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Causes of Adolescent Cigarette Smoking: Tests of a Structural Equation Model

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A structural equation model of the causes of adolescent cigarette smoking is presented. This model is derived from a general paradigm or "meta-theory" which proposes that the social environment influences behavior directly and through the mediation of beliefs about the consequences of behavior; these two factors are predicted to interact with personality in causing behavior. Five social environmental variables, four belief factors, and three personality characteristics were analyzed in several large surveys of young adolescents. Siblings' smoking, friends' smoking, and enjoyment beliefs were found to affect cigarette smoking; a portion of the friends' smoking effect was mediated by enjoyment beliefs. The influence of friends upon beliefs and behavior was found to be partially dependent upon the adolescent's tendencies toward rebelliousness and disobedience. Implications are drawn for social psychological theory and public health action.

INTRODUCTION

Cigarette smoking among adolescents is a major public health concern (e.g., Hamburg, 1979). Despite increasingly widespread awareness of the long-term consequences of heavy smoking (e.g., Allegrante et al., 1977), the proportion of young females smoking has increased (Horn, 1978). Most educational and persuasive programs that have been implemented in public schools do not appear to deter the onset of smoking (Thompson, 1978; Leventhal and Cleary, 1980). The recognition that narrow strategies of prevention are not effective has led researchers to probe the problem more carefully in search of the critical social and psychological factors and processes which determine the onset of smoking (e.g., Evans et al., 1979; McAlister, 1979). Theoretically based notions of how and why adolescents start smoking have yielded promising early results in recent intervention studies (Botvin et al., 1980; Evans et al., 1978, 1980;

Hurd et al., 1980; McAlister et al., 1980). However, no comprehensive model of the causes of smoking has been empirically evaluated.

Reviews of the literature (e.g., Evans, 1979; Leventhal and Cleary, 1980) list different variables that appear to be associated with smoking among adolescents, but these variables are usually examined individually rather than constructed into a general explanatory model. Individual research reports have tended to concentrate on only a few of the factors that may be directly related to smoking rather than probing the complexities of direct, indirect, and interactive effects. Thus, our empirical knowledge of how and why young people become cigarette smokers has remained at a fairly basic level (Leventhal and Cleary, 1980; O'Rourke, 1980; U.S. Department of Health and Human Services, 1980).

There is, of course, no general model that is universally agreed upon to encompass all the causes of human behavior. However, a general theory of social learning (Bandura, 1977a) has gained broad support. In simple terms, the theory proposes that direct and vicarious experiences with rewards and punishments in one's environment lead to the acquisition of specific beliefs about the consequences of behaviors and circumstances. These beliefs shape an individual's behavior. Events in one's environment also affect personality (Mischel, 1973). These more general cognitive dispositions interact with environmental influences and

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specific beliefs in causing general behavioral tendencies. Jessor and Jessor (1977) present a similar model.

This set of processes is diagrammed in Figure 1. Events in one's environment influence beliefs about the consequences of behavior (process a) (Mettlin, 1973, 1976) which in turn influence behavior (process b) (Fishbein and Ajzen, 1975; Zajonc, 1968). Behavior shapes one's environment (process c), and beliefs influence one's environment through behavior (e.g., Freedman and Sears, 1965). When a person performs a behavior and observes its consequences, those observations either reinforce or challenge beliefs (process d); indeed, simply performing a behavior may cause one to believe that it has positive consequences (Bem, 1972). These processes of influence are partially regulated by personality factors (processes e and f) (e.g., Bandura, 1977b; Jessor and Jessor, 1977; Spielberger, 1966); one's environment and beliefs will be more or less influential depending upon these general psychological characteristics. Personality develops according to the general nature of environment (process g). This set of direct, indirect, and interactive influence processes constitutes the general model with which we attempt to explain adolescent cigarette smoking.

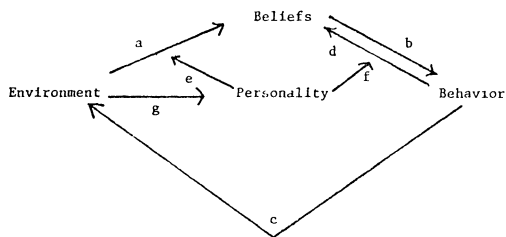


Figure 1. Model of the Causal Relationships Among Environment, Beliefs, Personality, and Behavior

Past research on cigarette smoking offers support for this very general model. Smoking by parents and siblings (e.g., Borland and Rudolph, 1975; Banks et al., 1978) and smoking by peers (e.g., Newman, 1970, 1971) have been shown to correlate with adolescent smoking behavior. Implicit and explicit sanctions set by important others are associated with smoking behavior (Mettlin, 1973, 1976). There is evidence that beliefs about health-related consequences of smoking are related to smoking behavior (Bewley et al., 1974; Bynner, 1970; Levitt and Edwards, 1970). Beliefs about consequences such as enjoyment, popularity, and tension reduction have been shown to correlate with smoking (Beaglehole, 1978; Bewley et al., 1974; Mausner and Mischler, 1966; McKennell

and Bynner, 1969). Personality traits such as anxiety (Walker et al., 1969), helplessness (Pflaum, 1965), self-confidence (Milne, 1979; Smith, 1969), and rebelliousness (Clausen, 1968; Milne, 1979; Milne and Colmen, 1973; Salber and Rochman, 1964; Stuart and Livson, 1966; Veldman and Brown, 1969) have been shown to be associated with smoking.

