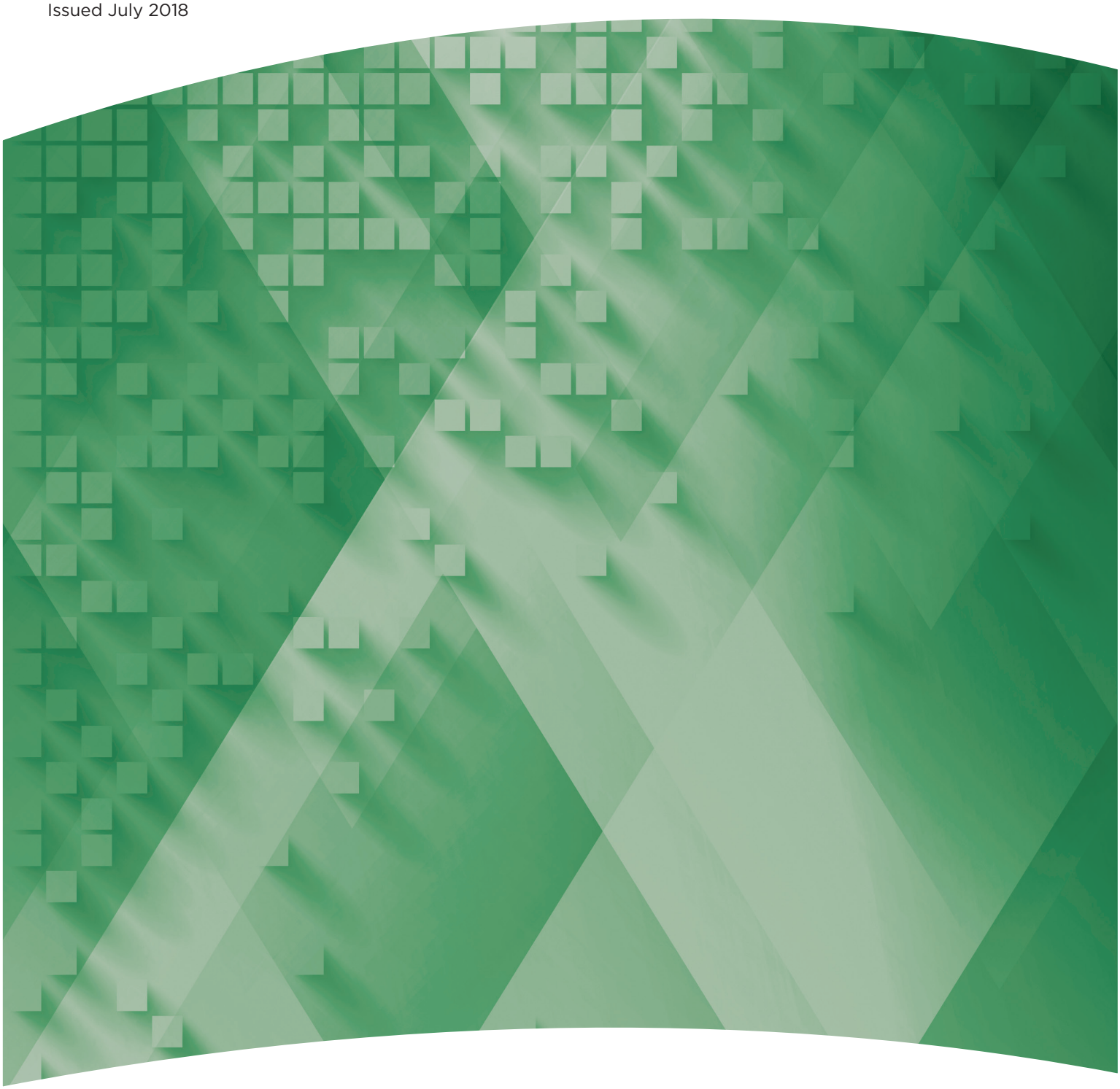
Understanding and Using American Community Survey Data

What All Data Users Need to Know

Issued July 2018



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UNDERSTANDING AND USING AMERICAN COMMUNITY SURVEY DATA: WHAT ALL DATA USERS NEED TO KNOW

Have you ever thought about how, or why, new roads, schools, after-school programs, or hospitals are placed in communities? What makes communities attractive to new businesses or tourists? Why there is no ATM or bike-share kiosk on a street corner? The answers often lie in the numbers—numbers that reflect what our communities look like, how our communities have changed, and how those changes impact our daily lives.

The U.S. Census Bureau's American Community Survey (ACS) is designed to answer these types of questions and to meet the needs of policymakers, business leaders, planners, and others nationwide who need good data to make informed decisions. The ACS provides a detailed portrait of the social, economic, housing, and demographic characteristics of America's communities.

This handbook provides an overview of the ACS to help data users understand the basics of the survey, how the data can be used, how to judge the accuracy of ACS estimates, and how to access ACS data on the Census Bureau's Web site. It also includes some recent case studies that show how ACS data are being used to help address important policy and program issues. Links to additional ACS resources, including technical documentation for more advanced users, are included throughout the handbook.

1. UNDERSTANDING THE ACS: THE BASICS

What Is the ACS?

The American Community Survey (ACS) is a nationwide survey designed to provide communities with reliable and timely social, economic, housing, and demographic data every year. A separate annual survey, called the Puerto Rico Community Survey (PRCS), collects similar data about the population and housing units in Puerto Rico. The Census Bureau uses data collected in the ACS and the PRCS to provide estimates on a broad range of population, housing unit, and household characteristics for states, counties, cities, school districts, congressional districts, census tracts, block groups, and many other geographic areas.

The ACS has an annual sample size of about 3.5 million addresses, with survey information collected nearly every day of the year. Data are pooled across a calendar year to produce estimates for that year. As a result, ACS estimates reflect data that have been collected over a period of time rather than for a single point in time as in the decennial census, which is conducted every 10 years and provides population counts as of April 1.

ACS 1-year estimates are data that have been collected over a 12-month period and are available for geographic areas with at least 65,000 people. The Census Bureau combines 5 consecutive years of ACS data to produce estimates for geographic areas with fewer than 65,000 residents. These 5-year estimates represent data collected over a period of 60 months.[1]

[1] The Census Bureau previously released 3-year estimates based on 36 months of data collection. In 2015, the 3-year products were discontinued. The 2011–2013 ACS 3-year estimates, released in 2014, are the last release of this product.

Starting with the 2014 ACS, the Census Bureau is also producing "1-year Supplemental Estimates"—simplified versions of popular ACS tables—for geographic areas with at least 20,000 people.

Because the ACS is based on a sample, rather than all housing units and people, ACS estimates have a degree of uncertainty associated with them, called sampling error. In general, the larger the sample, the smaller the level of sampling error. To help users understand the impact of sampling error on data reliability, the Census Bureau provides a "margin of error" for each published ACS estimate. The margin of error, combined with the ACS estimate, give users a range of values within which the actual "real-world" value is likely to fall.

TIP: In general, data users should be careful in drawing conclusions about small differences between two ACS estimates because they may not be statistically different.

The ACS provides vital information on a yearly basis about our nation and its people, helping local officials, community leaders, businesses, and the public plan and make decisions based on the changes taking place in their communities. Through the ACS, we know more about demographic trends, jobs and occupations, educational attainment, veterans, homeownership, and many other topics. Because data collection is ongoing, the ACS also provides essential, up-to-date information about population and housing characteristics both before and after natural disasters like Super Storm Sandy or economic crises like the Great Recession of 2007 to 2009.

Table 1.1. **Population and Housing Data Included in American Community Survey Data Products**

Social Characteristics
- Ancestry
- Citizenship Status
- Disability Status[1]
- Educational Attainment
- Fertility
- Grandparents as Caregivers
- Language Spoken at Home
- Marital History[2]
- Marital Status
- Migration/Residence 1 Year Ago
- Period of Military Service
- Place of Birth
- School Enrollment
- Undergraduate Field of Degree[3]
- Veteran Status[2]
- Year of Entry

Economic Characteristics
- Class of Worker
- Commuting (Journey to Work)
- Employment Status
- Food Stamps/Supplemental Nutrition Assistance Program (SNAP)[4]
- Health Insurance Coverage[2]
- Income and Earnings
- Industry and Occupation
- Place of Work
- Poverty Status
- Work Status Last Year

Housing Characteristics
- Computer and Internet Use[5]
- House Heating Fuel
- Kitchen Facilities
- Occupancy/Vacancy Status
- Occupants Per Room
- Plumbing Facilities[6]
- Rent
- Rooms/Bedrooms
- Selected Monthly Owner Costs
- Telephone Service Available
- Tenure (Owner/Renter)
- Units in Structure
- Value of Home
- Vehicles Available
- Year Householder Moved Into Unit
- Year Structure Built

Demographics Characteristics
- Age and Sex
- Group Quarters Population
- Hispanic or Latino Origin
- Race
- Relationship to Householder
- Total Population

[1] Questions on Disability Status were significantly revised in the 2008 survey to cause a break in series.
[2] Marital History, Veterans' Service-Connected Disability Status and Ratings, and Health Insurance Coverage were added in the 2008 survey.
[3] Undergraduate Field of Degree was added in the 2009 survey.
[4] Food Stamp Benefit amount was removed in 2008.
[5] Computer and Internet Use was added to the 2013 survey.
[6] One of the components of Plumbing Facilities, flush toilet, and Business or Medical Office on Property questions were removed in 2016.
Source: U.S. Census Bureau.

*TIP: The ACS was designed to provide estimates of the **characteristics** of the population, not to provide counts of the population in different geographic areas or population subgroups. For basic counts of the U.S. population by age, sex, race, and Hispanic origin, visit the Census Bureau's Population and Housing Unit Estimates Web page.*[2]

The content collected through the ACS can be grouped into four main types of characteristics: social, economic, housing, and demographic, as shown in Table 1.1. Various tables in the ACS have different "universes," or base reference totals against which all other characteristics are compared. Some tables cover population characteristics, while others cover housing characteristics. Among the population tables, some cover the entire population (such as tables of the population by age), while some cover only a subset of the population (such as tables of employment status, which include data only for the population aged 16 and older).

ACS content is designed to meet the needs of federal government agencies, and every question in the ACS is asked for a reason. For example, questions about how people get to work, when they leave, and the length of their commutes are used for planning improvements to roads, highways, rail lines, and bus routes, and for planning emergency response routes. Because participation in the ACS is mandatory, the Office of Management and Budget (OMB) will only approve necessary questions for inclusion in the ACS. The OMB's responsibility under the Paperwork Reduction Act requires that new questions demonstrate the practical utility of the data and minimize "respondent burden." Respondent burden can be defined in different ways, but is often related to the length of the interview or questionnaire, or the extent to which questions are viewed as being intrusive or too personal.

Some people are reluctant to respond to the ACS because of concerns about the confidentiality of the data. However, strict confidentiality laws protect all ACS information that could be used to identify individuals or households under Title 13 of the U.S. Code.[3] This is true even for interagency communication: other government agencies do not have the legal right to access individuals' confidential information.

[2] U.S. Census Bureau, Population and Housing Unit Estimates, <www.census.gov/popest/>.

[3] U.S. Census Bureau, Title 13 - Protection of Confidential Information, <www.census.gov/about/policies/privacy/data_protection/title_13_-_protection_of_confidential_information.html>.

Who Uses the ACS and Why?

The ACS puts up-to-date information about important social issues at the fingertips of people who need it, including policymakers, researchers, businesses, nongovernmental organizations, journalists, teachers, students, and the public (see Box 1.1). Businesses use ACS data to better understand their current or potential customers. The federal government uses ACS information to evaluate the need for federal programs and to run those programs effectively. Nongovernmental organizations use the ACS in a variety of ways to monitor trends among important subgroups of the population. Journalists use ACS data to report on new or emerging social trends or to put a piece of anecdotal evidence into a broader context. State and local governments are using ACS information to keep track of year-to-year changes in their jurisdictions so they can better address the needs of their constituents.

Box 1.1. ***How Different Data-User Communities Use ACS Data***

Federal agencies: ACS data help determine how more than $675 billion in federal funds are distributed to state and local areas each year.[1] Federal agencies rely on the ACS to help them make operational decisions, including managing and evaluating programs, determining eligibility for programs, and benchmarking other statistics. For example, the U.S. Department of Veterans Affairs uses ACS data on the characteristics of veterans to evaluate the need for educational, employment, and health care programs to assist those who have served in the military. The Special Supplemental Food Program for Women, Infants, and Children (WIC) uses income data from the ACS to determine the potential demand for food assistance across states and counties. The Appalachian Regional Commission (ARC) uses ACS data to assess the status of communities in the Appalachian Region on a host of social and economic measures, which in turn enables ARC to develop strategies to improve conditions in Appalachia. For more information about how federal agencies use ACS data, visit the Census Bureau's *American Community Survey Handbook of Questions and Current Federal Uses*.[2]

Nongovernmental organizations: The Lucile Packard Foundation for Children's Health uses ACS data to track annual changes in the well-being of children in California, including measures of child poverty, family structure, school enrollment, and employment status of parents. The Migration Policy Institute uses ACS data to present detailed, state-level information about the 42.4 million current U.S. residents who were born outside the United States. The State Health Access Data Assistance Center uses ACS data to monitor trends in health insurance coverage.

Journalists: Journalists regularly report ACS data to keep the public informed about emerging social, economic, housing, and demographic trends. For example, the *New York Times* used ACS data to map poverty rates and men's employment in America.[3] *The Wall Street Journal* reported on the cities with the fastest-growing median household incomes, based on ACS data.[4] *The Durango Herald* (Durango, Colorado) used ACS 5-year data to show that many of Colorado's newest residents are arriving from California and Texas.[5]

State and local governments: Information from the ACS is critical for state and local policymakers and planners who need up-to-date information about their communities to evaluate the need for new roads, hospitals, schools, senior centers, and other basic services. For example, the Council on Virginia's Future, which advises the Governor and the Virginia General Assembly, relies on ACS data to monitor annual trends in travel time to work. New York City's Department of City Planning used ACS data to identify the need for bilingual voting materials in certain New York neighborhoods.[6]

Businesses: Businesses use information from the ACS to understand their customers, make location or relocation decisions, and provide background information in loan applications. For example, ACS data are a key component of Zillow's database of more than 110 million U.S. homes, helping homeowners and potential buyers learn more about their

[1] U.S. Census Bureau, Uses of Census Bureau Data in Federal Funds Distribution, 2017, <www2.census.gov/programs-surveys/decennial/2020/program-management/working-papers/Uses-of-Census-Bureau-Data-in-Federal-Funds-Distribution.pdf>.

[2] U.S. Census Bureau, *American Community Survey Handbook of Questions and Current Federal Uses*, 2014, <www.census.gov/programs-surveysw/acs/operations-and-administration/2014-content-review/federal-uses.html>.

[3] Gregor Aisch, Josh Katz, and David Leonhardt, "Where Men Aren't Working," Dec. 11, 2014, <www.nytimes.com/interactive/2014/12/12/upshot/where-men-arent-working-map.html?_r=0#>.

[4] Josh Zumbrun, "For Cities Getting Richer the Fastest, Look to the South," Sept. 15, 2016, <http://blogs.wsj.com/economics/2016/09/15/for-cities-getting-richer-the-fastest-look-to-the-south/>.

[5] Jessica Pace, "Texas, California Sending Many New Residents to Colorado," Dec. 2, 2016, <https://durangoherald.com/articles/118903-texas-california-sending-many-new-residents-to-colorado>.

[6] National Research Council, "Chapter 7: Legal and Social Equity Uses of ACS Data," in Benefits, Burdens, and Prospects of the American Community Survey: Summary of a Workshop, Daniel L. Cork, rapporteur, Committee on National Statistics, Division of Behavioral and Social Sciences and Education, Washington, DC: The National Academies Press, 2013, <www.nap.edu/read/18259/chapter/8>.

Box 1.1. How Different Data-User Communities Use ACS Data—Con.

communities.[7] Many data vendors, such as Esri and Nielsen, also incorporate ACS data either directly or indirectly into their commercial data products, which businesses use for market segmentation, site selection, and marketing strategies.[8]

Researchers: Researchers both inside and outside of academia regularly use ACS data to test hypotheses, analyze data patterns across different geographic areas, and to investigate trends over time. For example, researchers at the Pew Research Center use ACS data—often in combination with decennial census data—to monitor long-term trends in U.S. education, income, employment, marriage, and family patterns. At Portland State University, researchers used ACS data to study migration patterns among young adults before and after the Great Recession.[9]

Disaster response and recovery: The American Red Cross uses ACS data to help identify vulnerable populations—before a disaster strikes—and to monitor the impacts of a disaster during the response and recovery phases.[10] In the aftermath of Hurricane Katrina in 2005, up-to-date, before-and-after snapshots of community characteristics helped first and subsequent responders to better target preparedness, response, and recovery efforts.[11]

[7] U.S. Census Bureau, Stats in Action: Zillow, 2015, <www.census.gov/library/video/sia-zillow.html>.

[8] U.S. Department of Commerce, Economics and Statistics Administration, *The Value of the American Community Survey: Smart Government, Competitive Businesses, and Informed Citizens,* 2015, <www.esa.gov/sites/default/files/the-value-of-the-acs.pdf>.

[9] Jason R. Jurjevich and Greg Schrock, America on the Move, <www.americamoves.org/>.

[10] National Research Council, "Chapter 3: Planning Social Services and Responding to Disasters," in Benefits, Burdens, and Prospects of the American Community Survey: Summary of a Workshop. Daniel L. Cork, rapporteur, Committee on National Statistics, Division of Behavioral and Social Sciences and Education, Washington, DC: The National Academies Press, 2013, <www.nap.edu/read/18259/chapter/4#51>.

[11] Kin Koerber, Migration Patterns and Mover Characteristics from the 2005 ACS Gulf Coast Area Special Products, 2006, <www.census.gov/library/working-papers/2006/demo/koerber-01.html>.

One of the main strengths of the ACS is the ability to disaggregate the data by age group, race, Hispanic origin, sex, and other characteristics. For example, data users can compare the poverty status of children and older adults, college enrollment rates for men and women, or housing costs for African Americans and non-Hispanic Whites. No other resource provides such a wealth of social, economic, housing, and demographic information for the nation, states, and substate geographic areas.

