

# Has the California Tobacco Control Program Reduced Smoking?

John P. Pierce, PhD; Elizabeth A. Gilpin, MS; Sherry L. Emery, PhD;  
Martha M. White, MS; Brad Rosbrook, MS; Charles C. Berry, PhD; Arthur J. Farkas, PhD

**Context.**—Comprehensive community-wide tobacco control programs are considered appropriate public health approaches to reduce population smoking prevalence.

**Objective.**—To examine trends in smoking behavior before, during, and after the California Tobacco Control Program.

**Design.**—Per capita cigarette consumption data (1983-1997) were derived from tobacco industry sales figures. Adult ( $\geq 18$  years) smoking prevalence data were obtained from the National Health Interview Surveys (1978-1994), the California Tobacco Surveys (1990-1996), the Current Population Surveys (1992-1996), and the California Behavioral Risk Factor Survey and its supplement (1991-1997). Trends were compared before and after introduction of the program, with the period after the program being divided into 2 parts (early, 1989-1993; late, 1994-1996).

**Main Outcome Measures.**—Change in cigarette consumption and smoking prevalence in California compared with the rest of the United States.

**Results.**—Per capita cigarette consumption declined 52% faster in California in the early period than previously (from 9.7 packs per person per month at the beginning of the program to 6.5 packs per person per month in 1993), and the decline was significantly greater in California than in the rest of the United States ( $P < .001$ ). In the late period, the decline in California slowed to 28% of the early program so that in 1996 an average of 6.0 packs per person per month were consumed. No decline occurred in the rest of the United States, and in 1996, 10.5 packs per person per month were consumed. Smoking prevalence showed a similar pattern, but in the late period, there was no significant decline in prevalence in either California or the rest of the United States. In 1996, smoking prevalence was 18.0% in California and 22.4% in the rest of the United States.

**Conclusions.**—The initial effect of the program to reduce smoking in California did not persist. Possible reasons include reduced program funding, increased tobacco industry expenditures for advertising and promotion, and industry pricing and political activities. The question remains how the public health community can modify the program to regain its original momentum.

*JAMA.* 1998;280:893-899

EARLY PUBLIC HEALTH approaches to reducing population smoking prevalence emphasized interventions aimed at individual smokers.<sup>1</sup> However, the results of numerous studies indicated that too few individuals were reached for such a strategy to effect a measurable reduc-

tion in population smoking prevalence.<sup>2</sup> The varied successes of several comprehensive, community and statewide tobacco control programs<sup>3-7</sup> led to this approach being widely recommended as the most appropriate way to reduce tobacco use in the United States.<sup>2,8</sup> Starting in 1989, the California Tobacco Control Program introduced the use of increased tobacco excise taxes to continuously fund a large, coordinated statewide effort to reduce the health costs associated with smoking.<sup>9</sup>

The voter initiative that led to the California Tobacco Control Program clearly specified that the program take a

multipronged or "shotgun" approach to reducing smoking. In addition to imposing an additional tax (\$0.25 per pack), the initiative mandated funding for mass media antitobacco campaigns, local health agencies to provide technical support and monitor adherence to antismoking laws, community-based interventions selected by a competitive grants process, and enhancement of school-based prevention programs. Additionally, it mandated that the program's effectiveness be evaluated.<sup>9</sup> In this article, we report the longer-term evidence that the California Tobacco Control Program affected smoking behavior.

One problem with assessing the effectiveness of tobacco control programs funded by cigarette taxes is that funding for evaluation research, including population surveys of smoking behavior, becomes available only after the first intervention (imposition of the tax) has occurred. In the United States, surveillance surveys have rarely had designs that provide precise enough estimates of smoking behavior at the state level to allow a sensitive assessment of changes in trends.<sup>10</sup> The research challenge is to reach valid conclusions from the analysis of preprogram trends derived from one set of surveys and postprogram trends from different surveys. Fortunately, another source of data is available from the collection of cigarette excise taxes. All states have such taxes, and the sales reporting methods for tax assessment are uniform. If there is no major change in the average level of consumption per smoker, trends in smoking prevalence should mirror trends in cigarette sales, which would increase the confidence in conclusions based on either analysis.

In this article, we assess trends in per capita cigarette consumption and adult smoking prevalence in California compared with the rest of the United States. The only previous report of the longer-term impact of a statewide tobacco control program indicated that the program

From the Cancer Prevention and Control Program, Cancer Center (Drs Pierce and Emery, Mss Gilpin and White, and Mr Rosbrook), and Department of Family and Preventive Medicine, Division of Health Care Sciences (Dr Berry), University of California, San Diego.

Reprints: John P. Pierce, PhD, Cancer Prevention and Control Program, Cancer Center, University of California, San Diego, La Jolla, CA 92093 (e-mail: JPPierce@ucsd.edu).

had an overall impact during its first year of operation.<sup>5</sup> However, the magnitude of this initial effect was not maintained over the next 4 years. A different pattern was observed for men and women; the rate of decline (trend) in smoking was greater only in men in the second period than it was in the preprogram period.<sup>11</sup> If the later trend is not larger than the preprogram trend, then the program can be considered to have lost its effect. Should an ongoing tobacco control program lose its effect, a careful examination of the possible reasons is essential so that appropriate revitalization measures can be taken. Also, it must be considered that counterstrategies used by the tobacco industry may play a role in diminishing a program's effectiveness.

## METHODS

### Cigarette Sales (Consumption)

The Tobacco Institute reports on monthly tax payments from all packs of cigarettes removed from wholesale warehouses to retail outlets for sale within each state.<sup>12</sup> Data from February 1983 through March 1997 are included in the present analysis. We estimated per capita consumption for a given state in any given year using census estimates for the state population aged 18 years and older. Decade census population data were assumed to reflect the population on April 1, 1980, and April 1, 1990. Supplemental estimates reported from the Current Population Surveys were assumed to reflect the population as of July 1 of each year.<sup>13,14</sup> To obtain monthly estimates of state populations, we interpolated regression lines fitted to the yearly census data. Since retail outlets appear to stock up in the last month of both the fiscal and calendar years, we removed this source of variation by considering bimonthly averages (for December-January, February-March, etc). The per capita consumption represents the average number of packs removed from wholesale warehouses during a 2-month period divided by the population estimate for the midpoint of the particular time interval. To further deseasonalize the data so that trends over time become more apparent, we applied the SABL procedure (available in the statistical package S-plus<sup>15</sup>) to the bimonthly data. The SABL procedure provides robust estimation of seasonal and trend components of a time series, possibly in the presence of nonadditive effects.<sup>16</sup> This procedure was used for both California and the rest of the United States to produce smoothed time-series trend lines indicating changes over time.

