Independent Evaluation of the California Tobacco Control Program: Relationships Between Program Exposure and Outcomes, 1996–1998

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Objectives. This study sought to determine the effects of the California Tobacco Control Program on tobacco-related attitudes and behaviors.

Methods. In 1996 and 1998, a telephone survey was conducted among adults in randomly selected households in 18 California counties. Tenth-grade youths in 84 randomly selected high schools completed a written survey. In analyses conducted at the county level, differences in outcomes were regressed on an index of program exposure.

Results. Among adults, program exposure was associated with decreased smoking prevalence rates, increased no-smoking policies in homes, and decreased violations of workplace no-smoking policies. Among youths, there was no effect of program exposure on outcomes.

Conclusions. These results suggest that the California Tobacco Control Program may have reduced adult smoking prevalence rates and exposure to environmental tobacco smoke. (*Am J Public Health.* 2002;92:975–983)

The California Tobacco Control Program (CTCP) was established in 1989, after the passage of a statewide referendum (Proposition 99) that increased the tax on tobacco products and earmarked the new revenues for tobacco control, medical care, and research activities. The program was the first of its kind in the United States, and it has stimulated other states to increase cigarette excise taxes[1–3] as well as serving as a model for those states that are developing programs funded by recent legal settlements with the tobacco industry.[4]

Annual funding for the CTCP has varied considerably over its 11-year history. With the exception of the 1990–1991 fiscal year, the California legislature underfunded the program from 1989 to 1996 by between 14% and 51% of the voters' funding mandate.[5] In 1997–1998, after civil lawsuits that challenged the state's redirection of funds for other purposes, the legislature restored program funding to its original level. However, total program funding declined again in the 1998–1999 and 1999–2000 fiscal years. Since its inception, per capita spending for the CTCP has ranged from $2.08 to $3.35, considerably below the $5.12 to $13.71 per capita range recommended by the Centers for Disease Control and Prevention for an effective statewide tobacco control program.[6]

The CTCP is a comprehensive program involving multiple, coordinated tobacco control strategies that aim to reduce tobacco use at the population level. Consistent with national trends in tobacco control,[7,8] the CTCP has evolved over time into a program approach focused on changing community norms regarding the acceptability of tobacco use.[9] The goal of the program is to alter the social–political environment in which tobacco initiation and cessation occur, and one of the primary mechanisms used to attain this goal is the passage and enforcement of local and statewide policies.

The specific strategies of the CTCP may be grouped into 3 program components. One component is the statewide media campaign, which disseminates anti-tobacco messages through television, radio, print media, and outdoor advertising. This program component is perhaps best known to public health professionals nationwide because of its hard-hitting ads designed to expose tobacco industry marketing tactics.[10,11] The second program component consists of local tobacco control initiatives, policy development, and public education programs implemented by county health departments and community-based organizations. The third component comprises school-based tobacco prevention programs, activities, and policies.

Since the inception of the CTCP, statewide surveillance of tobacco-related attitudes and behaviors among adults and adolescents has been used to evaluate program effectiveness.[12,13] The state has also sponsored 2 "independent evaluations" of the CTCP.[14–17] The first focused on process evaluation and assessed program inputs, such as the structure and staffing of programs, numbers and types of tobacco control activities, and characteristics of program participants, from 1990 to 1994.[15] The second independent evaluation, which we began in 1996, aims to determine the effectiveness of the CTCP by examining relationships between program inputs and exposure and program outcomes.[16,17]

Our evaluation differs from previous studies of the CTCP in 3 important respects. First, it has the capacity to link program implementation directly to changes in outcomes through the use of a repeated cross-sectional design in a sample of counties. Second, multiple, integrated data collection methods (e.g., surveys of in-school youths, adult residents, community program directors, school program personnel, enforcement agency staff, community opinion leaders) are used to measure program inputs, program exposure, and individual- and county-level outcomes. Third, the evaluation measures both intermediate outcomes—such as personal behaviors; public support for tobacco control strategies; and passage of restrictions on smoking, youth access, and tobacco industry promotions—and ultimate outcomes—such as smoking prevalence and exposure to environmental tobacco smoke.