History of the ACS

Every 10 years since 1790, Congress has authorized funds to conduct a national census of the U.S. population, as required by the U.S. Constitution. Censuses conducted between 1940 and 2000 consisted of a "short form," which included basic questions about age, sex, race, Hispanic origin, household relationship, and owner/renter status, and a "long form" used for only a sample of households. The "long form" included not only the basic "short-form" questions but also detailed questions about social, economic, and housing characteristics.

Data from the census long form provided a detailed snapshot, every 10 years, of America's population and households. However, in today's world, our communities can change very quickly. Between decennial censuses, local governments, organizations, and businesses need timely data to assess and plan for local needs. Costly mistakes can result when planners and policymakers do not have current data on which to base their decisions. That is one of the key reasons the Census Bureau moved to a new way of gathering data. Rather than taking a snapshot of communities once every 10 years, the ACS was designed to provide a dynamic and timely picture of the nation every year.

The ACS underwent years of extensive testing, including demonstration surveys conducted in parallel with the 2000 Census to evaluate the reliability of survey results. The ACS achieved full, nationwide implementation in 2005 for the household population and was expanded to cover the full population (including group quarters—such as college dormitories) in 2006. In 2010, the ACS replaced the census long form as the nation's source of social and economic data for population and housing characteristics.

Over time, questions have been added, revised, or removed from the survey, as shown in Table 1.1. For example, in 2008 three new questions on marital history, health insurance coverage, and veteran's service-connected disability were added, while the questions on disability were significantly revised to cause a break in series. The data from these new and revised questions collected in 2008 were first available in the ACS products released in 2009. A new question on bachelor's field of degree was added in 2009—with data available in 2010—while in 2013, three new questions on computer ownership and Internet access were added, with data available in 2014.

When a new question is added to the survey, 1-year estimates are available the following year, but it takes 5 years to accumulate data for small geographic areas. While ACS 1-year estimates of health insurance coverage were first available in 2009, ACS 5-year estimates of coverage (for 2008–2012) were first available in 2013.

In 2014, the Census Bureau conducted a comprehensive assessment of the ACS program, including a review of each ACS question. This ACS Content Review sought to understand which federal programs use the information collected by each question and assess how the Census Bureau might reduce respondent burden.[4] Based on this assessment, the questions on the presence of a flush toilet and whether there is a business or medical office on the property were removed from the ACS, beginning with the 2016 survey.

The sample size of the ACS and the ways data are collected have also changed over time, as described in more detail in the next section.

How Are ACS Data Collected?

From 2005 through 2012, the ACS collected data using three sequential methods, or "modes": paper questionnaires through the mail, phone interviews, and personal visits with a Census Bureau interviewer. Starting in 2013, the Census Bureau added a fourth mode—an Internet response option—that simplified data collection and reduced survey costs. Starting in late 2017, based on declining response rates and increasing costs, the Census Bureau discontinued using phone interviews to follow up with nonrespondents. The annual sample size of the ACS has also increased over time, from 2.9 million addresses in 2005 to more than 3.5 million addresses in 2015. This increased sample size has improved the precision of the ACS estimates. Over a 5-year period, the Census Bureau samples approximately 1-in-9 households nationwide, but the sampling rate is higher in areas with small populations and low predicted response rates.

Of the 3.5 million addresses selected for ACS interviews in 2015, about 2.3 million resulted in final interviews. The number of final interviews is smaller than the number of initial addresses selected because the Census Bureau conducts in-person interviews with only a subset of those who do not respond by Internet, mail, or phone. Addresses are also excluded if they are determined to be invalid or commercial, or if a household refuses to participate. In 2015, the national response rate for the ACS was 95.8 percent.[5] For more information about ACS sample size and response rates, visit the Census Bureau's Web page on Sample Size and Data Quality.[6]

The annual ACS sample is smaller than that of the 2000 Census long-form sample, which included about 18 million housing units. As a result, the ACS needs to combine population or housing data from multiple years to produce reliable numbers for small counties, neighborhoods, and other local areas. To provide information for communities each year, the ACS currently provides 1-year estimates for geographic areas with at least 65,000 people and 5-year estimates for smaller geographic areas down to the census tract and block-group level. Starting with the 2014 ACS, the Census Bureau is also producing 1-year Supplemental Estimates—simplified versions of popular ACS tables for geographic areas with populations of 20,000 or more.

One important fact to remember about the ACS is that the request to complete the survey is not mailed to specific people, but rather to specific addresses. The Census Bureau selects a random sample of addresses to be included in the ACS. Each address has about a 1-in-480 chance of being selected in a given month, and no address should be selected more than once every 5 years. Each month, the Census Bureau sends an initial mail package to approximately 295,000 addresses across the United States. This is a small number of housing units considering there are more than 180 million addresses in the United States.

[4] U.S. Census Bureau, American Community Survey, 2014 Content Review, <www.census.gov/programs-surveys/acs/operations-and-administration/2014-content-review.html>.

[5] The survey response rate is the ratio of the estimate of housing units interviewed after data collection is complete to the estimate of all units that should have been interviewed. Interviews include complete and partial interviews with enough information to be processed.

[6] U.S. Census Bureau, American Community Survey, Sample Size and Data Quality, <www.census.gov/acs/www/methodology/sample-size-and-data-quality/>.

Until 2015, the Census Bureau sent all selected addresses an advance notification letter informing people living at that address that they had been selected to participate in the ACS. Shortly thereafter (for most U.S. addresses), instructions for completing the survey by Internet were mailed. Beginning in August 2015, the Census Bureau eliminated the advance notification letter and instead included instructions in the initial mail package for completing the survey by Internet or over the phone through a toll-free Telephone Questionnaire Assistance (TQA) line. If households do not respond by Internet or TQA, then a paper questionnaire is mailed to the address. In Puerto Rico and some hard-to-reach areas, only a paper questionnaire is mailed.

Until 2017, if no response was received by Internet, TQA, or mail within a month following the initial mailing, the Census Bureau followed up with a telephone interview when a telephone number was available. However, beginning in October 2017, the Census Bureau discontinued the telephone Nonresponse Followup operation because of declining response rates and increasing costs. Respondent data are still collected via telephone through the TQA operation.

If the Census Bureau is unable to get a response by Internet, mail, or TQA, then the address may be selected for an in-person interview. Because of the high cost per completed interview, the Census Bureau samples about one in three nonrespondent housing units for personal visit interviews. The proportion of nonresponding households selected for in-person interviews is higher in areas with lower predicted response rates. A sample of people living in group quarters facilities—such as college dorms, skilled nursing facilities, or correctional facilities—is also interviewed in person to ensure coverage of people who are not living in housing units.

Population Controls

As with most household surveys, the ACS data are controlled so that the numbers of housing units and people in certain categories agree with the Census Bureau's official estimates. The ACS uses a weighting method to ensure that ACS estimates are consistent with official Census Bureau population estimates by age, sex, race, and Hispanic origin—as well as estimates of total housing units. ACS estimates are controlled to official population and housing units at the county level. ACS single-year estimates are controlled to population and total housing unit estimates as of July 1 of the survey year, while ACS 5-year estimates are controlled to the average of the July 1 population and housing unit estimates over the 5-year period.

Starting with the 2009 survey, ACS estimates of the total population of incorporated places (self-governing cities, towns, or villages) and minor civil divisions (such as county precincts) are also adjusted so that they are consistent with official population estimates.

TIP: ACS data for small statistical areas (such as census tracts) have no control totals, which may lead to errors in the population and housing unit estimates. In such cases, data users are encouraged to rely more upon noncount statistics, such as percent distributions or averages.

For more information about ACS methods, visit the Census Bureau's Design and Methodology Report Web page.[7]

When Are ACS Data Released?

ACS data are very timely because they are released in the year immediately following the year in which they are collected (see Table 1.2). Beginning with data collected in 2005, 1-year estimates have been published for areas with populations of 65,000 or more, including all states, the District of Columbia, and many large counties and cities. In 2010, the Census Bureau released the first ACS 5-year estimates for the nation, states, cities, counties, and other small geographic areas. These 5-year estimates have been updated annually by removing the earliest year and replacing it with the latest one, thus providing an unprecedented ability to annually monitor social and economic trends in local communities.

The Census Bureau also produced ACS 3-year estimates, starting in 2008, but that series was discontinued in 2015. However, every community in the nation will continue to receive a detailed statistical portrait of its social, economic, housing, and demographic characteristics through ACS 1-year and 5-year data products.

In July 2016, the Census Bureau released a series of Supplemental Estimates, consisting of new 1-year estimates for geographic areas with populations of 20,000 or more. These tables provide 1-year estimates for many geographic areas that were previously only available through the 3-year or 5-year data products.

[7] U.S. Census Bureau, American Community Survey, American Community Survey Design and Methodology, <www.census.gov /programs-surveys/acs/methodology/design-and-methodology.html>.

Table 1.2. **Release Schedule for ACS Data**

Year of data release	Data product, population threshold, and year(s) of data collection			
	1-year estimates (65,000+)	1-year Supplemental Estimates (20,000+)	3-year estimates (20,000+)	5-year estimates (All areas)
2006	2005	NA	NA	NA
2007	2006	NA	NA	NA
2008	2007	NA	2005–2007	NA
2009	2008	NA	2006–2008	NA
2010	2009	NA	2007–2009	2005–2009
2011	2010	NA	2008–2010	2006–2010
2012	2011	NA	2009–2011	2007–2011
2013	2012	NA	2010–2012	2008–2012
2014	2013	NA	2011–2013	2009–2013
2015	2014	NA	NA	2010–2014
2016	2015	2014/2015	NA	2011–2015
2017	2016	2016	NA	2012–2016

NA Not available.
[1] The Census Bureau produced ACS 3-year estimates starting in 2008, but that series was discontinued in 2015.
[2] Five-year estimates are available for areas as small as census tracts and block groups.
Source: U.S. Census Bureau.

ACS data collected for earlier years, from 2000 through 2004, are also available for areas with 250,000 people or more, including all states, the District of Columbia, and many large counties and cities.[8]

Additional Background Information

American Community Survey Site Map
<www.census.gov/acs/www/sitemap.php>
The ACS site map provides an overview of the ACS-related links and materials that are available on the Census Bureau's Web site.

What Is the ACS?
<www.census.gov/programs-surveys/acs/about.html>
This Web page includes basic information about the ACS and provides links to additional background materials.

ACS Questionnaire Archive
<www.census.gov/programs-surveys/acs/methodology/questionnaire-archive.html>
Browse archived sample ACS questionnaires for the household and group quarters populations in English and Spanish with instruction guides from 1996 through the present.

Methodology
<www.census.gov/programs-surveys/acs/methodology.html>
This Web page contains links to information on ACS data collection and processing, evaluation reports, and related topics.

Questions on the Form and Why We Ask
<www.census.gov/acs/www/about/why-we-ask-each-question/>
This Web page provides more information about how federal agencies and other data users use the ACS in their work.

ACS Data Releases
<www.census.gov/programs-surveys/acs/news/data-releases.html>
This Web page includes information about the ACS data release schedule, guidance on using the latest ACS data, and technical information about geography and product changes. Users can also browse the notes from previous years.

Table and Geography Changes
<www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes.html>
This Web page provides information about changes to tables and geography for each ACS data release.

[8] U.S. Census Bureau, American Community Survey, American Community Survey Design and Methodology, <www.census.gov/programs-surveys/acs/methodology/design-and-methodology.html>.

2. GEOGRAPHIC AREAS COVERED IN THE ACS

Data from the American Community Survey (ACS) are tabulated for a variety of different geographic areas ranging in size from broad geographic regions (Northeast, Midwest, South, and West) to states, cities, towns, census tracts, and block groups (see Box 2.1). Table 2.1 shows the type and number of geographic areas included in the ACS 1-year and 5-year products for 2015. For example, in 2015, ACS 1-year data were available for 830 counties (26 percent of all counties), while the remaining 2,390 counties (74 percent of all counties) received 5-year estimates. Note that the information in this table is based on current geographic boundaries and is expected to change over time. The ACS uses boundaries as of January 1 of the last year of the estimate period. For example, the 2011–2015 ACS 5-year estimates use boundaries as of January 1, 2015, as reported to the U.S. Census Bureau.

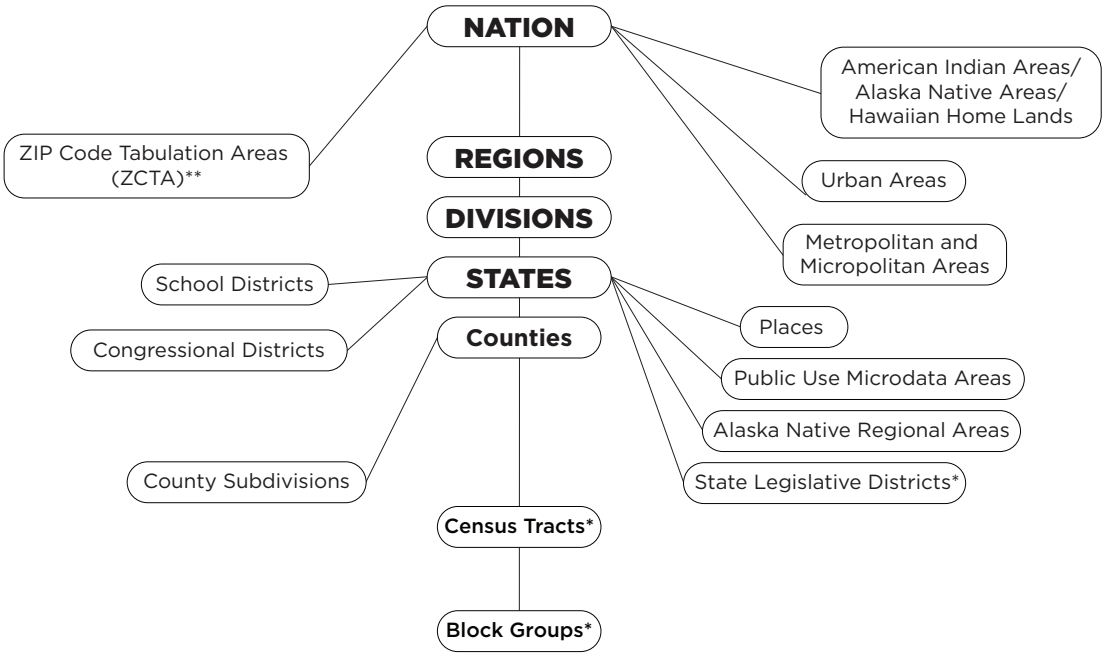
Box 2.1. ***Explaining Census Bureau Geography***

For reporting purposes, the nation is subdivided into two main types of geographic areas, legal and statistical. Legal areas are defined specifically by law, and include state, local, and tribal government units, as well as some specially defined administrative areas like congressional districts. Many, but not all, are represented by elected officials. An example of a legal area is New York State.

Statistical areas are defined directly by the Census Bureau and state, regional, or local authorities, and include census tracts and urban areas. The primary purpose of statistical areas is to tabulate and present census data. An example of a statistical area is the Boston-Cambridge-Newton, MA-NH Metropolitan Statistical Area.

Geographic areas are organized in a geographic hierarchy (see Figure 2.1). Larger units, such as states, include smaller units, such as counties and census tracts. This structure is derived from the legal, administrative, or areal relationships of the entities.

Figure 2.1. **Hierarchy of Select Geographic Entities in the ACS**



*Five-year estimates only.

**Five-year estimates only, first released in 2012 for the 2007–2011 ACS estimates.

Table 2.1. **Selected Geographic Areas Published in the 2015 American Community Survey 1-Year and 5-Year Estimates**

Geographic areas	Total number of areas	Areas receiving 1-year and 5-year estimates		Areas receiving only 5-year estimates[1]	
		Number	Percent	Number	Percent
United States	1	1	100.0	0	0.0
Region	4	4	100.0	0	0.0
Division	9	9	100.0	0	0.0
States, the District of Columbia, and Puerto Rico	52	52	100.0	0	0.0
County or equivalent[2]	3,220	830	25.8	2,390	74.2
County subdivision[3]	36,631	223	0.6	36,408	99.4
Subminor civil division (Puerto Rico only)	145	NA	NA	145	100.0
Census tract	74,001	NA	NA	74,001	100.0
Block group	220,333	NA	NA	220,333	100.0
Place (incorporated places and census designated places)	29,574	596	2.0	28,978	98.0
Consolidated city	8	NA	NA	8	100.0
Alaska Native Regional Corporation	12	3	25.0	9	75.0
American Indian Area/Alaska Native Area/ Hawaiian Home Land	693	12	1.7	681	98.3
Specified American Indian Area-Tribal Census Tract	481	NA	NA	481	100.0
Specified American Indian Area-Tribal Census Tract-Tribal Block Group	915	NA	NA	915	100.0
Metropolitan Statistical/Micropolitan Statistical Area	929	516	55.5	413	44.5
Principal City of Metropolitan or Micropolitan Statistical Areas	1,249	388	31.1	861	68.9
Metropolitan Division	31	31	100.0	0	0.0
Combined Statistical Area	169	167	98.8	2	1.2
Combined New England City and Town Area	6	6	100.0	0	0.0
New England City and Town Area	38	25	65.8	13	34.2
Principal Cities of New England City and Town Areas	58	19	32.8	39	67.2
New England City and Town Area Division	10	10	100.0	0	0.0
Urban Area	3,592	432	12.0	3,160	88.0
Congressional Districts, 114th Congress	435	435	100.0	0	0.0
Delegate District, 114th Congress (at Large, District of Columbia)	1	1	100.0	0	0.0
Resident Commissioner District, 114th Congress (at Large, Puerto Rico)	1	1	100.0	0	0.0
State Legislative District, Upper Chamber[4]	1,954	NA	NA	1,954	100.0
State Legislative District, Lower Chamber[4]	4,825	NA	NA	4,825	100.0
Public Use Microdata Area	2,378	2,378	100.0	0	0.0
5-digit ZIP Code Tabulation Area	33,120	NA	NA	33,120	100.0
Elementary School District	2,181	76	3.5	2,105	96.5
Secondary School District	538	90	16.7	448	83.3
Unified School District	10,923	851	7.8	10,072	92.2
TOTAL	428,517	7,156	1.7	421,361	98.3

NA Not available.
[1] Geographic areas with populations of 20,000 or more also receive 1-year Supplemental Estimates, which are simplified versions of popular ACS tables.
[2] County equivalents include Alaska boroughs, municipalities, city and boroughs, and census areas; Louisiana parishes; Puerto Rico municipios; and independent cities in Maryland, Missouri, Nevada, and Virginia.
[3] For 1-year estimates, qualifying Minor Civil Divisions in 20 states only. For 5-year estimates, all county subdivisions.
[4] Legislative session year 2014.
Note: Figures based on geographic area boundaries as of January 1, 2014, new and dissolved incorporations as of January 1, 2015, and population estimates from the July 1, 2015, Census Bureau Population Estimates. The Census Bureau does not publish ACS data for individual blocks.

