The Behavioral Risk Factor Surveys: Design, Methods, and Estimates from Combined State Data

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In recent years, health professionals and the public have become increasingly aware of the relationship of personal risk behaviors on the leading causes of premature death among adults in the U.S. Beginning in 1981, the Centers for Disease Control began assisting states in conducting telephone surveys whose primary objective was to determine the prevalence of behaviors such as smoking, alcohol misuse, uncontrolled hypertension, seatbelt non-use, overeating, and lack of exercise in their state.

Between April 1981 and October 1983, Behavioral Risk Factor Telephone Surveys were conducted individually in 28 states and the District of Columbia. In order to provide states with national-level reference data with which they could compare state-specific results, a supplemental survey of all remaining states, excluding Hawaii, was conducted in the summer of 1983.

Although a few states used simple random sampling, the majority of the samples were selected using a three-stage cluster design suggested by Waksberg (1). In the first stage, a random sample of telephone number clusters was selected from among all possible clusters within the state. A cluster consists of the first 8 digits of the 10-digit number, that is the area code, prefix, and first 2 digits of the suffix. To screen out primarily business clusters, a telephone number from each cluster was selected at random, and the cluster retained only if the number chosen was residential. In the second stage, numbers from each retained cluster were selected by randomly generating the last two digits of the telephone number. Finally, in the third stage of sampling, one adult was randomly selected for interviewing. The second and third stages were repeated until the desired number of completed interviews per cluster were obtained.

Calls were made according to a specified protocol with regard to time of day and number of callbacks. Supervisors, usually health agency personnel, carried out questionnaire editing and monitored the interviews and survey procedures. The training of the supervisory and interviewing staff was conducted by CDC comparably across states. The supervisory staff participated in a one-day workshop in survey sampling and survey operations, including monitoring techniques and quality control procedures. Interviewers underwent a detailed review of the questionnaire, including practice with other interviewers and "mock" interviews with local residents. CDC staff members provided the training and exchanged information after each survey to maintain consistency in survey operations.

The 28-state surveys and the District of Columbia and supplemental surveys were combined and treated as a stratified probability sample of adults aged 18 and older in the continental portion of the U.S. Individual survey samples were roughly equal in size, even though they were chosen from states of different population size. In order to compensate for respondents from smaller states contributing a disproportionately large share to estimates produced from the combined sample, and to compensate for variation in selection probabilities, a five-stage weighting factor was computed.

First, we adjusted for the fact that we selected only one adult from each household, and for the fact that households with multiple telephone numbers had greater selection probabilities. Secondly, because equal cluster sizes are needed to achieve equal-probability samples of households, we adjusted for unequal cluster sizes that occasionally occurred within samples. Some states used geographic stratification in their sample design. Therefore, we made a third adjustment so that geographic substrata within each state sample would be proportionately represented.

In order to reduce the joint effects of differential telephone coverage and survey nonresponse, we developed a post-stratification adjustment to bring the weighted distribution of the sample by age, race, and sex in each individual survey population into line with the 1980 census. Finally, we adjusted for population growth between the 1980 census and the midpoint of the surveys: July, 1982.

The unweighted BRFS age and sex distributions compared to the weighted distribution are shown in Table 1. Persons 18-24 years old were undersampled and those 25-44 years old were oversampled. There was a slight undersampling of 45-54 year olds. Overall, males were undersampled and females were oversampled. Although it is not shown here, blacks were slightly undersampled and hispanics were oversampled. Response rates ranged from 64 percent in New Jersey and North Carolina to 91 percent in Alabama, with no apparent geographic patterns. Refusals accounted for the majority of nonresponses. Although the post-stratification adjustment compensates for these discrepancies in sampling, we must bear in mind that it cannot completely correct for differences that undoubtedly exist between those who respond and those who do not.

Table 1. 1981-1983 Behavioral Risk Factor Surveys: age and sex distribution, weighted and unweighted.

	Total Sample	
	Unweighted	Weighted
Age Group		
18-24	14.3	18.7
25-34	26.9	23.2
35-44	18.7	16.0
45-54	12.9	14.3
55-64	13.2	13.5
65+	14.0	14.3
Sex		
Male	42.7	47.7
Female	57.3	52.3

The individual surveys used complex multistage cluster sampling rather than simple random sampling; thus, the sample design for the combined surveys also has complex features:

cluster sampling, stratification, and even greater variation among sample weights because of widely different sampling rates in the individual surveys.

A practical implication of the design complexity is that statistical programs used to perform analyses which assume simple random samples are inappropriate. Variances estimated by assuming simple random sampling tend to underestimate the variance resulting from the actual, more complex design, especially when the joint effects of cluster sampling and variable sample weights are substantial. The variance from the actual sampling design divided by the variance assuming a simple random sample of the same size is called the design effect, which measures the overall effect of the complex design on the sample size.

