2023

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 public health 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 help in the formulation of research hypotheses, as well as aid the following actions:

- 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 prevention/control strategies for diseases, injuries, and adverse exposures.
- 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. It will affect about 41.9 million US residents during their lifetime (Table 1-1 Lifetime Asthma Population Estimates–in Thousands). In 2021, about 8 million adults and 1.8 million children had an asthma attack, which can be life threatening (2021 National Health Interview Survey (NHIS) Data | CDC). More than 3,500 people died from asthma-related complications in 2021 (Most Recent National Asthma Data | CDC).

Managing asthma and reducing the burden of this disease requires a long-term, multifaceted approach that includes patient education, behavior changes, asthma-trigger avoidance, pharmacological therapy, frequent medical follow-up, and the development of best practices that put the findings of asthma-related research into sound public-health practice. In this way, disease-related data can help state and local health departments evaluate the needs of their asthma control programs and interventions.

CDC's National Asthma Control Program (NACP) plays a critical role in addressing the health risks that US residents face from this disease. The program funds states, cities, and schools to improve asthma surveillance, train health professionals, raise public awareness, and educate individuals with asthma and their families. The NACP is a function of the Asthma and Air Quality Branch (AAQB), Division of Environmental Health Science and Practice in the National Center for Environmental Health (NCEH).

What is the history of asthma surveys at CDC?

Surveys by the National Center for Health Statistics have been collecting 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 trends at the state level.

State health agencies acquire and use resources to reduce behavioral health risks and the diseases that may result from them. AAQB saw the need to expand existing data systems and develop new systems to make data readily available at a state or local level and provide asthma data with more detail.

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 Population Health, in the 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 participating US territories. The BRFSS is a telephone survey that obtains information on chronic diseases, health risk behaviors, clinical preventive health practices, and health care access, primarily related to chronic disease and injury. The BRFSS population is drawn from a random, representative sample of noninstitutionalized adults in each state. States use BRFSS data to identify emerging health problems, establish and track health objectives, and develop public health policies and programs. Many states also use BRFSS data to inform health-related policies.

In 2000, AAQB added questions about current and lifetime asthma prevalence to the core BRFSS survey. Since 2001, states have also had the option of adding an adult Asthma History Module to their survey, and in 2005 a Child Asthma Prevalence Module was included in the questionnaire (which requires the use of the Random Child Selection Module as well). Several states, however, choose not to add these modules, primarily due to cost or the state's health department electing to pursue other health-related data.

Using the BRFSS to collect additional information on asthma met two of AAQB's three objectives to improve asthma surveillance. First, the BRFSS provides data for state and metropolitan statistical areas for states/territories in the 50 states, the District of Columbia, and participating US territories. Second, it is a timely data source; data are available as soon as possible from the end of the calendar year of data collection.

The third AAQB surveillance objective is to increase the content detail for asthma surveillance data. Efforts to meet this objective began in 1998 when AAQB began creating a new survey with more detailed asthma content, called the National Asthma Survey (NAS). A few pilot tests of the survey were conducted in 2001 and 2002. The first survey used the State and Local Area Integrated Telephone Survey (SLAITS), an independent survey mechanism that was an offshoot of the National Immunization Surveys at CDC. The NAS 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 state and local levels.

In 2003 and early 2004, data were collected by the NAS in a national sample and in four states, but this proved to be a complex and costly process; therefore, in 2004, AAQB considered using the BRFSS to identify respondents with asthma for further interviewing on a call-back basis because the BRFSS includes a much larger sample size in each area than that of the NAS. Respondents who answered "Yes" to questions about current or lifetime asthma during the BRFSS interview would be eligible for the subsequent asthma survey.

During the questionnaire design in 2005, the original National Asthma Survey (NAS) questionnaire was modified to accommodate questions on the BRFSS Asthma Call-back Survey (ACBS). The purpose was to remove the redundancy of questions between the two surveys, which eased the burden on the respondents. This was done in collaboration with the participating states. The BRFSS infrastructure provided the respondents for the call-back survey in three asthma grantee states (Minnesota, Michigan, and Oregon) for the call-back pilot. AAQB 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. This increase in sample size, however, was very expensive, costing an additional $500,000 per state. Consequently, since 2006, the state BRFSS sample has not been increased for the ACBS.

States that plan to conduct the ACBS among adults with asthma no longer need to add the Adult Asthma History Module to the BRFSS, since the questions on the call-back survey provide more detailed answers. Nevertheless, if states wish to include children in the call-back survey, they must also include both BRFSS child modules: Random Child Selection and Childhood Asthma Prevalence Module.

