



**2006-2010**

**Behavioral Risk Factor Surveillance System**

**Asthma Call-Back Survey**

**History  
And  
Analysis Guidance**



**National  
Asthma  
Control  
Program**

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## **Asthma Call-Back Survey History**

### **What is health surveillance?**

The cornerstone of CDC's work has always been surveillance. Public health surveillance is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in planning and delivering public health action to reduce morbidity (disease) and mortality (death) and to improve health. Data disseminated by a public health surveillance system can be used for immediate public health action, program planning and evaluation, and formulating research hypotheses. Examples of ways surveillance data are used include:

- guiding immediate action in a public health emergency
- measuring the prevalence of a disease
- identifying populations at high risk for disease
- monitoring disease outbreaks
- planning, implementing and evaluating programs to prevent and control disease, injury and adverse exposure
- monitoring behavior that increases health risk.

### **Why do we need asthma surveillance?**

Asthma is one of the nation's most common and costly chronic conditions, affecting over 38 million Americans at some time in their lives. An estimated 8.6 million adults and 4.1 million children had an asthma attack in the past twelve months (2008 NHIS). The cost of asthma is estimated to be over \$30 billion a year. Asthma can also be life threatening; over 3,600 people die from asthma each year.

CDC's National Asthma Control Program plays a critical role in addressing the health risk. The program funds states, cities, and school programs to help them improve surveillance of asthma, train health professionals, educate individuals with asthma and their families, and explain asthma to the public. The National Asthma Control Program is a function of the Air Pollution and Respiratory Health Branch (APRHB) of the Division of Environmental Hazards and Health Effects in the National Center for Environmental Health.

Although much has been learned in recent years about asthma management and control, the information still needs to be put into sound public health practice. Managing asthma requires a long-term, multifaceted approach, including patient education, behavior changes, asthma trigger avoidance, pharmacological therapy, and frequent medical follow-up. Asthma data need to be available at the state and local level to direct and evaluate interventions undertaken by asthma control programs located in state health departments. Improved tracking for asthma is critical for planning and evaluating efforts to reduce the health burden from this disease.

In addition, Healthy People 2020 (HP2020) goals include 8 objectives that require asthma surveillance data. (<http://www.healthypeople.gov/hp2020/Objectives/TopicArea.aspx?id=43&TopicArea=Respiratory+Diseases>)

### **What is the history of asthma surveys at CDC?**

The National Center for Health Statistics surveys collect data on asthma prevalence, asthma-related deaths (mortality), and several indirect indicators of asthma-related illness (morbidity), such as

hospitalizations. These data provide a good basis for analyzing national trends, but not all can be analyzed by state, and they do not become publicly available until 2 to 3 years after collection.

State health agencies have the primary role of targeting resources to reduce behavioral health risks and the diseases that may result from those behaviors. To make asthma data more useful, APRHB saw the need to expand existing data systems and develop new systems in order to make data available at a state or local level, make data available more quickly, and provide more detailed asthma data.

In 1984, CDC established the Behavioral Risk Factor Surveillance System (BRFSS), a state-based system of health surveys administered and supported by the Division of Community Health, National Center for Chronic Disease Prevention and Health Promotion. Beginning with 15 states in 1984, the BRFSS is now conducted in all states, the District of Columbia, and three territories. The BRFSS is currently a function of the Division of Behavioral Surveillance in the newly created Office of Surveillance, Epidemiology and Laboratory Services in the Surveillance Program Office. The BRFSS is a telephone survey that obtains information on health risk behaviors, clinical preventive health practices, and health care access, primarily related to chronic disease and injury, from a random, representative sample of adults in each state. States use the data to identify emerging health problems, establish and track health objectives and develop and evaluate public health policies and programs. Many states also use BRFSS data to support health-related legislative efforts.

In 2000, APRHB added questions about current and lifetime asthma prevalence to the core BRFSS survey. Since 2001, states have had the option of adding an adult asthma history module to their survey, and in 2005 a child asthma prevalence module was added (which requires the use of the child selection module as well). However, many states do not choose to add these modules because of cost or the more pressing need for other health-related data.