Key Geographic Areas in the ACS

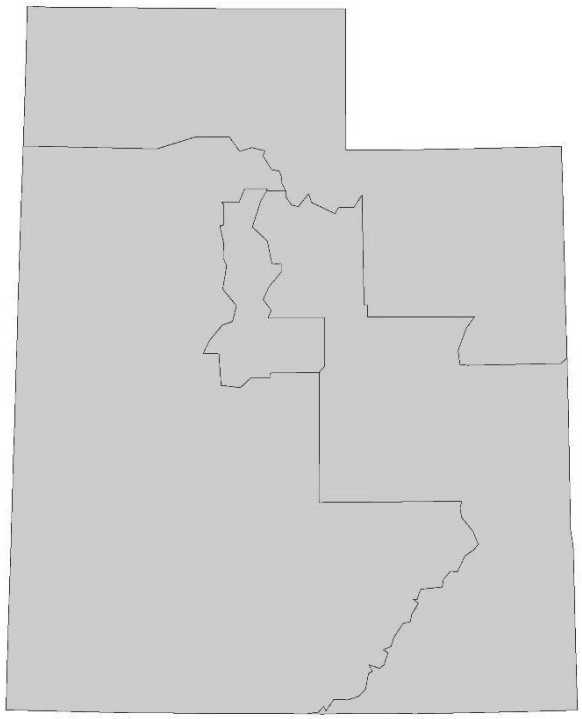
In Figures 2.2 through 2.5, sample maps for four different states—Utah, Kentucky, Iowa, and Vermont—show data users some of the key geographic areas available through the ACS: congressional districts, Public Use Microdata Areas, counties, and census tracts.

Congressional districts are redrawn after each census for the purpose of electing the members of the U.S. House of Representatives. Each of Utah's four congressional districts (shown in Figure 2.2) includes approximately 750,000 people. ACS data on congressional districts can be used to compare the home districts of the 435 House members and how they have changed over time.

The Census Bureau also divides each state into a series of Public Use Microdata Areas, or PUMAs, each of which has a minimum population of 100,000. PUMAs are constructed based on county and neighborhood boundaries and do not cross state lines. Typically, counties with large populations are subdivided into multiple PUMAs, while PUMAs in more rural areas are made up of groups of adjacent counties. PUMAs are especially useful for rural areas because, unlike counties, they all meet the 65,000-population threshold that is needed to produce ACS 1-year estimates. Kentucky's PUMAs are shown below in Figure 2.3.

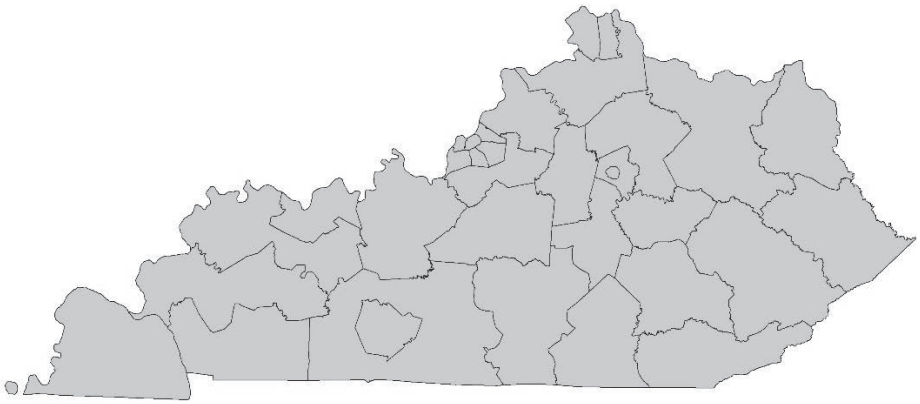
Counties are also important because they are the primary legal subdivision within each state. ACS 1-year estimates are currently available for 10 of Iowa's 99 counties—those with populations of 65,000 or more in 2015 (see Figure 2.4). Iowa has 34 counties with populations of at least 20,000 people that receive 1-year Supplemental Estimates. The 65 counties in Iowa with fewer than 20,000 people only receive 5-year estimates.

Figure 2.2. **Congressional Districts in Utah**



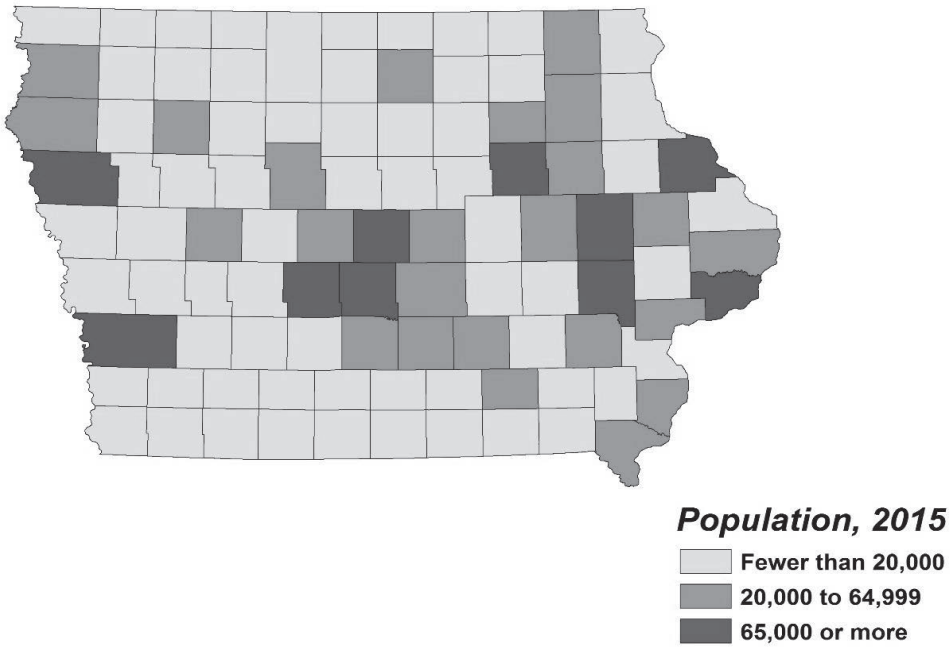
Source: U.S. Census Bureau, Congressional District Cartographic Boundary Shapefiles, accessed at <www.census.gov/geo/maps-data/data/cbf/cbf_cds.html>.

Figure 2.3. **Public Use Microdata Areas in Kentucky**



Source: U.S. Census Bureau, Public Use Microdata Sample Cartographic Boundary Shapefiles, accessed at <www.census.gov/geo/maps-data/data/cbf/cbf_puma.html>.

Figure 2.4. **Counties in Iowa by Population Size in 2015**



Source: U.S. Census Bureau, Population Estimates; and County Cartographic Boundary Shapefiles, accessed at <www.census.gov/geo/maps-data/data/cbf/cbf_counties.html>.

Figure 2.5. **Census Tracts in Vermont**

Source: U.S. Census Bureau, Census Tract Cartographic Boundary Shapefiles, accessed at <www.census.gov/geo/maps-data/data/cbf/cbf_tracts.html>.

Census tracts are small geographic areas—with an average of about 4,000 people each—that are commonly used to present information for small towns, rural areas, and neighborhoods. For example, in Vermont, there are currently 184 census tracts with data available through the ACS 5-year data products (see Figure 2.5).

There are also more than 300 ACS data tables available for block groups—subdivisions of census tracts—that include between 600 and 3,000 people each. In the ACS, block groups are the lowest (smallest) level of geography published. Block group data are only available in the ACS 5-year data products.

Additional Background Information

Geography & ACS
<www.census.gov/programs-surveys/acs/geography-acs.html>
This Web page includes information about changes in geographic boundaries in the ACS, key concepts and definitions, and reference maps.

3. UNDERSTANDING AND USING ACS SINGLE-YEAR AND MULTIYEAR ESTIMATES

Each year, the U.S. Census Bureau publishes American Community Survey (ACS) 1-year estimates for geographic areas with populations of 65,000 or more. The 65,000-population threshold ensures that 1-year data are available for all regions, divisions, states, the District of Columbia, Puerto Rico, congressional districts, Public Use Microdata Areas, and many large counties and county equivalents, metropolitan and micropolitan areas, cities, school districts, and American Indian areas.[9] The 1-year Supplemental Estimates, simplified versions of popular ACS tables, are also available for geographic areas with at least 20,000 people. These annual data provide policymakers, planners, business leaders, and others with a critical source of up-to-date information to plan for services such as transportation, medical care, housing, and schools.

For geographic areas with smaller populations, the ACS samples too few housing units to provide reliable single-year estimates. For these areas, several years of data are pooled together to create more precise multiyear estimates. Since 2010, the ACS has published 5-year data (beginning with 2005–2009 estimates) for all geographic areas down to the census tract and block group levels.[10]

This means that there are two sets of numbers—both 1-year estimates and 5-year estimates—available for geographic areas with at least 65,000 people, such as the state of Virginia. Less populous areas, such as Bath County in Virginia's Shenandoah Valley, receive only 5-year estimates. As shown in Table 2.1 in the section on "Geographic Areas Covered in the ACS," the vast majority of geographic areas receive only 5-year estimates.

Understanding Period Estimates

Single-year and multiyear estimates from the ACS are all "period" estimates derived from a sample collected over a period of time, as opposed to "point-in-time" estimates such as those from past decennial censuses. For example, the 2000 Census "long form" sampled the resident U.S. population as of April 1, 2000.

While an ACS 1-year estimate includes information collected over a 12-month period, an ACS 5-year estimate includes data collected over a 60-month period.

In the case of ACS 1-year estimates, the period is the calendar year (e.g., the 2015 ACS covers the period from January 2015 through December 2015). In the case of ACS multiyear estimates, the period is 5 calendar years (e.g., the 2011–2015 ACS estimates cover the period from January 2011 through December 2015). Therefore, ACS estimates based on data collected from 2011–2015 should not be labeled "2013," even though that is the midpoint of the 5-year period.

Multiyear estimates should be labeled to indicate clearly the full period of time (e.g., "The child poverty rate in 2011–2015 was X percent."). They do not describe any specific day, month, or year within that time period.

Multiyear estimates require some considerations that single-year estimates do not. For example, multiyear estimates released in consecutive years consist mostly of overlapping years and shared data.

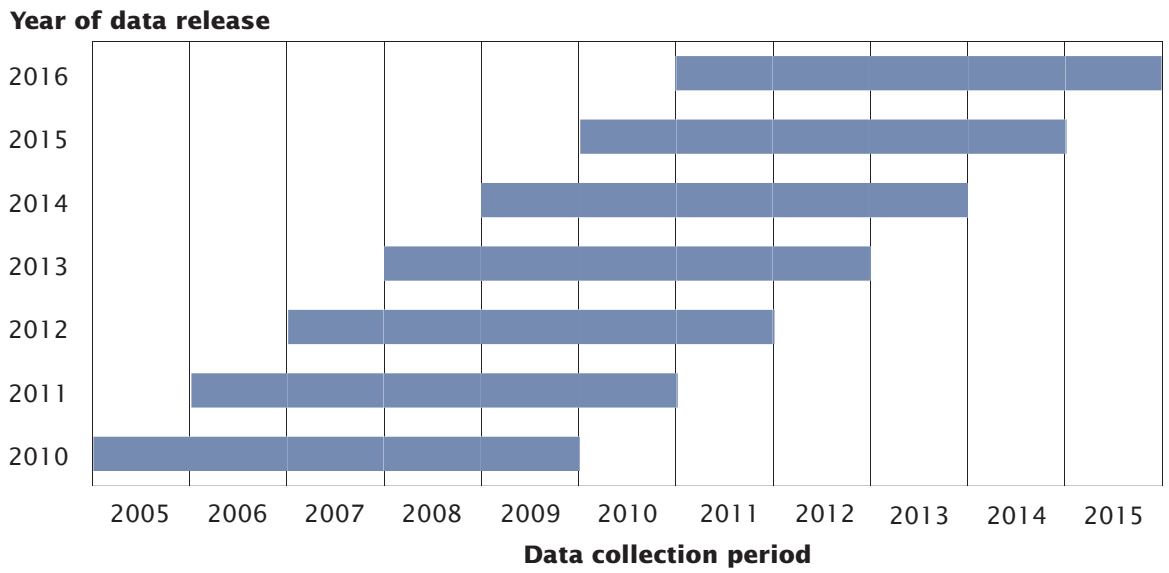
TIP: As shown in Figure 3.1, consecutive 5-year estimates contain 4 years of overlapping coverage (for example, the 2010–2014 ACS 5-year estimates share sample data from 2011 through 2014 with the 2011–2015 ACS 5-year estimates). Because of this overlap, users should use extreme caution in making comparisons with consecutive years of multiyear estimates.

The primary advantage of using multiyear estimates is the increased statistical reliability of the data compared with that of single-year estimates, particularly for small geographic areas and small population subgroups. Figure 3.2 shows the improved precision of an ACS 5-year estimate, compared with a 1-year estimate, for child poverty statistics in Rice County, Minnesota—a county with about 65,000 residents in 2015. The lines above and below the point estimates represent the confidence intervals, or ranges of uncertainty, around each estimate. The confidence interval for the 1-year child poverty estimate ranges from 1.4 percent to 9.4 percent (8 percentage points) while the interval for the 5-year estimate is narrower, ranging from 12.8 percent to 19.2 percent (6 percentage points). (Refer to the section on "Understanding Error and Determining Statistical Significance" for a detailed explanation of uncertainty in ACS data.)

[9] Public Use Microdata Areas, or PUMAs, are collections of counties—or tracts within counties—with approximately 100,000 people each. PUMAs do not cross state lines.

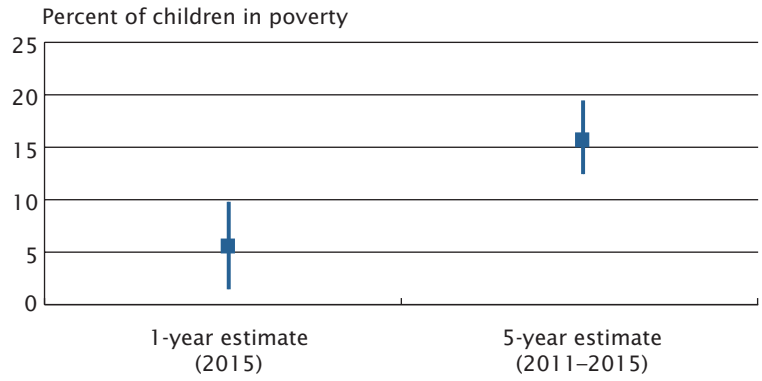
[10] For several years, the Census Bureau produced both ACS 3-year estimates (for areas with populations of 20,000 or more) and ACS 5-year estimates (for all geographic areas). Starting with the 2014 data release, the 3-year products were discontinued, but 5-year estimates are still published each year.

Figure 3.1. **Sample Cases Used in Producing ACS 5-Year Estimates**



Source: U.S. Census Bureau, "When to Use 1-year, 3-year, or 5-year Estimates," accessed at <www.census.gov/programs-surveys/acs/guidance/estimates.html>.

Figure 3.2. **Child Poverty Rate in Rice County, Minnesota: 2015 and 2011–2015**



Source: U.S. Census Bureau, American FactFinder, Table DP03: Selected Economic Characteristics in the United States.

Deciding Which ACS Estimate to Use

For data users interested in obtaining detailed ACS data for small geographic areas (areas with fewer than 65,000 residents), ACS 5-year estimates are the only option.[11] However, data users interested in estimates for areas with populations of 65,000 or more have a choice between the 1-year and 5-year data series. Which data should be used?

The 1-year estimates for an area reflect the most current data but they have larger margins of error than the 5-year estimates because they are based on a smaller sample. The 5-year estimates for an area have larger samples and smaller margins of error than the 1-year estimates. However, they are less current because the larger samples include data that were collected in earlier years. The main advantage of using multiyear estimates is the increased statistical reliability for smaller geographic areas and small population groups.

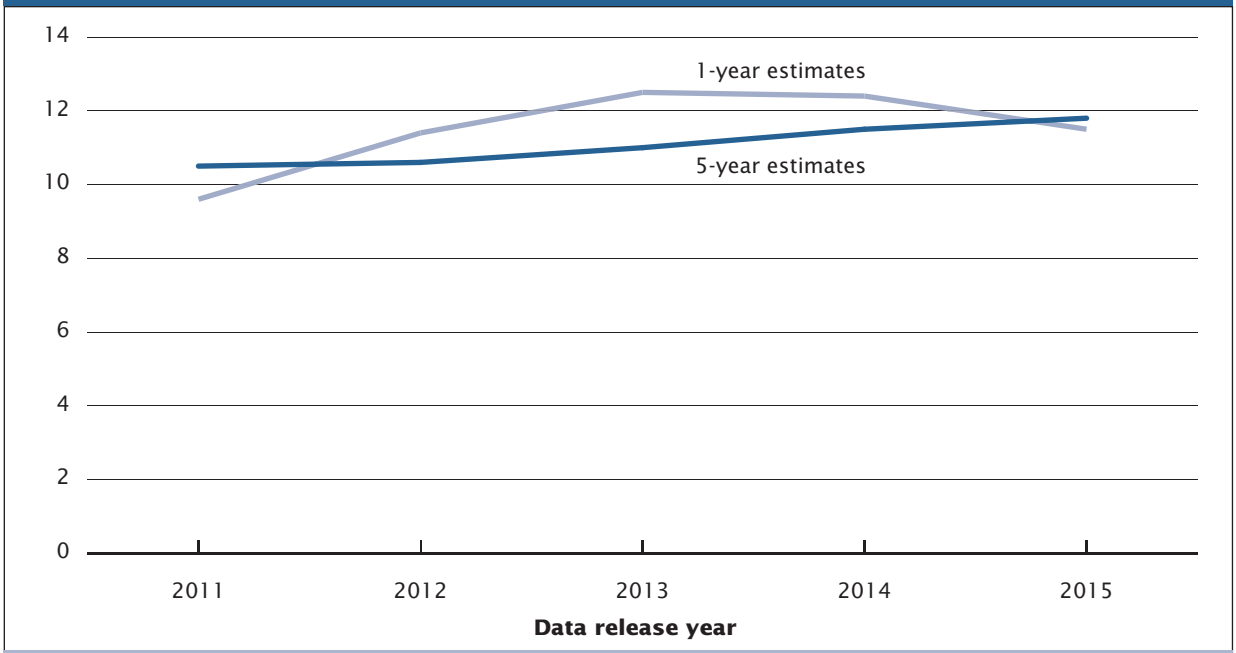
One-year estimates are particularly useful for geographic areas with rapidly changing characteristics because they are based on the most current data—data from the past year. For example, ACS 1-year data were used to compare poverty rates before, during, and after the 2007–2009 recession. In contrast, 5-year estimates provide less current information because they are based on both data from the previous year and data that are 2 to 5 years old. For many areas undergoing minimal change, using the "less current" multiyear estimates may not have a substantial influence on the estimates. However, in areas experiencing major changes over a given time period, the multiyear estimates may be quite different from the single-year estimates for any of the individual years. The single-year and multiyear estimates will not be the same because they are based on data from two different time periods. This will be true even if the ACS single year is the midyear of the ACS multiyear period (e.g., 2013 single year, 2011–2015 multiyear).