A piecewise linear spline regression model was applied to the bimonthly raw

data to further quantify trends. Indicator variables were included to account for the effects of the 6 bimonthly time points. This model allows for changes in the slope at defined points of time.<sup>17,18</sup> The first cut point was defined as January 1989, when the additional excise tax was imposed in California. The deseasonalized trends suggested that a second cut point occurred in California in mid-1994 and in the rest of the United States in mid-1993, so January 1994 was used to make the analyses consistent. A 2-tailed statistical test yielded a *P* value for differences in slope from one period to the next. Also, from computed SEs for the piecewise slopes, a *z* statistic could be computed to assess (2-tailed) differences in slopes between California and the rest of the United States.

### Smoking Prevalence

**Surveys.**—Smoking prevalence estimates were obtained from several different population-based surveys conducted nationally and in California.<sup>19-25</sup> These differed considerably in the methods used, including sample selection, survey mode (face-to-face or telephone), smoking status questions, respondents (self or proxy<sup>20</sup>), and sampling variability. These issues made combining all the survey estimates and examining trends over time problematic. Therefore, the data from each survey type were first examined separately to establish that they were not contradictory to each other; then they were combined in an

analysis similar to the one used for per capita consumption.

Since 1965, the National Health Interview Surveys (NHIS) have been the surveillance system of choice for smoking prevalence in the United States.<sup>10,19</sup> Although the NHIS provide only estimates at the regional level, California is the largest state in the Western region. Thus, the NHIS sample sizes for California smoking prevalence estimates are reasonably large. The 1978-1994 NHIS were used for an initial assessment of preprogram and postprogram smoking prevalence trends in California and the rest of the United States. The NHIS conducted before 1978 were excluded, either because they did not include persons as young as 18 years (1976 and 1977 surveys) or because smoking status information was missing for more than 1.5% of respondents (1974 survey). The 1992 NHIS was excluded because it was cancelled suddenly at the midpoint of fieldwork with unknown consequences to response rate and representativeness. The paucity of data points after the start of the California Tobacco Control Program results in insufficient statistical power to precisely evaluate changes in trend or to compare California with the rest of the United States. Nevertheless, we used the piecewise linear regression approach to determine whether these data appeared consistent with the postprogram change in slope identified from the per capita consumption data.

Since 1989, there have been several large-scale population surveys conducted

Table 1.—Survey Data Used for Analysis of Smoking Prevalence (Samples Sizes and Response Rates)\*

| Year | NHIS†      |                              | CTS          | BRFS/<br>CATS | CPS              |                              |
|------|------------|------------------------------|--------------|---------------|------------------|------------------------------|
|      | California | United States–<br>California |              |               | California       | United States–<br>California |
|      | California | United States–<br>California | California   | California    | California       | United States–<br>California |
| 1978 | 1178       | 10 399                       | ...          | ...           | ...              | ...                          |
| 1979 | 2578       | 21 535                       | ...          | ...           | ...              | ...                          |
| 1980 | 1112       | 9303                         | ...          | ...           | ...              | ...                          |
| 1983 | 2309       | 20 109                       | ...          | ...           | ...              | ...                          |
| 1985 | 3572       | 30 058                       | ...          | ...           | ...              | ...                          |
| 1987 | 5064       | 39 059                       | ...          | ...           | ...              | ...                          |
| 1988 | 5030       | 39 203                       | ...          | ...           | ...              | ...                          |
| 1990 | 4898       | 36 206                       | 65 139 (75)‡ | ...           | ...              | ...                          |
| 1991 | 5747       | 39 029                       | ...          | 2995 (60)§    | ...              | ...                          |
| 1992 | ...        | ...                          | 21 872 (73)  | 3982 (62)     | (September) 8081 | 97 856 (89)                  |
| 1993 | 2668       | 18 360                       | 63 269 (70)  | 7371 (60)     | (January) 8272   | 96 831 (89)                  |
| 1993 | ...        | ...                          | ...          | ...           | (May) 8151       | 96 769 (86)                  |
| 1994 | 2382       | 17 356                       | ...          | 8169 (62)     | ...              | ...                          |
| 1995 | ...        | ...                          | ...          | 8207 (53)     | (September) 5966 | 77 570                       |
| 1996 | ...        | ...                          | 78 337 (53)  | 8165 (49)     | (January) 5780   | 69 375                       |
| 1996 | ...        | ...                          | ...          | ...           | (May) 6041       | 70 164                       |

\*NHIS indicates National Health Interview Surveys; CTS, California Tobacco Surveys; BRFS, Behavioral Risk Factor Surveys; CATS, California Adult Tobacco Surveys; and CPS, Current Population Surveys. Ellipses indicate data not applicable. Numbers in parentheses are response rates in percent, where available.

†Although not published, the NHIS claim a response rate exceeding 86%.

‡For CTS, this is the number of screening interviews completed as a percentage of all households targeted (including telephone numbers for which it was unknown whether the number was that of a residence or a business).

§For BRFS/CATS, this is the product of the household response rate (see CTS) and the interviewee response rate.

||For CPS, this is the percentage of respondents targeted for smoking supplement interviews for whom the interview was completed. For smoking status, the response was higher because proxy information is included.

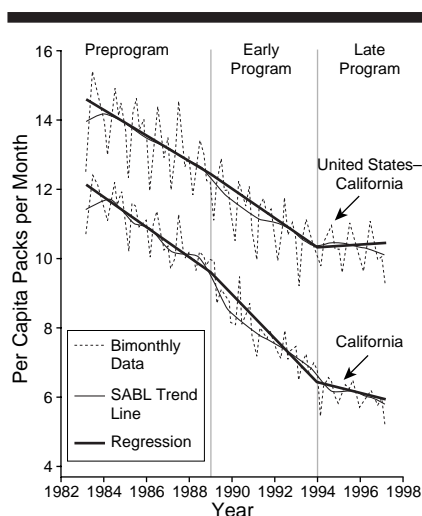


Figure 1.—Trends in monthly per capita adult ( $\geq 18$  years) cigarette consumption in California and the rest of the United States.