Using the BRFSS for collection of additional information on asthma met two of APRHB's three objectives to improve asthma surveillance. First, the BRFSS is local, providing data for state and metropolitan areas in 50 states, the District of Columbia and 3 territories. Second, it is timely; data are available within 6 months from the end of the calendar year of data collection.

The third APRHB surveillance objective is to increase the content detail for asthma surveillance data. Efforts to meet this objective began in 1998 when APRHB began creating a new survey with very detailed asthma content, called the National Asthma Survey (NAS). A number of pilot tests of the survey were conducted in 2001 and 2002. The first survey used the State and Local Area Integrated Telephone Survey, an independent survey mechanism that is an off-shoot of the National Immunization Program survey at CDC. The NAS survey complemented and extended survey work from the National Health Interview Survey, National Health and Nutrition Examination Survey and the BRFSS. It added depth to the existing body of asthma data, helped to address critical questions surrounding the health and experiences of persons with asthma, and in addition, could provide data at the state and local level.

In 2003 and early 2004, data were collected by the NAS in a national sample and in 4 state samples, but this proved to be a complex and costly process. So, in 2004, APRHB considered using the BRFSS as a way to identify respondents with asthma for further interviewing on a call-back basis. The BRFSS includes a much larger sample size in each area than the NAS did. Respondents who answered yes to questions about current or lifetime asthma during the BRFSS interview would be eligible for the subsequent asthma survey.

In 2005, the original NAS questionnaire was modified to eliminate items already on the BRFSS and to add some content requested by the individual states. The BRFSS provided respondents for the call-back survey in three asthma grantee states (Minnesota, Michigan, and Oregon) for the call-back pilot. APRHB increased the size of each state's BRFSS sample to 10,000 respondents, hoping to obtain at least 1,000 respondents with asthma to call back. However, this increase in sample size was very expensive, costing an additional \$500,000 per state. Consequently, since 2006 the state BRFSS sample has not been increased for the Asthma Call-back Survey (ACBS).

States that plan to conduct the ACBS among adults with asthma identified during the BRFSS no longer need to add the Adult Asthma Module to the BRFSS, since the questions on the call-back survey provide even more detailed answers. However, if states wish to include children in the call-back survey, they must also include both BRFSS child modules: the child selection module and the child prevalence module.

The number of states or territories participating in the ACBS has increased every year since 2005:

- 2006: 25 BRFSS areas
- 2007: 35 BRFSS areas
- 2008: 35 BRFSS areas
- 2009: 37 BRFSS areas
- 2010: 39 BRFSS areas

States participating each year are shown in the following table. Funds are available for the ACBS from APRHB yearly through the BRFSS cooperative agreement. Any state or territory can apply for funds to implement the ACBS. States must include both child modules to include children in the call-back survey. The BRFSS sample size will not be increased for the ACBS. In order to produce a sufficient number of respondents for detailed analysis, it is recommended that a state conduct the ACBS for 2 consecutive years at the very least.