For example, suppose a school district official in Prince George's County, Maryland, is interested in measuring recent trends in the population speaking Spanish at home. Comparing data by release year shows that the 5-year estimates for the Prince George's County Public School District are lagging behind the 1-year estimates (see Figure 3.3). While the 1-year estimates show an increase in the share of people speaking Spanish at home, followed by a decline, the 5-year estimates show a steady increase over time.

TIP: In general, ACS 1-year data are more likely to show year-to-year fluctuations, while consecutive 5-year estimates are more likely to show a smooth trend, because 4 of the 5 years in the series overlap from one year to the next.

[11] In July 2016, the Census Bureau released a series of Supplemental Estimates, consisting of new 1-year estimates for geographic areas with populations of 20,000 or more. These tables provide 1-year estimates for many geographic areas that were previously only available through the 3-year or 5-year data products.

Figure 3.3. **Percentage of People Aged 5 and Older Who Speak Spanish at Home in the Prince George's County, MD, Public School District**



Source: U.S. Census Bureau, American FactFinder, DP02: Selected Social Characteristics in the United States.

Table 3.1. **Distinguishing Features of ACS 1-Year, 1-Year Supplemental, 3-Year, and 5-Year Estimates**

1-Year Estimates	1-Year Supplemental Estimates	3-Year Estimates[1]	5-Year Estimates
12 months of collected data Example: 2015 ACS 1-year estimates Dates collected: January 1, 2015, to December 31, 2015	12 months of collected data Example: 2015 ACS 1-year Supplemental Estimates Dates collected: January 1, 2015, to December 31, 2015	36 months of collected data Example: 2011-2013 ACS 3-year estimates Dates collected: January 1, 2011, to December 31, 2013	60 months of collected data Example: 2011-2015 ACS 5-year estimates Dates collected: January 1, 2011, to December 31, 2015
Data for areas with populations of 65,000 and more	Data for areas with populations of 20,000 and more	Data for areas with populations of 20,000 and more	Data for all areas
Smallest sample size	Smallest sample size	Larger sample size than 1-year	Largest sample size
Less reliable than 3-year or 5-year	Less reliable than 5-year	More reliable than 1-year; less reliable than 5-year	Most reliable
Most current	Most current	Less current than 1-year; more current than 5-year	Least current
Annually released: 2005 ACS 1-year data to present	Annually released: 2014 ACS 1-year data to present	Annually released: 2005–2007 ACS 3-year data to 2011–2013 ACS 3-year data	Annually released: 2005–2009 ACS 5-year data to present
Best used when	**Best used when**	**Best used when**	**Best used when**
Currency is more important than precision Analyzing large populations	Currency is more important than precision Analyzing smaller populations Examining smaller geographic areas because the standard 1-year estimates are not available	More precise than 1-year, spans fewer years than 5-year Analyzing smaller populations Examining smaller geographic areas because the standard 1-year estimates are not available	Precision is more important than currency Analyzing very small populations Examining tracts and other small geographic areas because 1-year estimates are not available

[1] ACS 3-year estimates have been discontinued. The 2005–2007, 2006–2008, 2007–2009, 2008–2010, 2009–2011, 2010–2012, and 2011–2013 ACS 3-year estimates will remain available to data users, but no new 3-year estimates will be produced. Every community in the nation will continue to receive a detailed statistical portrait of its social, economic, housing, and demographic characteristics through 1-year and 5-year ACS products.

TIP: Data users may think that multiyear estimates are only appropriate when working with data for small areas, but this is not the case. Large geographic areas also benefit from the larger sample used for 5-year estimates, resulting in more precise estimates of population and housing characteristics, especially for subpopulations within those areas.

In addition, ACS 5-year estimates are not subject to the same data suppression rules that the Census Bureau applies to 1-year estimates. The Census Bureau restricts some 1-year data tables from publication because the estimates are not reliable. For more information, visit the Census Bureau's Web page on Data Suppression.[12]

Some users may prefer to use 1-year estimates, despite their reduced reliability, as building blocks to produce estimates for meaningful higher levels of geography. For example, data for neighboring counties could be combined to produce estimates for a metropolitan or regional planning area. These aggregations will similarly benefit from the increased sample sizes, through improved precision.

There are no hard-and-fast rules for choosing between 1-year and 5-year data, but the margins of error provided with ACS data can help data users decide on the tradeoff between currency and reliability. Table 3.1 shows the different features of ACS 1-year, 1-year Supplemental, 3-year, and 5-year estimates that data users can consider in choosing which estimates to use. Data users can also refer to the section on "Understanding Error and Determining Statistical Significance" for guidance on assessing the reliability of ACS estimates.

[12] U.S. Census Bureau, American Community Survey, Data Suppression, <www.census.gov/programs-surveys/acs/technical-documentation/data-suppression.html>.

4. MAKING COMPARISONS WITH ACS DATA

One of the main benefits of the American Community Survey (ACS) is the ability to make comparisons—over time, across different geographic areas, and across different population subgroups. For example, data users may be interested in:

- Comparing the proportion of people without health insurance in two counties.
- Comparing the child poverty rate with the poverty rate for the working-age population.
- Comparing the proportion of people who are foreign-born in a city in 2015 with the corresponding share in 2014.
- Comparing the proportion of people with college degrees from 2000 to 2015 in a state, based on data from the ACS and the 2000 Census.

When making comparisons with ACS data, note that differences in survey design, questionnaire content and design, sample size, or geography may affect comparability of estimates.

TIP: ACS data users interested in making comparisons also need to pay attention to sampling error because differences between estimates may, or may not, be statistically significant.

This section describes some of the key considerations for data users making comparisons with ACS data. The U.S. Census Bureau also provides extensive guidance on comparing ACS data on their Web site.[13] The section on "Understanding Error and Determining Statistical Significance" includes guidance on how to calculate and interpret the statistical significance of differences between estimates.

The Census Bureau created a statistical testing tool to help data users test whether ACS estimates are statistically different from one another.[14]

Comparing ACS Data Across Geographic Areas

One of the challenges for data users is deciding how to compare geographic areas with different population sizes. Estimates for areas with fewer than 20,000 people are produced only in the form of 5-year estimates. However, for larger areas with at least 65,000 people (or 20,000 people in the case of the 1-year Supplemental Estimates) both 1-year and 5-year data are available, so data users need to choose which estimates to use.[15]

TIP: When comparing ACS estimates across different geographic areas or population subgroups, data users should avoid comparing ACS single-year estimates with ACS multiyear estimates. That is, 1-year estimates should only be compared with other 1-year estimates, and 5-year estimates should only be compared with other 5-year estimates.

For example, suppose a policymaker wanted to compare veterans' characteristics in Athens, Texas—a small city southeast of Dallas—with veterans in Houston. Although the ACS publishes annual estimates on veterans for Houston, only 5-year estimates are available for Athens. Thus, the policymaker should compare 2011–2015 ACS 5-year estimates for Athens with 2011–2015 ACS 5-year estimates for Houston, even though more recent, single-year estimates for 2015 are available for Houston.

TIP: Another option for presenting ACS data for less populated areas is to show single-year estimates for large counties in Texas and then combine the remaining counties into a state "residual" by subtracting the available single-year data from the state total. Alternatively, data users could present ACS estimates for Public Use Microdata Areas, since they meet the 65,000-population threshold required for single-year estimates and are often used as a substitute for county-level data.[16]

Comparing ACS Data Over Time

TIP: Data users are encouraged to compare ACS data over time based on nonoverlapping estimates.

When using ACS 1-year data, these comparisons are generally straightforward. Using multiyear estimates to look at trends for small populations can be challenging because they rely on pooled data for 5 years. For example, comparisons of 5-year estimates from 2010 to 2014 and 2011 to 2015 are unlikely to show much difference because four of the years overlap; both sets of estimates include the same data collected from 2011 through 2014.[17] The Census Bureau suggests comparing

[13] U.S. Census Bureau, American Community Survey (ACS), Comparing ACS Data, <www.census.gov/programs-surveys/acs/guidance/comparing-acs-data.html>.

[14] U.S. Census Bureau, American Community Survey (ACS), Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

[15] In July 2016, the Census Bureau also released a series of 1-year Supplemental Estimates—simplified versions of popular ACS tables available for geographic areas with at least 20,000 people.

[16] Although Public Use Microdata Areas typically follow county boundaries, this is not always the case, particularly in some New England states.

[17] While the interpretation of this difference is difficult, these comparisons can be made with caution. Users who are interested in comparing overlapping multiyear period estimates should refer to the section on "Understanding Error and Determining Statistical Significance" for more information.

5-year estimates that do not overlap—for example, comparing 2006–2010 ACS 5-year estimates with 2011–2015 ACS 5-year estimates. When new ACS 5-year data are released, it will be possible to update this trend, based on data from 2007–2011 and 2012–2016.

TIP: Changes to ACS questions over time may make it difficult to measure trends. For example, the Census Bureau made substantial changes to the 2008 ACS questions on labor force participation and number of weeks worked. As a result, the Census Bureau recommends using caution when comparing 2008 and later labor force data with 2007 and earlier estimates.

TIP: Data users are also encouraged to pay attention to sampling error associated with ACS data when looking at trends over time. For example, 1-year estimates for a relatively small population subgroup may vary widely from year to year because of sampling variation, obscuring an underlying trend. In this case, multiyear estimates may be useful for assessing an underlying, long-term trend.

However, because multiyear estimates have an inherent smoothing effect on trends—because of overlapping estimates from year to year—they will tend to mask rapidly developing changes.

Changes in Geography

ACS data generally reflect the geographic boundaries as of the year the data are collected. While geographic boundary changes are somewhat infrequent, they do occur, and those changes can affect a data user's ability to make comparisons over time. For example, congressional districts are redrawn every 10 years immediately following the decennial census. Congressional district data from the 2012 ACS and later years reflect the new boundaries that were drawn after the 2010 Census, while ACS data for earlier years reflect the 2000 Census boundaries. Given the major changes to district boundaries after each census, a comparison of congressional district data between 2011 and 2012 is not feasible.

ACS data are also regularly updated to reflect local changes in geographic boundaries. For example, the city of Jurupa Valley, California, incorporated in July 2011. Data for this city was first published in 2012, and has been updated each subsequent year, but data are not available for Jurupa Valley for 2011 and earlier years. The Census Bureau does not revise ACS data for previous years to reflect changes in geographic boundaries. For more information, visit the Census Bureau's Web page on Geography & ACS.[18]

Changes in Population Controls

The ACS uses a weighting methodology to ensure that ACS estimates are consistent with official Census Bureau population estimates by age, sex, race, and Hispanic origin. With each annual release of population estimates, the Population Estimates Program revises and updates the entire time series of estimates from the previous decennial census to the current year. However, ACS estimates for prior years are not revised or reweighted based on updated population estimates.

The change in the population estimates from 2009 to 2010 was particularly significant. The 2010 ACS 1-year data and 2006–2010 ACS 5-year data were controlled to population estimates that reflected the results of the 2010 Census. However, the 1-year and 5-year data for 2009 and earlier years used population estimates that were based on the 2000 Census.

TIP: Because the 2009 ACS and 2010 ACS 1-year estimates use controls that are based on different decennial census base years, data users need to use caution when making comparisons across these years. Specifically, estimates of the number of people in a given geographic area or population subgroup are not strictly comparable between these two years. However, rates and percentages—as well as monetary data, such as median income values—are generally comparable between the two periods.

Comparisons With Data From the 2000 Census and the 2010 Census

The ACS was modeled after the long form of the decennial census, and data users interested in long-term trends can, in many cases, make valid comparisons between ACS and the 2000 Census (and earlier decennial census) estimates. Census Bureau subject matter specialists have reviewed the factors that could affect differences between ACS and the 2000 Census estimates and they have determined that ACS estimates are similar to those obtained from past decennial census sample data for most areas and characteristics.

However, differences in residence rules, universes (base reference totals against which all other characteristics are compared), and reference periods between the two surveys should be considered when making these comparisons. For example, the ACS

[18] U.S. Census Bureau, American Community Survey (ACS), Geography & ACS, <www.census.gov/programs-surveys/acs/geography-acs.html>.

data are collected throughout the calendar year while the 2000 Census long form sampled the population as of April 1, 2000. Given the differences in the reference period, the two surveys may yield very different estimates for communities with large seasonal populations or those undergoing rapid change. The section on "Differences Between the ACS and the Decennial Census" provides more information about these differences.

The 2010 Census was a short-form only census so it does not include all of the detailed social, economic, and housing data available from previous censuses. However, data users can make valid comparisons between ACS estimates and basic characteristics from the 2010 Census, including age, sex, race, Hispanic origin, household relationship, and homeowner status. For basic counts of the U.S. population by age, sex, race, and Hispanic origin between censuses, data users are encouraged to use the Census Bureau's official population estimates, available on the Census Bureau's Population and Housing Unit Estimates Web site.[19]

Using Monetary Data

TIP: Data users also need to use caution in looking at trends involving income or other measures that are adjusted for inflation, such as rental costs, home values, and utility costs.

For example, to compare published monetary data for the most recent year with data from the 2010 ACS, data users need to adjust the 2010 data for inflation, based on a national-level consumer price index.

[19] U.S. Census Bureau, Population and Housing Unit Estimates, <www.census.gov/programs-surveys/popest.html>.

ACS multiyear estimates with dollar values are adjusted for inflation to the final year of the period. For example, the 2011–2015 ACS 5-year estimates are tabulated using dollars adjusted to 2015.

Note that inflation adjustment does not adjust for differences in costs of living across different geographic areas. The section on "Using Dollar-Denominated Data" provides more information on the adjustment of ACS single-year and multiyear estimates for inflation.

Additional Background Information

Geography & ACS
<www.census.gov/programs-surveys/acs/geography-acs.html>
This Web page describes changes to local geographic area boundaries, which may affect comparisons of ACS data over time.

Comparing ACS Data
<www.census.gov/programs-surveys/acs/guidance/comparing-acs-data.html>
This Web page provides guidance on making valid comparisons between the latest ACS data and ACS data from the previous year, the 2000 Census, and the 2010 Census.

Statistical Testing Tool
<www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>
The Statistical Testing Tool is a spreadsheet that tests whether ACS estimates are statistically different from one another. Simply copy or download ACS estimates and their margins of error into the tool to get instant results of statistical tests.

5. ACCESSING ACS DATA

American FactFinder (AFF) is the U.S. Census Bureau's primary tool for accessing population, housing, and economic data from the American Community Survey (ACS), the Puerto Rico Community Survey, the decennial census, and many other Census Bureau data sets.[20] AFF provides comprehensive access to pretabulated ACS data for a wide range of geographic areas, including states, cities, counties, census tracts, and block groups.

Other specialized tools, such as My Congressional District and Census Business Builder, provide users with quick and easy access to statistics for particular geographic areas and topics.[21] More advanced users also have several options to access more detailed ACS data through downloadable Summary Files, the Public Use Microdata Sample Files, or the Census Bureau's Application Programming Interface (API).[22]

Accessing ACS Data in American FactFinder

With several different options for accessing ACS data, how should you decide which tool to use? For most data users, AFF is the best place to start because it houses almost all of the ACS data tables produced by the Census Bureau. Below, you will find a brief description of the different tools that can be found on AFF, along with some guidance to help you decide which tool is right for you. Click on a tool to navigate to a search results page prefiltered for the ACS program, a product type, and a dataset. From the search results page you can further filter your results by keywords and geographic areas.

[20] U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov/>.

[21] U.S. Census Bureau, My Congressional District <www.census.gov/mycd/>; Census Business Builder (CBB) <www.census.gov/data/data-tools/cbb.html>.

[22] U.S. Census Bureau, American Community Survey (ACS), Summary File Data, <www.census.gov/programs-surveys/acs/data/summary-file.html>; American Community Survey (ACS), PUMS Data, <www.census.gov/programs-surveys/acs/data/pums.html>; Developers, <www.census.gov/developers/>.

Data Profiles: The Data Profiles are good places to start for novice data users, as they contain the most frequently requested social, economic, housing, and demographic data.[23] Each of these four subject areas is a separate profile. The Data Profiles summarize the data for a single geographic area, providing both estimates and percentages, to cover the most basic data on all ACS topics.

Geographic areas covered: All areas down to the neighborhood (census tract) level.

Why this tool may be right for you	Why you may want to consider another tool
The profiles help novice users get acquainted with ACS data tables.	The tables may not contain enough detail for your topic(s) of interest.
The profiles provide broad social, economic, housing, and demographic statistics for many levels of geography.	Data are not available for block groups.

[23] U.S. Census Bureau, American FactFinder, Data Profiles, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_product_type%3ADATA_PROFILE>.

Subject Tables: Data users interested in a particular topic (e.g., employment, education, and income) may wish to start with the Subject Tables, which provide pretabulated estimates and percentages for a wide variety of topics, often available separately by age, sex, or race/ethnicity.[24]

Geographic areas covered: All areas down to the neighborhood (census tract) level.

Why this tool may be right for you	Why you may want to consider another tool
Tables are available for most of the subjects in the ACS.	Not all topics have a corresponding Subject Table.
It provides more in-depth statistics on a particular subject than either Data Profiles or Comparison Profiles.	The tables may not contain enough detail for your topic(s) of interest.
It provides estimates and percentages for many levels of geography.	Data are not available for block groups.

