State Smoking Prevalence Estimates: A Comparison of the Behavioral Risk Factor Surveillance System and Current Population Surveys

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ABSTRACT

Objectives. This study examined whether there are systematic differences between the Behavioral Risk Factor Surveillance System (BRFSS) and the Current Population Survey (CPS) for state cigarette smoking prevalence estimates.

Methods. BRFSS telephone survey estimates were compared with estimates from the US Census CPS tobacco-use supplements (the CPS sample frame includes persons in households without telephones). Weighted overall and sex- and race-specific BRFSS and CPS state estimates of adult smoking were analyzed for 1985, 1989, and 1992/1993.

Results. Overall estimates of smoking prevalence from the BRFSS were slightly lower than estimates from CPS (median difference: −2.0 percentage points in 1985, −0.7 in 1989, and −1.9 in 1992/1993; $P < .05$ for all comparisons), but there was variation among states. Differences between BRFSS and CPS estimates were larger among men than among women and larger among Blacks than among Hispanics or Whites; for most states, these differences were not significant.

Conclusions. The BRFSS generally provides state estimates of smoking prevalence similar to those obtained from CPS, and these are appropriate for ongoing state surveillance of smoking prevalence. (*Am J Public Health.* 1997;87:1665–1669)

Introduction

Tobacco-control initiatives and programs are often developed and administered at the state level[1]; this makes regular estimates of state cigarette smoking prevalence essential. These estimates are commonly used to determine the magnitude of smoking-related problems.[2] Most states use telephone survey data from the Behavioral Risk Factor Surveillance System (BRFSS)[3,4] to estimate smoking prevalence.

Before the increase in BRFSS participation, Current Population Survey (CPS) tobacco-use supplements based on household interview surveys conducted by the Census Bureau[5] were the only source of state smoking data. The CPS sample includes households without telephones, and interviews are conducted both within households and by telephone (mixed mode). In contrast to BRFSS data, which are collected monthly, CPS tobacco supplements are conducted every few years.

Telephone surveys such as the BRFSS have substantial cost advantages over household interview surveys,[6] and data collected by telephone are available in a more timely manner. However, telephone surveys can underestimate the prevalence of cigarette smoking (especially among disadvantaged populations[7]) because some risk behaviors are more common among persons in households without telephones,[7] nonresponse rates are higher among smokers,[7] and underreporting of smoking does occur in telephone interviews.[8]

The validity of smoking estimates obtained by BRFSS interviews has been examined for a few localities[8,9] and for several states combined,[10] but no comparisons have been made across multiple states or across years. Our purpose was to examine whether there were any systematic differences in state smoking prevalence estimates from the BRFSS compared with the CPS.

Methods

Behavioral Risk Factor Surveillance System

Details of the BRFSS have been described elsewhere.[3,11,12] Briefly, the BRFSS is a monthly state-based telephone survey of adults 18 years of age or older. For most states, the sample is selected by means of a Waksberg multistage cluster-sampling design,[13] although some states use simple random- or stratified-sample designs.[11] Interviews are conducted by trained personnel and last between 10 and 20 minutes; no proxy interviews are obtained. In states with substantial Hispanic populations, interviews are conducted in Spanish when necessary. States use similar methodology for survey administration, and all states use the same core set of questions.[11,14]

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TABLE 1—Median Differences in State Smoking Prevalence Estimates from the Behavioral Risk Factor Surveillance System (BRFSS) and Current Population Survey (CPS), by Sex and Race/Ethnicity: 1985, 1989, and 1992/1993

	1985	1989	1992/1993
	Median Difference[a] and Range (n = 22 States)	Median Difference[a] and Range (n = 40 States)	Median Difference[a] and Range (n = 49 States)
Overall	−2.0* (−6.0 to 3.8)	−0.7* (−7.0 to 2.4)	−1.9* (−5.6 to 3.8)
Sex			
Male	−2.6* (−9.4 to 3.0)	−1.4* (−8.1 to 3.7)	−2.2* (−7.5 to 6.2)
Female	0.3 (−7.7 to 5.3)	0.2 (−6.3 to 6.0)	−1.4* (−4.7 to 3.3)
Race/ethnicity			
White	−0.7 (−7.8 to 4.1)	−0.4 (−7.5 to 4.5)	−1.5* (−5.2 to 3.9)
Black[b]	−2.7 (−13.1 to 13.2)	−1.1 (−15.5 to 5.9)	−2.9* (−10.4 to 6.9)
Hispanic[c]	0.5 (−8.8 to 7.2)	1.4 (−6.3 to 8.1)	0.8 (−22.4 to 9.4)

[a]BRFSS estimates minus CPS estimates.
[b]Based on 12 states in 1985, 20 states in 1989, and 35 states in 1992/1993.
[c]Based on 5 states in 1985, 8 states in 1989, and 23 states in 1992/1993.
*$P < .05$.

