

# The Power of Policy: The Relationship of Smoking Policy to Adolescent Smoking

MARY ANN PENTZ, PhD, BONNIE R. BRANNON, EdD, VENTURA L. CHARLIN, PhD, EDITH J. BARRETT, PhD,  
DAVID P. MACKINNON, PhD, AND BRIAN R. FLAY, DPHIL

**Abstract:** This study examined the effects of smoking policy on 4,807 adolescents in 23 schools over a two-county area in California. Amounts and prevalence rates of adolescent smoking were measured with a self-report survey and a biochemical measure; school smoking policy was measured with two independent surveys of school staff. Policy effects were evaluated with multiple and logistic regression analyses controlling for school-level socioeconomic status and environmental support for teaching and administration. Of the 23 schools, 100 percent had a formal written and regularly enforced policy component restricting student smoking on school grounds, 94 percent restricted students leaving school grounds, 65 percent

restricted smoking near school grounds, and 57 percent had a smoking prevention education plan. Schools with policies having all four versus less than four components, high versus low emphasis on prevention, and a low versus high emphasis on cessation reported lower amounts of smoking in the last week and in the last 24 hours. Punitive consequences of policy violation had no effect. Results were compared to school staff observations of adolescent smoking, and school archival records of student smoking violations in the last year. Results suggest that school smoking policy is associated with decreased amounts of smoking in adolescents. (*Am J Public Health* 1989; 79:857-862.)

## Introduction

Despite widespread knowledge of the health risks of cigarette smoking, 26.5 percent of adults and 18.7 percent of graduating high school seniors in the United States continue to smoke daily.<sup>1,2</sup> Fortunately, among adults, the prevalence of smoking and the associated rates of chronic disease mortality rates have declined steadily in the last 20 years.<sup>1,3</sup> However, among adolescents, smoking has decreased only 1.6 percent in the last five years.<sup>4</sup>

The effectiveness of school-based educational programs for preventing early adolescent smoking has been well documented.<sup>5,6</sup> Nevertheless, additional prevention strategies may be required to produce long-term changes in adolescent smoking behavior.

Over 90 percent of adult smokers who quit smoking do so on their own.<sup>3,7-9</sup> This percentage suggests that the steady decline in adult smoking prevalence rates may be at least partially attributable to efforts that have been aimed at motivating smokers to quit, such as anti-smoking mass media campaigns, increased taxation of cigarettes, public smoking education, and regulatory policies that restrict smoking in the workplace or public settings.<sup>10-15</sup>

No studies have yet evaluated the effectiveness of policy in reducing adolescent smoking. A logical approach would be to evaluate the effects of school smoking policy on adolescents, controlling for school-level socioeconomic status (SES), support for teaching and administration, and variables differentiating components of policy that relate to educational programming for smoking prevention from components that relate to regulation of smoking.<sup>16,17</sup> We undertook such a study.

From the Institute for Health Promotion and Disease Prevention Research, University of Southern California School of Medicine (Pentz, Brannon, Charlin, Barrett, MacKinnon), and the Prevention Research Center, University of Illinois School of Public Health at Chicago (Flay). Address reprint requests to Mary Ann Pentz, PhD, Associate Professor of Research, Institute for Health Promotion and Disease Prevention Research, Department of Preventive Medicine, University of Southern California, 35 North Lake Avenue, Suite 200, Pasadena, CA 91101. This paper, submitted to the *Journal* July 27, 1988, was revised and accepted for publication December 12, 1988.

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## Methods

### Subjects

Subjects included 4,807 seventh grade students, 104 teachers, 21 principals, and 23 school clerks from 23 middle/junior high schools in Los Angeles and San Diego counties. The 23 schools represented all of the middle/junior high schools from three large school districts that are participating in a five-year trial of the effects of varied smoking education programs on prevention of adolescent smoking.<sup>18</sup> The average grade size per school was 213, with a student population characterized as high minority and low socioeconomic status (20 percent White, 27 percent Black, 44 percent Hispanic; 23 percent receiving free lunch as part of the federal Aid to Families with Dependent Children (AFDC) program). The population was 49 percent female.