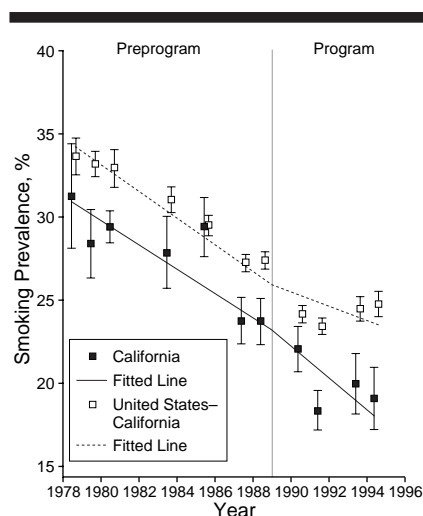


Figure 2.—Trends in adult ( $\geq 18$  years) smoking prevalence in California and the rest of the United States from National Health Interview Surveys data. Error bars indicate SEs.

Table 2.—Summary of Decreases in per Capita Cigarette Consumption\*

| Period                   | California                 |          | Rest of the United States  |          |
|--------------------------|----------------------------|----------|----------------------------|----------|
|                          | Rate of Decline, Pack (SE) | Packs/mo | Rate of Decline, Pack (SE) | Packs/mo |
| Pre-1989 (preprogram)    | -0.42† (0.03)              | 9.7      | -0.36 (0.02)               | 12.5     |
| 1989-1993 (early period) | -0.64‡§ (0.03)             | 6.5      | -0.42 (0.03)               | 10.4     |
| 1994-1996 (late period)  | -0.17†§ (0.07)             | 6.0      | 0.04§ (0.06)               | 10.5     |

\*The per capita adult ( $\geq 18$  years) cigarette consumption in December 1998, December 1993, and December 1996 were estimated from piecewise linear model.

† $P < .01$ , California vs the rest of the United States.

‡ $P < .001$ , California vs the rest of the United States.

§ $P < .001$ , change from previous period.

in California on a periodic basis. The California Tobacco Surveys (CTS) were the largest of these and specifically funded to evaluate the California Tobacco Control Program. To date, they have been conducted in 1990, 1992, 1993, and 1996. The CTS are random-digit-dialed telephone surveys of households in California.<sup>20,21</sup> A brief screening interview was conducted with a household adult to enumerate all residents and to obtain demographic information, including age and smoking status. Both self and proxy data from the screening interview were included. The Behavioral Risk Factor Surveys (BRFS) have been conducted in California every year since 1984.<sup>22</sup> Beginning in 1991, the sample size was increased, and quality control procedures were established (using California Tobacco Control Program funds) to make this survey a potentially useful tool for assessing trends. Beginning in 1993, a special smoking supplement (modeled after the CTS), the California Adult Tobacco Surveys (CATS), was attached to the BRFS.<sup>23</sup> Finally, the national Current Population Surveys (CPS),<sup>24,25</sup> conducted in September 1992, January and May 1993, September 1995, and January and May 1996, were de-

signed to provide state-specific estimates. The 1985 and 1989 CPS also had smoking-status questions, but these data were missing from more than 1.5% of respondents, so they were not included in our analyses. The various surveys with sample sizes and response rates (if known) are summarized in Table 1.

**Smoking Status.**—Respondents to all surveys were asked if they (or the person they were responding for) had smoked at least 100 cigarettes in their lifetime and whether they smoked now. In a few of the more recent surveys (NHIS since 1993, CPS since 1992, and BRFS/CATS since 1994), respondents were asked if they currently smoked "everyday," "some days," or "not at all." The everyday and some days smokers were considered to "smoke now." The CTS computed smoking prevalence based on the smoke now question. The other surveys also required that smokers report smoking at least 100 cigarettes in their lifetimes before being asked the current smoking question.

**Weighting and Variance.**—Survey weights, provided with each of the data sets, were constructed to account for the probability that an individual is sampled

and to adjust for differential nonresponse using poststratification procedures. The poststratification procedures for the various surveys were based on different demographic subgroups, and population totals for these subgroups were from different years. Because the demographics of the population changed between 1978 and 1996, data from each survey were standardized (direct method for weighted prevalence) according to sex, age (18-29, 30-39, 40-49, 50-59, and  $\geq 60$  years), race (white, nonwhite), and educational level (no college, some college). Variance estimates were generated for each estimate (data available from the authors) so that 95% confidence intervals could be computed and so that rates of change in prevalence estimated from each survey during the postprogram period could be evaluated (data available from the authors).

Finally, once it was established that trends from the various surveys were not contradictory, all the data were combined into one piecewise linear regression analysis, using the same model form as for the per capita consumption data. This analysis, though still problematic for all the reasons discussed above, provides a summary of the prevalence trends that can be examined against the per capita consumption data.

## RESULTS

### Per Capita Cigarette Consumption

Figure 1 shows the bimonthly raw data, the SABL deseasonalized trends, and the fitted trends from the piecewise linear model for monthly per capita cigarette consumption in California and the rest of the United States. Before the California Tobacco Control Program began, the annual rate of decline in monthly per capita cigarette consumption was -0.42 pack, which was significantly ( $P < .01$ ) more rapid (more negative) than the rate of decline of -0.36 pack in the rest of the United States. From January 1989 through December 1993, the annual rate of decline in monthly per capita consumption increased significantly (became more negative) in California, from -0.42 to -0.64 pack ( $P < .001$ ) or by a factor of 52%. There was a slight but insignificant increase in the rate of decline during this period in the rest of the United States. The rate of decline was significantly ( $P < .001$ ) greater in California (by a factor of 52%) than in the rest of the United States during this period. These results are summarized in Table 2. From January 1994 through December 1996, the annual rate of decline in monthly per capita consumption changed significantly ( $P < .001$ ) in California to -0.17 pack, which was only 28%



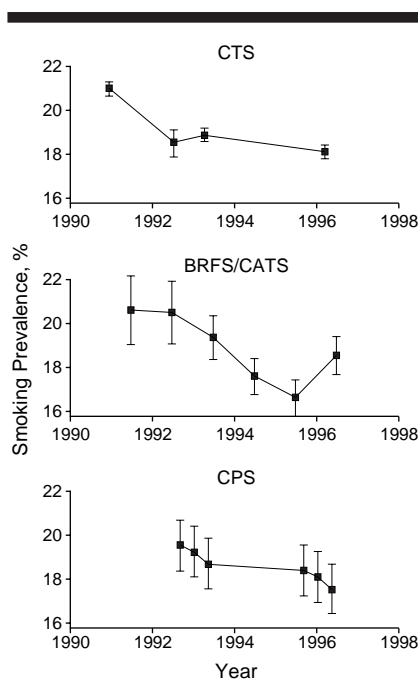


Figure 3.—Top, Trends in adult ( $\geq 18$  years) smoking prevalence in California from California Tobacco Surveys (CTS) data. Middle, Behavioral Risk Factor Surveys and California Adult Tobacco Surveys (BRFS/CATS) data. Bottom, Current Population Surveys (CPS) data. Error bars indicate 95% confidence intervals.