Surveillance studies have indicated that the CTCP has been responsible for reductions in smoking prevalence and consumption beyond what would have been expected from a price increase alone.[12,13,18,19] During the early phase of the CTCP, smoking prevalence rates among adults decreased more rapidly than before the program began and more rapidly than for the United States overall. From 1993 to 1996, when funding allocations for the CTCP began to decrease, the rates of decline in adult smoking prevalence slowed. Among adolescents, the prevalence of 30-day smoking (i.e., having smoked on at least 1 day in the past 30 days) did not change in the early phase of the program; however, from 1993 to 1996, adolescent smoking prevalence rates increased.[13]

A comparison of smoking among youths in California relative to the rest of the United States, based on data from the Monitoring the Future study, suggested that the rate of increase in 30-day smoking from 1993 to 1996 was less dramatic in California.[16] Several econometric studies have shown the CTCP to be associated with a significant decline in per capita cigarette consumption, and the declines are attributable to both the cigarette tax increase and the tobacco control program.[18,19] Recently, the CTCP has been linked with declines in lung cancer incidence (during the period 1988 to 1997[20]) and heart disease mortality (during the period 1989 to 1997[21]).

To allow a more complete understanding of the effectiveness of comprehensive tobacco control programs, surveillance and econometric studies need to be supplemented by program evaluation studies that focus on measuring program implementation and strength, receipt of the program by the target population, intermediate outcome indicators, and tobacco industry efforts to counter program efforts.[22,23] The current study investigated the effectiveness of the CTCP by examining changes in program outcomes as a function of program exposure. In a representative sample of California counties, we assessed relationships between exposure to the media, community, or school tobacco control program components and changes in intermediate and ultimate outcomes among adults and youths from 1996 to 1998. On the basis of research suggesting that multicomponent prevention interventions (e.g., school-based programs supported by a media campaign) are more effective in reducing adolescent tobacco use than are single-component interventions (e.g., a school program alone),[24,25] we hypothesized that counties in which increased proportions of residents were exposed to multiple CTCP components would show enhanced program outcomes.

METHODS

Tobacco Control Program Intervention

The 3 primary CTCP components are designed to address the overall program objectives, which include (1) reducing exposure to environmental tobacco smoke, (2) countering pro-tobacco influences, (3) reducing youth access to tobacco products, and (4) promoting tobacco use cessation.[9] From January 1997 to June 1998, the media component included 40 media campaign spots that targeted the state's population overall (20 on television, 12 on radio, and 8 in outdoor locations). Of the total campaign expenditures during this period, 44% were allocated to spots that focused on reducing environmental tobacco smoke, 34% focused on countering pro-tobacco influences, 20% addressed smoking cessation, and 2% focused on reducing youth access.[26] Although the state also had media spots targeting ethnic-specific audiences, these spots were not the focus of our evaluation.

The community program component of the CTCP consists of a broad range of activities, implemented by county health departments and community-based organizations, that are designed to change community norms regarding tobacco use. From 1996 to 1998, efforts to counter pro-tobacco influences included activities such as mobilizing community support for policies designed to decrease tobacco advertising and sponsorship and conducting educational campaigns about the tobacco industry's manipulation of young people.

Efforts to reduce exposure to environmental tobacco smoke included activities such as expanding workplace policies to increase smoking restrictions and conducting campaigns to increase the number of families with personal policies restricting smoking in their homes and vehicles.[27,28] Efforts to reduce youth access to tobacco included activities such as creating local support for enforcement of laws to reduce illegal tobacco sales, educating tobacco retailers about youth access laws, and conducting educational campaigns to address social (i.e., nonretail) sources of tobacco. To facilitate tobacco use cessation, local programs provided cessation services and publicized the statewide cessation telephone counseling program.[29]

The school-based program component consists of school policies prohibiting tobacco use, classroom instruction focused on tobacco use prevention, schoolwide tobacco prevention events, and direct cessation services for smokers. During the 1996–1997 school year, the majority of high schools that received competitive tobacco use prevention grant funds provided tobacco use prevention lessons (84%) and on-site tobacco cessation services (92%). About half of these schools also implemented schoolwide activities such as Great American Smoke-Out events, tobacco prevention contests, and tobacco-specific assemblies. In 97% of school districts statewide, prevention activities were supported by policies prohibiting tobacco use by students, staff, and visitors.[30]

Study Design and Sample

This study focused on 2 waves of cross-sectional data from adult residents and 10th-grade youths in a sample of California counties.[16,17] Baseline measurement took place in October 1996 to February 1997, and the 18-month follow-up took place between March and July 1998. The conceptual framework for the evaluation measures has been described elsewhere.[16]

Counties. We chose counties as the primary sampling units for the study because the majority of funds for local tobacco control programs are awarded to county health departments. A cluster approach was used to select 18 counties that would be representative of the 58 counties in California. Because the statewide media campaign was one of the 3 program components to be evaluated, the 5 counties that overlap with the 5 largest media markets in the state were preselected. The cluster analysis was applied to the remaining 53 counties.