We are conducting a program of research testing these hypotheses: (1) Because of pervasive information on the health hazards of cigarettes, most children who do not frequently observe smoking by others will tend to hold unfavorable beliefs about cigarettes. (2) Children who do observe smoking by others, particularly family and peers, will tend to develop favorable beliefs about cigarettes. (Of course, some children will observe regular smokers who may exhibit primarily undesirable consequences of smoking such as discomfort, e.g., chronic coughing. For these children, unfavorable beliefs will be reinforced.) (3) The effect of a specific social model on beliefs and behavior will depend upon the child's general susceptibility to influences by that model (which would be reflected in measures of personality; e.g., a general tendency toward rebelliousness would enhance the tendency to imitate proscribed behavior of peers). A specific belief will be particularly influential on behavior if the consequence addressed by the belief is relevant to the child's general orientation (which would also be reflected in measures of personality; e.g., chronic anxiety would increase the salience of beliefs about tension-reducing effects of cigarette smoking).

We began our studies with only vague notions of what specific constructs might fall in the domains of beliefs and personality. We expected that beliefs would address consequences such as peer and parental reactions and psychopharmacological and health effects. We suspected that relevant personality characteristics of adolescents might include self-esteem, anxiety, and responsiveness to parents, other adults, and peers as models and as sources of sanctions. We therefore began our research by evaluating the latent structure of specific variables in these two domains.

In designing this investigation, we considered a number of data-gathering techniques, including direct observation and interviews of children, parents, teachers, and others close to the child. However, the number of subjects on whom we wished to gather data was quite large, and we questioned how practical, obtrusive, and ethical direct measurements might be. Therefore, we chose an admittedly imperfect but highly feasible alternative: self-administered questionnaires consisting of multiple-choice items.

In this paper, we report our initial work in developing measures of constructs in the domains included in our general model and in testing our hypotheses using cross-sectional data. We first gathered questionnaire items to measure variables in the model's four domains: environmental influences, beliefs, personality, and behavior. Below, we report results of analyses of pretest data collected from junior high school students; we conducted these analyses to refine our measures. We then report tests of our hypotheses.

DEVELOPMENT OF MEASURES

Behavior

To measure children's smoking behavior, we asked two types of questions. The first type involved specific behavioral reports; the items asked whether the child had smoked a cigarette in the last month, week, and day. These three items were combined into an index. The second type of question asked for a global estimate of smoking frequency, with five answer choices: never; once a month; once a week; every day; used to but quit. Regression analysis of data collected from junior high school students indicated good convergent validity for the two scales ($R^2 = .69$, $df = 4/2469$).¹

Since we suspect that quitting smoking is unreliably measured (particularly at this age), we decided to eliminate quitters from our analyses. An alternative to eliminating quitters from the analyses would have been to give them a zero on the index, i.e., treat them like nonsmokers. However, as a group the quitters were significantly different from nonsmokers, with 24% of the students who called themselves quitters reporting having smoked a cigarette in the last year (compared to 0% for the nonsmokers). Eliminating them from the sample does not appear to have changed our conclusions: an analysis using pair-wise deletion of subjects (including the quitters) which is discussed below obtained results no different from the sample without quitters.

¹ To evaluate the convergent validity of the two scales measuring smoking behavior, we regressed the behavioral index on a series of dummy variables representing the global estimate scale. D1 was coded "1" if the child reported smoking once a month; D2 was coded "1" if the child reported smoking every day; and D4 was coded "1" if the child responded "used to but quit." The regression showed that students who said they smoke every day have a mean score of "2" on the index. Students who smoke once a month have a mean score of "1" on the index. Quitters tended to score "1", "2", or "3" on the index in a significant number of cases.

Environment

Items measuring a child's perceptions of environmental influences asked the cigarette smoking rate of each parent (answer choices: never; once a month; once a week; every day), whether any brothers and/or sisters smoke cigarettes regularly, how many of a child's "really good friends" smoke cigarettes regularly (the number of friends who smoke divided by the total number of friends), and what instructions a child's parents have given him or her about cigarette smoking (answer choices: I should smoke; nothing or smoking isn't a big deal; I shouldn't smoke). These variables served as indicators of four constructs: *parents' smoking*; *siblings' smoking*; *friends' smoking*; and *parents' instructions*.

The treatment of missing data on the measures of parental, sibling, and friends' behavior is complicated. Some of the students in our samples have no mother or no father or no sisters or no brothers or no really good friends. The procedure we used to test our model requires complete data on all the indicators in the model. If we omitted these children from the sample that we analyzed, we may generalize our conclusions to only a limited population. However, to include children with no mother, for example, we must give them a valid score on the item measuring mother's smoking behavior.