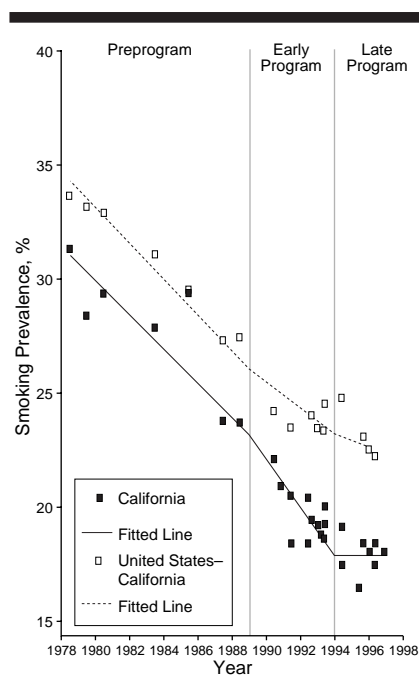


Figure 4.—Trends in adult ( $\geq 18$  years) smoking prevalence in California and the rest of the United States computed from all survey sources combined.

Table 3.—Summary of Decreases in Smoking Prevalence\*

| Period                   | California              |                       | Rest of the United States |                       |
|--------------------------|-------------------------|-----------------------|---------------------------|-----------------------|
|                          | Rate of Decline, % (SE) | Smoking Prevalence, % | Rate of Decline, % (SE)   | Smoking Prevalence, % |
| Pre-1989 (preprogram)    | -0.74 (0.12)            | 23.3                  | -0.77 (0.09)              | 26.2                  |
| 1989-1993 (early period) | -1.06†‡ (0.17)          | 18.0                  | -0.57 (0.14)              | 23.3                  |
| 1994-1996 (late period)  | 0.01‡ (0.21)            | 18.0                  | -0.28 (0.26)‡             | 22.4                  |

\*Adult ( $\geq 18$  years) smoking prevalence in December 1998, December 1993, and December 1996 were estimated from piecewise linear model.

† $P < .05$ , California vs the rest of the United States.

‡ $P < .001$ , change from previous period.

of the rate of decline identified for January 1989 through December 1993 and only 40% of the preprogram rate of decline. In the rest of the United States, the annual rate of change in monthly consumption halted altogether (only 0.04 pack), which was a significant change from the earlier period ( $P < .001$ ). The rate of decline in California, although considerably diminished, was still significantly ( $P < .01$ ) greater than the essentially zero decline in the rest of the United States for this period.

In December 1988, before the California Tobacco Control Program began, monthly per capita cigarette consumption, 9.7 packs, was less than the 12.5 packs for people in the rest of the United States, by a factor of 22%. In December 1996, the per capita consumption of 6.0 packs was 43% less than the 10.5 packs seen in the rest of the United States.

### Cigarette Smoking Prevalence

**Change From Preprogram.**—The NHIS data from California and the rest of the United States are presented in Figure 2. The rate of decline in California before the start of the California Tobacco Control Program was  $-0.72\%$  (SE, 0.19%) per year, which was not statistically different from the rate of decline in the rest of the United States, which was  $-0.79\%$  (SE, 0.10%) per year. After 1988, the rate of decline in California increased (more negative) to  $-0.98\%$  (SE, 0.35%) per year. This 36% increase in the rate of decline was not statistically significant because there were too few estimates to provide sufficient precision. In the rest of the United States, the rate of decline was  $-0.42\%$  (SE, 0.20%) per year, but the decrease (less negative) from the earlier rate of decline was also not statistically significant. The overall rate of

decline in the rest of the United States from 1978 to 1994 was  $-0.67\%$  (SE, 0.07%) per year, and in California it was  $-0.79\%$  (SE, 0.11%) per year.

### Changes During Program Period.

Figure 3 gives the standardized smoking prevalence estimates with 95% confidence intervals from the various surveys conducted in California in the postprogram period. The top panel presents CTS estimates. The decline ( $\pm 95\%$  confidence interval) from  $20.9\% \pm 0.5\%$  in 1990 to  $18.9\% \pm 0.5\%$  in 1993,  $-0.85\% \pm 0.30\%$  per year, was significantly greater ( $P < .001$ ) than the rate of decline of  $-0.22\% \pm 0.17\%$  per year from 1993 to a prevalence of  $18.1\% \pm 0.4\%$  in 1996.

The middle panel of Figure 3 shows the standardized smoking prevalence estimates from the BRF/CATS. In 1991, the prevalence estimate was  $20.5\% \pm 1.6\%$ , which decreased to  $17.6\% \pm 0.8\%$  by 1994; this represents a rate of decline of  $-0.99\% \pm 0.59\%$  per year. By 1996, the prevalence estimate was  $18.5\% \pm 0.9\%$ , which was a rate of increase of  $0.47\% \pm 0.60\%$  per year from 1994. The difference between the rate of decline in the early period and the rate of increase in the later period was statistically significant ( $P < .001$ ).

The bottom panel of Figure 3 shows the standardized CPS data for California. For example, smoking prevalence was  $18.7\% \pm 1.1\%$  in May 1993 and  $17.5\% \pm 1.1\%$  in May 1996, which represented a rate of change of  $-0.39\% \pm 0.55\%$  per year, which was not statistically different from zero.

In summary, the CTS data indicate a slower rate of decline in the later period as compared with the earlier period, the BRF/CATS indicate a decline in the early period and an increase in the later period, and the CPS showed no significant change in the later period.

**Combined Analysis.**—Since data from the California surveys did not contradict the observation that a decline occurred in the early period that was not maintained later, the data from all of them, including the NHIS, were combined into a single analysis similar to the one performed on the per capita cigarette consumption data. Figure 4 shows all the data points and the resulting fitted regression lines, and Table 3 presents the rates of decline and prevalence estimates derived from the model. Before the California Tobacco Control Program began in 1989, smoking prevalence declined at about the same rate in California ( $-0.74\%$  per year) and the rest of the United States ( $-0.77\%$  per year). The rates of decline were not statistically different, but prevalence in California was below that for the rest of the United States. The rate of decline increased (became more negative) significantly