The analysis was designed to yield 3 strata based on county population density and rural area percentage. Thirteen counties were randomly selected from the 3 strata. The final sample included these 13 counties along with the 5 media market counties. Overall, these

18 counties represented approximately 75% of the population of California.

Adults. During each wave of data collection, approximately 388 adults in randomly selected households within each county were administered 20-minute computer-assisted telephone interviews. In the first wave, a randomly selected sample of 24 101 residential telephone numbers was contacted, and screening interviews were completed with 11 958 adults in those households (50% screening rate). As a means of achieving a random sample within the household, 1 of the screening questions identified the adult with the most recent birthday. Of those who completed screening interviews, 7127 were eligible to participate in the survey (60% eligibility rate). Eligibility was restricted to residents of the 18 counties who spoke English or Spanish, were 18 years or older, and had lived in the county for at least 6 months. Of the respondents who were eligible, 6985 completed the survey (98% completion rate).

In the second wave, in addition to the approximately 384 adults per county sampled, an oversample of 1218 Hispanic and African American households was included. A total of 26 682 randomly selected telephone numbers were contacted, and 15 573 screening interviews were conducted (58% screening rate). Of those screened, 8572 were eligible to complete the survey (55% eligible rate), and 8122 actually completed it (95% completion rate).

Youths. Within the 18 counties, a sample of high schools that had an enrollment of at least 100 students in grade 10 was randomly selected for participation in the study. Schools were sampled in 2 strata: (1) schools that had received a competitive Tobacco Use Prevention Education grant from the California Department of Education and (2) all other eligible high schools in the target counties. Of the schools selected for participation in either wave of data collection, 35% declined participation and were replaced. A total of 65 and 79 high schools, respectively, participated in the first and second waves, with 60 of these schools participating in both waves.

Within each school, approximately 5 classes of 10th-grade students enrolled in a required discipline, such as English or social studies, were randomly selected to participate in the survey. All students in the selected classes were eligible to participate. An implied parental consent procedure was used in which students were assumed to have parental consent if their parents did not return a signed form declining the youth's permission to participate. Students were free to decline participation if they so chose. In the first and second waves, only 1% and 3% of parents declined participation, respectively. In both waves, 99% of students whose parents provided consent chose to participate. The mean rate of absentees in both waves was 13.7%. The final samples included 6911 and 8186 grade 10 youths in the first and second waves, respectively.

Adult data collectors trained by the research staff administered the anonymous, 50-minute surveys during regular classroom periods. In each of the 2 waves, 95% of students completed the survey within the allotted period of time.

Measures

We addressed 2 ultimate program outcomes and a subset of intermediate outcomes that were selected a priori to represent the primary objectives of the program. Because most of the CTCP strategies target cigarette use, the outcome measures focused on cigarette smoking rather than other forms of tobacco use. Most of the survey items were based on previous surveillance studies.[5,31] Items with continuous scales that had nonnormal distributions were recoded into dichotomous variables.

Ultimate outcomes. Among adults, *cigarette smoking prevalence* was defined as the proportion of adults within the county who had smoked at least 100 cigarettes in their lifetimes and who now reported smoking "every day" or "some days"; among 10th-grade youths, it was defined as the proportion who had smoked on at least 1 day during the past 30 days. *Exposure to environmental tobacco smoke* was measured with 2 items. For adults, the items assessed the number of days in the previous week that respondents had been exposed to tobacco smoke in their homes and, if applicable, at work. Because the consent procedure for the study precluded asking any questions about the home environment, the items for youths assessed exposure to tobacco smoke in an indoor area and a car. All responses were recoded into 2 categories: 0 days vs 1 or more days.