Informed consent was required of both student and parent. Of the 6,101 students enrolled in seventh grade at the time of the study, 319 declined to participate and 975 were absent, resulting in a response rate of 79 percent. Of the school staff solicited for participation, 100 percent of teachers, 91.3 percent of principals, and 100 percent of school clerks responded and participated in assessment. Two principals (8.7 percent) who initially agreed to participate were unavailable during the data collection period and, consequently, were not assessed.

### Policy

The California State Education Code bans all student smoking on school grounds in middle and junior high schools. At the initiation of this study in 1986, the policy had been in effect for an average of 34 years in the participating middle and junior high schools, and students had been exposed to the policy for an average of 13 months.

### Measures

Sources of data included school archival records, a student self-report survey and biochemical measure of smoking, and surveys of teachers, principals, and school clerks.<sup>19</sup> (See Appendix for details of specific items analyzed for this study.)

Students completed a 109-item questionnaire measuring amount (number of cigarettes smoked) and prevalence rates (percent of smokers) of cigarette smoking in lifetime, last

week, and last 24 hours; related attitudes and behaviors; and demographic characteristics (gender, race/ethnicity, socioeconomic status).<sup>20</sup> During questionnaire administration, students also provided an expired air sample for carbon monoxide analysis of smoking, and were informed of the use of the sample as a test for smoking.<sup>21,22</sup>

The science and health education teachers and the principal of each school independently completed a 96-item questionnaire about staff and student smoking policies, including restriction of smoking on and near school grounds, a closed campus limiting opportunities for smoking off school grounds, and a formal educational plan for smoking prevention.<sup>16,23</sup> Staff awareness, perceived effectiveness of policy, and observations of staff and student smoking were also assessed. Environmental support for teaching and administration was measured using a modified form of the Moos Classroom Environment Scale, which was originally designed to assess supportive teaching environment in the classroom as it relates to student academic and social behavior.<sup>24</sup>

School clerks were interviewed with a 21-item survey which measured the extent to which smoking was allowed on school grounds, the length of years policy had been in effect, level of enforcement of policy, change in the number of smoking violations in the school in the last year, consequences of policy violation, and emphasis of the policy on punishment, prevention, and cessation.

**Statistical Analysis**

Separate t-tests were conducted to determine the equivalence of principal and teacher responses for pooling these groups in analyses. Principals and teachers did not differ in their reports of smoking levels of students or staff, or existence of policy or smoking prevention programs (none of the schools had smoking prevention programs). Within-school internal consistency of responses was high (calculated as a Cronbach alpha of all items across respondents within each school, average alpha = .83, ranging from .50-.99 for each school). Thus, principal and teacher ratings were averaged to produce one rating for each item for each school. For four schools in which the principal survey was incomplete, the rating for each item for that school was based on the average rating by the four to five teacher respondents.

Multiple linear and logistic regression analyses were conducted on each adolescent smoking item (amount and prevalence), with each policy variable (comprehensiveness, prevention emphasis, cessation emphasis, punishment emphasis) entered as an independent variable, and school-level socioeconomic status and school environmental support entered as covariates. To increase test validity, staff awareness and perceived effectiveness of policy were additionally controlled for in analyses of the effect of number of policy components. Separate t-tests were also conducted to determine whether individual policy components had a significant effect on smoking. The SAS software program was used for all analyses (GLM ANOVA for linear regression; CATMOD for logistic regression).<sup>25</sup> Analyses were conducted using school as the unit by aggregating individual respondents' data by school, and then merging the three data sets by a three-digit school identification code.