Table 4.—Funding for the California Tobacco Control Program and the Advertising and Promotion of Cigarettes in California\*

| Expenditures Targeted at Tobacco Use in California, \$ Millions <sup>31</sup> |             |              |             |             |             |             |             |                     |
|---|-------------|--------------|-------------|-------------|-------------|-------------|-------------|---------------------|
| Budget Category   | Fiscal Year |              |             |             |             |             |             | Total,<br>1989-1996 |
|   | 1989-1990   | 1990-1991    | 1991-1992   | 1992-1993   | 1993-1994   | 1994-1995   | 1995-1996   |                     |
| Mass media  | 14.3        | 14.3         | 16.0        | 15.4        | 12.9        | 12.2        | 6.6         | 91.7                |
| Local lead agency   | 35.6        | 35.4         | 14.5        | 17.8        | 13.5        | 16.4        | 10.2        | 143.4               |
| Competitive grants  | 3.3         | 49.7         | 1.1         | 27.5        | 15.1        | 10.9        | 9.7         | 117.3               |
| Local schools   | 32.6        | 32.6         | 24.3        | 23.3        | 19.6        | 16.8        | 15.3        | 164.5               |
| <b>Actual Totals</b>  | <b>85.8</b> | <b>132.0</b> | <b>55.9</b> | <b>84.0</b> | <b>61.1</b> | <b>56.3</b> | <b>41.8</b> | <b>516.9</b>        |

| Expenditures by the Tobacco Industry in California, \$ Millions <sup>32</sup> |               |            |            |            |            |            |            |                     |
|---|---------------|------------|------------|------------|------------|------------|------------|---------------------|
| Budget Category   | Calendar Year |            |            |            |            |            |            | Total,<br>1989-1995 |
|   | 1989          | 1990       | 1991       | 1992       | 1993       | 1994       | 1995       |                     |
| Advertising   | 111           | 114        | 112        | 99         | 94         | 89         | 82         | 701                 |
| Incentive to merchants  | 100           | 102        | 116        | 151        | 156        | 168        | 187        | 980                 |
| Promotional items   | 122           | 149        | 207        | 252        | 332        | 210        | 201        | 1473                |
| Other   | 28            | 34         | 31         | 22         | 22         | 17         | 19         | 173                 |
| <b>Totals</b>   | <b>361</b>    | <b>399</b> | <b>466</b> | <b>524</b> | <b>604</b> | <b>484</b> | <b>489</b> | <b>3327</b>         |

\*Data are from Balbach et al<sup>31</sup> and the US Federal Trade Commission.<sup>32</sup> Dollar amounts are not adjusted for inflation.

( $P < .001$ ) in California after the program began, whereas in the rest of the United States it did not. As a result, the rate of decline from 1989 through 1993 was significantly greater ( $P < .05$ ) by a factor of nearly 90% in California ( $-1.06\%$  per year) than in the rest of the United States ( $-0.57\%$  per year). After 1993, the rate of decline in California and in the rest of the United States was not significantly different from zero, and in both instances, the change in the rate of decline was significantly less ( $P < .001$ ) than in the preceding period. Obviously, these late program trends were less than the preprogram rates of decline.

From the fitted model (Table 3), adult smoking prevalence in December 1988 was 11% lower than in the rest of the United States, and by December 1996 it was 20% lower.

## COMMENT

Analysis of trends in per capita cigarette consumption indicates that the start of the California Tobacco Control Program in 1989 was associated with a 50% more rapid rate of decline that was unique to California. After 1993, the rate of decline in per capita consumption in California slowed to less than one third of the rate observed from 1989 through 1993 and to less than one half of the rate of decline observed before the program began. However, this post-1993 rate of decline was still significantly more rapid in California than in the rest of the United States, for which the decline in consumption halted.

The smoking prevalence trends from the combined survey data are fairly consistent with the changes observed in per capita consumption. The initiation of the program was associated with a 36% increase in the rate of decline of smoking prevalence, which was nearly twice the rate of decline identified for the rest of

the United States. However, from 1994 through 1996, there was no identifiable decline in smoking prevalence either in California or the rest of the country. In California, smokers may be reducing their consumption rather than quitting, while it appears that in the rest of the United States they are doing neither.

It is important to the future of tobacco control in general and to the California Tobacco Control Program specifically to hypothesize why the loss of the early program success occurred. Additional analyses will be required to fully understand the influences of various factors. Did the program lose its effectiveness because it failed to introduce new and innovative approaches to interest the population in tobacco control, or did it suffer from countermeasures used by the tobacco industry? The fact that the tobacco industry lowered prices for premium brands of cigarettes in 1993<sup>26</sup> could be at least partly responsible. Also, it is possible that lower funding for the Tobacco Control Program or increased expenditures by the tobacco industry for advertising and promotion played a role. Finally, the tobacco industry engaged in a variety of political activities, which may have influenced the level of commitment of the state administration and legislature to the California Tobacco Control Program. These possibilities will be examined in some detail below.

There were several tobacco control strategies that were emphasized during the early phase of the California Tobacco Control Program. One was support for the adoption of ordinances at the local level that restricted or banned smoking in indoor workplaces and public places. The percentage of indoor workers reporting smoke-free workplaces increased during the early years of the program but continued to increase even more later.<sup>21</sup> California Assembly Bill 13 was enacted in

January 1994, and it prohibited smoking statewide in 1995 in all indoor workplaces except bars, taverns, and casinos. If smoke-free workplaces encourage smokers to reduce their consumption or quit, the effect on per capita consumption and prevalence should have been evident throughout the entire program period. Another important element of the very early California Tobacco Control Program was a well-funded and effective media campaign.<sup>27</sup> Antismoking television ads focused on the duplicity of the tobacco industry and the dangers of secondhand tobacco smoke. Funding for the media campaign was vetoed by the governor in 1992 and later restored,<sup>28</sup> but it was reinstated at a lower level than previously (Table 4). Also, the administration has been accused of "watering down" the antismoking advertising.<sup>27</sup>

Economic theory and empirical data have suggested that cigarette price is a major determinant of smoking behavior.<sup>10,29</sup> However, recent data suggest that when tobacco control programs are in place, the price elasticity of demand may be altered (S. Emery, E. A. Gilpin, J. P. Pierce, unpublished data, 1998).<sup>30</sup> In 11 of the 14 states that participated in the American Stop Smoking Intervention Study (ASSIST), where there was a decrease in the real price of cigarettes from 1992 to 1994 (which spanned the date when the tobacco companies lowered the price of cigarettes), per capita cigarette consumption did not increase as economic theory would predict.<sup>30</sup> In the remaining 3 ASSIST states, the increase in consumption was very minimal. In the non-ASSIST states (excluding California), all showed a decrease in the real price of cigarettes from 1992 to 1994, and over half showed the expected increase in per capita consumption. A recent analysis of changes in cigarette price and per capita consumption in Cali-

California showed that when the excise tax increase went into effect the percentage change in per capita consumption (12.2%) closely matched what economic theory would predict from the resultant change in cigarette price (11.8%) (S. Emery, E. A. Gilpin, J. P. Pierce, unpublished data, 1998). The increased tax was the first element of the California Tobacco Control Program implemented, and as additional programs were introduced, the expected relationship between price and consumption disappeared. Importantly, per capita consumption decreased 8.5% from 1993 to 1994, when the price decrease would have predicted a 4.9% increase. The price of cigarettes has remained stable from 1993 through 1996. These results suggest that price alone cannot be responsible for the loss of effect of the California Tobacco Control Program.

