

## ABSTRACT

**Objectives.** Trends in smokeless tobacco use were examined for men in Indiana, Iowa, Montana, and West Virginia from 1988 through 1993.

**Methods.** State survey data from the Behavioral Risk Factor Surveillance System (BRFSS) were analyzed.

**Results.** Demographic characteristics associated with smokeless tobacco use included age less than 35 years, a high school education or less, and rural residence. Overall, there was little change in smokeless tobacco use among men in these states (range = -0.4-0.4 percentage points annually); only West Virginia had a significant decline.

**Conclusions.** Reasons for the overall lack of decline may include increased advertising and promotional expenditures or substitution of smokeless tobacco for cigarettes. Increased prevention and cessation efforts are needed. (*Am J Public Health*. 1996;86:1300-1303)

# Trends in Smokeless Tobacco Use among Men in Four States, 1988 through 1993

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## Introduction

The use of smokeless tobacco products is associated with gum recession, leukoplakia, nicotine addiction, increased cardiovascular disease mortality, and cancers of the oral cavity, larynx, and pharynx.<sup>1-6</sup> Despite evidence of increased consumption during the early 1980s,<sup>4</sup> questions about smokeless tobacco use have rarely been included on national surveys,<sup>7-9</sup> making national trend analyses impossible. This is unfortunate, because trend data are useful for determining the need for prevention and cessation programs, monitoring the effectiveness of existing prevention efforts, and estimating the impact of tobacco industry marketing efforts. However, Indiana, Iowa, Montana, and West Virginia have included questions about adult smokeless tobacco use on state surveys each year from 1988 through 1993. This provided an opportunity to determine whether smokeless tobacco use among men changed in these states over this time period.

## Methods

We obtained 1988 through 1993 data from the Behavioral Risk Factor Surveillance System (BRFSS). Details of the BRFSS have been described elsewhere.<sup>10,11</sup> Briefly, state health departments conduct monthly telephone surveys of persons aged 18 years and older. Respondents are selected by using a multistage cluster design and random-digit dialing and are interviewed by trained staff. The four states were selected for this study because they have included questions on smokeless tobacco use in their surveys each year since 1988.

We limited our study population to men because smokeless tobacco use is uncommon among women.<sup>1-3,7-9</sup> Annual sample sizes of men over the 6-year period ranged from 880 to 992 in Indiana, 317 to 804 in Iowa, 482 to 515 in Montana, and 643 to 938 in West Virginia. (The same sampling methodology was used in each state across all years of the study;

differences in sample sizes within states were the result of availability of funding.)

## Definitions

For all years, respondents were asked two questions about smokeless tobacco use: "Have you ever used or tried any smokeless tobacco products such as chewing tobacco or snuff?" and "Do you currently use any smokeless tobacco products such as chewing tobacco or snuff?" Respondents who answered "yes" to both questions were considered current smokeless tobacco users.

The demographic characteristics of participants were based on responses to questions about age, education level, and county of residence; the number of men who were other than White was too small to provide stable estimates by race or ethnicity. We used county data from the 1990 census to categorize population density by quartile within each state.<sup>12</sup>

## Statistical Analyses

Prevalence estimates were weighted to reflect the age and sex distribution for Iowa, Montana, and West Virginia and the age, sex, and race distribution for Indiana. Unknown or missing data were excluded from all analyses. We calculated annual overall state prevalence of smokeless tobacco use and smokeless tobacco use stratified by age, education level, and population density. Because preliminary analyses revealed that there were small numbers of respondents in certain strata

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(especially men aged 18–24 years), we pooled data from the last 2 years (1992 and 1993) and report these estimates.

SUDAAN was used to calculate standard errors and 95% confidence intervals.<sup>13</sup> Using annual data, we created weighted least-squares linear regression models to identify state trends in smokeless tobacco use by age, education, and population density and multiple linear regression models to determine overall state trends controlling for these potential confounding variables.<sup>14</sup> The fit and significance of these models were based on  $R^2$  coefficients and  $P$  values.

## Results

Response rates, based on methodology recommended by the Council of the American Survey Research Organization,<sup>15</sup> ranged from 68.8% to 82.5% across all states over the study period. Overall prevalence of smokeless tobacco use among men in 1992 and 1993 was 6.5% in Indiana, 7.5% in Iowa, 14.4% in Montana, and 17.4% in West Virginia (Table 1). Demographic characteristics associated with higher levels of use included age less than 35 years, having a high school or less than a high school education, and residence in more rural areas. These associations were consistent across all study years (data available from authors).