Detailed Tables: The Detailed Tables are designed for advanced data users or those who want access to the most comprehensive ACS tables.[25] Detailed Tables are also available for download through the ACS Summary File on the Census Bureau's File Transfer Protocol (FTP) Web site.[26]

*Geographic areas covered: All areas down to the block group level.**

Why this tool may be right for you	Why you may want to consider another tool
Along with the Summary Files, the Detailed Tables are the best sources for the most comprehensive ACS tables.	The tables may contain more detail than needed for your topic.
The tool covers all subjects in the ACS.	The tool does not provide percentages.
Beginning with the 2009–2013 ACS 5-year release, statistics are available for areas down to the block group level in AFF.	Block group level data prior to the 2009–2013 ACS 5-year release are not available in AFF.

* Block groups were available for the first time in American FactFinder with the 2009–2013 ACS 5-year data release. Previously, this geography level was only available in the ACS Summary File.

[24] U.S. Census Bureau, American FactFinder, Subject Tables, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_product_type%3ASUBJECT_TABLE/>.

[25] U.S. Census Bureau, American FactFinder, Detailed Tables, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_product_type%3ADETAILED_TABLE/>.

[26] U.S. Census Bureau, American Community Survey (ACS), Data via File Transfer Protocol, <www.census.gov/programs-surveys/acs/data/data-via-ftp.html>.

Supplemental Estimates: The Supplemental Estimates are simplified Detailed Tables that provide access to the most recent ACS data at a lower population threshold than the standard 1-year tables.[27]

Geographic areas covered: All areas with populations of 20,000 or more.

Why this tool may be right for you	Why you may want to consider another tool
The tables contain the most recent statistics for more geographic areas than are available from the standard 1-year data tables.	Data are not available for geographic areas with fewer than 20,000 people.
The tables include statistics on popular topics such as education, housing, and jobs.	The tables contain only a subset of all ACS topics.
	Data are not available prior to the 2014 ACS release.

Geographic Comparison Tables: Those interested in geographic comparisons for areas other than states may be interested in the Geographic Comparison Tables, which allow comparison of ACS data across a variety of geographic areas.[28]

Geographic areas covered: States, metropolitan/micropolitan statistical areas, cities, counties, congressional districts, and several other geographic areas.

Why this tool may be right for you	Why you may want to consider another tool
The tables readily compare geographic areas on a selected topic.	The tables may not contain enough detail for your topic(s) of interest.
Tables are available for most of the subjects in the ACS.	The tables do not contain data for some levels of geography.
Comparisons can be made for many levels of geography.	

[27] U.S. Census Bureau, American FactFinder, Supplemental Estimates, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_dataset%3AACS_16_SPL/>.

[28] U.S. Census Bureau, American FactFinder, Geographic Comparison Tables, <https://factfinder.census.gov/bkmk/navigation /1.0/en/d_program%3AACS/d_product_type%3AGEO_COMPARISON_TABLE/>.

Selected Population Profiles: Detailed race/ethnicity data are available through the Selected Population Profiles, which provide summary tables separately for more than 100 detailed racial, ethnic, and tribal groups.[29] Beginning with the 2007 ACS, the Selected Population Profiles also include country of birth. Selected Population Profiles are only available for 1-year estimates.

Geographic areas covered: All areas with populations of 65,000 or more.

Why this tool may be right for you	Why you may want to consider another tool
The profiles provide broad social, economic, housing, and demographic statistics for a variety of detailed race, ethnic, and tribal groups.	The profiles may not contain enough detail for your topic(s) of interest.
The profiles provide broad social, economic, housing, and demographic statistics for many levels of geography.	Data are not available for some levels of geography.

Comparison Profiles: The 5-year Comparison Profiles show data side-by-side from two different years, indicating where there is a statistically significant difference between the two sets of estimates. The 5-year Comparison Profiles first became available with the release of the 2011–2015 ACS 5-year data. The 1-year Comparison Profiles show data side-by-side for 5 years, indicating where there is a statistically significant difference between the most current year compared to 4 prior years of data.[30]

Geographic areas covered: Areas with populations of 5,000 or more. The 1-year Comparison Profiles provide estimates for populations of 65,000 or more for most available geographic areas. The 5-year Comparison Profiles are available for the nation, states, counties, places, congressional districts, and metropolitan/micropolitan statistical areas with populations of 5,000 or more.

Why this tool may be right for you	Why you may want to consider another tool
The profiles help novice users get acquainted with ACS data tables.	The profiles may not contain enough detail for your topic(s) of interest.
The profiles provide broad social, economic, housing, and demographic statistics for many levels of geography.	Data are not available for some levels of geography.
The profiles show yearly data side-by-side, indicating statistical significance between sets of estimates.	

[29] U.S. Census Bureau, American FactFinder, Selected Population Profiles, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_product_type%3ASELECTED_POP_PROFILE/>.

[30] U.S. Census Bureau, American FactFinder, Comparison Profiles, <https://factfinder.census.gov/bkmk/navigation/1.0/en/d_program%3AACS/d_product_type%3ACOMPARISON_PROFILE>.

Ranking Tables: As their name implies, Ranking Tables provide state-level rankings on more than 80 key ACS variables.[31]

Geographic areas covered: Nation, 50 states, District of Columbia, and Puerto Rico.

Why this tool may be right for you	Why you may want to consider another tool
The tables readily display state rankings on the topic(s) of your choice.	Data are only available at the state level.
The tables include statistics on popular topics, such as finances, jobs, housing, age, and education.	The tables may not contain enough detail for your topic(s) of interest.

Thematic Maps: The Census Bureau's Thematic Maps provide graphical displays of selected ACS data available through AFF tables (e.g., Geographic Comparison Tables, Ranking Tables).[32] Different shades of color are used to display variations in the data across geographic areas. Data users can also highlight areas with statistically different values from a selected state, county, or metropolitan area of interest.

Creating a Thematic Map: From your Table Results page in AFF, click the Create a Map button. Select a data cell from the table that you want to map. The row and column headers corresponding to that data cell will determine the data item that will be mapped.

Why this tool may be right for you	Why you may want to consider another tool
The maps provide a visual comparison of geographic areas on a selected topic.	You prefer information in tabular format.
Maps are available for most of the subjects in the ACS.	Maps can only be displayed through selected AFF tables, which may not contain enough detail for your topic(s) of interest.
Maps are interactive and allow users to select topics of interest.	Maps cannot be displayed for some levels of geography.
Most of the maps can be shared.	Maps contain only a subset of ACS topics.

[31] U.S. Census Bureau, American Community Survey, Ranking Tables, <www.census.gov/acs/www/data/data-tables-and-tools/ranking-tables/index.php>.

[32] U.S. Census Bureau, American FactFinder, <https://factfinder.census.gov/>.

Other Specialized Tools for Accessing ACS Data

My Congressional District: My Congressional District gives users quick and easy access to selected statistics for U.S. congressional districts, based on data from the ACS and County Business Patterns database.[33]

Geographic areas covered: Current U.S. congressional districts.

Why this tool may be right for you	Why you may want to consider another tool
It contains statistics for every district.	The geography selection is limited to congressional districts.
It includes statistics on popular topics such as education, housing, and jobs.	It contains only a subset of all ACS topics.
The results page can be embedded on your Web site.	Maps cannot be displayed for some levels of geography.

My Tribal Area: My Tribal Area is a specialized tool that allows data users to easily access and view population and housing estimates for American Indian and Alaska Native areas from the ACS.[34] The tool displays tables of the latest ACS 5-year estimates for selected demographic characteristics and measures of employment, income, health insurance, housing, and education.

Geographic areas covered: American Indian and Alaska Native areas.

Why this tool may be right for you	Why you may want to consider another tool
Data are displayed for a large number of American Indian and Alaska Native areas.	It contains only a subset of all ACS topics.
The tables contain data on popular social, economic, housing, and demographic topics.	Data are only displayed for the most recent 5-year period.
The data are timely and easy to access.	Data are not available for detailed tribal groups—only tribal areas.

[33] U.S. Census Bureau, My Congressional District, <www.census.gov/mycd/>.
[34] U.S. Census Bureau, My Tribal Area, <www.census.gov/tribal/index.html>.

Census Business Builder: As its name implies, Census Business Builder is designed for users needing data (e.g., potential customers, similar businesses, and consumer spending) to help start or grow a business, or to better understand an area's business landscape.[35] The data can be used in determining potential locations for new businesses or in creating a business plan for investors.

Geographic areas covered: Custom regions built by county or groups of counties, cities/towns, ZIP codes, and neighborhoods (census tracts).

Why this tool may be right for you	Why you may want to consider another tool
You want to open a new business or expand an existing business.	The geographic selection is limited to counties, places, ZIP codes, and census tracts.
It combines ACS statistics with economic data to guide your research.	It contains only a subset of all ACS topics.
The interactive map allows you to select areas and compare their results to those of neighboring areas.	
Reports are downloadable and printable.	

QuickFacts: As its name indicates, QuickFacts provides fast, easy access to the most requested social, economic, and housing characteristics of a given state, county, city, or town.[36] QuickFacts uses data from the ACS, Population Estimates, and other databases.

Geographic areas covered: All states and counties, plus cities and towns with 5,000 or more people.

Why this tool may be right for you	Why you may want to consider another tool
The tool is easy to use—just choose your state, county, city, or town.	The geography selection is limited to state, county, city, and town.
It combines statistics from the ACS with other surveys to give a broader view of a particular geography in table, map, and chart formats.	It contains only a subset of all ACS topics.
Results can be downloaded or shared.	The ACS data shown in this tool are only for the most recent 5-year estimates.

[35] U.S. Census Bureau, Census Business Builder, <www.census.gov/data/data-tools/cbb.html>.
[36] U.S. Census Bureau, QuickFacts, <www.census.gov/quickfacts>.

Narrative Profiles: Narrative Profiles are short, analytic reports derived from the ACS 5-year estimates.[37] Covering 15 different topic areas, each Narrative Profile provides text and bar charts to display highlights of selected social, economic, housing, and demographic estimates for a selected geographic area.

Geographic areas covered: Nation, states, metropolitan/micropolitan statistical areas, counties, cities, ZIP Code Tabulation Areas, American Indian Areas/Alaska Native Areas/Hawaiian Home Lands, and neighborhoods (census tracts).

Why this tool may be right for you	Why you may want to consider another tool
The profiles provide a broad social, economic, housing, and demographic overview of a particular geographic area.	You prefer the information in tabular format.
The profiles provide not only summary text, but also colorful tables and charts to illuminate key highlights.	The profiles are only available for 5-year estimates.*
The profiles include popular topics, such as finances, jobs, housing, age, and education.	The narrative may not contain enough detail for your topic of interest.
	The profiles are only available for certain levels of geography.

* The Census Bureau discontinued the Narrative Profiles for both the 1-year and 3-year data releases. The 2012 ACS 1-year and 2010–2012 ACS 3-year Narrative Profiles are the last release in American FactFinder. Beginning with the 2008–2012 ACS 5-year data release, only 5-year Narrative Profiles are available.

OnTheMap for Emergency Management: OnTheMap for Emergency Management is a public data tool that provides an intuitive Web-based interface for accessing U.S. population and workforce statistics, in real time, for areas being affected by natural disasters.[38] The tool allows users to retrieve reports containing detailed workforce, population, and housing characteristics for areas with federally declared disasters such as the ones affected by hurricanes, floods, and wildfires.

Geographic areas covered: Block groups aggregated to approximate event boundaries.

Why this tool may be right for you	Why you may want to consider another tool
You need to access statistics for event areas in real time.	The geographic selection is limited to event areas.
It combines ACS statistics with data from other sources to give a broader view of an event area.	It contains only a subset of all ACS topics.
It has linkable maps and reports to share.	

[37] U.S. Census Bureau, American Community Survey, Narrative Profiles, <www.census.gov/acs/www/data/data-tables-and-tools/narrative-profiles/>.

[38] U.S. Census Bureau, OnTheMap for Emergency Management, <https://onthemap.ces.census.gov/em/>.

Advanced Tools for Accessing ACS Data

In addition to the products described above, the Census Bureau makes ACS data available in a variety of formats for data users interested in using more advanced statistical, geographic, database, or programming applications.

Summary Files: The ACS Summary Files are comma-delimited text files that contain all of the Detailed Tables for the ACS data releases.[39] The files are stored with only the data from the tables and without such information as the table title, description of the rows, or geographic identifiers. That information is located in other files that the user must merge with the data files to reproduce full tables. (Users can do so through such statistical packages as SAS, SPSS, or STATA.)

Geographic areas covered: All areas down to the block group level. The Summary Files are currently the only source for accessing block group data from the 2005–2009 through 2008–2012 ACS 5-year data, since those estimates are not available through AFF.

Why this tool may be right for you	Why you may want to consider another tool
Along with the Detailed Tables, the Summary Files are the best source for the most comprehensive ACS tables.	You are able to use AFF to access your table(s) of interest (particularly the Detailed Tables).
The Summary Files cover all subjects in the ACS.	The Summary Files may contain more detail than needed for your topic.
Statistics are available for areas down to the block group level.	The tool does not provide percentages.
You are a skilled programmer with access to statistical software to conduct analysis (e.g., SAS, SPSS, STATA).	

Public Use Microdata (PUMS): Data users with expertise in using statistical packages may also be interested in the Public Use Microdata Sample (PUMS) files, which contain a sample of individual records of people and households that responded to the survey (stripped of all identifying information).[40] The PUMS files permit analysis of specific population groups and custom variables that are not available through AFF. For example, PUMS data users can look at the proportion of children aged 5 to 11 living in low-income working families or the number of scientists and engineers earning more than $75,000. Data users can also combine multiple years of PUMS data to produce estimates for relatively small population subgroups (e.g., American Indian physicians).

Geographic areas covered: Nation, states, and Public Use Microdata Areas (PUMAs). PUMAs are special nonoverlapping areas that partition each state into contiguous geographic units containing no fewer than 100,000 people each.

Why this tool may be right for you	Why you may want to consider another tool
You are a skilled programmer with access to statistical software to conduct analysis (e.g., SAS, SPSS, STATA).	Your table of interest is already pretabulated in AFF.
You need to create a custom table that is not available on AFF.	The PUMS geography selection is limited to the nation, states, and PUMAs.
You want to access a sample of actual ACS responses for the nation, a state, or a PUMA.	

[39] U.S. Census Bureau, American Community Survey (ACS), Summary File Data, <www.census.gov/programs-surveys/acs/data/summary-file.html>.

[40] U.S. Census Bureau, American Community Survey (ACS), PUMS Data, <www.census.gov/programs-surveys/acs/data/pums.html>.

PUMS through **DataFerrett**: Users without access to statistical software can access the ACS PUMS through DataFerrett, a data analysis and extraction tool that allow users to develop customized tables, graphs, and maps without any additional software.[41]

Why this tool may be right for you	Why you may want to consider another tool
You do not have access to statistical software.	Your table of interest is already pretabulated in AFF.
You need to create a custom table that is not available in AFF.	You are interested in conducting more complex statistical analysis.
You want to download a subset of the variables or geographic areas available in the PUMS files.	The PUMS geography selection is limited to nation, region, division, state, and PUMAs.

Data via **FTP**: The Census Bureau produces downloadable ACS data files on the Census Bureau's File Transfer Protocol (FTP) server.[42] Files on the FTP server are intended for advanced users. The ACS directories contain a variety of data files and tables.

Why this tool may be right for you	Why you may want to consider another tool
You are a skilled programmer with access to statistical software to conduct analysis (e.g., SAS, SPSS, STATA).	Your table of interest is already pretabulated in AFF.
You need to create a custom table that is not available in AFF.	Depending on the original data source accessible through FTP, the types of available geographic areas may be limited.
You want to access a sample of actual ACS responses for the nation, a state, or a PUMA.	

Application Programming Interface (API): The Census Bureau's API allows developers to design Web and mobile apps to explore or learn more about America's changing population and economy.[43] The API lets developers customize ACS statistics into Web or mobile apps that provide users quick and easy access to an ever-increasing pool of publicly available datasets. More data sets will be added over time. Developers could use the ACS statistics available through this API to create apps that:

- Show commuting patterns for every city in America.
- Display the latest numbers on owners and renters in a particular neighborhood.
- Provide a local government a range of socioeconomic statistics on its population.

Why this tool may be right for you	Why you may want to consider another tool
You are a skilled programmer.	You just want to download data, not create an app.
You wish to create a data retrieval app for use on your own Web site or as a mobile app.	There are limited datasets available.

[41] U.S. Census Bureau, DataFerrett, <https://dataferrett.census.gov/>.
[42] U.S. Census Bureau, FTP Server, American Community Survey, <www2.census.gov/programs-surveys/acs/>.
[43] U.S. Census Bureau, Developers, <www.census.gov/developers/>.

Restricted-Use Microdata: The Census Bureau partners with various universities, research institutions, and agencies to form a nationwide network of secure Federal Statistical Research Data Centers (FSRDC).[44] At these secure centers, qualified researchers with approved projects (i.e., projects that benefit Census Bureau programs and demonstrate scientific merit) can perform statistical analysis on selected internal ACS microdata from the Census Bureau and other statistical agencies.

Why this tool may be right for you	Why you may want to consider another tool
You have data needs that cannot be met with publicly available data.	You need to submit a formal project proposal to the Census Bureau.
You are affiliated with a FSRDC.	All work must be conducted inside the secure FSRDC location. Research output is reviewed before release to ensure individual persons or businesses cannot be identified.
	You must be specially sworn to protect the confidentiality of the data you access.

Custom Tables: The Census Bureau allows users to purchase custom tabulations of ACS data.[45] However, the Census Bureau encourages all users to look at the other ACS data products available before considering such a request.

Why this tool may be right for you	Why you may want to consider another tool
You have data needs that cannot be met through publicly available data.	After initial discussions with Census Bureau staff, users must allow at least 8 weeks (and often longer) for the request to be completed.
You are not an experienced data user with programming experience.	The minimum cost for a custom tabulation is $3,000.
You are not affiliated with a Census Bureau Research Data Center.	The Census Bureau's Disclosure Review Board must review and approve all requests before work can begin.

[44] U.S. Census Bureau, Research @ Census, Restricted-Use Microdata, <www.census.gov/research/data/restricted_use_microdata.html>.
[45] U.S. Census Bureau, American Community Survey (ACS), Custom Tables, <www.census.gov/programs-surveys/acs/data/custom-tables.html>.