The level of funding for the California Tobacco Control Program has varied over the course of the program.<sup>31</sup> Expenditure data for the Health Education Account (which funds the Tobacco Control Program) are shown in Table 4 (top) for the line items of mass media, local lead agencies, competitive grants and school programs, and other expenses.<sup>31</sup> The funds allocated for administration and evaluation, which averaged about 5% of the total budget each year, are not included. There is variation over time, which suggests that money from 1 year was brought forward to the next, particularly in the category of competitive grants. From fiscal year 1989-1990 to fiscal year 1992-1993, the average annual expenditure was \$85.5 million, or \$3.35 per capita per year (considering a population of 25.5 million people in California >12 years old). However, beginning with fiscal year 1993-1994, there was a marked reduction in program funding. The annual average was \$53.0 million, or \$2.08 per capita, which was a reduction of 40% from the early years of the program. This reduction in the level of effort aimed at reducing smoking in California is a possible explanation for the loss of program effect.

Concurrent increases in the amount of money the tobacco industry spent to promote cigarette use may have exacerbated the problem. The lower portion of Table 4 shows the estimated amount spent for each of several line-item categories as reported to the Federal Trade Commission.<sup>32</sup> Traditional print media and billboard expenditures constitute the advertising category. We combined the categories for "coupons," "retail value added," and "specialty item distribution" into one category labeled "promotional items." The category "incentives to merchants" includes the Federal

Trade Commission category that they designate as "promotional allowances," which covers expenditures to encourage wholesalers and retailers to stock and promote particular cigarette brands. We assumed that the tobacco industry did not specifically target California with its marketing dollars and that California received a share of the industry's national promotion and advertising effort in proportion to its population (approximately 10%). This assumption is likely to be conservative, since the tobacco industry may have specifically increased their promotional efforts in California to counteract the Tobacco Control Program when there were early indications that it was having an impact.<sup>7,33</sup> Furthermore, the data on expenditures for advertising and promotion are for manufactured cigarettes only and do not include other tobacco products, such as cigars. The amount spent on advertising has decreased over time, but the amount spent on incentives to merchants has increased markedly, as has the budget allocation for promotional items. From 1989 to 1993, it is estimated that the tobacco industry spent an average of \$437 million annually, or \$17.14 per capita, in California; thereafter, it spent an average of \$525 annually, or \$20.59 per capita, an increase of 20% from the earlier period. In the earlier period, the industry outspent the program by approximately \$5 to \$1 (\$17.14 to \$3.35 per capita), and in the period from 1993 to 1996, it outspent the program by nearly \$10 to \$1 (\$20.59 to \$2.02 per capita).

The cuts made by the administration and legislature in the California Tobacco Control Program budget appeared to be about the same in each budget category of the Health Education Account, except in 1995-1996, when the expenditure for the media program was halved. The decision by the administration to divert funding for the program could not have been justified on the basis that the program was considered to be performing above expectations. The 1993 interim assessment of the program suggested that since early indications demonstrated that the program was having an effect on smoking behavior, this effect needed to be increased by 50% more in order for the program to meet its goal for the year 2000.<sup>34</sup> The goal was to decrease adult smoking prevalence by 75% within a 12-year period. Further, the decision to reduce expenditures for the program was made in the face of active lobbying by health advocacy organizations and lawsuits against the administration brought by the American Lung Association, Americans for Nonsmokers' Rights, the American Cancer Society, and the American Heart Association.

Recently, a set of internal memoranda from the Tobacco Institute surfaced. These internal memoranda, written in 1990, outlined a strategic plan for combatting the California Tobacco Control Program.<sup>35</sup> The plan called for lobbying the California legislature to intervene, encouraging and supporting minority organizations to oppose the program, convincing the health services director to pull or modify media messages that reflected poorly on the industry, and encouraging the governor to intercede against the program. There is evidence that these strategies were used and met with some success. As mentioned previously, the governor initially vetoed the media budget in 1992, although he reconsidered following significant public pressure.<sup>28</sup> Antismoking media funding was reduced by 50% for 1995-1996, and anti-industry media spots were short-lived.<sup>27</sup> Furthermore, tobacco industry campaign contributions to legislature candidates, other elected officials, political parties, and political party committees totaled over \$1.5 million in 1995-1996; this was a 70% increase compared with the level of such contributions in the 1993-1994 election cycle.<sup>31</sup> On a per legislator basis, members of the California legislature received twice as much money as did members of the US Congress, even though California is not a tobacco-producing state.<sup>31</sup> The slowing of the decline in smoking in recent years may well be a result of these political counterstrategies by the tobacco industry.

The California Tobacco Control Program has confirmed findings from earlier studies<sup>3-7</sup> that large health promotion programs can have a major influence on smoking behavior. Similar programs have been initiated in Massachusetts (1993), Arizona (1995), and Oregon (1996). Furthermore, the Robert Wood Johnson Foundation and the Centers for Disease Control and Prevention have provided limited support for the development of similar tobacco control programs in other states.<sup>36,37</sup> Only the relatively well-funded Massachusetts program<sup>38</sup> has been in effect long enough to potentially confound the results of our analyses. However, Massachusetts represents a small percentage of the US population, so it was not surprising that a reanalysis of the data without it did not change the results.

In conclusion, the California Tobacco Control Program clearly lost its original positive effect on reducing smoking, which must be of considerable concern to the public health movement. In this article, we have discussed some of the factors that might have been associated with the loss of effect. The Tobacco Institute memoranda<sup>35</sup> revealed that the



tobacco industry decided early on to actively oppose any potentially effective tobacco control efforts. Traynor and Glantz<sup>39</sup> and Heisner and Begay<sup>40</sup> have outlined the political difficulties faced in developing and maintaining an effective tobacco control program in such a climate. Despite active industry opposition and political influences, it is urgent that the public health community determine how the California Tobacco Control Program can be modified to regain its original momentum.

Preparation of this article was supported by funding from the Cancer Prevention Research Unit, National Institutes of Health grant CA72092, funded by the National Cancer Institute, Bethesda, Md. Data for the CTS were collected under contract 95-23211 from the California Department of Health Services, Tobacco Control Section, Sacramento. Dr Pierce is supported in part by an Established Investigator Award from the American Heart Association.