Based on multiple linear regression models controlling for age, education, and population density, the average annual percentage point change in smokeless tobacco use among men was  $-0.4$  in West Virginia ( $P < .05$ ),  $-0.1$  in Indiana,  $0.2$  in Montana, and  $0.4$  in Iowa ( $P < .05$ ) (Table 2). Smokeless tobacco use among men aged 25 to 34 years increased in all four states (range =  $0.6$ – $2.5$  percentage points annually), although this increase was significant only for Indiana and Montana; we found no other consistent patterns of use by age across states. With the exception of men in West Virginia who had some college education, there were no significant changes in smokeless tobacco use across education or population-density levels in any state.

## Discussion

Except for West Virginia, these data demonstrate that smokeless tobacco use among men in the states we examined has not declined since 1988, nor have there been declines in use across most age, education, and population-density levels. Our findings confirm that smokeless to-

**TABLE 1—Percentage of Men Who Currently Use Smokeless Tobacco, by State, Age, Education, and Population Density: Behavioral Risk Factor Surveillance System, 1992 and 1993**

	Men Who Use Smokeless Tobacco, %			
	Indiana (n = 1853)	Iowa (n = 1549)	Montana (n = 1007)	West Virginia (n = 1826)
Age, y				
18–24	10.5 ± 4.4	11.5 ± 5.4	18.6 ± 8.3	22.8 ± 6.3
25–34	8.2 ± 2.7	9.4 ± 3.3	25.9 ± 6.3	23.7 ± 5.0
35–54	5.2 ± 1.6	4.4 ± 1.7	11.1 ± 3.1	14.5 ± 2.8
55+	4.4 ± 1.8	8.0 ± 2.7	8.2 ± 3.6	14.3 ± 3.1
Education				
< high school	6.9 ± 3.0	12.6 ± 5.2	12.9 ± 6.2	23.5 ± 4.5
High school	7.5 ± 2.0	8.7 ± 2.5	17.5 ± 4.3	20.7 ± 3.3
Some college	6.5 ± 2.5	5.7 ± 2.6	14.4 ± 4.5	12.6 ± 3.8
College graduate	4.3 ± 2.3	4.9 ± 2.5	10.7 ± 4.3	8.0 ± 3.1
Population density <sup>a</sup>				
Low	10.7 ± 2.9	11.6 ± 3.6	18.6 ± 5.7	22.9 ± 4.0
Low-moderate	6.4 ± 2.2	9.1 ± 2.9	12.0 ± 4.0	20.0 ± 4.4
Moderate-high	4.4 ± 2.1	6.7 ± 3.0	13.7 ± 4.7	15.5 ± 4.0
High	4.0 ± 1.9	3.7 ± 2.9	14.9 ± 4.9	12.4 ± 3.0
Overall	6.5 ± 1.2	7.5 ± 1.4	14.4 ± 2.4	17.4 ± 1.9

Note. Numbers following ± are 95% confidence limits. Ranges of state sample sizes by subpopulations were as follows: age 18 to 24 years (range = 89–228), age 25 to 34 years (range = 198–443), age 35 to 54 years (range = 429–760), age 55+ years (range = 290–552); less than high school (range = 133–408), high school (range = 351–730), some college (range = 258–428), college graduate (range = 265–409); low population density (range = 205–480), low-moderate population density (range = 297–453), moderate-high population density (range = 277–393), high population density (range = 224–560).

<sup>a</sup>Based on 1990 county population of respondents and categorized by quartile within each state.

**TABLE 2—Estimated Average Annual Percentage Point Change in the Prevalence of Current Smokeless Tobacco Use among Men, and Goodness of Fit of Linear Regression Models,<sup>a</sup> 1988 through 1993**