One way to accomplish this would be to give children with no mother the same score as we give to children with a nonsmoking mother. We found that children with no mother tended to smoke more than children with a nonsmoking mother ($F = 26.98$, $df = 1/2058$, $p < .001$). Similarly, children with no father tended to smoke more than children with a nonsmoking father ($F = 12.81$, $df = 1/2051$, $p < .001$). In contrast, children with no brothers or no sisters tended to smoke at about the same rate as children with nonsmoking brothers or sisters (Brothers: $F = .058$, $df = 1/1159$, n.s.; Sisters: $F = .006$, $df = 1/1155$, n.s.). Children with no really good friends tended to smoke more than children with nonsmoking friends ($F = 6.05$, $df = 1/1093$, $p < .025$). Based upon these results, we omitted from further analysis children with no father or no mother or no really good friends. Children with no sisters or no brothers were given the same score on sisters' or brothers' smoking as were children with nonsmoking siblings.

Beliefs

We developed a set of items measuring children's beliefs about the consequences of smoking from observations of young adoles-

cents in structured discussions about their thoughts and feelings concerning cigarettes and their experiences with smoking. In order to evaluate the structure of these items, we conducted analyses suggested by Armor (1974) and Milburn (1978), beginning with a principal components exploratory factor analysis with varimax rotation. From analysis of our first pretest data from 718 students, there appeared to be two meaningful factors underlying our items according to a screening test. The solution is displayed in Table 1. While the first factor might represent beliefs about favorable consequences, it might also represent beliefs about social consequences. Similarly, the second factor might represent beliefs about unfavorable or personal consequences. Because we measured no unfavorable social beliefs or favorable personal beliefs, we were not able to specify the meanings of these factors without further investigation.

We therefore collected a second set of pretest data from 1758 students. We asked of these subjects an item addressing an undesirable social consequence ("Smoking cigarettes makes people act stupid") and another addressing a desirable personal consequence ("If I smoked cigarettes, I would feel more relaxed") in addition to the belief items appearing in Table 2, except for Q106 (removed to reduce the length of the questionnaire). A principal components factor analysis of these items again extracted two meaningful factors. Because the item addressing favorable personal consequences loaded on the first factor, we labeled it *favorable beliefs* rather than social beliefs. Because the item addressing unfavorable social consequences loaded on the second factor, we labeled it *unfavorable beliefs* rather than personal beliefs. The health belief item loaded only slightly on both factors (less than .30) so we decided to treat it as an indicator of a third factor.

A confirmatory factor analysis (using LISREL IV; Jöreskog and Sörbom, 1978) of the items other than the health belief item suggested that their latent structure is in fact more complex than it first appeared. The first-order derivatives indicated that *popularity beliefs* are distinct from *enjoyment beliefs*. After altering the model along these lines, we dropped low-loading items according to the matrices of residuals to maximize factor independence. Since one of the indicators of *enjoyment beliefs* shared residual variance with the three indicators of *popularity beliefs*, we allowed those residual covariances to vary from zero. The parameter estimates for the resulting model appear in Table 2 along with two goodness-of-fit indicators, χ^2 and Delta (see Bentler and Bonnett, 1980; Sörbom, 1975 for details). The model fits the data quite well. The two *favorable beliefs* factors are moderately correlated, and *unfavorable beliefs* is essentially uncorrelated with either of them.

Personality

We gathered a pool of questionnaire items to measure personality factors of interest such as self-esteem, rebelliousness, anxiety, social adjustment, depression, and persuasibility from the work of Coopersmith (1967). In order to evaluate the latent structure of these items, we again conducted a principal components exploratory factor analysis with varimax rotation of pretest data from 475 students. According to a scree test, a four-factor solution was most meaningful. The solution appears in Table 3. We labeled the first factor *social anxiety*, the second *obedience*, the third *rebelliousness*, and the fourth *self-esteem*.

A similar exploratory factor analysis of a second set of pretest data from 1772 students extracted the same four factors from these items (Q148 and Q154 were not included be-

Table 1. Exploratory Factor Analysis of Belief Items (N = 718)

Item	Translation of Item	Factor Loadings	
		Factor 1	Factor 2
Q85	If I smoked, I would have more friends.	.749	
Q86	If I smoked, older kids would like me more.	.737	
Q97	If a girl smokes, boys like her more.	.732	
Q96	If a boy smokes, girls like him more.	.726	
Q95	Smoking cigarettes makes you look cool.	.680	
Q87	If a kid smokes, it proves he's tough.	.651	
Q91	Kids who smoke have more fun.	.570	
Q106	Is smoking a lot of cigarettes bad for one?		.729
Q101	If I smoked, I'd be afraid of getting caught.		.644
Q105	How often can one smoke without it hurting them?		-.544

Note: Entries in the table are standardized factor loadings.

Table 2. Confirmatory Factor Analysis of Belief Items (N = 1758)