**Results**

Schools varied widely in the number and combination of policy components related to regulation of smoking (no smoking on school grounds, near school grounds, and closed

campus), but were about evenly divided on the component related to smoking education (smoking prevention education plan). Characteristics of schools with and without a smoking prevention education plan were similar (Table 1). The groups did not differ significantly on any of the characteristics.

Averaged across all schools, 5.1 percent of adolescents reported having smoked in the last week, and 2 percent in the last 24 hours. Smokers averaged 7.1 cigarettes in the last week, and 2.3 cigarettes in the last 24 hours.

In a separate sub-study conducted under more controlled field test conditions, number of cigarettes smoked in the last 24 hours was assessed on a random sample of the same students one year later (n = 2,500) and correlated with a double expired air measurement following procedures by Biglan, *et al.*<sup>21</sup> The correlation of self-reported smoking with parts per million concentrations of carbon monoxide averaged r = .41, consistent with the average correlation of .35 reported by other researchers for similar age/grade groups.<sup>22</sup>

**Effect of Policy on Smoking**

As expected, all of the 23 schools had a formal rule banning smoking on school grounds; 22 (94 percent) also had a closed campus. However, only 65 percent had a rule banning smoking near school grounds, and 57 percent had a formal health education plan for smoking prevention programming, although none of the schools had implemented smoking prevention education at the time of this study. All of the school clerks reported that smoking policy was enforced "very regularly."

Table 2 shows the relation of policy to adolescent smoking, dichotomizing schools into two groups formed by the median split of each variable, for ease of illustration. Schools with all four policy components had lower smoking prevalence rates and lower mean amounts of smoking per smoker in the last week and in previous 24 hours than schools with less than four components. When schools with all four components were compared to schools with three or two components, differences in amount of smoking were more pronounced (see Figure 1). Regression analyses—using all four policy components and controlling for socioeconomic status, school environmental support, and staff awareness

**TABLE 1—Characteristics of Schools with and without a Smoking Prevention Education Plan in Smoking Policy**

Characteristics	Without Smoking Prevention Education Plan (n = 10)	With Smoking Prevention Education Plan (n = 13)
Mean Grade Size	211	214
% Female	49	49
% Minority	83	78
% English 2nd Language	19	10
% Aid to Families with Dependent Children (AFDC)	26	21
Mean California Achievement Profile (CAP)	142	149
% Fathers in Professional Occupations (School SES)	20	23
Mean Community SES	3.09	2.86
Mean School Support <sup>†</sup>	.01	.04
% Adolescents Smoked in Lifetime	41	41
% Staff Currently Smoking	9	12

NOTE: Based on N = 23 schools, N = 4,807 adolescents, N = 125 school staff; school as unit of analysis. All comparisons were non-significant, based on t-tests for mean values and tests between proportions for percentage values, % and means unadjusted.  
<sup>†</sup>Standardized score (x = 0, SD = 1, range = -.95 to .89).

TABLE 2—Prevalence and Amount of Adolescent Smoking by Level of Smoking Policy

Policy Variables	Prevalence of Smoking (% of Smokers)		Amount of Smoking (Mean No. of Cigarettes per Smoker)	
	Last Week	Last 24 Hours	Last Week	Last 24 Hours
<b>Number of Policy Components</b>				
Four	4.93	1.84	3.87	1.81
Less than four	5.60	2.43	6.05	1.99
Difference	-.67	-.59	-2.18	-.18
(90% CI of difference) <sup>†</sup>	(-2.52,1.18)	(-1.46,.28)	(-5.29,1.26)	(-1.01,1.37)
<b>Prevention Emphasis</b>				
High	4.31	1.88	3.11	1.46
Low	5.77	2.15	6.46	3.43
Difference	-1.46	-.27	-3.35	-1.97
(90% CI of difference)	(-3.01,.09)	(-1.06,.52)	(.28,6.40)	(.69,3.11)
<b>Cessation Emphasis</b>				
High	5.29	2.18	5.87	2.55
Low	4.72	1.78	2.92	1.63
Difference	-.57	.40	2.95	.92
(90% CI of difference)	(-2.30,1.14)	(-1.23,.43)	(-3.91,-1.83)	(-1.75,-.09)
<b>Punishment Emphasis</b>				
High	4.91	1.92	4.57	2.16
Low	5.38	2.21	5.00	2.53
Difference	-.47	-.29	-.43	-.37
(90% CI of difference)	(-1.28,2.23)	(-.56,1.13)	(-3.12,3.97)	(-1.03,.33)