Intermediate outcomes. Intermediate outcomes assessed included *reductions in environmental tobacco smoke exposure, countering of pro-tobacco influences,* and *reductions in youth access to tobacco.* In regard to reducing exposure to environmental tobacco smoke, perceived violations of workplace smoking policies were examined by asking adults how many smokers in their workplace break the no-smoking rules (0=none, 5=all). This item was recoded as having seen no smokers vs any smokers break the rules. Also, adult respondents were asked about personal policies regarding smoking in their home ("Can family and visitors smoke wherever they want or in certain rooms only or not smoke anywhere in your home?") and their family cars ("Is smoking never allowed in any car or allowed sometimes in some cars or there are no rules about smoking in your car?"). These items were recoded as total ban vs any smoking allowed.

In the countering pro-tobacco influences category, adults were asked how many items with a tobacco company brand name or logo they owned (0=none, 1=at least 1). Adults' support for advertising bans was assessed with a composite index that averaged responses to 3 items regarding whether tobacco advertising should be banned in stores, on billboards, and on buses and whether tobacco company sponsorship of sport and community events should be disallowed (1=strongly disagree, 4=strongly agree; Cronbach α=0.85). Youths' negative attitudes toward the tobacco industry were measured with a composite index that averaged 3 items regarding whether tobacco companies try to get people addicted to cigarettes, try to get young people to start smoking by using advertisements that are attractive to youths, and would keep selling cigarettes even if they knew for sure that smoking is harmful (1=strongly disagree, 4=strongly agree; Cronbach α=0.51).

Youths' perceptions of access to tobacco were measured with a single item asking how easy or difficult it would be for them to obtain cigarettes if they really wanted some (recoded as very or somewhat easy vs very or somewhat hard). In regard to other intermediate outcomes among youths, youths were classified as susceptible to smoking if they gave a response other than "definitely not" to

one or both of the following questions: "If one of your best friends were to offer you a cigarette, would you smoke it?" and "At any time during the next year, do you think you will smoke a cigarette?" Also, youths' estimates of smoking prevalence among peers were measured with a single item: "Out of 100 students your age, about how many smoke cigarettes once a month or more?" (0=none, 10=about 100). Responses were multiplied by 100 to obtain a percentage estimate.

To assess the reliability of our outcome measures, we reinterviewed 7% of the second-wave adult telephone interview respondents (n=600) 2 to 4 weeks after they had completed the initial interview. The mean κ coefficient for the dichotomous outcome variables was 0.71; the mean intraclass correlation for the continuous variables was 0.63.

Program exposure. Adult and youth respondents were asked a series of questions about their awareness of and exposure to the media and community components of the CTCP; youths were also asked about their exposure to the school component. The question format was based on previous studies of exposure to pro- and anti-tobacco media campaigns.[32–39] Adults were asked whether they recalled seeing or hearing 6 of the CTCP media spots (e.g., "Have you seen the television commercial in which a woman named Debi is smoking through a hole in her throat?") and were aware of 12 community-based tobacco control activities during the year before the 1998 survey (e.g., "Have you heard of local efforts to reduce tobacco company sponsorship of community and sporting events?").

Youths were asked similar questions about 7 media spots and 12 community-based activities, as well as whether they had participated in 4 school-based tobacco prevention activities (e.g., lessons, special events). Recall of media spots was prompted by brief descriptions of the spots and validated with an additional question about their meaning. Among adults, the mean test–retest κ coefficient for the media and community program exposure items was 0.46.

A composite program exposure index was created as follows. For each program component (media, community, and schools), respondents received a score of 0 if they recalled none of the specific activities or spots and a score of 1 if they recalled at least 1 activity, media spot, or local initiative. Scores for the program components were summed, resulting in scores ranging from 0 to 2 for adults and 0 to 3 for youths. Next, these individual scores were aggregated to create county means. The county-level multicomponent exposure score represented the proportion of respondents who were exposed to the CTCP through 2 or more different program components.

Data Analysis

Adult survey data were first weighted to account for the number of adults and telephone lines in a given household. In the second step, weights were applied to match the target population parameters obtained from Claritas, an online database of current census estimates.[40] Within each of 12 regions of the state, distributions were weighted according to ethnicity, sex, and age.