The ACBS has been implemented through BRFSS every year since 2006. Since the 2011 survey, the weighting methodology for the BRFSS was changed significantly, and cell phone samples were added to the traditional landline phone samples. The new weighting methodology—iterative proportional fitting (also known as "raking") replaced the post stratification weighting method that had been used with previous BRFSS data sets. Due to these two methodological changes, data from years 2010 and earlier are not comparable with data from year 2011 and later. Since the ACBS is methodologically linked to the BRFSS survey, data from the ACBS are also subject to the two methodological changes. Consequently, ACBS data from 2010 and earlier should not be compared or combined with ACBS data from 2011 and later.

In addition, while BRFSS initiated cell phone samples in 2011, not all ACBS-participating states included the cell phone sample in the ACBS. In 2011, only 6 of the 40 states included the cell phone sample in the ACBS; therefore, the ACBS used only the landline samples. The landline sample weight was used to produce the ACBS weight and only landline data were included in the 2011 public-release file.

Detailed information for ACBS data for previous years from 2017–2023 can be found in the documents titled "History and Analysis Guidance" at: CDC - BRFSS - BRFSS Asthma Call-back Survey.

Data from the ACBS 2011 landline-only file are methodologically comparable with data from the landline-only files from 2012 and later but are not comparable with the ACBS Landline and Cell Phone (LLCP) data. Data from the ACBS 2012 LLCP files are methodologically comparable only with ACBS LLCP files from 2013 and later. From 2015 forward, ACBS publicly released files that include only the states collecting both landline and cell phone samples for both adult and child data.

In 2014, ACBS protocol required that states collect both landline and cell phone (LLCP) samples for both adult and child. The adult ACBS LLCP public file includes 31 states/territories that met data quality standards from the states/territories that did both LLCP samples. Furthermore, many states/territories collected child data; however, only 8 states/territories met the data-quality standards from the states/territories that did both LLCP samples.

Questionnaires, tables, data files, and documentation for the ACBS can be accessed at CDC - BRFSS - BRFSS Asthma Call-back Survey.

The BRFSS cooperative agreement provided funding for the 2023 ACBS from AAQB. Any state or territory can apply for funds to implement the ACBS. States must include both the Childhood Asthma Prevalence Module and Random Child Selection Module to include children in the call-back survey. The BRFSS sample size will not be increased for the ACBS. To produce a sufficient number of respondents for detailed analysis, it is recommended that a state conduct the ACBS for at least 3 consecutive years. States participating in the 2023 ACBS are shown in the following table.

2023 Participating States

States	Adult LLCP	Child LLCP
Arizona	✓	DNCCD
California	✓	*
Connecticut	✓	✓
Florida	✓	✓
Georgia	✓	*
Hawaii	✓	*
Illinois	+	*
Indiana	✓	✓
Iowa	✓	DNCCD
Kansas	✓	*
Kentucky	✓	*
Maine	✓	*
Massachusetts	✓	*
Michigan	✓	*
Minnesota	✓	*
Missouri	✓	*
Montana	✓	*
Mississippi	+	DNCCD
Nebraska	✓	*
Nevada	+	DNCCD
New Hampshire	✓	*
New Jersey	✓	✓
New Mexico	+	*
New York**	✓	*
Ohio	✓	*
Oregon	+	DNCCD
Rhode Island	✓	*
Texas	✓	✓
Utah	✓	✓
Vermont	✓	✓
Wisconsin	✓	*
Puerto Rico	✓	*

Table Legend:

LLCP = Landline Cell Phone Combined Sample
DNCCD = Did Not Collect Child Data
* Child data not included in the public use file due to having < 75 completes (See Data Anomalies).
+ Adult data not included in the public use file (See Data Anomalies).
✓Included in public use file.
**State utilized version 1 of sample split for adults and version 1 for children

Asthma Call-back Survey
Analysis Guidelines

The Asthma Call-back Survey (ACBS) is conducted within 2 weeks after the survey of the Behavioral Risk Factor Surveillance System (BRFSS). BRFSS respondents who report ever being diagnosed with asthma are eligible for the ACBS. If the respondent is selected from a state's randomly selected child module and has ever been diagnosed with asthma, then the child is eligible for the ACBS. If both the selected child and the BRFSS adult participants in a household have asthma, then one or the other is eligible for the ACBS (50/50 split).

BRFSS collects data in all 50 states as well as in the District of Columbia and participating US territories. BRFSS questionnaires, data, and reports are available at CDC - BRFSS. The most-recent BRFSS data user guide can be found at: The BRFSS Data User Guide August 15, 2013 (cdc.gov).

From the parent survey (BRFSS), the ACBS inherits a complex sample design involving multiple reporting states/territories. These factors complicate the analysis of the ACBS. Additionally, some states stray from traditional 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 CDC – 2023 BRFSS Survey Data and Documentation

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

Several states did not collect ACBS data some months, over the 12-month collection period. This may be an issue when investigating seasonal patterns in the data. States missing 6 months or more ACBS data in the 12-month collection period are excluded from the public use data file.