## Participating States by Year

States	2005	2006	2007	2008	2009	2010	2011
	Pilot	IN FILE*	IN FILE*	IN FILE*	IN FILE*	IN FILE*	Expected
Alabama						2010 AC**	2011 AC
Alaska		2006 AC	2007 AC				
Arizona		2006 AC	2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
Arkansas							
California		2006 AC	2007 AC	2008 AC**	2009 AC**	2010 AC**	2011 AC
Colorado		2006 A	2007 A				
Connecticut		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Delaware							
District of Columbia		2006 AC	2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
Florida			2007 A	2008 A	2009 A	2010 A	2011 A
Georgia		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Hawaii		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Idaho							
Illinois			2007 AC	2008 AC	2009 AC	2010 AC**	2011 AC
Indiana		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Iowa		2006 AC	2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
Kansas		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Kentucky							2011 A
Louisiana					2009 AC	2010 AC**	2011 AC
Maine		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC**	2011 AC
Maryland		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Massachusetts		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC**	2011 AC
Michigan	2005 AC	2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Minnesota	2005 AC						
Mississippi			2007 C	2008A** C**		2010AC	2011AC
Missouri		2006 AC	2007 AC	2008 AC		2010 AC**	2011 AC
Montana		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Nebraska		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
Nevada			2007 A	2008 A	2009 A	2010 A	2011 A
New Hampshire		2006 AC	2007 AC	2008 AC	2009 A	2010 A	2011 A
New Jersey				2008 AC	2009 AC	2010 AC	2011 AC
New Mexico			2007 AC	2008 AC	2009 AC**	2010 AC	2011 AC
New York		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC**	2011 AC
North Carolina					2009 A**	2010 A**	2011 A
North Dakota				2008 AC	2009 AC**	2010 AC**	2011 AC
Ohio			2007 AC	2008 AC	2009 AC	2010 AC**	2011 AC
Oklahoma			2007 AC	2008 AC	2009 AC**	2010 AC	2011 AC
Oregon	2005 AC	2006 AC	2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
Pennsylvania			2007 AC			2010 AC	2011 AC
Rhode Island				2008 AC	2009 AC	2010 AC**	2011 AC
South Carolina							
South Dakota							

<b>Tennessee</b>							
<b>Texas</b>		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
<b>Utah</b>			2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
<b>Vermont</b>		2006 AC	2007 AC	2008 AC	2009 AC	2010 AC	2011 AC
<b>Virginia</b>				2008 AC	2009 AC**		
<b>Washington</b>		2006 A	2007 A	2008 A	2009 AC	2010 AC	2011 AC
<b>West Virginia</b>			2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
<b>Wisconsin</b>		2006 AC	2007 AC	2008 AC	2009 AC**	2010 AC**	2011 AC
<b>Wyoming</b>							
<b>Guam</b>							
<b>Puerto Rico</b>					2009 AC	2010 A	2011 A
<b>U.S. Virgin Islands</b>							

\*In File: "A" indicates data are in the adult file; "C" indicates data are in the child file.  
A\*\* Adult data are not included in the file for technical reasons. See Data Anomalies.  
C\*\* Child data are not included in the file for technical reasons. See Data Anomalies.

## **Asthma Call-back Survey Analysis Guidelines**

The Asthma Call-back Survey is conducted approximately 2 weeks after the Behavioral Risk Factor Surveillance Survey (BRFSS). BRFSS respondents who report ever being diagnosed with asthma are eligible for the asthma call-back. If a state includes children in the BRFSS and the randomly selected child has ever been diagnosed with asthma, then the child is eligible for the asthma call-back. If both the selected child and the BRFSS adult in a household have asthma, then one or the other is eligible for the ACBS (50/50 split).

The BRFSS is a cross-sectional surveillance survey currently involving 54 reporting areas.<sup>1,2</sup> BRFSS questionnaires, data, and reports are available at [www.cdc.gov/brfss](http://www.cdc.gov/brfss).

From the parent survey (BRFSS), the ACBS inherits a complex sample design and multiple reporting areas. These factors complicate the analysis of the ACBS. Some states vary from both BRFSS and ACBS protocol. These variations should be considered prior to analysis of these data. Information on the BRFSS deviations can be found in the document titled **Comparability of Data** which can be accessed at: [http://www.cdc.gov/brfss/technical\\_infodata/surveydata.htm](http://www.cdc.gov/brfss/technical_infodata/surveydata.htm)

### **A. Data anomalies and deviations from sampling frame and weighting protocols**

***Several states did not collect ACBS data for all 12 months of the year. This may be an issue when investigating seasonal patterns in the data.***