TABLE 1—Independent Evaluation of the California Tobacco Control Program: Demographic Characteristics of Adult and Youth Samples, 1996 and 1998

	1996		1998	
	No.	Weighted %	No.	Weighted %
Adult sample				
Sex				
Female	4054	50.4	4509	50.7
Male	2931	49.6	3613	49.3
Race/ethnicity				
White non-Hispanic	5065	61.3	4866	55.8
Hispanic	1071	25.0	1770	28.4
African American	294	5.5	667	5.5
Asian/Pacific Islander	308	5.9	441	7.7
Native American	127	1.7	106	0.8
Other	60	0.6	174	1.8
Education				
Less than 12th grade	639	12.1	779	11.5
High school	1727	23.9	1898	23.6
Some college	2050	27.3	2508	29.8
College or more	2535	36.7	2883	35.0
Age, y				
18–24	783	13.2	968	13.8
25–34	1503	21.5	1702	20.0
35–44	1672	23.4	1925	22.2
45–54	1260	16.2	1498	18.0
55–64	771	12.7	856	12.5
≥65	905	13.0	1068	13.4
Youth sample				
Sex				
Female	3406	46.9	4016	47.4
Male	3505	53.0	4170	52.6
Race/ethnicity				
White non-Hispanic	2676	27.2	3406	32.6
Hispanic	1533	31.4	1800	27.7
African American	339	12.4	477	13.4
Asian/Pacific Islander	1110	13.5	1234	12.5
Multiethnic	863	12.3	975	12.4
Other	317	3.2	134	1.4

Note. Sample sizes are for raw data. Percentages represent weighted population estimates.

Weights for the youth data were based on school enrollment data obtained from the California Department of Education.[41] Each student was given a school weight based on the total number of 10th-grade students enrolled at that school. To create a final weight, we aggregated school weights to the enrollment counts. All final youth survey weights were divided by the average weight of the data set to obtain relative weights equating the weighted sample sizes to the actual sample sizes.

Each cross section of adult and youth data was weighted on the basis of population estimates from the same year the data were collected. Table 1 presents unweighted sample sizes and weighted percentages of demographic characteristics for the adult and youth samples in 1996 and 1998. We used SUDAAN, a software package that accounted for the complex sampling design and weighting factors in the data sets, to calculate the standard errors of the prevalence estimates.[42]

Analyses of relationships between program exposure and changes in outcomes were conducted at the county level, because the data were longitudinal at that level (i.e., the 2 waves of data collection consisted of 2 different random samples of individuals in the same 18 counties). This county-level analysis strategy also eliminated the effects of intraclass correlation on the standard errors of the regression coefficients. All weighted variables were aggregated to the county level through computation of weighted means for adult and youth respondents in each county. To assess changes in the outcome variables, each county's baseline mean was subtracted from its follow-up mean to create a difference score. These outcome difference scores then were regressed on the program exposure variable via SAS PROC GLM.[43]

The regression models, which we ran separately for adult and youth respondents, included no covariates. In some models, 1 of the counties was found to be an outlier. To eliminate the influence of this outlier, the county was represented as an additional dummy variable and allowed to enter the regression model through a forward selection process after the program exposure variable had been forced into the model. If the dummy variable for the county was significantly associated with the outcome variable at $P<.05$, we partialed out its effect before evaluating the regression coefficient for program exposure.[44]

TABLE 2—California Tobacco Control Program Exposure Among Adults and 10th-Grade Youths, 1998

Type of Program Component	Adults (n = 8122), %	Youths (n = 8186), %
None	2	4
Community only	16	2
Media only	2	6
School only	. . .	2
Community and media	80	22
Media and school	. . .	6
Community and school	. . .	3
School, community, and media	. . .	55

RESULTS

In 1998, most Californians reported that they had been exposed to tobacco control messages during the previous year through at least 2 different program components (Table 2). Among adults, 80% were exposed to both media and community programs. Among 10th-grade youths, 55% were exposed to all 3 components (community, media, and schools), and 31% were exposed to 2 of the components.

Among adults, none of the 1996 to 1998 changes in outcome variables was significant (Table 3). Among 10th graders, there were significant decreases in prevalence rates of 30-day cigarette smoking and indoor environmental tobacco smoke exposure (*P*s<.05).