## References

1. US Department of Health, Education, and Welfare. *Smoking and Health: A Report of the Surgeon General*. Washington, DC: US Dept of Health, Education, and Welfare, Public Health Service, Office of the Assistant Secretary for Health, Office on Smoking and Health; 1979. DHEW publication PHS 79-50066.
2. National Cancer Institute. *Strategies to Control Tobacco Use in the United States: A Blueprint for Public Health Action in the 1990's*. Bethesda, Md: National Institutes of Health, National Cancer Institute; 1992. Smoking and Tobacco Control Monograph No. 1. NIH publication 92-3316.
3. Farquhar JW, Fortmann SP, Flora JA, et al. The Stanford Five-City Project: effects of community-wide education on cardiovascular disease risk factors. *JAMA*. 1990;264:359-365.
4. Egger G, Fitzgerald W, Frape G, et al. Results of large scale media antismoking campaign in Australia: North Coast "Quit for Life" programme. *BMJ*. 1983;287:1125-1128.
5. Dwyer T, Pierce JP, Hannan CD, Burke N. Evaluation of the Sydney "Quit for Life" anti-smoking campaign, II: changes in smoking prevalence. *Med J Aust*. 1986;144:344-347.
6. The COMMIT Research Group. Community Intervention Trial for Smoking Cessation (COMMIT), I: cohort results from a four-year community intervention. *Am J Public Health*. 1995;85:183-192.
7. Pierce JP, Burns DM, Berry C, et al. Reducing tobacco consumption in California: Proposition 99 seems to work. *JAMA*. 1991;265:1257-1258.
8. Klausner R. The evolution of tobacco control studies at the National Cancer Institute. *Tob Control*. 1998;6(suppl 2):S1-S2.
9. Bal DG, Kizer KW, Felton PG, Mozar HN, Neimeyer D. Reducing tobacco consumption in California: development of a statewide antitobacco use campaign. *JAMA*. 1990;264:1570-1574.
10. US Department of Health and Human Services. *Reducing the Health Consequences of Smoking: 25 Years of Progress: A Report of the Surgeon General*. 1989. Washington, DC: US Dept of Health and Human Services; 1989. Publication CDC 89-8411.
11. Pierce JP, Macaskill P, Hill D. Long-term effectiveness of mass media led antismoking campaigns in Australia. *Am J Public Health*. 1990;80:565-569.
12. The Tobacco Institute. *Monthly State Cigarette Tax Reports, February 1983-June 1997*. Washington, DC: Tobacco Institute; 1997.
13. US Bureau of Census. *Resident Population for Selected Age Groups: 1980-1989*. Washington, DC: US Bureau of the Census, Population Distribution Branch; 1990.
14. US Bureau of Census. *Resident Population for Selected Age Groups: 1990-1996*. Washington, DC: US Bureau of the Census, Population Distribution Branch; 1996.
15. Becker RA, Chambers JM, Wilks AR. *The New S Language: A Programming Environment for Data Analysis and Graphics*. Pacific Grove, Calif: Wadsworth & Brooks/Cole; 1988.
16. Cleveland WS, Devlin SJ. Calendar effects in monthly time series: modeling and adjustments. *J Am Stat Assoc*. 1982;77:520-528.
17. Neter J, Wasserman W, Kutner MH. *Applied Linear Statistical Models: Regression, Analysis of Variance, and Experimental Designs*. 2nd ed. Homewood, Ill: Richard D Irwin Inc; 1985.
18. SAS Institute Inc. *SAS System for Regression*. 2nd ed. Cary, NC: SAS Institute Inc; 1991.
19. Pierce JP, Fiore MC, Novotny TE, Hatziaandreu E, Davis R. Trends in cigarette smoking in the United States: projections to the year 2000. *JAMA*. 1989;261:61-65.
20. Gilpin EA, Pierce JP, Cavin SW, et al. Estimates of population smoking prevalence: self vs proxy reports of smoking status. *Am J Public Health*. 1994;84:1576-1579.
21. Pierce JP, Gilpin EA, Emory SL, et al. *Tobacco Control in California: Who's Winning the War? An Evaluation of the Tobacco Control Program, 1989-1996*. La Jolla: University of California, San Diego; 1998.
22. Giovino GA, Schooley MW, Zhu B-P, et al. Surveillance for selected tobacco-use behaviors—United States, 1990-1994. *MMWR Morb Mortal Wkly Rep*. 1994;43(SS-3):1-43.
23. California Department of Health Services. *California Adult Tobacco Survey SAS Dataset Documentation and Technical Report, 1993-94*. Sacramento: Cancer Surveillance Section, California Dept of Health Services; 1994.
24. Hansen RH. *The Current Population Survey: Design and Methodology*. Washington, DC: US Dept of Commerce, Bureau of the Census; July 1995. Technical paper 40.
25. Shopland DS, Hartman AM, Gibson JT, Mueller MD, Kessler LG, Lynn WR. Cigarette smoking among US adults by state and region: estimates from the current population survey. *J Natl Cancer Inst*. 1996;88:1748-1758.
26. Shapiro E. Cigarette burn: Philip Morris price cut on Marlboro jolts industry and upsets rosy profit assumptions. *Wall Street Journal*. April 5, 1993:A1, A10.
27. Goldman LK, Glantz SA. Evaluation of anti-smoking advertising campaigns. *JAMA*. 1998;279:772-777.
28. Skolnick AA. Court orders California governor to restore antismoking media campaign funding. *JAMA*. 1992;267:2721-2723.
29. Lewit EM, Coate D. The potential for using excise taxes to reduce smoking. *J Health Econ*. 1982;1:121-145.
30. Manley MW, Pierce JP, Gilpin EA, Rosbrook B, Berry C, Wun LM. Impact of the American Stop Smoking Intervention Study on cigarette consumption. *Tob Control*. 1998;6(suppl 2):S5-S11.
31. Balbach ED, Monardi FM, Fox BJ, Glantz SA. *Holding Government Accountable: Tobacco Policy Making in California, 1995-1997*. San Francisco: Institute for Health Policy Studies, School of Medicine, University of California, San Francisco; 1997.
32. US Federal Trade Commission. *Federal Trade Commission Report to Congress: Pursuant to the Federal Cigarettes Labeling and Advertising Act*. Washington, DC: Federal Trade Commission; 1997.
33. Flewelling RL, Kenney E, Elder JP, Pierce JP, Hohnson M, Bal DG. First-year impact of the California cigarette tax increase on cigarette consumption. *Am J Public Health*. 1992;82:867-869.
34. Pierce JP, Evans N, Farkas AJ, et al. *Tobacco Use in California: An Evaluation of the Tobacco Control Program, 1989-1993*. La Jolla: University of California, San Diego; 1994.
35. Chilcote SD. *Memoranda to Members of the Executive Committee of the Tobacco Institute*. Washington, DC: Tobacco Institute; April 18, 1990.
36. Lynch BS, Bonnie RJ, eds. *Growing Up Tobacco Free: Preventing Nicotine Addiction in Children and Youth*. Washington, DC: National Academy Press; 1995.
37. Manley M, Lynn W, Epps RP, Grande D, Glynn T, Shopland D. The American Stop Smoking Intervention Study (ASSIST) for Cancer Prevention: an overview. *Tob Control*. 1997;6(suppl 2):S12-S16.
38. Harris JE, Connolly GN, Brooks D, Davis B. Cigarette smoking before and after an excise tax increase and an antismoking campaign—Massachusetts, 1990-1996. *MMWR Morb Mortal Wkly Rep*. 1996;45:966-970.
39. Traynor MP, Glantz SA. California's tobacco tax initiative: the development and passage of Proposition 99. *J Health Polit Policy Law*. 1996;21:543-585.
40. Heisner PF, Begay ME. The campaign to raise the tobacco tax in Massachusetts. *Am J Public Health*. 1997;87:968-973.