Item	Translation of Item	Loading	Disturbance Variance																																								
<i>Popularity Beliefs (PB)</i>																																											
Q86	If I smoked, older kids would like me more.	.693	.519																																								
Q85	If I smoked, I would have more friends.	.644	.586																																								
Q95	Smoking cigarettes makes you look cool.	.605	.634																																								
<i>Enjoyment Beliefs (EB)</i>																																											
Q91	Kids who smoke have more fun.	.594	.645																																								
Q1*	If I smoked, I would feel more relaxed.	.582	.661																																								
<i>Unfavorable Beliefs (UB)</i>																																											
Q2*	If I smoked, I would feel more uptight.	.768	.410																																								
Q101	If I smoked, I'd be afraid of getting caught.	.392	.846																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: center;"><i>Factor Correlations</i></th> <th colspan="4" style="text-align: center;"><i>Residual Correlations</i></th> </tr> <tr> <th></th> <th>PB</th> <th>EB</th> <th>UB</th> <th></th> <th>Q86</th> <th>Q85</th> <th>Q95</th> </tr> </thead> <tbody> <tr> <td>Pb</td> <td>—</td> <td></td> <td></td> <td>Q91</td> <td>.140</td> <td>.200</td> <td>.252</td> </tr> <tr> <td>EB</td> <td>.532</td> <td>—</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>UB</td> <td>-.014</td> <td>-.219</td> <td>—</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>				<i>Factor Correlations</i>				<i>Residual Correlations</i>					PB	EB	UB		Q86	Q85	Q95	Pb	—			Q91	.140	.200	.252	EB	.532	—						UB	-.014	-.219	—				
<i>Factor Correlations</i>				<i>Residual Correlations</i>																																							
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$\chi^2_8 = 12.54, p = .129$ Delta = .99																																											

* New Items.

cause some children had difficulty understanding them, and some items with low loadings on all four factors in Table 3 were not included). We again conducted a confirmatory factor analysis of these items. The first derivatives produced by the estimation procedure indicated considerable share residual variance of the *self-esteem* factor with other factors. Consequently, we eliminated *self-esteem* from the model. In addition, we removed other indicators to maximize the independence of the factors.

The parameter estimates and the χ^2 and Delta values for the resulting model are pre-

sented in Table 4. Delta indicates that 94% of possible fit is accomplished by the model. The correlations among the factors suggest that *social anxiety* and *rebelliousness* are essentially orthogonal, and *obedience* seems to be moderately correlated with each of them.

STUDY ONE

Model

To test our hypotheses derived from Figure 1, we estimated the parameters of the model presented in Figure 2 using data collected from 2533 junior high school students. The

Table 3. Exploratory Factor Analysis of Psychological Factor Items (N = 475)

Item	Translation of Item	Factor Loadings			
		Factor 1	Factor 2	Factor 3	Factor 4
Q150	I wish I could be as happy as others.	.658			
Q156	It's hard to tell if people like me.	.630			
Q148	I feel stupid in front of others.	.602			
Q122	How often do you feel lonely?	.600			
Q141	Things get so rough, I feel I can't win.	.595			
Q154	I don't have any real friends.	.574			
Q160	I'm nervous when I meet new people.	.571			
Q140	I'm too nervous.	.570			
Q136	I follow my parents' teachings.		.640		
Q144	When my parents tell me to do something, I obey.		.587		
Q124	I'm more comfortable with family than friends.		.583		
Q119	Teachers pick on me.			.567	
Q152	I do things just to bother my teacher.			.556	
Q157	Other people think I'm tough.			.437	
Q131	How many classmates do you like?				.681
Q137	How many classmates like you?				.678
Q123	My friends do what I suggest.				.463
Q133	I can do almost anything I put my mind to.				.425

Note: Entries in the table are standardized factor loadings.

Table 4. Confirmatory Factor Analysis of Personality Items (N = 1772)

Item	Translation of Item	Loading	Disturbance Variance
<i>Social Anxiety (SA)</i>			
Q141	Things get so rough, I feel I can't win.	.697	.514
Q160	I'm nervous when I meet new people.	.547	.701
Q156	It's hard to tell if people like me.	.421	.822
<i>Rebelliousness (REB)</i>			
Q152	I do things just to bother my teacher.	.688	.527
Q110	I enjoy doing things I shouldn't do.	.567	.678
Q119	Teachers pick on me.	.466	.783
<i>Obedience (OBD)</i>			
Q136	I follow my parents' teachings.	.715	.489
Q144	When my parents tell me to do something, I obey.	.501	.749
Q124	I'm more comfortable with family than friends.	.443	.804

Factor Correlations:

	SA	REB	OBD
SA	—		
REB	.115	—	
OBD	.296	-.384	—

$$\chi^2_{24} = 111.42, p < .001$$

$$\Delta = .94$$

structural model includes four environmental factors: *parents' smoking* (PS); *siblings' smoking* (SS); *friends' smoking* (FS); and *parents' instructions* (PI). Each of these is hypothesized to cause four belief factors: *popularity beliefs* (PB); *enjoyment beliefs* (EB); *unfavorable beliefs* (UB); and *health beliefs* (HB).

These belief factors have direct effects and we have not measured all beliefs that may mediate environmental influences, as the unmediated effect of environment on behavior is included in the model. The structural model also specifies that omitted causes of the four belief factors (U_{PB} , U_{EB} , U_{UB} , U_{HB}) may be correlated