Linear regression models at the county level showed that multicomponent exposure

TABLE 3—California Tobacco Control Program Outcomes Among Adults and 10th-Grade Youths, 1996 and 1998

Outcome	1996 Estimate	1996 95% CI	1998 Estimate	1998 95% CI
Adults[a]				
Ultimate				
Cigarette smoking, %	17.7	16.1, 19.3	19.3	17.8, 20.8
ETS exposure, home, %	23.8	21.4, 26.6	22.5	20.0, 24.0
ETS exposure, work, %	28.4	25.4, 30.6	26.5	24.0, 28.0
Intermediate				
Have home smoking ban, %	75.7	73.8, 78.1	78.5	76.6, 79.7
Have car smoking ban, %	65.5	63.9, 68.1	66.9	65.2, 68.6
Have seen workers break no-smoking rule, %	26.3	23.3, 28.7	24.2	21.8, 26.2
Own tobacco promotional item, %	19.1	17.3, 20.7	19.5	17.1, 21.9
Support for advertising ban, mean[b]	2.76	2.73, 2.79	2.79	2.76, 2.82
Youths[c]				
Ultimate				
30-day cigarette smoking, %	27.4	23.6, 31.2	21.8	20.3, 23.3*
ETS exposure, indoors, %	65.9	62.3, 69.5	58.2	55.6, 60.8*
ETS exposure, car, %	44.5	40.5, 48.5	38.7	36.1, 41.3
Intermediate				
Susceptibility to smoking, %	59.0	55.1, 62.9	54.2	52.0, 56.4
Easy perceived access to cigarettes, %	89.1	86.4, 91.8	87.0	85.6, 88.4
Perceived peer smoking prevalence, %	50.6	48.5, 52.6	49.5	48.2, 50.8
Negative attitudes toward tobacco industry, mean[b]	3.37	3.28, 3.45	3.50	3.46, 3.54

Note. CI = confidence interval; ETS = environmental tobacco smoke.
[a]1996, n = 6985; 1998, n = 8122.
[b]On a 4-point scale.
[c]1996, n = 6911; 1998, n = 8186.
*$P<.05$

TABLE 4—Independent Evaluation of the California Tobacco Control Program: County-Level Analysis of Effects of Multicomponent Program Exposure on Changes in Outcomes Among Adults and 10th-Grade Youths, 1996 to 1998

	Standard β	*P*
Adults		
Ultimate outcomes		
Cigarette smoking	−0.634	.03
ETS exposure, home	−0.537	.13
ETS exposure, work	−0.165	.51
Intermediate outcomes		
Have home smoking ban	0.678	.04
Have car smoking ban	0.415	.25
Have seen workers break no-smoking rule	−0.703	.04
Own tobacco promotional item	−0.155	.62
Support for tobacco advertising ban	0.124	.63
Youths		
Ultimate outcomes		
Cigarette smoking	−0.024	.93
ETS exposure, indoors	−0.222	.44
ETS exposure, car	−0.355	.20
Intermediate outcomes		
Susceptibility to smoking	−0.141	.53
Easy perceived access to cigarettes	0.109	.67
Perceived peer smoking prevalence	−0.312	.21
Negative attitudes toward tobacco industry	0.218	.41

Note. ETS = environmental tocacco smoke.

was significantly associated with reductions in the prevalence of adult cigarette smoking, increases in home smoking bans, and reductions in perceived violations of workplace no-smoking rules (*P*s<.05; Table 4). Figure 1 demonstrates these effects graphically, dividing the sample of counties into tertiles based on levels of multicomponent exposure. Counties with the highest multicomponent exposure rates had the greatest reductions in adult smoking prevalence, the largest increases in home smoking bans, and the greatest reductions in workplace no-smoking policy violations. None of the changes in outcomes among youths was associated with multicomponent exposure (Table 4).

DISCUSSION

The results of this study indicate that exposure to the CTCP was associated with reductions in adult cigarette smoking prevalence rates from 1996 to 1998. These findings are consistent with those of previous studies that have shown correlations between trends in adult smoking prevalence and per capita cigarette consumption and fluctuations in CTCP funding, providing rough approximations of program impact.[5,12,13,18,19] Program evaluation studies conducted in Massachusetts and Oregon have also shown an association between implementation of a statewide tobacco control program and declines in adult smoking prevalence rates.[3,45–47]

We also found a significant relationship between program exposure and increases in the prevalence of no-smoking policies in homes, as well as a moderate, nonsignificant relationship between program exposure and decreased environmental tobacco smoke exposure in homes. Counties with higher levels of program exposure showed fewer perceived no-smoking policy violations in workplaces than did counties with less program exposure. These results suggest that the strongest effects of the CTCP may be related to the program objective of reducing the public's exposure to environmental tobacco smoke. California has been a leader in enacting strong, comprehensive state laws designed to reduce residents' exposure to environmental tobacco smoke in a variety of settings. Statewide and locally, efforts to reduce exposure, including promoting and enforcing state laws and encouraging voluntary adoption of smoke-free home and car policies, have been sustained over a longer period than have efforts related to the other CTCP objectives.