	Indiana		Iowa		Montana		West Virginia	
	Change	$R^2$	Change	$R^2$	Change	$R^2$	Change	$R^2$
Age, y								
18–24	1.1	0.38	0.3	0.03	-1.9	0.57	-1.8	0.35
25–34	0.7 <sup>b</sup>	0.78	0.6	0.18	2.5 <sup>b</sup>	0.85	1.2	0.43
35–54	-0.5 <sup>c</sup>	0.76	-1.0 <sup>c</sup>	0.74	1.2 <sup>c</sup>	0.77	-0.7	0.51
55+	-0.3	0.28	1.0	0.27	-0.2	0.04	0.6	0.23
Education								
< high school	-0.7	0.21	0.9	0.23	1.6	0.19	0.7	0.14
High school	0	0	0	0	0.6	0.19	-0.5	0.36
Some college	0.3	0.12	-0.2	0.03	-0.4	0.40	-1.3 <sup>b</sup>	0.84
College graduate	0.5	0.53	0.5	0.36	1.5	0.54	1.0	0.29
Population density <sup>d</sup>								
Low	0.1	0.01	0.1	0	-0.2	0.03	-1.2	0.52
Low-moderate	-0.4	0.24	0.1	0	0.7	0.23	0.4	0.16
Moderate-high	0.2	0.06	0.3	0.07	1.1	0.28	0.9	0.49
High	0.6	0.51	-0.5	0.66	0.8	0.26	-1.1	0.20
Overall <sup>e</sup>	-0.1	0.36	0.4 <sup>c</sup>	0.40	0.2	0.42	-0.4 <sup>c</sup>	0.50

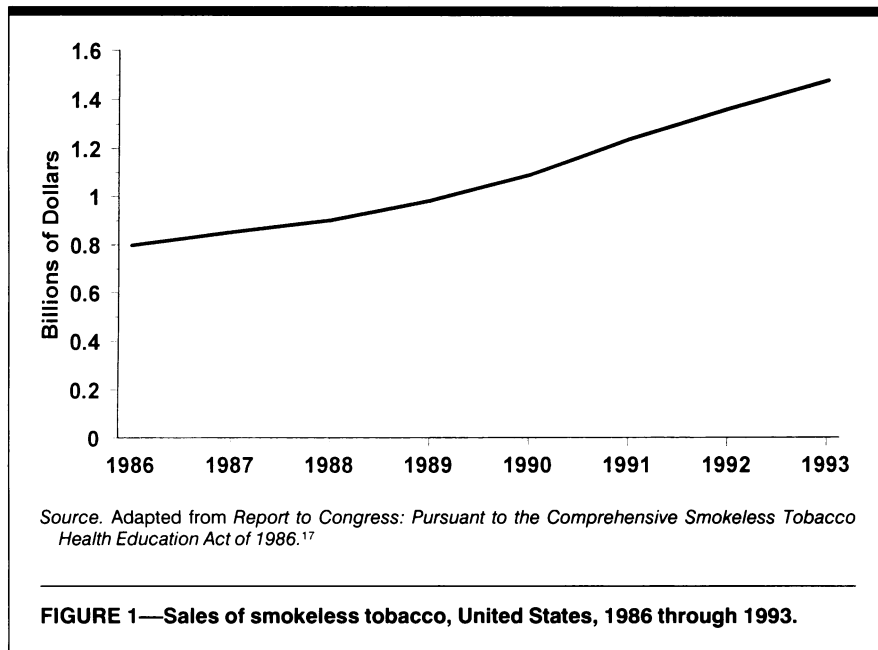
<sup>a</sup>Based on  $R^2$  values.

<sup>b</sup> $P < .01$ .

<sup>c</sup> $P < .05$ .

<sup>d</sup>Based on 1990 county population of respondents and categorized by quartile within each state.

<sup>e</sup>From multiple linear regression models controlling for age, education, and population density.



bacco use remains high among men in West Virginia (despite the downward trend) and Montana.<sup>7,9</sup> Direct comparisons with national survey data are problematic because of differences in the wording of questions, but the 1993 prevalence of smokeless tobacco use in all four states was higher than the 1991 national prevalence of 5.6% for men.<sup>3</sup> Not surprisingly, Montana and West Virginia had the first and third highest prevalence of smokeless tobacco use among male adolescents surveyed in 29 states in 1993.<sup>16</sup> No state-specific data on sales of smokeless tobacco products are available, but national data indicate smokeless tobacco sales increased from \$798 million in 1986 to \$1.48 billion in 1993, an increase of 85% (Figure 1).<sup>17</sup>

Reasons for the lack of decline in smokeless tobacco use in most of these states are not known. One possibility may include advertising and promotional expenditures: nationally, these increased from \$68 million in 1988 to \$119 million in 1991, an increase of 75%.<sup>17</sup> Smokeless tobacco products appear to be heavily marketed toward rural men, with substantial use of imagery depicting outdoor themes such as cowboys and bears and brand names such as Levi Garrett, Kodiak, and Redman.<sup>18,19</sup> One tobacco company even sponsors the annual National Intercollegiate Rodeo Championship in Bozeman, Mont. Another reason for the general lack of decline in use may be that cigarette smokers, in an effort to stop smoking, substitute smokeless tobacco products for cigarettes.<sup>3,20</sup>