GIS Shapefiles and Geodatabase Files: For GIS (Geographic Information Systems) software users, the Census Bureau produces TIGER/Line shapefiles and geodatabases.[46] These products are spatial extracts from the Census Bureau's Master Address File (MAF)/TIGER database, and they contain such features as legal and statistical geographic boundary areas, roads, railroads, and rivers. The geodatabases bring together geography from the TIGER/Line shapefiles and the ACS 5-year estimates. Users can incorporate shapefiles and geodatabases into a variety of GIS software applications, where they can map ACS data.

Why this tool may be right for you	Why you may want to consider another tool
You wish to display ACS data visually.	You prefer the information in tabular format.
You are a skilled user of GIS software.	You do not have access to GIS software.
You need to create a custom map that is not available through the Census Mapping Tools (as described above in "Thematic Maps").	Your desired map can already be created through the Census Mapping Tools (as described above in "Thematic Maps").
Maps can be created for a variety of geographic areas.	

Census Flows Mapper: The Census Flows Mapper is a Web mapping application intended to provide users with a simple interface to view, save, and print county-to-county migration flows maps of the United States.[47] Data users can choose inbound, outbound, or net migration flows within the United States for counties. Data are currently available from the ACS 5-year releases.

Why this tool may be right for you	Why you may want to consider another tool
You wish to display ACS data visually.	You prefer information in tabular format.
You need to create a custom map that is not available through the Census mapping tools (as described above in "Thematic Maps").	Geography selection is limited to counties.
	It contains only a subset of all ACS topics.

Additional Background Information and Tools

How to Use American FactFinder
<https://factfinder.census.gov/help/en/index.htm#>
This Web page describes how to access data you are looking for in AFF in three easy steps. You can also receive a virtual tour of the AFF site from this page.

ACS Data and Tools
<www.census.gov/acs/www/data/data-tables-and-tools/>
This Web page provides links to all of the major tools that the Census Bureau offers for accessing ACS data.

Table and Geography Changes
<www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes.html>
This Web page provides information about changes to tables and geography for each ACS data release.

[46] U.S. Census Bureau, Geography, TIGER Products, <www.census.gov/geo/maps-data/data/tiger.html>.
[47] U.S. Census Bureau, Census Flows Mapper, <flowsmapper.geo.census.gov/>.

6. CASE STUDIES USING ACS DATA

Case Study #1: New Orleans Smoke Alarm Outreach Program

Skill Level: Intermediate
Subject: Age, Income, Poverty, Year Structure Built, Year Householder Moved Into Unit
Type of Analysis: Analyses of trends/patterns within a community
Tool(s) Used: American FactFinder, statistical software, mapping software
Author(s): Oliver Wise, Director of the Office of Performance and Accountability, City of New Orleans

As a component of its fire prevention effort, the New Orleans Fire Department (NOFD) offers free smoke alarm installation to all city residents. Initially the program was fairly passive—requiring individuals to contact the fire department to request a smoke alarm, but local leaders wondered if the program was as effective as it could be.

To answer that question, and to help guide the city's efforts in reducing fire fatalities, the Office of Performance and Accountability teamed up with the NOFD to pilot a more targeted approach to smoke alarm installation. The team developed a model to identify neighborhoods most at risk for fire fatalities. That model then helped NOFD prioritize a door-to-door effort to install free smoke alarms in homes across New Orleans.

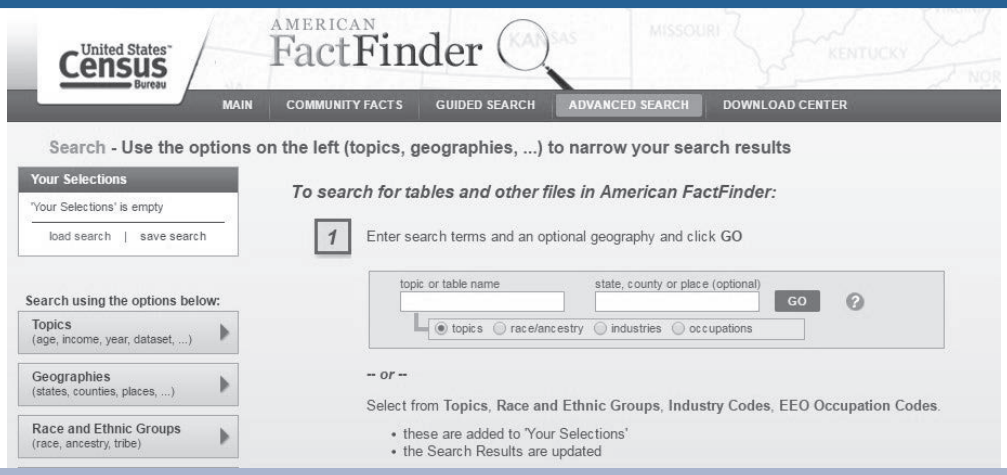
This analysis combined data from multiple sources, but would not have been possible without the American Community Survey (ACS).

The first step was to estimate the likelihood that homes in a neighborhood were missing smoke alarms. From the American Housing Survey (AHS), the research team identified three key factors associated with lack of a smoke alarm: the age of the structure, the length of time the householder has lived in the structure, and the household's ratio of income to the poverty level. However, AHS data are only available for relatively large areas. (Parishes, the equivalent of counties in other states, are the smallest reported geographies in Louisiana.) NOFD needed a smaller spatial scale for targeted outreach. The ACS filled that local data requirement because ACS data are available at a small neighborhood scale. For this project, we used block group data from the 2009–2013 ACS 5-year estimates to identify neighborhoods most at risk for lack of smoke alarms.

To produce the block-group-level analysis of smoke alarm risk, we downloaded three ACS tables from American FactFinder (AFF): B25034 (Year Structure Built), C17002 (Ratio of Income to Poverty Level in the Past 12 Months), and B25038 (Tenure by Year Householder Moved Into Unit).

- First, we went to the AFF Web site: <https://factfinder.census.gov>.
- To access the data from AFF, we chose the Advanced Search option (see Figure 6.1).

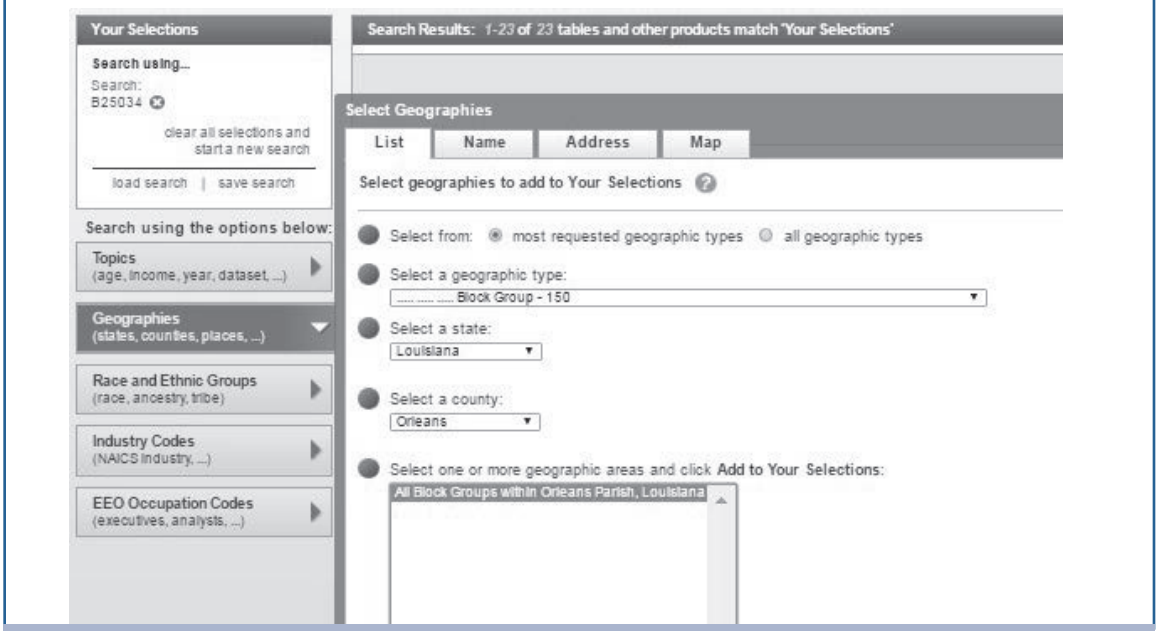
Figure 6.1. **Advanced Search in American FactFinder**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- We then selected Block Group from the "Geographies" drop-down menu and narrowed the query by selecting Louisiana as the state and Orleans as the county, or parish (see Figure 6.2).

Figure 6.2. **Selecting Geographies in American FactFinder**

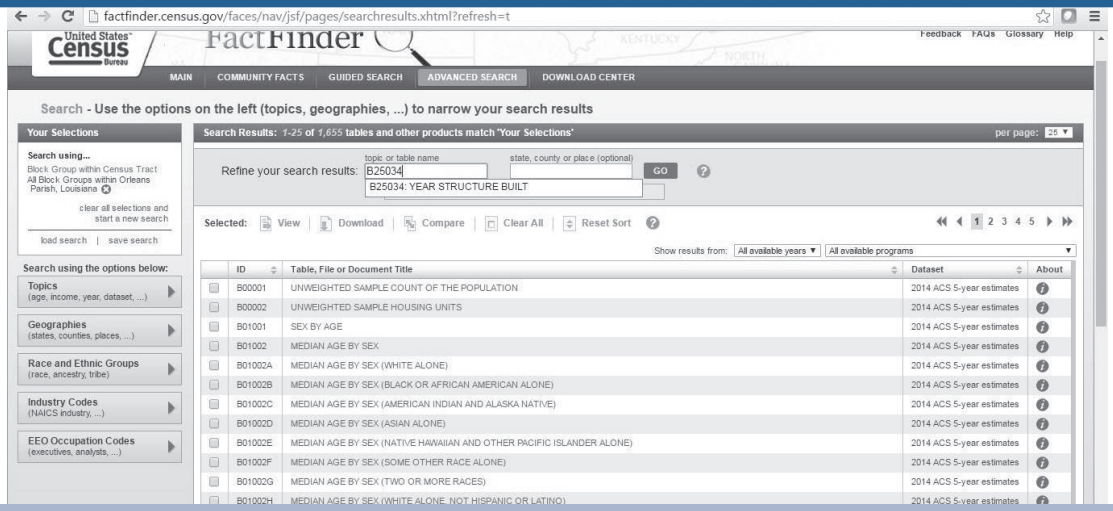


Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- Highlighting the phrase "All Block Groups within Orleans Parish, Louisiana" and then clicking "Add to Your Selections" ensures that AFF will extract data for all block groups in Orleans Parish.

- Because we knew which tables we wanted to extract for the analysis, we typed a table number into the "topic or table name" search bar in AFF and clicked "Go" (see Figure 6.3).

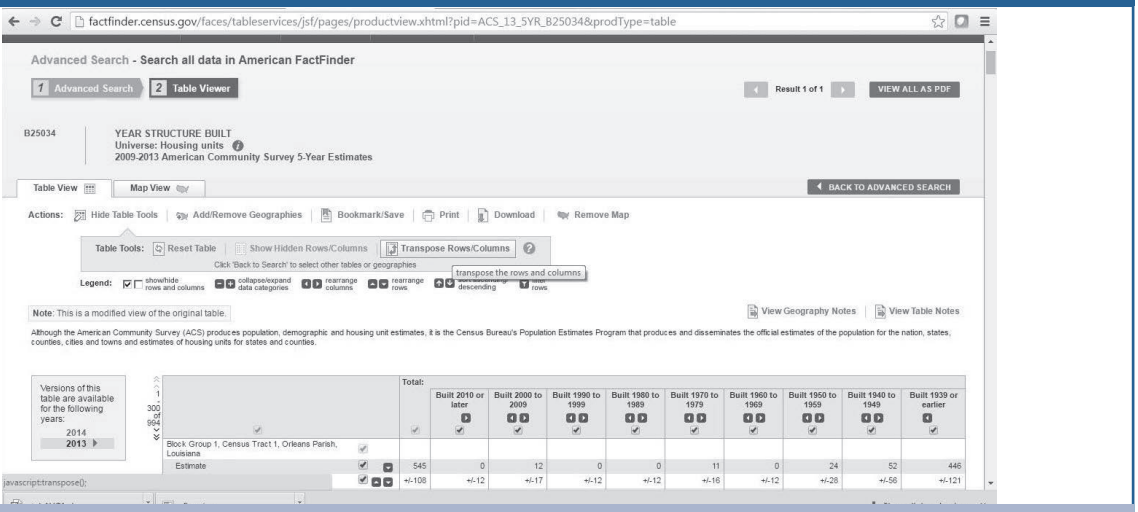
Figure 6.3. **Selecting Tables in American FactFinder**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- We then selected the year of interest (in this case the 2013 ACS 5-year data) to view the results.
- To format the data for downloading, we used the "Modify Table" option in AFF to Transpose Rows/Columns (see Figure 6.4).

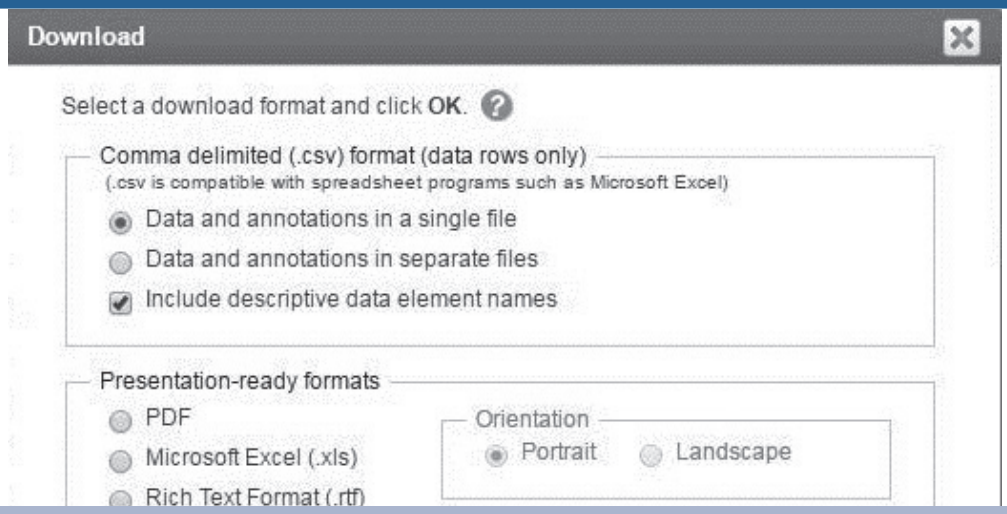
Figure 6.4. **Transposing Table Rows and Columns in American FactFinder**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- We then downloaded the data as a .csv file and repeated the process for the other two tables (see Figure 6.5).

Figure 6.5. **Downloading the Data**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

The research team then used a statistical program to aggregate the data from each table into relevant risk categories. We used data from Table C17002 to calculate the percentage of households in each block group with income below 200 percent of the federal poverty level, data from Table B25034 to identify the percentage of housing structures built before 1949, and data from Table B25038 to identify the percentage of householders who moved into their home before 2000. We then used these three indicators to assign a risk score to each block group.

It is important to note that some block groups are sparsely populated, and some have no population at all. For example, Lake Pontchartrain is probably not a relevant block group for smoke alarm outreach. To account for this, we removed large, sparsely populated (or completely unpopulated) block groups from the analysis.

The second step of the analysis was to estimate fire fatality risk. Since young children and older adults are most at risk of death in a fire, we used 2010 Census data to identify block groups with high proportions of people under the age of 5 or age 65 or older. In addition, we added fire frequency data from NOFD records for March 2009 to March 2015. Using these three pieces of information, we compiled a fire fatality risk map.

Overlaying the smoke alarm risk map—based on ACS data—with the fire fatality risk map, we were able to highlight neighborhoods where fire mortality risk was high and where homes were unlikely to have smoke alarms. NOFD used that map to begin a door-to-door campaign in high-risk neighborhoods to install smoke alarms. We estimated that the program was twice as effective as random assignment would have been for contacting households in need of smoke alarms.

Shortly after the program began, a fire occurred in one of the homes in which a smoke alarm had been installed based on the targeted installation outreach. Eleven people survived that fire because they had an early warning from the alarm.

Because the model is based on ACS data available nationwide, the analysis could be replicated—and fire safety improved—for other communities around the nation. The code for this analysis can be found online.[48] You can also view the Census Bureau's Stats in Action video to learn more about this project.[49]

[48] See <https://github.com/cno-opa/smoke-alarm-outreach>.

[49] U.S. Census Bureau, Stats in Action: New Orleans, LA: Smoke Alarm Outreach Program, 2016, <www.census.gov/library/video/2016/sia-nola-saop.html>.

Case Study #2: Atlanta Region 20-County Data Dashboard

Skill Level: Intro/intermediate
Subject: County-level demographic and socioeconomic data
Type of Analysis: Analysis and visualization of ACS data across the 20-county metro Atlanta region
Tool(s) Used: American FactFinder, Excel, data visualization tools
Author(s): Taylor Tyger, Senior Planner, Atlanta Regional Commission
Jim Skinner, Senior Principal Planner, Atlanta Regional Commission
Mike Carnathan, Division Manager, Atlanta Regional Commission

The Atlanta Regional Commission's (ARC) Research and Analytics Division uses various databases, analysis tools, and visualization programs to improve data outreach in metro Atlanta. One of those tools is the Atlanta Region 20-County Data Dashboard.[50] This data dashboard was created to provide an interactive platform for users seeking demographic and socioeconomic information at the county level. The dashboard consolidates data from various data sources into eight categorical "bins": population, employment, housing, education, health, crime, income, and forecasts. The designated "bins" were identified based on common data requests ARC receives.

We used the Census Bureau's County Population Estimates and ACS 5-year estimates to "feed" parts of the dashboard (see Table 6.1). Some of the counties for which populations are included in the dashboard are fairly small. As a result, ACS 5-year estimates must be used instead of ACS 1-year estimates. Other data sources used in the dashboard include U.S. Bureau of Labor Statistics, U.S. Department of Housing and Urban Development, Georgia Department of Public Health, Georgia Department of Education, Federal Bureau of Investigation, and Atlanta Regional Commission forecasts.

