 1981; 71:1320–1324.
18. Pechacek TF, Murray DM, Luepker RV, Mittelmark MB, Johnson CA, Shultz JM: Measurement of adolescent smoking behavior; rationale and methods. J Behav Med 1984; 7:123–140.
19. Dixon W: (ed): BMDP Statistical Software. Berkeley: University of California Press, 1983.
20. Ajzen I, Fishbein M: The prediction of behavior from attitudinal and normative variables. J Exp Soc Psychol 1970; 6:466–487.