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

- 2023
  - Adult data for Illinois, Mississippi, Nevada, New Mexico, and Oregon were not included in the public-release data file because of having too-few records (<200) to produce reliable weights.
  - New York collected version 1 of call-back questionnaire for adult; New York collected version 1 of call back questionnaire for child.
  - Arizona, Iowa, Mississippi, Nevada, and Oregon did not collect child ABCS data.
  - Child data for California, Georgia, Hawaii, Illinois, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Mexico, New York, Ohio, Rhode Island, Wisconsin, and Puerto Rico, were not included in the public-release data file because of having too few records (<75) to produce reliable weights.
  - Adult data among weighted states in Arizona, California, Connecticut, Florida, Georgia, Hawaii, Indiana, Kentucky, Massachusetts, Maine, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, Ohio, Rhode Island, Texas,

Vermont, and Wisconsin had more than 10% missing BRFSS records for respondents with asthma missing and did not record information about the call-back participation. For these states, weighting was done using a Modified Adjustment Factor Method.

- Data for children among weighted states in Connecticut, Florida, Indiana, New Jersey, Utah, Texas, and Vermont had more than 10% missing BRFSS records for respondents with asthma and did not record information about the call-back participation. For these states, weighting was done using a Modified Adjustment Factor Method.

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 one (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 asked the ACBS consent questions directly after the asthma questions in the core of the BRFSS survey. Other states asked the consent questions at the end of the BRFSS interview.

- The data-collection period starts in January of the calendar year of the BRFSS sampling year until the end of March of the following year. Approximately 10% of the ACBS interviews are completed in the following year of BRFSS sampling year. The variable IYEAR_F identifies the year of the call-back interview.

Information about survey disposition codes, item non-response, and 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, which can be accessed at CDC - 2023 BRFSS Survey Data and Documentation

C. Data file and record issues

Data file

- When the intent of an analysis is to compare those with asthma with 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/without asthma. The percentage of ACBS adult respondents, non-respondents, and BRFSS-eligible asthma respondents by demographic groups and state/territory can be found in the 2023

Summary Data Quality Report with Response Rates on CDC - 2023 BRFSS Survey Data and Documentation. When the intent of an analysis is to compare subpopulations of those with asthma, the appropriate file to use is the asthma 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: CDC – BRFSS Annual Survey Data after selecting an individual survey year.

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/DEHSP/AAQB (asthmacallbackinfo@cdc.gov)

Calculated variables

- Not all the variables in the public use data set are taken directly from the ACBS questionnaire. CDC prepares a large set of calculated variables that are added to the actual questionnaire responses. Most 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 ASTHMA3 (CASTHNO2 and CASTHDX2 for children) or the BRFSS adult calculated variables _CASTHM1 and _LTASTH1.
    - The combined call-back variables _CUR_ASTH_C and _EVER_ASTH_C use the BRFSS responses when the respondent agreed with them and the ACBS 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**.

Questionnaire changes

- 2023 ACBS questionnaire changes included:
  - Disposition code 2220 removed.
  - Disposition code 4800 added.
  - A question regarding whether a child took quick relief medicine.
  - A question regarding whether a blood relative of a child was ever told by a professional they have asthma.
  - A question was added, regarding whether a child had any kind of respiratory allergy.
  - A question was added, regarding whether a child had any kind of food/digestive allergy.
  - A question was added, regarding whether a child had any eczema or skin allergy.
- There were no questionnaire changes in 2022.
- 2021 ACBS questionnaire changes included:
  - An informed consent question was added for cell phone surveys.
  - A history of asthma question was deleted.
  - A health care utilization question was added (Q5.10: During the past 12 months, does anyone help you arrange or coordinate your asthma care among the different doctors or services that you use?").
  - 7 new medications were added to list of inhalers; 1 new nebulizer was added to the nebulizer list.
  - The entire comorbid conditions section was deleted.
  - The entire complementary and alternative therapy section was deleted.
- There were no changes to the ACBS questionnaire for 2014 through 2020.
- 2013 ACBS questionnaire changes included:
  - Inhaler medications Brethaire, Intal, and Tilade were deleted since all have been discontinued.
  - Inhaler medications Alvesco and Dulera were added.
  - Nebulizer medications Combivent Inhalation Solution and Perforomist/Formoterol were added.
- 2012 ACBS questionnaire changes included:
  - The name for INH_MEDS 25 was changed to Flex Haler.
  - Three inhaler medication questions were deleted (ILP01, ILP02, and ILP07).
  - Response categories for inhaler medication question ILP03 were changed.
  - The question PILLX (how long taking a specific pill) was deleted and PILL01 (on daily use) was added.
  - Three questions on nebulizers were added.
  - Some skip patterns and help screens were revised in the medication section.