Twenty-two states participated in the BRFSS in 1985, 40 states in 1989, and 49 states in 1992/1993. Total sample sizes were 25 192 in 1985, 66 719 in 1989, and 195 227 in 1992/1993. (BRFSS data for 1992 and 1993 were combined to approximate the time period covered by the 1992/1993 CPS [see below].) The median Council of the American Survey Research Organization (CASRO)[15] response rate, which is the proportion of telephone numbers called that resulted in completed interviews, was 65% in 1985 and 1989, and 71% in 1992/1993.

For all years, the BRFSS included two questions for determining cigarette smoking status: "Have you smoked at least 100 cigarettes in your entire life?" and "Do you smoke cigarettes now?" Persons who answered yes to both questions were considered current smokers.

Public-use data files were used in all analyses, and we examined overall, sex-specific, and race/ethnicity-specific (White, Black, or Hispanic) smoking prevalence data.

Current Population Survey

The CPS is a national household survey conducted in all states by the Census Bureau.[5] Questions about smoking were added as supplements in September 1985, September 1989, September 1992, January 1993, and May 1993. The last three supplements were combined and classified as 1992/1993 data as recommended by the Census Bureau. Monthly samples are chosen by means of a stratified-cluster design. Attempts are made to conduct interviews in person, but because of logistical and cost issues, many interviews are conducted by telephone. If no household member speaks English, attempts are made to send a Spanish-speaking interviewer or to conduct telephone interviews using the best available translator.[16]

CPS accepts proxy responses from other household members; an estimated 45% of interviews were completed by proxies in 1985, 28% in 1989, and 19% in 1992/1993. Public-use data tapes provided by the Census Bureau were used in all analyses, and data were restricted to the same states as the BRFSS. Total sample sizes were 51 368 in 1985, 97 534 in 1989, and 269 750 in 1992/1993. Response rates for all study years averaged between 85% and 90%.

In 1985 and 1989, the CPS used two questions that were essentially the same as those asked in the BRFSS: "Has _____ smoked at least 100 cigarettes in his/her lifetime?" and "Does _____ smoke cigarettes now?" A respondent or proxy who answered yes to both questions was considered a current smoker.

The CPS definition of current smoker changed in 1992/1993. Respondents or proxies were asked the same question about 100 cigarettes in a lifetime (ever smoked); then, ever smokers were asked, "Does _____ now smoke cigarettes every day, some days, or not at all?" Current smokers were ever smokers who smoked every day or some days. (This new definition results in estimates approximately 1 percentage point higher than the definition using the words "smoke ... now."[17]) Overall, sex, and race/ethnicity data on smoking prevalence were analyzed.

Statistical Analyses

By means of the most recently available Census Bureau estimates, all survey data were weighted to the adult population of each state on the basis of age, sex, and race distribution. Prevalence estimates were calculated by SAS,[18] and standard errors and 95% confidence intervals were estimated with SESUDAAN and SUDAAN[19,20] for BRFSS data and with Census Bureau design parameters for CPS data.

We used the Wilcoxon signed-rank test for paired observations[21] to analyze the median differences between the BRFSS and CPS prevalence estimates. We analyzed state-specific differences between BRFSS and CPS with z tests,[21] under the assumption that these were independent estimates within a state. We restricted analyses of race/ethnicity to states with a minimum of 50 Blacks or 50 Hispanics in both survey samples. Because state estimates are independent of one another, no adjustments were made for multiple comparisons.

Results

For the BRFSS, overall state sample sizes ranged from 726 to 2386 in 1985, from 1171 to 3415 in 1989, and from 2369 to 7651 in 1992/1993. State sample sizes for the CPS ranged from 875 to 7046 in 1985, from 1171 to 3415 in 1989, and from 2209 to 20 809 in 1992/1993.

For all three study periods, the overall median BRFSS smoking estimate was lower than the overall CPS smoking estimate (Table 1). Although there was variation across states, overall differences were significant for 14% of states in 1985, 18% of states in 1989, and 47% of states in 1992/1993. In nearly all instances where differences were significant, BRFSS estimates were lower than CPS estimates.

Most of the difference in the overall smoking prevalence estimates between the BRFSS and the CPS was the result of lower BRFSS estimates among men (Table 1). Differences in smoking among men were significant for 18% of states in 1985, 13% of states in 1989, and 33% of

states in 1992/1993; for all states in which there were significant differences, estimates were lower in the BRFSS than in the CPS. In contrast, differences for smoking prevalence among women were significant for 9% of states in 1985, 15% of states in 1989, and 27% of states in 1992/1993; for several of these comparisons, BRFSS estimates were higher than CPS estimates.