- 2005: all three states conducted ACBS interviews in all 12 months
- 2006:
  - Nebraska did not conduct ACBS interviews in March, August, and November.
  - The District of Columbia did not conduct child ACBS interviews from January to June.
  - Alaska did not conduct adult ACBS interviews in September and did not conduct child interviews in September, October, or November.
  - Georgia did not conduct ACBS interviews in November and did not conduct child interviews in October or November.
- 2007:
  - Ohio did not conduct BRFSS interviews in June or July or subsequent call-back interviews.
- 2008:
  - Georgia did not conduct the ACBS in January, February, and March.
  - Montana did not conduct the ACBS in April and May.
  - Wisconsin did not conduct the ACBS for adults in May, June and July and for children from March through August. However, ACBS interviews for the BRFSS respondents for those months were conducted in later months.
  - Mississippi collected ACBS data for 2008, but all interviews were conducted in February and March of 2009.
- 2009:
  - Arizona did not conduct ACBS interviews from January through June but did conduct BRFSS interviews from February through December. ACBS interviews were conducted from July through December for BRFSS respondents from July through November (5 months).
  - Illinois did not conduct the ACBS from January through July, but did conduct BRFSS interviews except in April and May. ACBS interviews were conducted from July through January 2010 for BRFSS respondents from June through December (7 months).
  - Puerto Rico only conducted ACBS child interviews in October, November and December.



- 2010:
  - Puerto Rico only conducted ACBS interviews in October, November and December.
  - Utah did not conduct ACBS interviews from January through April.

***Several states varied from ACBS protocol in ways that affected the weighting procedures.***

- 2005:
  - Minnesota used two different samples: one from the BRFSS and another separate sample to increase the sample size. Weighting was done using the Optimal Factors methods.
- 2006:
  - Alaska used two different samples: one from BRFSS and another separate sample. Weighting was done using the Optimal Factors methods.
- 2007:
  - Florida had a large BRFSS sample and, after asking the call-back consent question, randomly selected approximately 46% to include in the ACBS.
  - Colorado did not do the adult or the child asthma call-back if there was a child under age 14 in the household, regardless of the child's asthma status.
  - Ohio stopped asking respondents for call-back permission after a quota was reached each month.
  - Texas (adults and children) and Wisconsin (adults and children) only did the call-back for the version 1 sample.
  - Massachusetts (adults and children) only did the call-back for the version 2 sample.
  - Pennsylvania only did the call-back for respondents in geostratum 1.
  - In Florida, Illinois, and Ohio, more than 10% of BRFSS respondents with asthma were not asked to participate in the call-back. For these three states, weighting was done using a Modified Adjustment Factor method. Some states deviated from the 50/50 adult/child split.
- 2008:
  - Massachusetts (adults and children) and Wisconsin (adults and children) only did the call-back for the version 1 sample.
  - In California the Modified Adjust Factor Weighting method was used for the child sample.
  - In Georgia the Modified Adjust Factor Weighting method was used for the adult sample.
  - The Modified Adjust Factor Weighting method was also used in Hawaii, New Jersey, Ohio, and Washington because more than 10% of BRFSS respondents with asthma were not asked to participate in the call-back.
  - California only included children with a yes response to the question "Does {the child} still have asthma?" This was not discovered until 2012. Since the data for California does not represent the same child population as other states (all children who have ever had asthma), data for children in California were not included in the public release file or in the response rate tables for children. The child data file for 2008 and related documentation were corrected and replaced in 2012.
  - Mississippi collected ACBS data for 2008, but all interviews were conducted in February and March of 2009. Since the data from Mississippi does not represent the same time frame as the data from the other states (continuous interviewing throughout the year of the BRFSS interview) it was not included in the public use file.
- 2009:

- North Carolina only included adults with asthma if there were no children in the household. Since the data for North Carolina does not represent the same population as other states (all adults with asthma), data for adults in North Carolina were not included in the public release file or in the response rate tables.
  - California only included children with a yes response to the question “Does {the child} still have asthma?” Since the data for California does not represent the same child population as other states (all children who have ever had asthma), data for children in California were not included in the public release file or in the response rate tables for children.
  - Child data for Arizona, the District of Columbia, Iowa, New Mexico, North Dakota, Oklahoma, Oregon, Virginia, West Virginia, and Wisconsin are not included in the public release file because there were too few records (<75) to produce reliable weights.
  - For adults in California, Indiana, Massachusetts, Ohio, and Wisconsin and for children in Indiana, Kansas, Louisiana, Montana, and Texas, more than 10% of the BRFSS records for respondents with asthma had no recorded information about call-back participation. For these states, weighting was done using a Modified Adjustment Factor method.
  - For adults in Arizona, a partial-year BRFSS weight was created because fewer than 6 months of BRFSS respondents were included in the Arizona ACBS. The standard weighting method was then used.
  - Massachusetts (adults and children) and New Mexico (adults and children) only did the call-back for the version 1 sample.
  - Maine (adults and children), Oklahoma (children) and Oregon (children) only did the call-back for the version 2 sample.
  - Washington only interviewed a random sample of adult BRFSS respondents who agreed to the call-back.
- 2010
    - North Carolina only included adults with asthma if there were no children in the household. Since the data for North Carolina does not represent the same population as other states (all adults with asthma), data for adults in North Carolina were not included in the public release file or in the response rate tables.
    - Child data for Alabama, Arizona, California, DC, Illinois, Iowa, Louisiana, Maine, Massachusetts, Missouri, New York, North Dakota, Ohio, Oregon, Rhode Island, West Virginia, and Wisconsin are not included in the public release file because there were too few records (<75) to produce reliable weights.
    - Florida (adults), Massachusetts (adults and children) and New York, (adults and children) only did the call-back for the version 1 sample.
    - For adults in California, Pennsylvania, and Wisconsin and for children in Hawaii, Indiana, Mississippi, New Mexico, Oklahoma, Pennsylvania, and Texas, more than 10% of the BRFSS records for respondents with asthma had no recorded information about call-back participation. For these states, weighting was done using a Modified Adjustment Factor method.
    - Washington only interviewed a random sample of adult BRFSS respondents who agreed to the call-back.

***For additional information on weighting the ACBS records, refer to the document “Asthma Call-back Weighting Methods” which can be requested from NCEH/EHHE/APRHB (asthmacallbackinfo@cdc.gov).***

## **B. Other limitations of the data**

- The Institutional Review Board (IRB) in some states required that asthma be mentioned when the BRFSS respondent was asked to participate in the ACBS. Other states required that asthma **not** be mentioned. Some state IRBs required that BRFSS respondents be specifically asked if their BRFSS responses could be linked to their ACBS responses. Other state IRBs did not. If a state required active consent to link the responses from the two interviews, the PERMISS variable on the data file will be coded 1 for yes. If consent was denied, the ACBS was not conducted and there will be no record in the file. Wording for specific consent scripts can be obtained from each participating state.
- Several states ask the ACBS consent questions directly after the asthma questions in the core of the BRFSS survey. Other states ask the consent questions at the end of the BRFSS interview.
- Approximately 3% of the ACBS interviews are completed in the calendar year following the BRFSS interview. The Variable IYEAR\_F identifies the year of the call-back interview.

Information about survey disposition codes, item non-response, complete and incomplete designation can be found in the ACBS Summary Data Quality Report. Similar information about the BRFSS can be found in the BRFSS Summary Data Quality Report ([http://www.cdc.gov/brfss/technical\\_infodata/quality.htm](http://www.cdc.gov/brfss/technical_infodata/quality.htm)) and the BRFSS Data Quality Report Handbook ([http://www.cdc.gov/brfss/technical\\_infodata/surveydata.htm](http://www.cdc.gov/brfss/technical_infodata/surveydata.htm)) for each survey year.

## **C. Data file and record issues**

### ***Data file***

- When the intent of an analysis is to compare those with asthma to those who do not have asthma, the appropriate file to use is the BRFSS file. The sample size is larger and the responses to BRFSS questions are available for all respondents with asthma and without asthma.
- When the intent of an analysis is to compare subpopulations of those with asthma, the appropriate file to use is the call-back file.