Therefore, when analyzing data from the individual or the combined risk factor surveys, it is necessary to use techniques which take the design effect into consideration. Accordingly, we used SESUDANN (2), a specialized statistical package for multistage sampling design, in all of our analyses.

Table 2 shows prevalences of chronic heavier drinking. I have included the standard errors for the BRF prevalence estimates in order to facilitate interpretation and comparisons. Using the same questions as the National Institute for Alcoholism and Alcohol Abuse (NIAAA) and the same definition of chronic heavier drinking, an average of two or more drinks per day during the past month, we found the prevalence estimate of chronic drinking to be 8.7 percent, which is comparable to the 1979 NIAAA estimate of 9 percent. The estimate of 13.8 percent for males is higher than the 4.0 percent for females, and is identical to the 1979 NIAAA results (3).

Table 2. 1981-1983 Behavioral Risk Factor Surveys: prevalence estimates and standard errors compared with other national survey estimates.

	Chronic Heavier Drinking		
	BRF Survey	(± s.e.)	1979*
Males	13.8	(.65)	14
Females	4.0	(.37)	4
Total	8.7	(.37)	9

*Adults 18 years of age and older, 1979 National Institute on Alcohol Abuse and Alcoholism Survey.

Using ≥120 percent of ideal body weight-for-height as estimated by the 1959 Metropolitan Life Study, 22.6 percent of the United States population is characterized as overweight (Table 3). The 23.6 percent male and 21.7 percent female estimates are comparable to those found in the 1979 National Telephone Survey of Personal Health Practices and Consequences, Wave I (4).

The BRF prevalence estimates of current smoking agree with the 1980 Health Interview Survey (HIS) results for the total population and for females (Table 4). For males, however, we show a slightly lower prevalence than that of the 1980 HIS, although this is in keeping with a continuous decline in male smoking, according to HIS Surveys, from 51 percent in 1965 to 37 percent in 1980 (5).

Table 3. 1981-1983 Behavioral Risk Factor Surveys: prevalence estimates and standard errors compared with other national survey estimates.

	Overweight		
	BRF Survey	(± s.e.)	1979*
Males	23.6	(.94)	23.1
Females	21.7	(.75)	20.9
Total	22.6	(.57)	N/A

*Adults 20-64 years of age, Wave I, 1979, National Telephone Survey of Personal Health Practices and Consequences.

Table 4. 1981-1983 Behavioral Risk Factor Surveys: prevalence estimates and standard errors compared with other national survey estimates.

	Current Smoking		
	BRF Survey	(± s.e.)	1979*
Males	34.0	(.99)	36.7
Females	29.1	(.84)	28.9
Total	31.5	(.64)	32.6

* Adults 17 years of age and older, 1980 Health Interview Survey.

Our questions on high blood pressure were obtained from a survey sponsored by the National Heart, Lung, and Blood Institute (NHLBI) (6). In their 1979 household interview survey, they found that approximately 5 percent of adults had been told they had high blood pressure, and their blood pressure was still high. Although our findings are somewhat lower, they appear to be consistent with NHLBI data (Table 5).

Table 5. 1981-1983 Behavioral Risk Factor Surveys: prevalence estimates and standard errors compared with other national survey estimates.

	Uncontrolled Hypertension		
	BRF Survey	(± s.e.)	1979*
Males	3.7	(.52)	5
Females	4.2	(.36)	5
Total	4.0	(.31)	5

* Adults 17 years of age and older, 1979 National Heart, Lung, and Blood Institute Survey.

The biggest discrepancy between results of the BRF survey and other national surveys is in the estimates for lack of seatbelt use. We found that 58.4 percent of males and 56.8 percent of females admitted to rarely or never using seatbelts, which is somewhat lower than the 66.6 percent for males and 65.1 percent for females reported by the 1979 National Telephone Survey of Personal Health Practices and Consequences Wave I study (Table 6). This difference could be the result of increased awareness regarding lifestyle behaviors and, perhaps, reflects a real change in the prevalence of seatbelt use by adults in the United States.

Table 6. 1981-1983 Behavioral Risk Factor Surveys: prevalence estimates and standard errors compared with other national survey estimates.

	Lack of Seatbelt Use		
	BRF Survey	(± s.e.)	1979*
Males	58.4	(1.10)	66.6
Females	56.8	(.90)	65.1
Total	57.6	(.70)	N/A

* Adults 20-64 years of age, Wave I, 1979 National Telephone Survey of Personal Health Practices and Consequences.

The results of the national aggregation suggest that estimates provided by the Behavioral Risk Factor Telephone surveys are quite similar to other national surveys. Further, they provide a reference point to which states or communities can compare themselves as they gather their own information for the purposes of defining program directions.

As a follow-up to these surveys, CDC has begun a cooperative venture with state health departments to conduct ongoing surveillance of the prevalence of behavioral risk factors by telephone interview. With this surveillance, individual states should be able to monitor trends in prevalence and track their progress toward the goals for health promotion and disease prevention set for 1990.

References

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