Based on N = 23 schools, school as unit of analysis. Means are adjusted for SES and school environmental support for teaching and administration, for the policy component variable, means are also adjusted for staff awareness and perceived effectiveness of policy.  
<sup>†</sup>CI = Confidence Intervals

and perceived effectiveness of policy—indicated that number of policy components was related to lower amounts of adolescent smoking. Prevalence rates of smoking and smoking violations reported by school clerks were less strongly related to number of policy components.

#### Effect of Policy Emphasis

When policy emphasis variables were regressed on each smoking variable, controlling for socioeconomic status and school environmental support, results indicated that a high emphasis on prevention and a low emphasis on cessation were associated with lower amounts of smoking in the last week and 24 hours (see Table 2 and Figure 2); results were similar for smoking in the last week and the last 24 hours. Schools with a high emphasis on prevention also had lower weekly smoking prevalence rates and decreased school smoking violations in the last year. When prevention and cessation emphasis variables were entered simultaneously into regression analyses, both had an impact on amount and prevalence rates of smoking. However, punishment and severity of consequences for violation of smoking (number of consequences) had no effect. In all analyses, higher SES was marginally related to lower amounts of smoking.<sup>+</sup>

In general, the emphasis of policy on assisting (prevention and cessation) versus punishing students was significantly related to lower amounts of adolescent smoking and, less consistently, to lower smoking prevalence rates.

#### Discussion

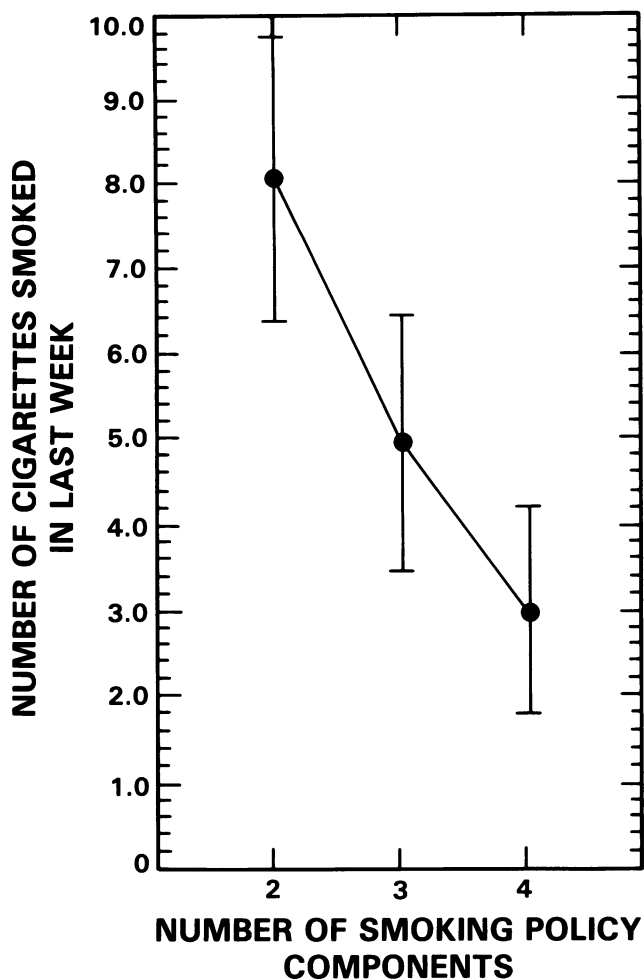
Results of the study indicate that the number of components in school smoking policy (presumably representative of policy comprehensiveness) has a marginal effect on adolescent smoking, and the use of punitive measures to regulate smoking has no effect. On the other hand, the relative