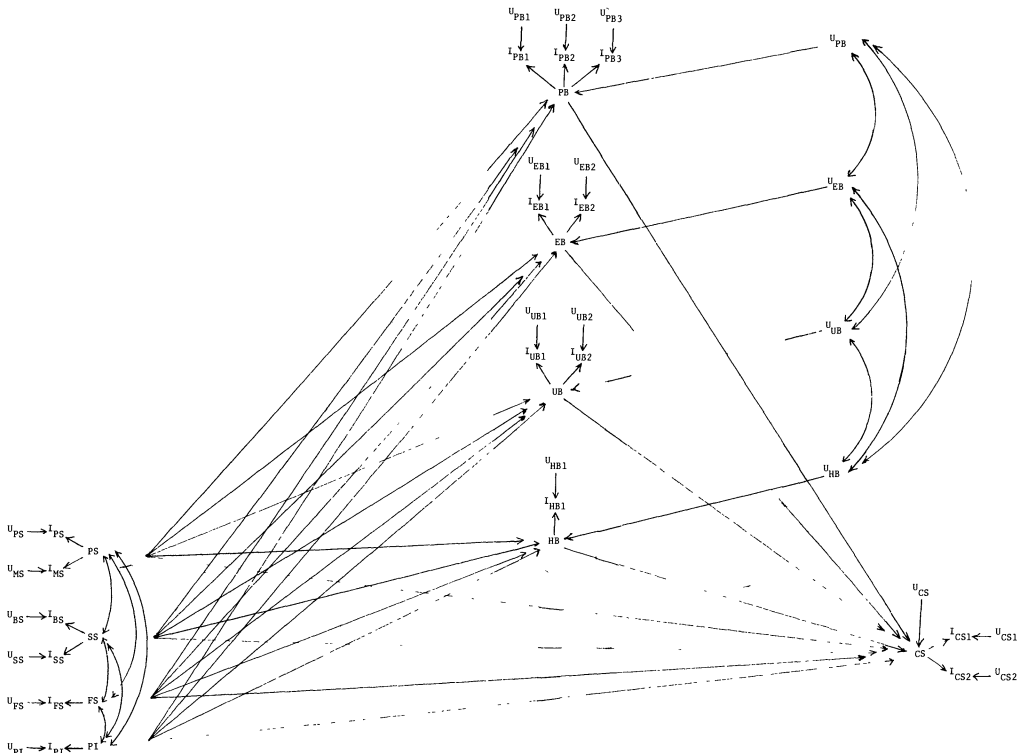


Figure 2. Measurement and Structural Models of the Causes of Smoking Behavior

Note: Correlations among disturbances to indicators allowed to vary from zero: $r_{U_{EB1}U_{PB1}}$, $r_{U_{EB1}U_{PB2}}$, $r_{U_{EB1}U_{PB3}}$

with one another. Similarly, the omitted causes of each of the environment factors may be correlated with one another.

The measurement model includes sixteen indicators (I 's in Figure 2). Father's smoking (I_{PS}) and mother's smoking (I_{MS}) are indicators of PS. Dummy variables representing brothers' smoking (I_{BS}) and sisters' smoking (I_{SS}) are indicators of SS. FS and PI each have single indicators (I_{FS} and I_{PI} , respectively) described above. The indicators of PB (I_{PB1} , I_{PB2} , and I_{PB3}), EB (I_{EB1} and I_{EB2}) and UB (I_{UB1} and I_{UB2}) are described in Table 2. HB has a single indicator (I_{HB1}), which is Q105 in Table 1. The global estimate (I_{CS1}) and the behavioral index (I_{CS2}) are indicators of CS. The disturbances to indicators of PS (U_{PS} , U_{MS}), SS (U_{BS} , U_{SS}), PB (U_{PB1} , U_{PB2} , U_{PB3}), EB (U_{EB1} , U_{EB2}) and CS (U_{CS1} , U_{CS2}) are assumed to be uncorrelated with one another, except that U_{EB1} is correlated with U_{PB1} , U_{PB2} , and U_{PB3} . The constructs with single indicators are assumed to be perfectly measured, so the disturbances to their indicators (U_{FS} , U_{PI} , U_{HB1}) are constrained at zero.

Estimation

We estimated the unknown parameters of this model using LISREL IV. The variance of each latent construct was fixed at unity; the resulting structural parameter estimates are standardized coefficients, as are the loadings. For a standardized model, LISREL requires as input a matrix of correlations among the indicators. Because the subjects we studied are nested within junior high schools, their responses are not independent to the extent that a school's climate influences the students in it; parameters may be misestimated from a matrix of simple correlations. To control for this nonindependence, we wished to extract variance in the indicators that is due to the effect of school climate. We therefore submitted to LISREL a matrix of partial correlations among the indicators, computed by controlling for nine dummy variables representing the ten schools involved.

Sample

A questionnaire including our measures of behavior, environmental influences, beliefs, and personality factors was administered anonymously in September, 1979, to 2533 6th, 7th, and 8th grade students in six Boston area schools and four Monterey Bay area schools during one class period. The bogus pipeline technique (see Evans et al., 1977, for details of the procedure) was employed to increase the validity of self-reported cigarette smoking.

Over half of the students were 12 years old; about one-quarter were 11 years old; about one-quarter were 13 years old. The sample contained equal numbers of boys and girls.

Complete data on all the indicators in the model and on school were required for subjects to be included in the sample for this analysis. We did not include students who did not have two parents, who had no really good friends, or who reported having quit smoking cigarettes. Of the students to whom we wish to generalize our findings (e.g., students with two parents, with one or more friends, and who did not report quitting smoking), 57% are not included in this analysis because they did not respond to one or more of the indicators in the model or to the question recording their school.