- The content of the Work-related asthma section was completely revised.
- The time reference period for the activity limitation variable was changed from 12 months to 30 days.

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/DEHSP/AAQB (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 2023, all states implementing the ACBS included the BRFSS landline and cell phone sample; therefore, the public use file was released for both landline and cell phone samples. The data file includes landline and cell phone data from the subset of states that included both the landline and the cell phone samples and met data quality standards.

  The ACBS child-data files must have a minimum of 75 completes to produce a reliable child weight. The public use file for children was released for the combined landline and cell phone samples (included 7 states/territories that met data quality standards).

  ACBS Landline and Cell Phone (LLCP) file
  In the 2023ACBS LLCP file, the ACBS final weight was produced using the BRFSS landline cell phone weight (_LLCPWT for adults and CLLCPWT for children). The 2023ACBS LLCP final weight variables are:
  - **LLCPWT_F** for adults
  - **CLLCPWT_F** for children

- **Variances**

The procedures for estimating variances described in most statistical texts and used in most statistical software packages are based on the assumption of simple random sampling (SRS). The data collected in the ACBS, however, 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.
- SUDAAN can be used for tabular and regression analyses and has additional options.
- Epi Info's C-sample can be used to calculate simple frequencies and two-way cross-tabulations.
- SPSS Complex Samples can be used to produce frequencies, descriptive analysis, cross-tabulations, and ratios as well as estimate general linear, logistic, ordinal, and Cox regression models.
- STATA can produce cross-tabulations, means, logit, and general linear regression models.

- **When using these software products, users must specify that the sample design is "With Replacement" and specify the stratum variable (_STSTR), the primary sampling unit (_PSU), and the record weight (LLCPWT_F, CLLCPWT_F)**

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 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 shown in the following steps:

    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 prevalence is 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/DEHSP/AAQB (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 what would be 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.

Precision desired	Sample size needed
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 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 (Frazier 1992; Kish 1965). 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 approach 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, but telephone interviews do have limitations. Telephone surveys may have higher levels of non-coverage than face-to-face interviews because some US households cannot be reached by telephone. While approximately 99% of households in the United States have telephones, several studies have shown that the telephone and non-telephone populations are different with respect to demographic, economic, and health characteristics (Groves 1979; Blumberg 2018; Federal Communications Commission 2021). 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 Black persons 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 (AAPOR 2021). Nevertheless, post stratification adjustments for age, race, and sex, and other weighting adjustments used for the BRFSS and ACBS data minimize the impact of differences in non-coverage, under-coverage, 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 (Frazier 1992; Hsia 2020). A summary of methodological studies of BRFSS can be found at: CDC - BRFSS Data Quality, Validity, and Reliability.

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. When measuring change over time, this type of bias is likely to be constant and is therefore not a factor in trend analysis.

REFERENCES

American Association for Public Opinion Research (AAPOR). The Future of U.S. General Population Telephone Research. Available at: Future-of-Telephone-Survey-Research-Report.pdf (aapor.org)
Accessed 5 December 2024

Centers for Disease Control and Prevention. *Most recent national asthma data*. Centers for Disease Control and Prevention. Most Recent Asthma Data | Asthma Data | CDC
Accessed 10 February 2025

Blumberg, Stephen J. and Luke, Julian V. (2021). Wireless substitution: early release of estimates From the National Health Interview Survey, January-June 2020. National Center for Health Statistics; 2021. Available at:
https://stacks.cdc.gov/view/cdc/100855
Accessed 5 December 2024

Federal Communications Commission USA. Universal Service Monitoring Report. 2021; DOC-379181A1.pdf (fcc.gov) (fcc.gov)
Accessed 6 December 2024

Frazier EL, Franks AL, Sanderson LM. Chapter 4: Behavioral risk factor data. In: *Using Chronic Disease Data: A Handbook for Public Health Practitioners*. Centers for Disease Control and Prevention; 1992. 4.1-1.17

Groves RM, Kahn RL. *Surveys by Telephone: A National Comparison with Personal Interviews*, Academic Press; 1979.

Hsia J, Zhao G, Town T, et al. "Comparisons of estimates from the Behavioral Risk Factor Surveillance System and other National Health surveys, 2011 – 2016. *Am J Prev Med*. 2020; 58(6): e181-e190.
Available at: https://doi.org/10.1016/j.amepre.2020.01.025.
Accessed 5 December 2024

Kish L. *Survey Sampling*. John Wiley & Sons; 1965.