Comparisons of BRFSS and CPS data for Whites were similar to overall estimates (Table 1), with significant differences between the two methods for 9% of states in 1985, 13% in 1989, and 37% in 1992/1993 (BRFSS estimates were lower than CPS estimates for states with significant differences). In all years, smoking prevalence was lower in the BRFSS than in the CPS for Blacks but similar for Hispanics (Table 1).

For Blacks, differences between the BRFSS and CPS were significant in 17% of states in 1985, 20% of states in 1989, and 14% of states in 1992/1993. Again, in states with substantial differences, BRFSS estimates were lower than CPS estimates in nearly all instances. For Hispanics, in 1985, there were no significant state differences; in 1989, BRFSS estimates were significantly higher in three states and lower in three states; and in 1992/1993, the BRFSS estimates were significantly higher than CPS estimates in one state and lower in two states.

Finally, we examined state-specific patterns in smoking prevalence estimates for Blacks and Hispanics (Tables 2 and 3). There were few patterns in differences within states that had data for two or more survey periods. For Blacks, only Maryland and South Carolina had significant differences across two survey periods (BRFSS lower than CPS in both 1989 and 1992/1993). For Hispanics, in 1989 and 1992/1993, BRFSS estimates were significantly higher than CPS estimates in New York but lower than those in Texas.

TABLE 2—State Differences in Cigarette Smoking Prevalence Comparing Behavioral Risk Factor Surveillance System (BRFSS) Data and Current Population Survey (CPS) Data for Blacks: 1985, 1989, and 1992/1993

Region and State	Percentage-Point Difference[a] 1985	1989	1992/1993
Northeast			
Connecticut	...	−4.4	−5.8
Massachusetts	...	...	6.9
New Jersey	...	...	−6.0
New York	13.2*	1.0	0.8
Pennsylvania	...	2.8	4.5
Rhode Island	...	...	−3.6
Midwest			
Illinois	−6.0	0.2	3.9
Indiana	−3.6	...	0.2
Kansas	...	...	−6.6
Michigan	...	1.4	−5.0*
Minnesota	...	...	−10.4
Missouri	...	2.3	−0.3
Nebraska	...	...	0
Ohio	−8.9	−9.7	4.5
Wisconsin	...	...	−5.6
South			
Alabama	...	−3.2	−8.1*
District of Columbia	0.6	−0.3	−7.1*
Delaware	...	...	0.1
Florida	7.0	3.3	−1.9
Georgia	−8.7	−9.7*	−2.2
Kentucky	−1.8	3.9	−7.2
Louisiana	...	...	−2.7
Maryland	...	−15.5*	−4.8*
Mississippi	...	...	−3.5
North Carolina	−1.8	−3.9	−3.1
Oklahoma	...	−12.1	−1.7
South Carolina	7.1	−13.1*	−6.4*
Tennessee	−6.0	0	−2.9
Texas	...	−5.3	−0.9
Virginia	...	−1.8	−4.6
West Virginia	...	...	−5.4
West			
Arizona	...	...	−3.9
California	−13.1*	5.9*	−2.2
Colorado	...	...	−2.2
Nevada	...	...	3.5

Note. Median state sample sizes were 123 (range: 53–491) for the BRFSS and 397 (range: 77–830) for the CPS in 1985; 192 (range: 60–975) for the BRFSS and 295 (range: 52–853) for the CPS in 1989; and 470 (range: 71–1877) for the BRFSS and 544 (range: 50–2219) for the CPS in 1992/1993. Median smoking-prevalence estimates were 31.0% (range: 24.1% to 41.9%) for the BRFSS and 34.2% (range: 24.7% to 42.6%) for the CPS in 1985; 25.5% (range: 17.0% to 36.1%) for the BRFSS and 29.3% (range: 20.4% to 36.1%) for the CPS in 1989; and 25.0% (range: 14.6% to 34.3%) for the BRFSS and 27.1% (range: 18.2% to 44.7%) for the CPS in 1992/1993.

[a]BRFSS estimates minus CPS estimates.

*$P < .05$.

Discussion

Our study confirmed findings from three smaller studies that BRFSS smoking prevalence estimates are generally similar to[8] or slightly lower than[9,10] estimates obtained from household interviews. Gentry et al.[10] compared sex-specific combined BRFSS estimates for 1981 through 1983 with those from the 1980 National Health Interview Survey for smoking and found that whereas BRFSS and NHIS estimates were similar overall and for women, BRFSS data gave lower estimates for men. Anda et al.[9] reported that Michigan BRFSS smoking estimates compared with household interview estimates were 2.1 percentage points lower for men and 1.3 points lower for women. Jackson et al.[8] also found that the BRFSS provided estimates of current smoking prevalence comparable to those from household interviews.