### ***Data record***

- The ACBS record for a respondent consists of the entire BRFSS interview record followed by the ACBS data. There is no need to merge the ACBS data with data from the BRFSS interview. The ACBS codebook, however, does not include the BRFSS portion of the data. BRFSS codebooks can be accessed at: [http://www.cdc.gov/brfss/technical\\_infodata/surveydata.htm](http://www.cdc.gov/brfss/technical_infodata/surveydata.htm)

### ***Skip patterns***

- The Asthma Call-back questionnaire has multiple and complex skip patterns. Each of the skip patterns has been coded into subsequent questions using individual value codes to identify the source response that caused the question to be skipped. These additional codes do not appear in the questionnaire, but are in the codebook. This skip coding allows the analyst to clearly determine an existing skip pattern and easily decide the denominator appropriate for any given analysis or statement without tracing skip patterns in the questionnaire. For more information on coding skip patterns see the document "Coding Skip Patterns," which can be requested from NCEH/EHHE/APRHB (asthmacallbackinfo@cdc.gov).

### ***Calculated variables***

- Not all of the variables that appear on the public use data set are taken directly from the ACBS questionnaire. CDC prepares a large set of calculated variables which are added to the actual questionnaire responses. The vast majority of the variables on the ACBS file are calculated variables. The calculated variables are created for the user's convenience. The procedures for the calculated variables vary in complexity; some only combine codes from one or two questions, while others require sorting and combining selected codes from multiple variables.
- At the time of the call-back interview, the respondent is asked to confirm the responses to the two asthma questions from the BRFSS interview. Not all respondents agree with the responses that were recorded from the initial interview.
  - The calculated combined call-back asthma variables `_CUR_ASTH_C` and `_EVER_ASTH_C` are not identical to the BRFSS asthma variables `ASTHNOW` and `ASTHMA2` (`CASTHNO2` and `CASTHDX2` for children) or the BRFSS adult calculated variables `_CASTHMA` and `_LTASTHM`.
  - The combined call-back variables `_CUR_ASTH_C` and `_EVER_ASTH_C` use the BRFSS responses when the respondent agreed with them and the responses at the time of the call-back interview when the respondent did not agree with the BRFSS responses.

**When using call-back data the combined variables ( `_CUR_ASTH_C` and `_EVER_ASTH_C` ) should be used and not the BRFSS interview variables.**

- For further details regarding these and other calculated variables, refer to the document entitled "Calculated Variables for the Asthma Call-back Survey," which can be requested from NCEH/EHHE/APRHB ([asthmacallbackinfo@cdc.gov](mailto:asthmacallbackinfo@cdc.gov)).

***Questionnaire changes***

- In 2008 there was a change to the medication section of the questionnaire. Several new medications were added and several medications no longer on the market were dropped.
- In 2010 the skip pattern was changed at the following locations:
  - The beginning of section 9 (adult and child)
  - At question 10.5 (adult and child) and at questions 10.12 (child)
  - The beginning of section 12 (adult) and section 11 (child)

**D. Estimation procedures**

***Statistical issues***

- **Record weights**

Unweighted data on the ACBS represent the actual responses of each respondent, before any adjustment is made for variation in respondents' probability of selection, disproportionate selection of population subgroups relative to the state's population distribution, or nonresponse. To produce the ACBS final weight, the BRFSS final weight is adjusted for loss of sample between the BRFSS interview and the ACBS interview. Weighted ACBS data represent results that have been adjusted to compensate for nonresponse at the BRFSS interview and at the ACBS interview. For further details regarding the ACBS final weight, refer to the document entitled "Asthma Call Back Weighting Method," which can be requested from NCEH/EHHE/APRHB ([asthmacallbackinfo@cdc.gov](mailto:asthmacallbackinfo@cdc.gov)).

**Use of the ACBS final weight is essential when analyzing these data.** If weights are not used, the estimates produced will be biased. In the adult ACBS file, the final weight variable is FINALWT\_F and in the child ACBS file the final weight variable is CHILDDWT\_F.