emphasis of policy on educating adolescents to stop smoking, and particularly to prevent smoking, rather than regulating smoking by punishment, is significantly related to lower recent smoking. More consistent effects were obtained on amounts of smoking rather than on prevalence rates, suggesting that current smoking policies for youth may work somewhat better for decreasing levels of smoking rather than for deterring smoking altogether or promoting cessation. Results do not appear to be confounded by any historical differences among schools in smoking risk or need for smoking cessation, as evidenced by the lack of difference among schools in school demographic characteristics, lifetime smoking prevalence rates of students, and staff smoking rates.

Our results are consistent with other recent cross-sectional studies of the relation of public or worksite no-smoking policy to smoking in adults, which suggest that policy may decrease cigarette consumption in settings affected by the policy, but not prevalence rates.<sup>26-29</sup> However, none of these studies is directly comparable to the present study, since each was based on a single policy with no differentiation of components or control for socioeconomic and environmental support variables; subsampling was used, with lower response rates; and policy effect was evaluated on an indirect or a single measure of smoking.

Adolescents may be more likely to comply with a smoking policy that is supportive and positive in focus. Such an interpretation is consistent with the findings of recent school-based smoking prevention studies that have shown positive skill-building prevention programs to be more effective in preventing or delaying the onset of smoking than programs focused on negative physiological consequences of smoking.<sup>6</sup> Also noteworthy is the finding that although all schools complied with the California state law banning smoking on school grounds, schools varied widely in representation of other policy components, staff awareness of policy, and consequences of policy violation. Perhaps most

<sup>+</sup>Data available on request to first author.

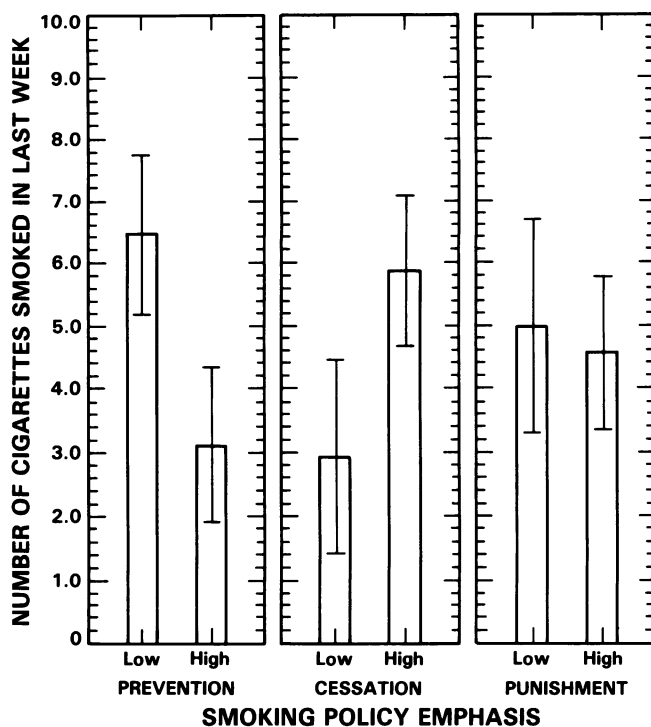


**FIGURE 1**—Amount of Smoking (no. of cigarettes smoked per smoker) in the Last Week in Schools with Two (n = 6), Three (n = 7), or Four (n = 10) Smoking Policy Components  
Means are adjusted for school level SES, support for teaching and administration, and staff awareness and perceived effectiveness of policy.

surprising was the finding that none of the schools had implemented a smoking prevention program, despite reports that 57 percent had a formal educational plan for smoking prevention. Simply having a formal statement of policy is not likely to impact on adolescent smoking—the policy should emphasize prevention and be actively implemented.