We might have chosen to use the pair-wise deletion method in computing the partial correlation matrix for this analysis. Correlations in such a matrix would be based on an average of 2099 cases, or 83% of the total sample. The amount of the available information utilized in such an analysis is quite large. We estimated the parameters of the model from this partial correlation matrix and found no differences between the coefficient estimates thus derived and ones based on a casewise deleted matrix, and because tests with the smaller sample size are more conservative, we report those parameter estimates and their significance levels below.

Results

The structural parameter estimates based upon the sample of 821 with complete data are presented in Table 5. Delta ($= .973$) indicates that the model fits the data well.

Given the model specification, the following main effects are significant. *Parents' smoking* affects *health beliefs* such that the more parents smoke, the less one is likely to believe that smoking has health consequences. *Friends' smoking* affects *popularity beliefs*, *enjoyment beliefs*, and *health beliefs*; the more of one's friends who smoke, the more likely one is to believe that smoking has popularity consequences and enjoyment consequences, and the less likely one is to believe smoking has health consequences. *Parents' instructions* affect *popularity beliefs* such that the more parents encourage smoking, the more likely one is to believe smoking will make him or her more popular. *Friends' smoking*, *siblings' smoking*, and *enjoyment beliefs* affect *cigarette smoking*, such that the more friends and siblings one has who smoke and the more one believes smoking has enjoyment consequences, the more one tends to smoke. These main effects explain 47.5% of the variance in cigarette smoking.

Table 5. Standardized Maximum Likelihood Structural Parameter Estimates

Effect	Causes								Disturbance Variance
	PS	SS	FS	PI	PB	EB	UB	HB	
PB	.063	-.016	.131*	.121*					.958
EB	.158	-.018	.397*	.042					.788
UB	.096	.029	.067	.053					.975
HB	.132*	-.013	.125*	.007					.961
CS	.019	.160*	.477*	.022	-.054	.252*	.000	.014	.525

Note: All variables are coded such that a higher score indicates a more pro-smoking value. PS = parents' smoking; SS = siblings' smoking; FS = friends' smoking; PI = parents' instructions; PB = popularity beliefs; EB = enjoyment beliefs; UB = unfavorable beliefs; HB = health beliefs; CS = cigarette smoking.

* Coefficient is greater than twice its standard error.

In summary, *friends' smoking* affects *cigarette smoking*, and part of its effect is mediated by *enjoyment beliefs*. *Siblings' smoking* also affects *cigarette smoking*. In addition, parents and friends affect beliefs. These findings are consistent with our hypotheses although we were particularly surprised to find that parents do not affect smoking and that *popularity beliefs*, *unfavorable beliefs*, and *health beliefs* do not affect smoking. We concluded that the model has been sufficiently supported to warrant investigation of the personality interaction hypotheses.

STUDY TWO

To test our hypotheses about personality interactions with environmental influences and beliefs in influencing cigarette smoking, we performed further analyses on data collected in a follow-up survey of half the subjects examined in *Study One*. The procedure for data collection in *Study Two* was the same as in *Study One*.

Model

Given the results of *Study One*, we decided to focus our tests of interactions on the effects of *friends' smoking* and *enjoyment beliefs*.

Specifically, we wished to test the following hypotheses: (1) For children who are high on *social anxiety*, *enjoyment beliefs* and *friends' smoking* will be more influential than for low-*social anxiety* children. (2) For high-*obedience* children, *friends' smoking* will be less influential than for low-*obedience* children. (3) For high-*rebelliousness* children, *friends' smoking* will be more influential than for low-*rebelliousness* children. To test these hypotheses, we estimated the parameters of the model presented in Figure 3.

The model includes three latent constructs, *friends' smoking* (FS), *enjoyment beliefs* (EB), and *cigarette smoking* (CS), and six observed variables. I_{FS1} is the percent of really good friends who smoke, and I_{FS2} is the response to "How many of your good friends smoke cigarettes?" (Answer choices: none; some; most; all). The two indicators of EB are the same as are shown in Table 4. I_{CS1} is the global estimate used in *Study One*, and I_{CS2} is a behavioral index computed as above from two questions asking whether a child smoked in the last week and in the last 24 hours. The disturbances to the indicators (U_{FS1} , U_{FS2} , U_{EB1} , U_{EB2} , U_{CS1} , U_{CS2}) and to the latent constructs (U_{EB} , U_{CS}) are all assumed to be uncorrelated with one another.