We found no evidence of an effect of program exposure on tobacco control outcomes among youths. Although there were significant decreases in prevalence rates of 30-day smoking and environmental tobacco smoke exposure among 10th-grade youths from 1996 to 1998, these changes were not associated with program exposure. These findings are consistent with results of surveillance studies in California, which have suggested that the tobacco control program has not brought about reductions in smoking prevalence rates among adolescents.[13]

In their review of the literature on comprehensive tobacco control programs, Wakefield and Chaloupka[23] suggested that the range of coordinated program strategies used in California, including school-based programs, a mass media campaign, enforcement of policies that restrict smoking in public places and youth access to tobacco, enactment and enforcement of policies restricting tobacco promotion and sponsorship, and price increases, ultimately will lead to reductions in teenage smoking. However, they speculated that a program approach such as California's, which focuses on environmental change through policy enactment, support, and enforcement, may require more time to affect adolescent smoking rates than to affect adult rates. These approaches aim to change social norms about smoking; as such, they affect youths more indirectly than directly. Thus, we may see reductions in smoking among California youths in the future, as the environmental approaches slowly bring about changes in social norms. On the other hand, reductions in adolescent smoking may be unlikely as long as tobacco industry advertising and promotional campaigns in the state continue to be strong.[13,48]

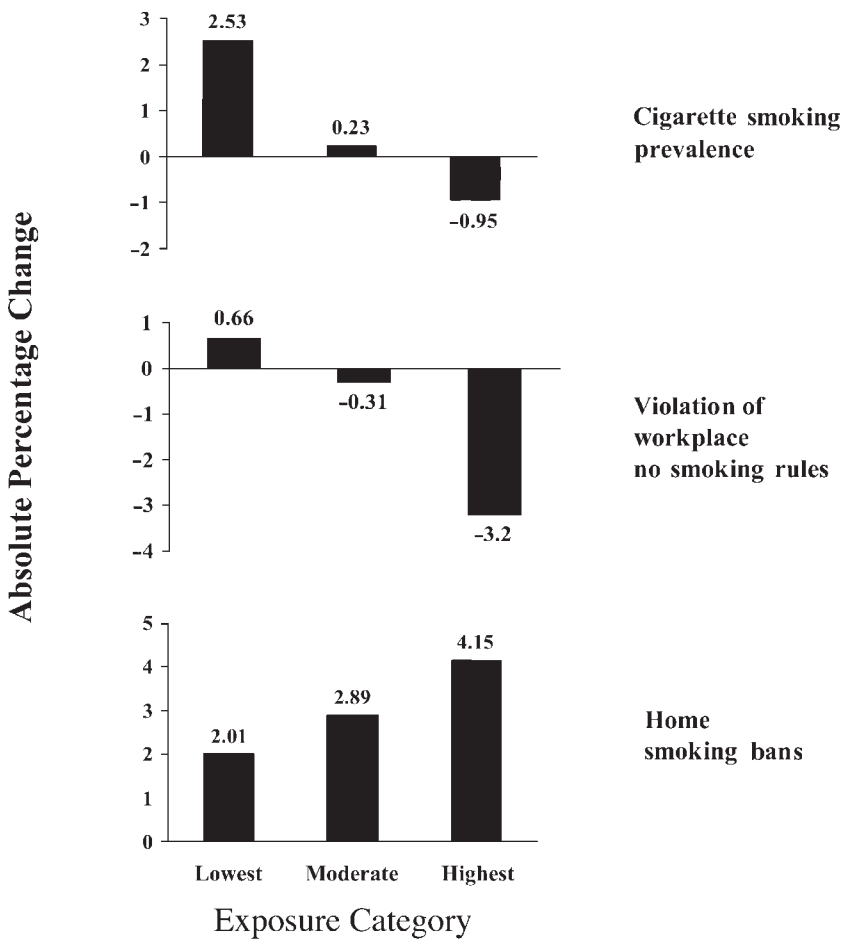

FIGURE 1—Changes in adult outcomes, by county-level multicomponent program exposure: California Tobacco Control Program, 1996–1998.