Table 6.1. **List of Variables Downloaded Through American FactFinder**

Variable	Dataset
Population	County Population Estimates
Race and ethnicity	County Population Estimates
Age	County Population Estimates
Housing tenure	ACS 5-Year Estimates
Vacancy rate	ACS 5-Year Estimates
Household composition	ACS 5-Year Estimates
School enrollment	ACS 5-Year Estimates
Educational attainment	ACS 5-Year Estimates
Median household income	ACS 5-Year Estimates
Population below poverty level	ACS 5-Year Estimates

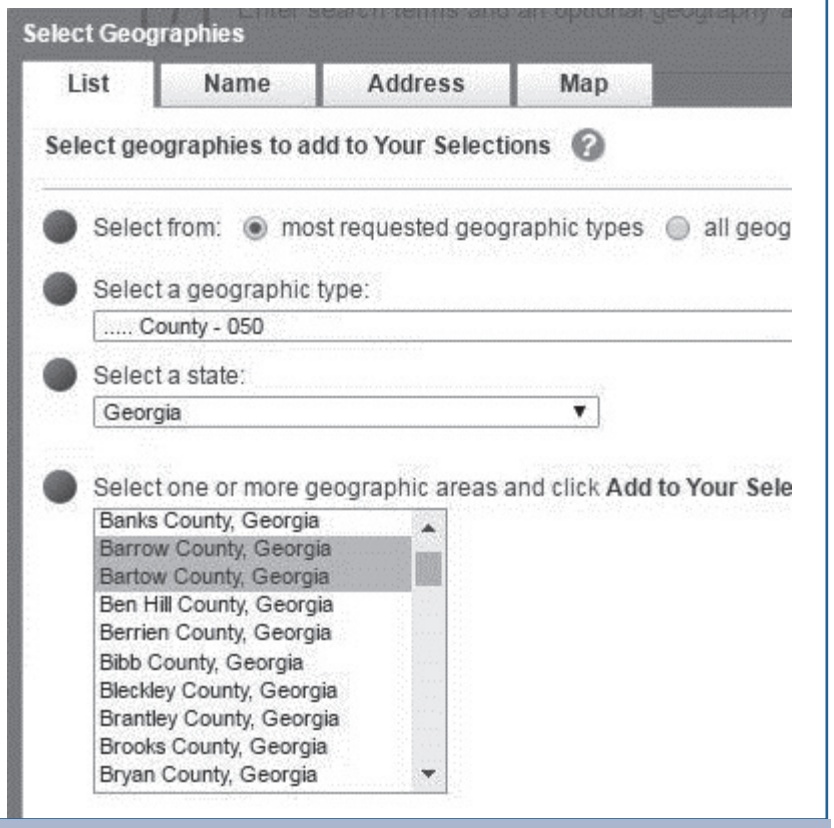
While we recognize that there is a level of uncertainty associated with ACS estimates, the margins of error are not included in the dashboard. We considered several factors in the decision not to show margins of error. First, we wanted to present the information in a concise format for data users. Second, we wanted to present information in a consistent way across measures, and several measures in the dashboard from other sources do not have margins of sampling error.

[50] Atlanta Regional Commission, 20-County Data Dashboard, <http://33n.atlantaregional.com/20-county-data-dashboard>.

To download the data, we used the AFF Advanced Search tool, as follows:

- Go to the AFF Web site at <https://factfinder.census.gov>.
- Under "Geographies," select "County" as a geographic type. Then select Georgia as the state. Holding down the CTRL key, select each of the 20 counties and then click "Add to Your Selections" (see Figure 6.6). We saved this search the first time—by clicking on the "save search" link in the "Your Selections" box—so that it could be reloaded later using the "load search" option. Reloading a saved query saves us time because it allows us to preselect the 20 counties of interest for each variable in the database.

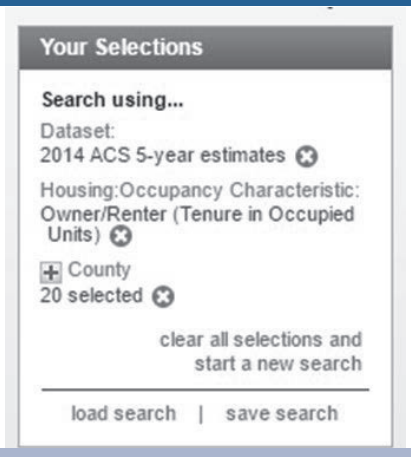
Figure 6.6. **Geography Selection in American FactFinder**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- Under "Topics," expand the "Dataset" tab, and click "2014 ACS 5-year estimates."
- Many variables in the dashboard use the ACS as the data source. For example, to find housing tenure (owner vs. renter) under "Topics," expand the "Housing" option, then expand "Occupancy Characteristic," and then select "Owner/renter." (See Figure 6.7 for an image of all the selections used.)

Figure 6.7. **Selections Used to Access the Housing Tenure Variable**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- From the results window, the table "Tenure" (B25003) is downloaded and saved (see Figure 6.8).

Figure 6.8. **American FactFinder Data Table B25003 Downloaded and Opened in Excel**

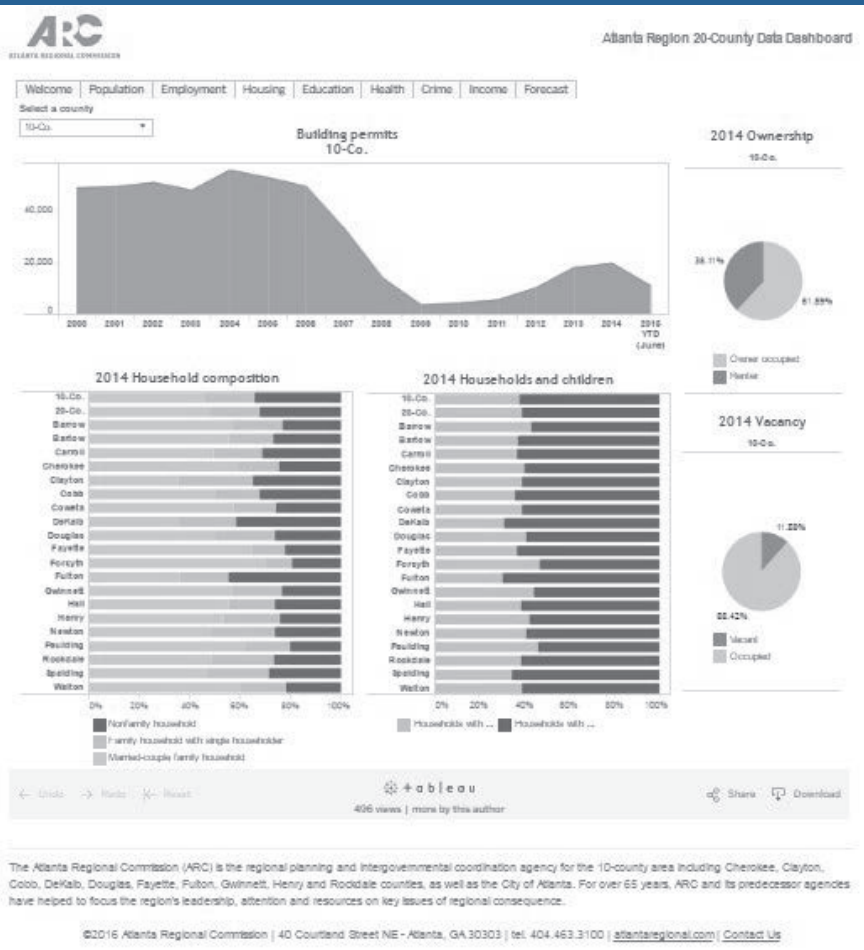
	A	B	C	D	E	F
1	GEO.id	GEO.id2	GEO.display-label	HD01_VD01	HD02_VD01	HD01_VD02
2	Id	Id2	Geography	Estimate; Total:	Margin of Error; Total:	Estimate; Total: - Owner occupied
3	0500000US13013	13013	Barrow County, Georgia	23064	482	17649
4	0500000US13015	13015	Bartow County, Georgia	35293	643	23612
5	0500000US13045	13045	Carroll County, Georgia	39610	556	25574
6	0500000US13057	13057	Cherokee County, Georgia	77654	803	60780
7	0500000US13063	13063	Clayton County, Georgia	87490	952	47133
8	0500000US13067	13067	Cobb County, Georgia	264805	1429	172044
9	0500000US13077	13077	Coweta County, Georgia	47666	524	35303
10	0500000US13089	13089	DeKalb County, Georgia	264120	1760	147784
11	0500000US13097	13097	Douglas County, Georgia	46708	706	32113
12	0500000US13113	13113	Fayette County, Georgia	38231	434	31168
13	0500000US13117	13117	Forsyth County, Georgia	59633	926	50733
14	0500000US13121	13121	Fulton County, Georgia	373005	2265	196020
15	0500000US13135	13135	Gwinnett County, Georgia	270773	1625	182874
16	0500000US13139	13139	Hall County, Georgia	61361	633	41303
17	0500000US13151	13151	Henry County, Georgia	69717	880	51500

Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

- We repeat this process for all ACS topics in the dashboard.
- Once all the variables are downloaded from AFF as tables, we process the data in a spreadsheet. In the default format, each variable table is downloaded with each of the 20 counties' identifiers in rows and then the data variables (including values and margins of error) in columns. In processing, two rows are added: a "10-county" and "20-county" summary geography. We use the 10- and 20-county definitions as references for comparing individual counties to the broader region.
- When needed, additional columns are added in order to aggregate or refine the data as downloaded. For example, we combined individual columns of age data to create an age range for the population aged 20 to 34. We also calculated percentages by downloading the "universe" of data for selected variables.
- Columns that are not needed are deleted, and the labels are edited for clarity.

An initial analysis can be done in a spreadsheet, by sorting results from highest to lowest and comparing county-level values to the 10- and 20-county reference points. However, most of the analysis and trend identification occurs in the visualization software, rather than in a spreadsheet. Figure 6.9 shows how the data are visualized in the final product.

Figure 6.9. **Atlanta Region 20-County Data Dashboard**



Source: Atlanta Regional Commission, Atlanta Region 20-County Data Dashboard, accessed at: <https://atlantaregional.org/atlanta-region/regional-data-resources/atlanta-region-20-county>.

The data dashboard is updated throughout the year as updated data become available. The dashboard can be found on the Atlanta Regional Commission Web site.[51] The tool also has its own page on the Atlanta Regional Commission's Research and Data Blog.[52]

The dashboard has been viewed more than 3,000 times and is used as a resource by internal agency coworkers, external partners, nonprofits, elected officials, and the general public. For example, within ARC, the Aging Services division uses the 20-County Data Dashboard to quickly access and summarize demographic information for clients. It has even served as a model for Aging Services to develop their own data dashboards. Local media partners have used the 20-County Data Dashboard to quickly pull data that informs their stories. In addition, Tableau showcased the 20-County Data Dashboard as a best practice example for using data visualization to improve data outreach in their Webinar "Data Driven Government."

[51] Atlanta Regional Commission, Atlanta Region 20-County Data Dashboard, <http://atlantaregional.org/atlanta-region-20-county-data-dashboard/>.

[52] Atlanta Regional Commission, 20-County Data Dashboard, <http://33n.atlantaregional.com/20-county-data-dashboard>.

Case Study #3: USDA 515 Rental Housing Maturation

Skill Level: Intro/intermediate
Subject: County-level rental housing data
Type of Analysis: Analysis and visualization of counties' affordable rental housing
Tool(s) Used: American FactFinder, spreadsheet, mapping software
Author(s): Keith Wiley, Research Associate, Housing Assistance Council

The 2010–2014 ACS 5-year data show that there are 5 million occupied rental housing units in rural areas.[53] Since its inception in 1963, the U.S. Department of Agriculture (USDA) Section 515 Rural Rental Housing loan program has financed the construction of more than 533,000 affordable rental units, and it represents an important part of this housing stock. The program has received attention recently because a growing number of these loans will begin reaching maturity and will be paid off; an estimated 6,684 loans are expected to reach maturity over the next 20 years.[54] After a loan is paid off, owners are under no obligation to maintain their properties as affordable housing and some fear many owners may no longer choose to do so.[55]

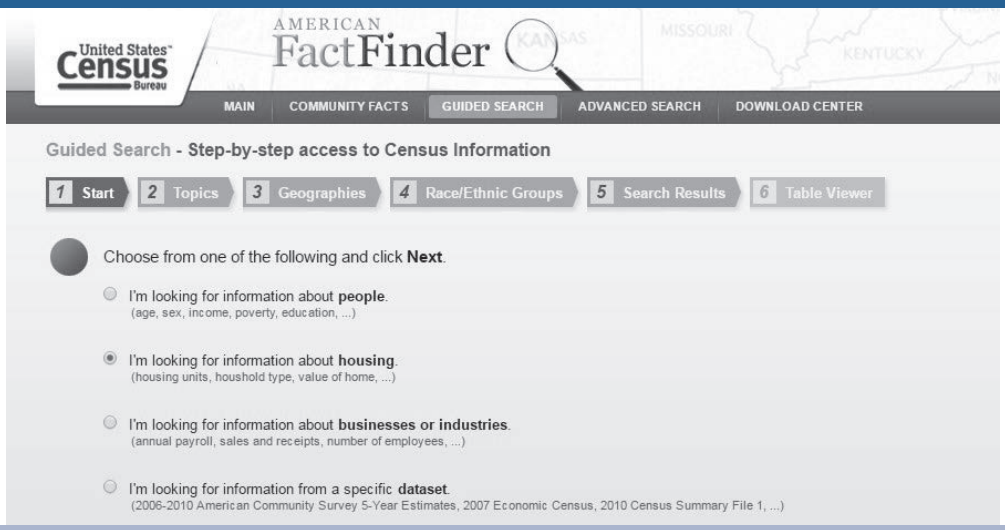
Given that the distribution of Section 515 units is not uniform across rural areas, the risk to affordable housing stocks associated with maturing loans will be greater for some areas than others. The following approach uses the 2010–2014 ACS 5-year data to identify those counties where the USDA Section 515 properties represent a relatively large portion of the overall rental housing stock. These are the areas where policymakers may want to concentrate efforts to ameliorate the potential loss of this important affordable housing option.

The Census Bureau's AFF Web site provides easy access to 2010–2014 ACS 5-year occupied-rental housing unit estimates. With these data, one can assess the role of the Section 515 program.

Steps:

- Go to the AFF Web site at: <https://factfinder.census.gov>.
- Select the "Guided Search" option, and click on "I'm looking for information about housing," which limits the search to housing characteristics. Click "Next" (see Figure 6.10).

Figure 6.10. **Guided Search in American FactFinder**



Source: U.S. Census Bureau, American FactFinder, accessed at <https://factfinder.census.gov>.

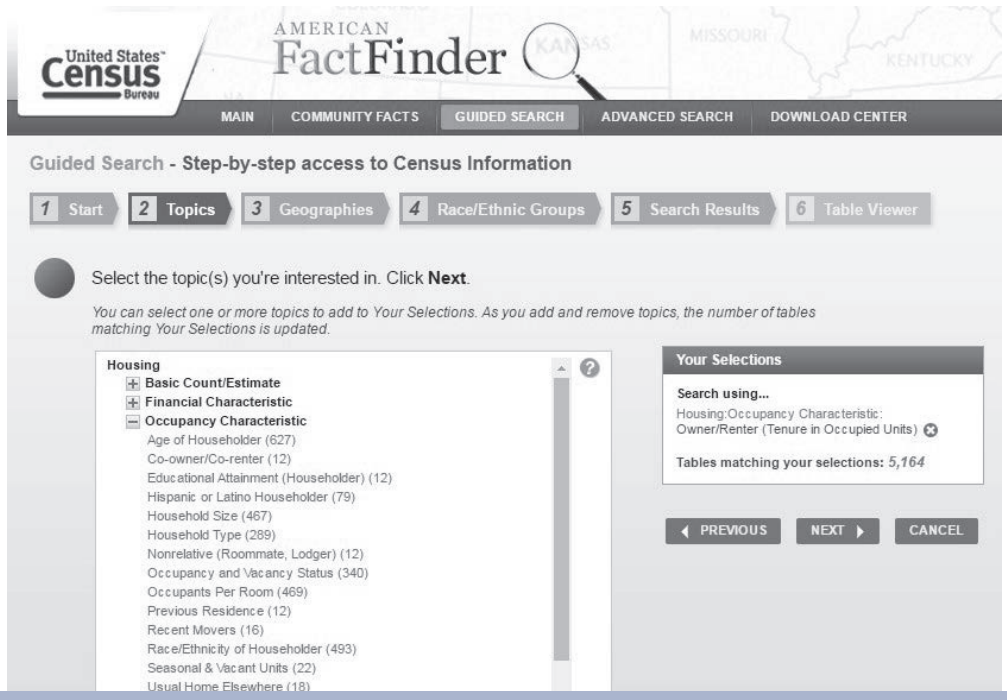
[53] In this case study, rural refers to all counties that are not part of an Office of Management and Budget defined metropolitan area using the 2013 classification.

[54] Housing Assistance Council, Rural Policy Note: Maturing USDA Rural Rental Housing Loans: An Update, 2016, <www.ruralhome.org/storage/documents/policy-notes/rpn_maturing-mortgages-usda-2016.pdf>.

[55] The New England Housing Network's June 30, 2015, letter to the U.S. Senate Appropriations Subcommittee on Agriculture, Rural Development, Food and Drug Administration, and Related Agencies exemplifies the concern raised by local housing advocates about the potential loss of Section 515 housing units. The letter, as accessed on 8/28/16, can be found at <http://housingactionnh.org/wp-content/uploads/2015/07/RD515LETTER2015.pdf>.

- Housing topics appear. Click on the "Occupancy Characteristics" since a count of renter occupied units is an occupancy measure. Then select the "Owner/Renter (Tenure in Occupied Units)" option. Click "Next" (see Figure 6.11).