Dr Fouts is completely on target. The nidus of the pathology is among the permanent members of the UN Security Council and especially in Washington, DC, which has initiated and been a key player in shaping the atomic age. The concept of nonproliferation was flawed from the outset. The superpowers retained the right to keep testing and modernizing weapons notwithstanding their huge arsenals and their qualitative and quantitative dominance. At the same time, the nonweapons states were expected permanently to forswear any intent of acquiring nuclear military capabilities. Such a double standard could not be permanently enforced. The options were 2: either eradicate the malignant virus, nuclearism, or witness its spread. The events in South Asia confirm the bankruptcy of nuclear apartheid policies.

From the vantage point of our long-range national security, nuclear weapons offer nothing except a dire threat. With the United States the strongest nation on earth by every conceivable military, economic, and scientific measure, legitimization of nuclear weapons detracts rather than bolsters our safety. They are potential equalizers, enabling the weak to inflict unacceptable damage on the strong. Nuclear know-how is everywhere. Terrorists are aware that a nuclear bomb affords "the cheapest and biggest bang for the buck." No blackmail would be as compelling as holding an entire city hostage. Few societies are more susceptible to their malevolent consequences than the rich, urbanized, highly developed, industrialized North, foremost the United States. It is already the object of growing global resentment and envy. One may surmise that it will increasingly be the target for terrorist acts.

Physicians for Social Responsibility and the International Physicians for the Prevention of Nuclear War have long argued that nuclear abolition is a "number one public health priority." Political leaders respond not to historic imperatives but to the clamor of their constituencies. Only an upsurge of public opinion in favor of nuclear abolition will sway Washington to reconsider a flawed, immoral, and dangerous course.

Bernard Lown, MD  
Harvard School of Public Health  
Brookline, Mass

### Proximal Myopathy Associated With Inhaled Steroids

**To the Editor:** A number of undesirable systemic effects have been reported with the use of inhaled corticosteroids, including cataracts, suppression of the hypothalamic-pituitary-adrenal axis, osteoporosis, and possibly glaucoma.<sup>1,2</sup>

**Report of a Case.** A 37-year-old woman who had a seizure disorder that was well controlled with carbamazepine therapy began to use a beclomethasone nasal inhaler, 42 µg of drug per nasal pump unit, 1 to 2 sprays in each nostril twice daily, for

the treatment of seasonal allergic rhinitis. Four weeks later, the patient began to experience tightness in her thighs and increased fatigability when she climbed stairs or walked distances that were previously readily tolerated. Findings on a general medical examination were normal. Neurologic evaluation revealed a mild to moderate reduction in strength (4½/5 range) in neck flexion and bilaterally in shoulder abduction and hip flexion. Muscle weakness had not been noted in the past. Findings on the remainder of the neurologic examination, including muscle strength elsewhere, cranial nerve function, and deep tendon reflexes, were within normal limits. Erythrocyte sedimentation rate, thyroid function test results, cortisol and serum creatine kinase levels, and antinuclear antibody titer were normal. Serum carbamazepine level was in the midtherapeutic range. Electromyography (EMG) showed normal resting activity, without fibrillations or trains of myotonic potentials. Voluntary contraction of proximal muscles showed an increased recruitment pattern and diminished average size of units, consistent with myopathy. The possibility of steroid-induced myopathy was considered, and the use of inhaled steroids was discontinued. At the time of follow-up 1 month later, the patient was free of exercise-induced muscle tightness and reported normal exercise tolerance and strength. Examination revealed full motor strength, and repeat EMG showed normal unit morphology and recruitment. Without steroids, she has had no recurrence of weakness for 2 years.

**Comment.** Clinicians may need to consider proximal myopathy among the possible undesirable systemic adverse effects that can occur with the use of inhaled corticosteroids.

Andrew G. Herzog, MD, MSc  
Beth Israel Deaconess Medical Center  
Boston, Mass

1. Garbe E, Suissa S, LeLorier J. Association of inhaled corticosteroid use with cataract extraction in elderly patients. *JAMA*. 1998;280:539-543.
2. Cumming RG, Mitchell P, Leeder SR. Use of inhaled corticosteroids and the risk of cataracts. *N Engl J Med*. 1997;337:8-14.

### CORRECTIONS

**Authors' Names Omitted:** In the Letter entitled "Acetaminophen and Risk Factors for Excess Anticoagulation With Warfarin," published in the August 26, 1998, issue of *THE JOURNAL* (1998;280:697), authors Daniel E. Singer, MD, and Steven J. Skates, PhD, were omitted.

**Incorrect Figure Key:** In the Original Contribution entitled "National Use and Effectiveness of β-Blockers for the Treatment of Elderly Patients After Acute Myocardial Infarction," published in the August 19, 1998, issue of *THE JOURNAL* (1998;280:623-629), there was an incorrect figure key. On page 627, the key to Figure 1 should have read "Prescribed Use, % (No.) of States."

**Author's Name Omitted:** In the Original Contribution entitled "Has the California Tobacco Control Program Reduced Smoking?" published in the September 9, 1998, issue of *THE JOURNAL* (1998;280:893-899), Arthur J. Farkas, PhD, was omitted from the byline.