The findings of this study must be evaluated in the context of design limitations of policy studies. Although a longitudinal relationship between policy and smoking is assumed, since the smoking policies had been in effect in schools an average of 34 years and adolescents had been exposed to these policies in middle school an average of 13 months before smoking was measured, the study is cross-sectional. An experimental design of longitudinal policy effect would require random assignment of schools or other units to policy or no-policy conditions, after which policy would be initiated, and baseline to multiple follow-up changes would be evaluated.

The other design limitations relate to assessment. The results were based on analysis of self-report data. It is always possible that social desirability or recall biases affected the validity of the findings.<sup>30</sup> However, most studies on smoking



**FIGURE 2**—Amount of Smoking (no. of cigarettes smoked per smoker) in the Last Week in Schools with High and Low Emphasis on Smoking Policy  
NOTE: Prevention Emphasis: n = 11 low, 12 high  
Cessation Emphasis: n = 9 low, 14 high  
Punishment Emphasis: n = 8 low, 15 high  
Means are adjusted for school level SES, and support for teaching and administration.

prevention and cessation have shown that self-report data are highly valid and reliable, particularly when collected in conjunction with a biochemical measure.<sup>19,21,22</sup> Another limitation in assessment was the inability to differentiate smoking in and around the school setting and during school hours, from smoking in other settings and after school. Several worksite studies have suggested that smoking policy may work by delaying smoking until after hours or in other settings not affected by policy, rather than by actually changing smoking levels.<sup>27-29,31</sup> Although mean amount of smoking included smoking in all settings and times, it is still possible that the school policy effect is limited to reducing smoking only in and around the school.

In summary, this study suggests that smoking policy can have an effect on reducing amount of smoking by adolescents and, to a lesser extent, on smoking prevalence rates. Questions remain concerning the extent to which the effect of policy may interact with the effect of a smoking intervention in schools that are implementing both. For example, if the decreased amount of smoking in schools with a prevention-oriented smoking policy represents a conscious effort by smokers to cut down their smoking in preparation to quit, could this effort be expedited by a prevention program that is implemented in the school, or by a cessation program? In addition, little is known about the cumulative effect of multi-component smoking policies that are implemented simultaneously across several settings, e.g., a community smoking ordinance, a school smoking policy, and informal home rules about smoking.