Smokeless tobacco use has previously been shown to be more common among residents living outside of metropolitan areas,<sup>3,7</sup> but our data extend these findings by demonstrating that smokeless tobacco use among men is inversely related to population density, with men in the most rural areas at highest risk. The associations of smokeless tobacco use with younger ages and lower education levels are consistent with previous research.<sup>1-4,7-9</sup>

There are study limitations. It was not possible to determine whether similar trends in smokeless tobacco use occurred in other states; however, there was no significant change in smokeless tobacco use among adult men in the United States based on National Health Interview Surveys conducted in 1987 and 1991.<sup>9</sup> Because questions about smokeless tobacco use were not asked in states during much of the 1980s, trends could only be estimated over the fairly short time period of 6 years. All data are based on self-reports, and the validity of self-reported smokeless tobacco use is not known, although for cigarette smoking it is quite good.<sup>21</sup> Persons in households without telephones could not be sampled; thus, BRFSS probably underrepresents persons in the lowest socioeconomic groups.<sup>22</sup> There were small numbers of respondents in certain categories (especially men aged 18–24 years); therefore, estimates based on small cell sizes were less precise. No data were available on frequency or amount of smokeless tobacco usually consumed or on the length of time

respondents had been smokeless tobacco users. Finally, because the broad definition encompassed by the question on ever use of smokeless tobacco would include some respondents who experimented but never become regular smokeless tobacco users, no attempt was made to analyze trends in former smokeless tobacco use or to examine smokeless tobacco quit ratios.

Further efforts are needed to reduce smokeless tobacco use, including increasing smokeless tobacco excise taxes, providing school-based prevention and cessation activities, restricting smokeless tobacco advertising and promotional activities to which minors are likely to be exposed, enforcing laws that restrict minors' access to smokeless tobacco products, and encouraging health care providers to routinely counsel patients about smokeless tobacco use cessation.<sup>3,23,24</sup> Finally, ongoing surveillance of smokeless tobacco use is needed in more states and at the national level. □

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## Daily Exposure to Environmental Tobacco Smoke: Smokers vs Nonsmokers in California

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### ABSTRACT

**Objectives.** This study examined the differences in environmental tobacco smoke exposure between smokers and non-smokers.

**Methods.** A probability sample of 1579 California adults completed a 1-day time diary of a full day's activities in which they reported whether any smoker was present during each activity.

**Results.** Some 61% of respondents reported at least some environmental tobacco smoke exposure in these diary accounts (for an average of up to 5 hours per day), and potential exposure rose monotonically with number of cigarettes actively smoked. Heaviest smokers reported about four times as much such exposure as nonsmokers.

**Conclusions.** Because smokers lead life-styles that expose them to far higher levels of environmental tobacco smoke exposure, that factor needs to be controlled in studies estimating the effects of active smoking. (*Am J Public Health*. 1996;86:1303–1305)

### Introduction

There has been increasing concern that nonsmokers are at risk to the adverse effects of smoking when they are exposed to the tobacco smoke (i.e., passive smoke) present in various microenvironments occupied by smokers. Although the concentrations of environmental tobacco smoke found in these locations are lower than the concentrations of mainstream smoke inhaled by active smokers, the smoke is chemically similar, containing many of the same carcinogenic and toxic agents. The Environmental Protection Agency has listed environmental tobacco smoke as an environmental carcinogen.<sup>1</sup>

Most existing studies on passive smoke have been concerned with the effects of environmental tobacco smoke from other smokers on persons who do not smoke themselves. In this way, previous studies have sought to assess the effects of passive smoke in a nonconfounded manner, that is, to compare nonsmokers who are exposed to environmental tobacco smoke with nonsmokers who are not exposed. However, in terms

of their daily activities, smokers themselves may be around other smokers more often than nonsmokers and thereby may be exposed to environmental tobacco smoke to a greater degree than nonsmokers. For smokers, disentangling the effects of passive smoke from active smoke would be quite difficult in usual epidemiological studies.

Recently, Siegal et al. reviewed the results of seven studies of the effects of environmental tobacco smoke on active smokers.<sup>2</sup> Elevated rates of lung cancer were found in five of these studies. Based on a meta-analysis of this literature and on a report produced by the Environmen-

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