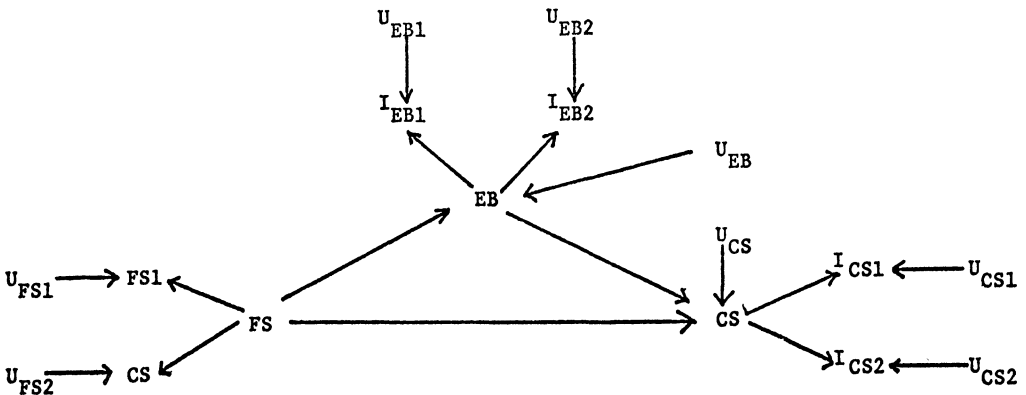


Figure 3. Measurement and Structural Models Examined in Study Three

Estimation

Given this model, an interaction with a personality factor is tested as follows. The parameters of the model are estimated separately and simultaneously for students in the top and bottom thirds of the personality factor distribution. LISREL produces a χ^2 statistic associated with these parameters. The model parameters are then re-estimated with the constraint that a given structural parameter must be equal in the two groups. If the χ^2 associated with these parameters is significantly different from the former χ^2 , the constrained parameter is significantly different in the two groups and an interaction is present. The difference between the two χ^2 s is distributed as χ^2 , with degrees of freedom equal to the difference between the degrees of freedom for the two χ^2 s (see Judd and Kenny, 1981).

Such between-group comparisons must be made using unstandardized structural coefficients (Judd and Milburn, 1980). To estimate this type of coefficient, one loading for each latent construct must be constrained at unity while the variances of the latent constructs are left unconstrained (Kenny, 1979). However, comparisons of unstandardized coefficients may only be made if each loading in the model is constrained to be equal in the two groups (Judd et al., 1981). This restriction is imposed on the model.

Using the items shown in Table 4, we computed factor scores for each respondent on the three personality factors. The reliability of the *social anxiety* scores is .507; for *rebelliousness*, .482; and for *obedience*, .428 according to the pretest confirmatory factor analysis.² Using LISREL, the parameters of the model were estimated for children in the top and bottom thirds of the *social anxiety*, *rebelliousness*, and *obedience* distributions. We again submitted to LISREL partial correlation matrices and standard deviations with variance asso-

ciated with between-school differences extracted. We used Delta to assess the goodness of fit of the model to data from the high and low groups on each personality factor.

Sample

The data used in Study Two were collected in the context of a smoking-prevention program evaluation; five of the schools surveyed in *Study One* received the treatment after the data were collected and the other five schools did not. In order to look at the process of smoking onset "uncontaminated" by a smoking-prevention program, the present analysis is based upon data collected at the control schools in May 1980. Most of the students surveyed at the second wave provided data used in *Study One*, though not all students in the present analysis did. A total of 1141 students were surveyed, and 65% of them provided complete data on all the indicators in the model. The bogus pipeline technique was again employed to enhance self-report solidity.

Results

Delta indicates that models specifying equal loadings between high and low groups fit the observed data extremely well in the cases of all three personality factors (*Social anxiety*: Delta = .99; *Rebelliousness*: Delta = .99; *Obedience*: Delta = .98).

The unconstrained structural parameters are presented in Table 6. Although two of the three parameters are larger for the high-*social anxiety* group, the effects do not differ significantly (Friends: $\chi^2_2 = 2.45$, $p < .05$; Beliefs: $\chi^2_1 = .4496$, $p < .05$). However, *friends' smoking* is significantly less influential for high-*obedience* children than for low-*obedience* children ($\chi^2_2 = 11.26$, $p < .005$). In addition, *friends' smoking* is significantly more influential for high-*rebelliousness* children than for low-*rebelliousness* and *obedience* in influencing cigarette smoking.

DISCUSSION

The purpose of this paper is to present and test a general model of the causes of cigarette smoking among adolescents. The meta-theory addresses constructs in four broad categories: environmental factors; beliefs about the consequences of behavior; personality variables; and behavior. We selected indicators of constructs in each of these categories using exploratory and confirmatory factor analysis techniques and multiple regression. We found the fit of the model including environmental factors, beliefs, and behavior to be quite ade-

² After comparing the reliabilities of scores computed in a number of ways, we chose to sum the standardized scores on all the indicators of a construct. The reliability of factor scores thus constructed, which is estimated by the squared correlation between the factor score and the construct, is derived as follows:

$$r_{cf}^2 = \frac{\left[\sum_{i=1}^k (\alpha_i \alpha_i^2) \right]^2}{\sqrt{\sigma_c^2} \sqrt{\sigma_f^2}}$$

Where r_{cf} is the correlation, α_i is the loading of the i th item, k is the number of items used to construct the factor score σ_c^2 is the variance of the latent construct, and σ_f^2 is the variance of the factor score. We thank David A. Kenny for deriving this formula.

Table 6. Unstandardized Parameter Estimates with Equal Measurement Models Across High and Low Groups

Group	Effects			N
	EB on CS	FS on EB	FS on CS	
High Social Anxiety	.438	1.182	1.401	261
Low Social Anxiety	.331	.821	1.632	247
High Rebelliousness	.192	.872	1.780	245
Low Rebelliousness	.211	.568	1.163	264
High Obedience	.292	.342	1.217	257
Low Obedience	.231	.845	1.949	245

quate, and we found evidence for interactions between the former two types of constructs and personality factors.