**APPENDIX A**  
Description of Items Analyzed for This Study

Variable	Source	No. of Items	Characteristics
Smoking Amount	Student questionnaire	2	No. of cigarettes smoked in last week, last 24 hours; continuous scale; high internal consistency, test-retest reliability. <sup>19</sup>
Prevalence Rate	Student questionnaire	3	0 = no smoking, 1 = any smoking in lifetime, <sup>†</sup> last week, last 24 hours, dichotomized from amount variables and aggregated to % of smokers in the school.
Current Staff <sup>†</sup>	Staff questionnaire	1	Continuous; estimated as % of staff currently smoking.
Observed Student <sup>‡</sup>	Staff questionnaire	1	Continuous; estimated as % of students observed smoking.
Smoking Violations <sup>‡</sup>	Clerk phone survey	1	Rated as change in last year, 1 = increased, 2 = decreased, 3 = stayed the same.
Expired Air (CO) <sup>‡</sup> Policy	Student CO measure	1	Continuous, parts per million CO analyzed at 1 year follow-up.
No. of Components (comprehensiveness)	Staff questionnaire	4	0 = no, 1 = yes for presence of formal (written and posted) rule about no smoking on school grounds, near school grounds, closed campus policy, formal health education plan for smoking prevention programming, summed to score 0-4; based on categories of school policy. <sup>18,23</sup>
Policy Emphasis	Clerk phone survey	3	1 = none, 4 = a lot for prevention, cessation, punishment.
Policy Enforcement <sup>‡</sup>	Clerk phone survey	1	1 = not at all, 4 = very regularly.
Time in Effect <sup>‡</sup>	Clerk phone survey	1	No. of years, months.
Consequences for Violation <sup>‡</sup>	Clerk phone survey	1	7 categories increasing in severity, re-scaled to 1 = detention, 2 = detention + other.
Policy on School Grounds <sup>‡</sup>	Clerk phone survey	1	0 = no, 1 = yes.
Staff Policy Awareness	Staff questionnaire	1	1 = low, 3 = high
Perceived Policy Effectiveness	Staff questionnaire	1	1 = low, 3 = high
Demographics			
Gender <sup>†</sup>	School archival records	1	% females in the school.
Race/ethnicity <sup>†</sup>	School archival records	2	5 categories re-scaled to % minority, % English as second language.
Socioeconomic Status (SES)	School archival records <sup>‡</sup>	1	% Aid to Families with Dependent Children.
	Student questionnaire	1	Father's occupation re-coded to 0 = no, 1 = professional occupation, aggregated to % in the school; high predictive validity for smoking. <sup>20</sup>
	Staff questionnaire <sup>‡</sup>	2	Community SES (1 = mostly professional occupation, 4 = mostly unskilled labor); summed across 2 items on school district and community SES, and standardized.
Student Achievement <sup>†</sup>	School archival records	3	% California Achievement Profile scores summed and averaged by school.
School Support	Staff questionnaire	20	1 = strongly agree, 4 = strongly disagree, summed and standardized; high validity and reliability for measuring supportive school environment. <sup>24</sup>

<sup>†</sup>Used for background descriptive information.

<sup>‡</sup>Used for comparison with other measures.

**ACKNOWLEDGMENTS**

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## Treatment of Destructive Behaviors is Focus of NIH Consensus Conference

A Consensus Development Conference on Treatment of Destructive Behaviors in Persons with Developmental Disabilities will be held in Masur Auditorium at the Clinical Center, National Institutes of Health, Bethesda, Maryland, September 11-13, 1989. This open forum will focus on the various treatments and approaches used to modify or eliminate destructive behaviors in persons with developmental disabilities. The forum will address the following questions:

- What are the nature, extent, and consequences of destructive behaviors in persons with developmental disabilities?
- What are the approaches to prevent, treat, and manage these behaviors?
- What is the evidence that these approaches, alone or in combination, eliminate or reduce destructive behaviors?
- What are the risks and benefits associated with the use of these approaches for the individual, family, and community?
- Based on the answers to the above questions, and taking into account a) the behavior; b) the diagnosis and functional level of the individual; c) possible effects on the individual, family, and community; d) the treatment setting; and e) other factors, what recommendations can be made at present regarding the use of the different approaches?
- What research is needed on approaches for preventing, treating, and managing destructive behaviors in persons with developmental disabilities?

Sponsored by the National Institute of Child Health and Human Development of NIH, the National Institute of Mental Health of the Alcohol and Drug Abuse and Mental Health Administration, the Bureau of Maternal and Child Health of the Health Resources and Services Administration, and by the NIH Office of Medical Applications of Research, this NIH Consensus Development Conference will bring together biomedical investigators, practicing physicians, consumers, and representatives of public interest groups to provide a scientific assessment of drugs, devices, and procedures and to evaluate their safety and effectiveness.

On the first two days, experts will present current scientific thinking about the diagnosis, management, and prevention of destructive behaviors in persons with developmental disabilities, and concerned voluntary organizations will be invited to make statements. On the third day, after considering the scientific evidence, the consensus panel will present its draft report and invite comments from the audience. Dr. R. Rodney Howell, Professor and Chairman, Department of Pediatrics at the University of Miami School of Medicine, will chair the panel.

To register for the conference or to obtain further information, contact:

Barbara McChesney  
Prospect Associates  
Suite 500  
1801 Rockville Pike  
Rockville, MD 20852  
(301) 468-6555