The conventional wisdom in the field of tobacco control is that comprehensive programs, involving a range of coordinated and complementary tobacco control strategies, are most effective in reducing tobacco use.[7,49,50] In our study, we investigated whether exposure to multiple tobacco control program components had a larger impact on outcomes than did exposure to only 1 component or to no components. In regard to tobacco control outcomes among adults, we found stronger effects in counties in which higher proportions of adults were exposed to multiple program components. These results provide support for a multifaceted approach to tobacco control such as that implemented in California.

The primary strengths of our study were its use of a repeated cross-sectional design in which changes in outcomes were examined in a representative sample of California counties and its ability to link program exposure to changes in outcomes for both adults and youths in these counties. Although the magnitude of the changes we were able to link with program exposure was small, these changes may have considerable significance for public health. For example, a decline of 1% in adult smoking prevalence in the counties with the highest program exposure represents about 70 000 fewer smokers in the state.

Several limitations of the study should be noted. First, because we did not conduct a randomized controlled trial, the study was limited in the extent to which changes in program outcomes could be attributed to programmatic efforts. Examining changes as a function of exposure is an approach to investigating tobacco control program effectiveness that should be used cautiously, in conjunction with examination of time-series data and comparisons of outcomes with those of other states.[51] Second, although the field has great interest in determining the components of a comprehensive tobacco control program that are most effective, our evaluation was designed to determine whether exposure to a combination of tobacco control program components was more effective than exposure to a single component rather than to determine, for example, whether the media campaign was more effective than community or school programs.

Third, our program exposure measure assessed recall, not actual exposure to program activities. Although previous studies have shown dramatic increases in recall of anti-tobacco messages after mass media campaigns,[38,39] there is a need for more research on the validity of self-reported exposure to anti-tobacco campaigns. An alternative approach might be to measure program inputs and to relate the degree of program implementation to changes in outcomes. We used measures of program recall because they were available for all program components, whereas county-level program input measures were not. Fourth, using counties as the units of analysis for relationships between program exposure and outcomes provided only modest statistical power to detect small program effects. However, our calculations showed, for example, that with 18 counties and statistical power of .80%, the minimal detectable effects in outcomes among youths ranged from 0.66 to 2.78 prevalence points for every 1% change in the program exposure measure.

A fifth limitation of our study is that we tested multiple nonindependent hypotheses regarding associations between program exposure and outcomes without adjusting significance values. However, these hypotheses were developed a priori for both youths and adults, and they were conceptually related to one another. Finally, this evaluation was not funded until 8 years after initiation of the CTCP. Ideally, the evaluation would have been designed, and the baseline data collected, before program implementation. Surveillance data have shown that the most

rapid changes in outcomes occurred in the early years of the program.[5] It is difficult to observe significant changes in outcomes in the middle of a program's history. The baseline for this evaluation assessed CTCP activities that occurred during 1995–1996, the lowest point in funding allocations for the program since its inception. Because this period was followed by a doubling in budget allocations for the program (by fiscal year 1997–1998), we might expect to observe greater changes in outcomes in future evaluations of the program.

CONCLUSIONS

This evaluation represents the first study of the CTCP to quantitatively link program exposure to changes in outcomes. We found significant associations between exposure to multiple program components and reductions in adult smoking prevalence rates, decreases in violations of workplace no-smoking rules, and increases in presence of personal policies prohibiting smoking in family homes. Although no effects of program exposure on youth outcomes were observed, the results suggest that the CTCP may be changing social norms about the acceptability of tobacco use and exposure to environmental tobacco smoke. Future research should examine the consistency between these findings and trends in state and national surveillance data. ■

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Note. The analyses, interpretations, and conclusions presented in this article are those of the authors, not of the California Department of Health Services.

Contributors

L.A. Rohrbach was the scientific director of the study. L.A. Rohrbach, B. Howard-Pitney, C. Dent, K.A. Howard, T.B. Cruz, H. Fishbein, and C.A. Johnson designed the study. L.A. Rohrbach, B. Howard-Pitney, and H. Fishbein supervised the data collection. L.A. Rohrbach, B. Howard-Pitney, J.B. Unger, C.W. Dent, K.A. Howard, T.B. Cruz, K.M. Ribisl, and G.J. Norman contributed to the data analytic strategy and interpretation of the data. J.B. Unger and G.J. Norman conducted the data analyses. L.A. Rohrbach wrote the article, with contributions from B. Howard-Pitney, J.B. Unger, K.A. Howard, T.B. Cruz, and K.M. Ribisl.

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