While our general model is quite similar to that examined by Jessor and Jessor (1977) in the study of problem behavior, the present paper makes two important advances over their empirical tests. First, we specified and evaluated a model of the cognitive process by which environmental factors influence behavior. Second, because we used techniques of causal modeling with latent variables, our effect estimates are distorted by errors of measurement. Thus, the present results enhance our understanding of the influence processes studied by Jessor and Jessor (1977).

Our confidence in the findings reported above is limited by several concerns. One stems from the cross-sectional nature of these data. Although our hypotheses about causal direction were found to be consistent with the data, the reciprocal effects of behavior upon environment and beliefs are no doubt significant. In addition, the causes of smoking onset and maintenance are confounded in the present investigation. Different environmental, belief, and personality factors may be responsible for onset than are responsible for maintenance. More extensive analyses of longitudinal data are required to address these issues.

A second concern is the fact that the data upon which we have based our analyses are all self-reported. Thus, the disturbances to various indicators may be correlated due to measurement method, social desirability influences, or other factors. Because the version of the model that we tested assumed that disturbances were uncorrelated, our structural parameter estimates may be biased. Further tests of the model should avoid using only self-report data.

A third limitation of our analyses is that we may not have measured all the appropriate beliefs. Fishbein (1980) has shown that beliefs about the consequences of others' behavior are often different from beliefs about the consequences of one's own behavior. The latter have been strongly associated with behavior, while

the former have been less so. Our measures of *popularity*, *enjoyment*, and *negative* beliefs referred to both the consequences of others' behavior and of one's own behavior. The confirmatory factor analyses suggested that the "other's/own" distinction was not important; associations between the two types of items were quite high within factors. However, health beliefs were only measured with respect to others; our conclusions about the importance of health beliefs may have been different had we measured with respect to one's self.

Despite these concerns, we believe that the present findings support the following conclusions. In general, these results appear to demonstrate the processes depicted in Figure 1. Environmental factors are associated with behavior, and parts of these associations seem to be mediated by beliefs about the consequences of behavior. Personality factors are found to modify the relationships between environment, beliefs, and behavior. Thus, the theoretical model has proven to be a useful guide in understanding the causes of adolescent cigarette smoking.

These findings have implications for public health actions to deter or reduce smoking among adolescents. The dominant causal role played by friends' smoking justifies efforts to interfere with peer influences on smoking behavior. However, the finding that expectation of enjoyment is the major cognitive mediator of peer influence indicates that the reinforcing effects of smoking are important and that such effects must be acknowledged in prevention programs. The finding that neither parents' smoking behavior nor parents' instructions are causes of smoking suggests that interventions that attempt to change parental behavior may have no effect on adolescent behavior.

The results also suggest that aspects of personality are indirectly involved in the process causing adolescent cigarette smoking. Obedient children are less influenced by peers, and rebellious children are more influenced by peers. Thus our findings support Jessor and Jessor's (1977) view of cigarette smoking as a

consequence of peer influence coupled with resistance to influence by adult authority. Perhaps prevention must address the conditions which engender that general resistance.

These results are consistent with the primary theories of alcohol consumption and drug use discussed by Kandel (1980). Jessor and Jessor's (1977) field theory proposes that the perceived social environment and personality systems are the domains of independent variables most useful in predicting problem behavior. Akers's (1977) integration of social learning theories proposes that the perceived social environment influences behavior by defining the consequences of behavior and by differential reinforcement. Kandel's (1980) framework suggests that the impact of competing social influences depends upon the individual's suggestibility to influence by specific agents, particularly parents and peers. Thus, the present paper offers support for theories which have proved useful in explaining substance abuse more broadly.

In summary, this paper offers support for a theory of cognitive mediation in the influence of one's environment upon one's behavior. In addition, it offers evidence for the existence and importance of personality factors that determine how environment affects behavior. The findings reported here advance our understanding of the causes of adolescent cigarette smoking. By developing valid measures of theoretically important variables and by examining their simultaneous relationships with behavior, we have begun to untangle the web of inconsistent evidence about relationships between variables previously studied in isolation.

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A Test of Equity Theory for Marital Adjustment

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This study investigated the relationship between perceptions of equity/inequity in marriage and marital adjustment. One hundred sixty-two couples completed the Walster Global Measure of Participants' Perceptions of Inputs, Outcomes, and Equity/Inequity and the Spanier Dyadic Adjustment Scale. Based upon equity theory it was predicted that: (a) Perceptions of equity/inequity within the marital dyad will be related to one's own and one's spouse's marital adjustment (the greater the inequity the less adjustment indicated). (b) Perceptions of equity will be related for husbands and wives; to the extent that one views oneself as overbenefited, one's spouse will view him/herself as underbenefited. (c) Relationships which both partners view as equitable will yield the greatest average marital adjustment. With the exception of wives' marital adjustment being related to degree of overbenefitedness, support was obtained for these hypotheses. Reasons why overbenefited wives did not behave in agreement with an equity framework are discussed.

Equity theory has been applied to the study of a variety of intimate and nonintimate re-

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lationships (see Walster et al., 1978a). The fundamental application of an equity theory approach to the study of intimate and nonintimate relationships emphasizes the following postulates (see Walster et al., 1978a:6 for a formal listing of the basic propositions of equity theory). Individuals are profit oriented concerning exchange in relationships with the recognition that maximum collective reward evolves with accepted standards for equitably