There are several possible reasons BRFSS estimates tended to be slightly lower than CPS estimates. Although 95% of the nation's households have telephones,[22] telephone coverage is lower in many southern states, and persons who do not have telephones are more likely to smoke cigarettes[8] (the largest statistically significant differences between BRFSS

TABLE 3—State Differences in Cigarette Smoking Prevalence Comparing Behavioral Risk Factor Surveillance System (BRFSS) Data and Current Population Survey (CPS) Data for Hispanics: 1985, 1989, and 1992/1993

Region and State	Percentage-Point Difference[a]		
	1985	1989	1992/1993
Northeast			
Connecticut	...	...	−1.1
Massachusetts	...	...	3.4
New Jersey	...	...	−2.3
New York	7.2	7.4*	6.7*
Pennsylvania	...	...	−0.4
Rhode Island	...	...	2.5
Midwest			
Illinois	0.5	6.9*	0.9
Kansas	...	...	−22.4*
Michigan	...	...	−6.4
Nebraska	...	...	2.5
South			
District of Columbia	...	...	−3.5
Florida	−8.8	−5.9*	−1.6
Texas	...	−6.3*	−4.5*
Virginia	...	...	3.1
West			
Alaska	...	...	9.2
Arizona	−0.7	−1.1	1.2
California	2.1	3.9*	1.5
Colorado	...	...	0.4
Idaho	...	8.1	−5.1
Nevada	...	...	0.8
New Mexico	...	−4.8*	−2.5
Oregon	...	...	9.4
Utah	...	...	1.0

Note. Median state sample sizes were 93 (range: 64–191) for the BRFSS and 384 (range: 111–1220) for the CPS in 1985; 166 (range: 65–421) for the BRFSS and 441 (range: 61–1387) for the CPS in 1989; and 171 (range: 69–1575) for the BRFSS and 158 (range: 61–5010) for the CPS in 1992/1993. Median smoking-prevalence estimates were 26.9% (range: 15.4% to 34.0%) for the BRFSS and 26.8% (range: 20.3% to 28.7%) for the CPS in 1985; 20.4% (range: 14.5% to 31.6%) for the BRFSS and 20.8% (range: 16.8% to 24.9%) for the CPS in 1989; and 19.7% (range: 15.2% to 29.2%) for the BRFSS and 20.1% (range: 10.5% to 38.9%) for the CPS in 1992/1993.

[a]BRFSS estimates minus CPS estimates.

*$P < .05$.

and CPS in 1989 and 1992/1993 for Blacks were in southern states). In 1990/1991 data from the National Health Interview Survey, 6.2% of men and 5.3% of women, 3.2% of Whites, 11.7% of Blacks, and 10.6% of Hispanics reported having no telephone (Centers for Disease Control and Prevention, unpublished data, 1995); for all groups, smoking prevalence was higher among persons without telephones.

Persons may also be less likely to report smoking behavior over the telephone than in a household interview survey.[8] This has also been found in studies estimating prevalence of marijuana and cocaine use by telephone vs household interviews,[23] although telephone underreporting effects are much larger for illicit drug use than for cigarette smoking. It must be noted, however, that many CPS interviews, especially those conducted in 1992/1993, were conducted by telephone.[24] Also, the CPS accepts many proxy responses, while the BRFSS accepts none; however, proxy information on current smoking prevalence is considered reliable for adults.[25] Because smokers are more likely to be survey nonrespondents and because the response rate was lower in the BRFSS, this may also have had an effect on our findings.

The 1992/1993 CPS used a different question for ascertaining current smoking status than did the BRFSS, which probably accounted for a substantial portion of the difference between the two surveys for these years.[17] Much of the difference in smoking prevalence estimates between the BRFSS and the CPS in 1992/1993 may be attributable to wording changes in questions.

For many states, sample sizes were inadequate to provide reliable estimates for Hispanics. Nevertheless, there were differences between the two systems for Hispanic smoking prevalence in six of eight states in 1989, although not in 1985 and 1992/1993. It is not known why BRFSS Hispanic smoking estimates were higher than CPS estimates in some states and lower in others in 1989.

In summary, compared with CPS mixed mode surveys (household and telephone interviews), BRFSS telephone survey estimates of adult smoking prevalence by state tended to be lower for men than for women and lower for Blacks than for Whites or Hispanics; nevertheless, for most states, the differences between the two surveys were not substantial. Telephone survey data from the BRFSS provide adequate estimates of state smoking prevalence and allow for timely, ongoing surveillance of this problem. □

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