- **Variations**

The procedures for estimating variations described in most statistical texts and used in most statistical software packages are based on the assumption of simple random sampling (SRS). However, the data collected in the ACBS are obtained through a complex sample design; therefore, the direct application of standard statistical analysis methods for variance estimation (including standard errors and confidence intervals) and hypothesis testing (p-values) may yield misleading results.

Computer programs that take such complex sample designs into account are available. SAS, SUDAAN, Epi Info, SPSS and STATA are among those suitable for analyzing these data.

- SAS SURVEYMEANS, SURVEYFREQ, SURVEYLOGISTIC, and SURVEYREG can be used for tabular and regression analyses.<sup>3</sup>
- SUDAAN can be used for tabular and regression analyses and also has additional options.<sup>4</sup>
- Epi Info's C-sample can be used to calculate simple frequencies and two-way cross-tabulations.<sup>5</sup>
- SPSS Complex Samples can be used to produce frequencies, descriptives, cross-tabulations, and ratios as well as estimate general linear, logistic, ordinal, and Cox regression models.<sup>6</sup>
- STATA can produce cross-tabulations, means, logit and general linear regression models.<sup>7</sup>

**When using these software products, users must specify that the sample design is “With Replacement” and also specify the stratum variable ( STSTR), the primary sampling unit ( PSU), and the record weight (FINALWT F or CHILDDWT F) -- all of which are on the public use data file.**

For more information on calculating variance estimations using SAS, see the *SAS/STAT Users Guide, Version 8*.<sup>3</sup> For information about SUDAAN, see the *SUDAAN Users Manual, Release 7.5*.<sup>4</sup> For information about Epi Info, see *Epi Info, Version 6.0*.<sup>5</sup> For information about SPSS see the *SPSS Complex Samples Manual*.<sup>6</sup> For information about STATA see the *Survey Data Reference Manual*.<sup>7</sup>

### **Analytic issues**

- **Sample size**

Although the overall number of respondents in the ACBS is more than sufficiently large for statistical inference purposes, subgroup analyses (including state level analysis) can lead to estimates that are unreliable. Consequently, users need to pay particular attention to the subgroup sample when analyzing subgroup data, especially within a single data year or geographic area. Small sample sizes may produce unstable estimates. Reliability of an estimate depends on the actual unweighted number of respondents in a category, not on the weighted number. Interpreting and reporting weighted numbers that are based on a small, unweighted number of respondents can mislead the reader into believing that a given finding is much more precise than it actually is.

ACBS follows a rule of not reporting or interpreting point estimates based on fewer than 50 unweighted respondents (e.g. percentages based upon a **denominator** of < 50) or for which the Relative Standard Error is greater than 30%. For this reason, and to protect confidentiality of these data, the FIPS County code is not included on the ACBS public use data record.

- **Aggregating data over Time**

- When data from one time period are insufficient, data from multiple periods can be combined as long as the prevalence of the factor of interest did not substantially change during one of the periods. One method that can be used to assess the stability of the prevalence estimates is as follows<sup>8</sup>:
  1. Compute the prevalence for the risk factor for each period.
  2. Rank the estimates from low to high.
  3. Identify a statistical test appropriate for comparing the lowest and the highest estimates at the 5% level of significance. For example, depending on the type of data, a t-test, or the sign test might be appropriate.
  4. Test the hypothesis that prevalence is not changing by using a two-sided test in which the null hypothesis is that the prevalences are equal.
  5. Determine whether the resulting difference could be expected to occur by chance alone less than 5% of the time (i.e., test at the 95% confidence level).
- When combining multiple years of ACBS data for the purpose of subgroup analysis, the final weight will need adjusting and the file year will need to be added as an additional stratum on the complex design specification. When combining multiple years of data for the purpose of examining trends, however, reweighting is not appropriate. For more information on reweighting combined years see the document "Reweighting Combined Files," which can be requested from NCEH/EHHE/APRHB (asthmacallbackinfo@cdc.gov).

- **Analyzing subgroups**

- Provided that the prevalence of risk factors did not change rapidly over time, data combined for two or more years may provide a sufficient number of respondents for additional estimates for population subgroups (such as age/sex/race subgroups or state populations). Before combining data years for subgroup analysis, it is necessary to determine whether the total number of respondents will yield the precision needed, which depends upon the intended use of the estimate. For example, greater precision would be required to justify implementing expensive programs than that needed for general information only.

The table below shows the sample size required for each of several levels of precision, based on a calculation in which the estimated risk factor prevalence is 50% and the design effect is 1.5.

<u>Precision desired</u>	<u>Sample size needed</u>
2%	3600
4%	900
6%	400
8%	225
10%	144
15%	64
20%	36

Precision is indicated by the width of the 95% confidence interval around the prevalence estimate. For example, precision of 2% indicates that the 95% confidence interval is plus (+) or minus (-) 2% of 50%, or 48% to 52%. As shown in the table, to yield this high a level of precision, the sample size required is about 3,600 persons. When a lower level of precision is acceptable, the sample size can be considerably smaller.

- The **design effect** is a measure of the complexity of the sampling design that indicates how the design differs from simple random sampling. It is defined as the variance for the actual sampling design divided by the variance for a simple random sample of the same size.<sup>8,9</sup> For most risk factors in most states, the design effect is less than 1.5. If it is more than 1.5, however, sample sizes may need to be larger than those shown in the table above.
- The standard error of a percentage is largest at 50% and decreases as a percentage approaches 0% or 100%. From this perspective, the required sample sizes listed in the table above are conservative estimates. They should be reasonably valid for percentages between 20% and 80%, but may significantly overstate the required sample sizes for smaller or larger percentages.

### E. Advantages and disadvantages of telephone surveys

- Compared with face-to-face interviewing techniques, telephone interviews are easy to conduct and monitor and are cost efficient. However, telephone interviews have limitations. Telephone surveys may have higher levels of non-coverage than face-to-face interviews because some U.S. households cannot be reached by telephone. While approximately 94.1% of households in the United States have telephones, a number of studies have shown that the telephone and non-telephone populations are different with respect to demographic, economic, and health characteristics.<sup>10,11,12</sup> Although the estimates of characteristics for the total population are unlikely to be substantially affected by the omission of the households without telephones, some of the subpopulation estimates could be biased. Telephone coverage is lower for population subgroups such as blacks in the South, people with low incomes, people in rural areas, people with less than 12 years of education, people in poor health, and heads of households under 25 years of age.<sup>13</sup> However, poststratification adjustments for age, race, and sex, and other weighting adjustments used for the BRFSS and ACBS data minimize the impact of differences in noncoverage, undercoverage, and nonresponse at the state level.

Despite the above limitations, prevalence estimates from the BRFSS correspond well with findings from surveys based on face-to-face interviews, including studies conducted by the National Institute on Alcohol Abuse and Alcoholism, CDC's National Center for Health Statistics, and the American Heart Association.<sup>8,14</sup> A summary of methodological studies of BRFSS is provided in the publication section at [www.cdc.gov/brfss](http://www.cdc.gov/brfss).

- Surveys based on self-reported information may be less accurate than those based on physical measurements. For example, respondents are known to underreport weight. Although this type of potential bias is an element of both telephone and face-to-face interviews, the underreporting should be taken into consideration when interpreting self-reported data. However, when measuring change over time, this type of bias is likely to be constant and is therefore not a factor in trend analysis.
- With ongoing changes in telephone technology, there are more and more households that have cellular telephones and no traditional telephone lines in their homes. These households are presently not in the sampling frame for the BRFSS, which may bias the survey results, especially as the percentage of cellular-telephone-only households continues to increase.<sup>15,16</sup> The BRFSS is continuing to study the impact of cellular phones on survey response and the feasibility of various methods for data collection to complement present survey methods.<sup>1</sup>

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