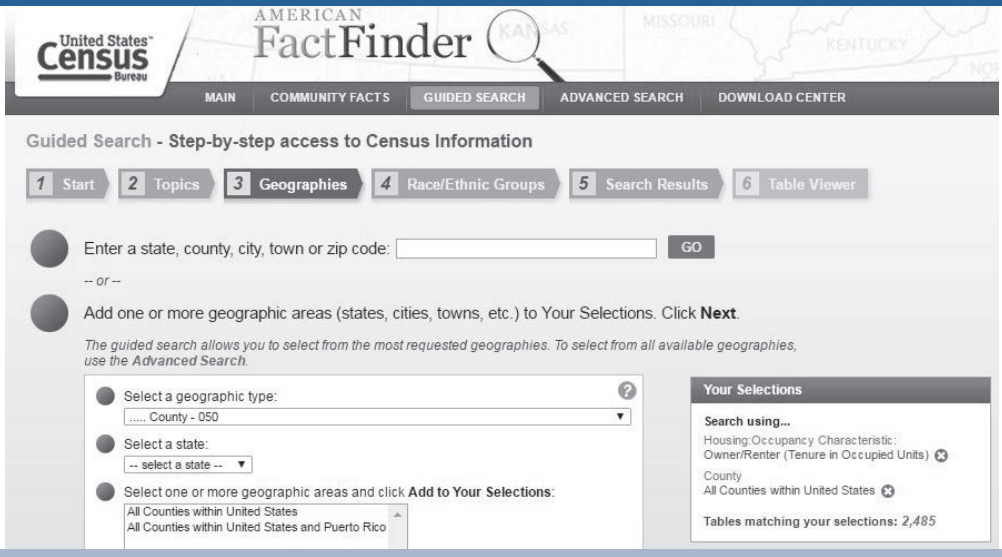
Figure 6.11. **Selecting Topics in American FactFinder Guided Search**



Source: U.S. Census Bureau, American FactFinder, Guided Search, <https://factfinder.census.gov/faces/nav/jsf/pages/guided_search.xhtml>.

- Geography options appear. Click on "Select a Geographic type:" and from the drop-down choices, select "County – 050." Additional options for choosing counties then appear. Since this is a national analysis, click on "All Counties within United States" and then "Add to Your Selections." Click "Next" (see Figure 6.12).

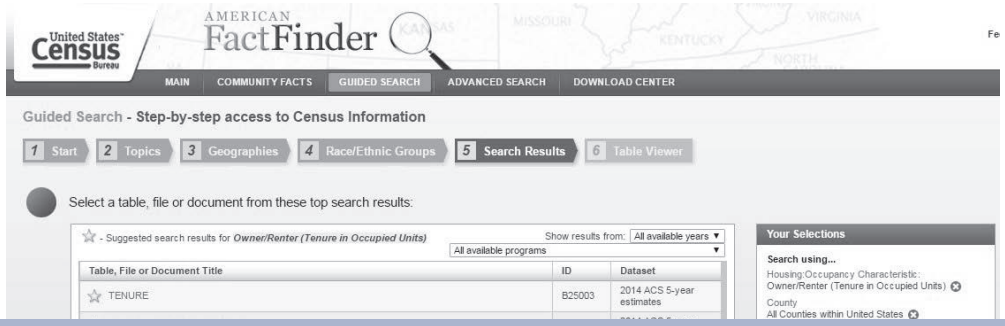
Figure 6.12. **Selecting Geographies in American FactFinder Guided Search**



Source: U.S. Census Bureau, American FactFinder, Guided Search, <https://factfinder.census.gov/faces/nav/jsf/pages/guided_search.xhtml>.

- The final option is to select data by race/ethnicity, which is not relevant here, so click on "Skip this step."
- The available data tables appear with stars highlighting the best matches. Click on the first table labeled "Tenure" (Dataset: 2014 ACS 5-year estimates). The Tenure data in table format appear for review; however, for analysis purposes the data must be downloaded. Click on the "Download" option and in the screen that pops up, leave the settings as they are, comma-delimited file elements highlighted, and click "OK."[56] A pop-up window notes when "Your file is complete." Click on the "Download" option in that window to download the zip file (see Figure 6.13).

Figure 6.13. **Results of Guided Search in American FactFinder**

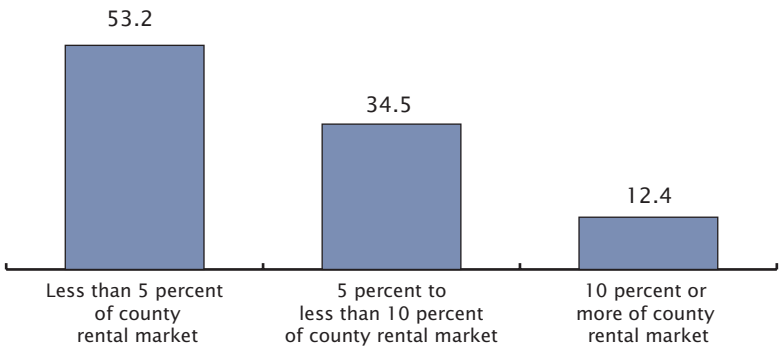


Source: U.S. Census Bureau, American FactFinder, Guided Search, <https://factfinder.census.gov/faces/nav/jsf/pages/guided_search.xhtml>.

- Clicking on the downloaded zip file will open a folder containing four files. Clicking on the file with an ending name of "with_ann.csv" will open the Tenure table in a spreadsheet.[57] The initial row can be deleted since the variables are already labeled. The data provide the user with estimates of the number of rental units in all counties.

The next step is to join the 2010–2014 ACS 5-year data with Section 515 property data, using a spreadsheet, and calculate the percentage of occupied rental units that are in the Section 515 program for each county.[58] Counties where Section 515 occupied units make up 10 percent or more of the entire occupied rental housing stock are considered most at risk as these loans mature. The potential loss of 10 percent or more of all rental housing units would be problematic for most counties. These at-risk counties are home to approximately 13 percent of USDA Section 515 properties containing 48,378 occupied units (see Figure 6.14).

Figure 6.14. **Percentage of USDA Section 515 Properties by Share of County Rental Housing Market**



Source: Analysis by the author of publicly available USDA Multi-Family Housing 515 (2014), and U.S. Census Bureau 2010–2014 American Community Survey 5-year data.

[56] There is a size limit on files that can be downloaded directly in Excel format. This request exceeds the column limits. There is no such restriction for comma delimited or CSV downloads, and they work just as well since the files also open in Excel.

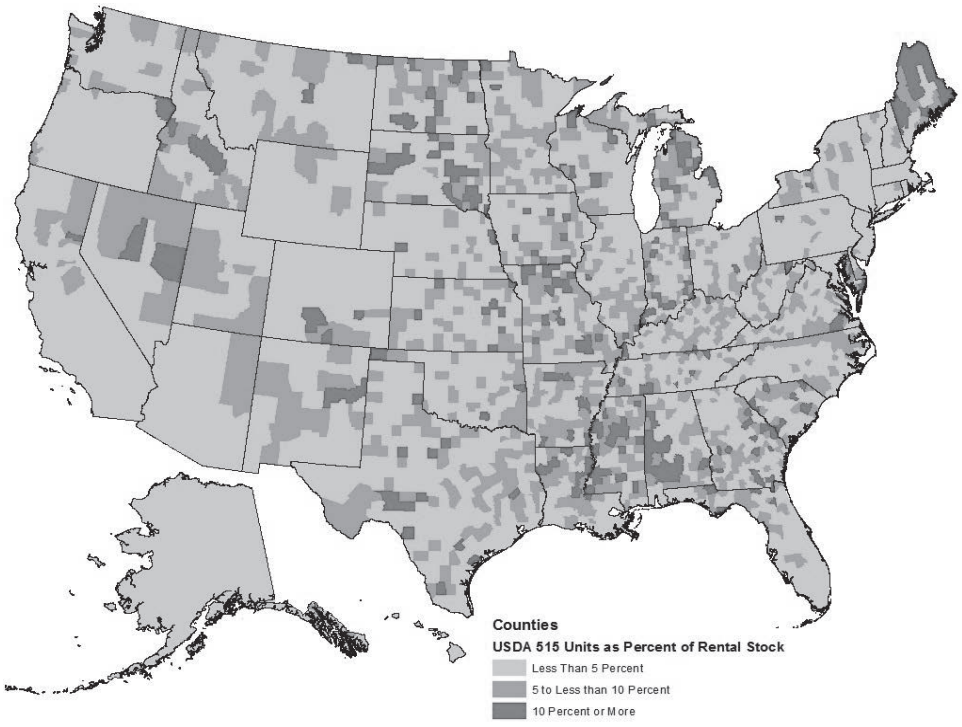
[57] The CSV file will open in Excel just fine. When saving the file, however, the user will want to specify that it will be saved in an Excel format.

[58] The USDA property data are publicly available at: <www.sc.egov.usda.gov/data/MFH.html>. This analysis involved aggregating these property data to the county level. The county-level USDA data were then linked to the ACS data using the state/county FIPS codes (labeled Id2 in ACS download data and State County FIPS Code in USDA data).

The final step is to use the data to create a map of at-risk counties across the nation (see Figure 6.15). Certain states, such as Alabama, Maine, Mississippi, and South Dakota, contain many of these counties.

Policymakers may want to monitor what occurs with these maturing loans over the next 10 to 15 years, particularly in those counties where USDA Section 515 units represent at least one in every 10 rental units. If there is a considerable amount of attrition in these affordable housing units, it would most likely be in areas with higher concentrations of Section 515 housing units. Knowing where the loss would have the greatest impact can also help policymakers decide how best to use limited resources to address any problems. This issue is difficult to address, however, because it will unfold over many years.

Figure 6.15 **USDA Section 515 Properties by Share of County Rental Housing Market**



Sources: Analysis by the author of publicly available USDA Multi-Family Housing 515 (2014), and U.S. Census Bureau, 2010–2014 American Community Survey 5-year data.

7. UNDERSTANDING ERROR AND DETERMINING STATISTICAL SIGNIFICANCE

Sources of Error

The data in American Community Survey (ACS) products are estimates of the actual figures that would have been obtained if the entire population—rather than the chosen ACS sample—had been interviewed using the same methodology. All estimates produced from sample surveys have uncertainty associated with them as a result of being based on a sample of the population rather than the full population. This uncertainty—called sampling error—means that estimates derived from the ACS will likely differ from the values that would have been obtained if the entire population had been included in the survey, as well as from values that would have been obtained had a different set of sample units been selected for the survey.

Sampling error is the difference between an estimate based on a sample and the corresponding value that would be obtained if the estimate were based on the entire population. Measures of the magnitude of sampling error reflect the variation in the estimates over all possible samples that could have been selected from the population using the same sampling methodology. The margin of error is the measure of the magnitude of sampling error provided with all published ACS estimates.

In addition to sampling error, data users should recognize that other types of error—called nonsampling error—might also be introduced during any of the complex operations used to collect and process ACS data. Nonsampling error can result from problems in the sampling frame or survey questionnaires, mistakes in how the data are reported or coded, issues related to data processing or weighting, or problems related to interviewer bias or nonresponse bias. Nonresponse bias results when survey respondents differ in meaningful ways from nonrespondents. Nonsampling error may affect ACS data by increasing the variability of the estimates or introducing bias into ACS results. The U.S. Census Bureau tries to minimize nonsampling error through extensive research and evaluation of sampling techniques, questionnaire design, and data collection and processing procedures.

Nonsampling error is very difficult to measure directly, but the Census Bureau provides a number of indirect measures to help inform users about the quality of ACS estimates. The section on "Measures of Nonsampling Error" includes a more detailed description of the different types of nonsampling error in the ACS and measures of ACS data quality. More information on ACS data quality measures for the nation and individual states is available on the Census Bureau's Web page on Sample Size and Data Quality.[59]

Measures of Sampling Error

Margins of Error and Confidence Intervals

A margin of error (MOE) describes the precision of an ACS estimate at a given level of confidence. The confidence level associated with the MOE indicates the likelihood that the ACS sample estimate is within a certain range (the MOE) of the population value. The MOEs for published ACS estimates are provided at a 90 percent confidence level. From these MOEs, data users can easily calculate 90 percent confidence intervals that define a range expected to contain the *true* or population value of an estimate 90 percent of the time. For example, in the Data Profile for Selected Social Characteristics (Table DP02) for Colorado, a portion of which is shown in Table 7.1, data from the 2015 ACS 1-year estimates indicate that there were 564,757 one-person households in the state in 2015 with an MOE of 10,127. By adding and subtracting the MOE from the point estimate, we can calculate the 90 percent confidence interval for that estimate:

564,757 – 10,127 = 554,630 = Lower bound of the interval

564,757 + 10,127 = 574,884 = Upper bound of the interval

[59] U.S. Census Bureau, American Community Survey, Sample Size and Data Quality, <www.census.gov/acs/www/methodology/sample-size-and-data-quality/>.

Table 7.1. **Sample Estimates and Margins of Error in American FactFinder: 2015**

Subject	Colorado			
	Estimate	Margin of Error	Percent	Percent Margin of Error
HOUSEHOLDS BY TYPE				
Total households	2,074,735	+/-7,548	2,074,735	(X)
Family households (families)	1,331,861	+/-11,075	64.2%	+/-0.5
With own children of the householder under 18 years	597,501	+/-8,075	28.8%	+/-0.4
Married-couple family	1,038,040	+/-9,389	50.0%	+/-0.4
With own children of the householder under 18 years	435,028	+/-7,158	21.0%	+/-0.3
Male householder, no wife present, family	93,024	+/-5,026	4.5%	+/-0.2
With own children of the householder under 18 years	48,969	+/-4,185	2.4%	+/-0.2
Female householder, no husband present, family	200,797	+/-6,582	9.7%	+/-0.3
With own children of the householder under 18 years	113,504	+/-4,699	5.5%	+/-0.2
Nonfamily households	742,874	+/-10,127	35.8%	+/-0.5
Householder living alone	564,757	+/-10,127	27.2%	+/-0.5
65 years and over	182,959	+/-5,249	8.8%	+/-0.3
Households with one or more people under 18 years	657,324	+/-8,777	31.7%	+/-0.4
Households with one or more people 65 years and over	497,903	+/-4,124	24.0%	+/-0.2

Source: U.S. Census Bureau, American FactFinder, Table DP02: Selected Social Characteristics in the United States.

Therefore, we can be 90 percent confident that the true number of one-person households in Colorado in 2015 falls somewhere between 554,630 and 574,884. Put another way, if the ACS were independently conducted 100 times in 2015, sampling theory suggests that 90 times the estimate of one-person households in Colorado would fall in the given confidence interval. Estimates with smaller MOEs—relative to the value of the estimate—will have narrower confidence intervals indicating that the estimate is more precise and has less sampling error associated with it.

TIP: When constructing confidence intervals from MOEs, data users should be aware of any "natural" limits on the upper and lower bounds. For example, if a population estimate is near zero, the calculated value of the lower confidence bound may be less than zero. However, a negative number of people does not make sense, so the lower confidence bound should be reported as zero instead.

For other estimates, such as income, negative values may be valid. Another natural limit would be 100 percent for the upper confidence bound of a percent estimate. Data users should always keep the context and meaning of an estimate in mind when creating and interpreting confidence intervals.

Standard Errors and Coefficients of Variation

A standard error (SE) measures the variability of an estimate due to sampling and provides the basis for calculating the MOE. The SE provides a quantitative measure of the extent to which an estimate derived from a sample can be expected to deviate from the value for the full population. SEs are needed to calculate coefficients of variation and to conduct tests of statistical significance. Data users can easily calculate the SE of an ACS estimate by dividing the positive value of its MOE by 1.645 as shown below:[60]

$$\mathrm{SE} = \frac{\mathrm{MOE}}{1.645} \tag{1}$$

Using the data in Table 7.1, the SE for the number of one-person households in Colorado in 2015 would be:

$$\frac{10{,}127}{1.645} = 6{,}156$$

[60] Data users working with ACS 1-year estimates for 2005 or earlier should divide the MOE by the value 1.65 as that was the value used to derive the published MOE from the SE in those years.

The SE for an estimate depends on the underlying variability in the population for that characteristic and the sample size used for the survey. In general, the larger the sample size, the smaller the SE of the estimates produced from the sample data. This relationship between sample size and SE is the reason that ACS estimates for less populous areas are only published using multiple years of data. Combining data from multiple ACS 1-year files increases sample size and helps to reduce SEs.

Coefficients of variation are another useful measure of sampling error. A coefficient of variation (CV) measures the *relative* amount of sampling error that is associated with a sample estimate. The CV is calculated as the ratio of the SE for an estimate to the estimate itself $(\hat{X})$ and is usually expressed as a percent:

$$\mathrm{CV} = \frac{\mathrm{SE}}{\hat{X}} * 100 \qquad (2)$$

A small CV indicates that the SE is small relative to the estimate, and a data user can be more confident that the estimate is close to the population value. The CV is also an indicator of the reliability of an estimate. When the SE of an estimate is close to the value of the estimate, the CV will be larger, indicating that the estimate has a large amount of sampling error associated with it and is not very reliable. For the example of one-person households in Colorado, the CV would be calculated as:[61]

$$\frac{6{,}156}{564{,}757} * 100 = 0.011 * 100 = 1.1\%$$

A CV of 1.1 percent indicates that the ACS estimate of one-person households in Colorado has a relatively small amount of sampling error and is quite reliable. Data users often find it easier to interpret and compare CVs across a series of ACS estimates than to interpret and compare SEs.

There are no hard-and-fast rules for determining an acceptable range of error in ACS estimates. Instead, data users must evaluate each application to determine the level of precision that is needed for an ACS estimate to be useful. For more information, visit the Census Bureau's Web page on Data Suppression.[62]

Determining Statistical Significance

One of the most important uses of ACS data is to make comparisons between estimates—across different geographic areas, different time periods, or different population subgroups. Data users may also want to compare ACS estimates with data from past decennial censuses. For any comparisons based on ACS data, it is important to take into account the sampling error associated with each estimate through the use of a statistical test for significance. This test shows whether the observed difference between estimates likely represents a true difference that exists within the full population (is statistically significant) or instead has occurred by chance because of sampling (is not statistically significant). Statistical significance means that there is strong statistical evidence that a true difference exists within the full population. Data users should not rely on overlapping confidence intervals as a test for statistical significance because this method will not always provide an accurate result.

[61] The examples provided in this section use unrounded values in their calculations, but the values displayed are rounded to three decimal places. For percentages that use a numerator or denominator from a prior example, the unrounded value is used, although the rounded value is displayed.

[62] U.S. Census Bureau, American Community Survey, Data Suppression, <www.census.gov/programs-surveys/acs/technical-documentation/data-suppression.html>.

When comparing two ACS estimates, a test for significance can be carried out by making several calculations using the estimates and their corresponding SEs. These calculations are straightforward given the published MOEs available for ACS estimates in American FactFinder (AFF) and many other Census Bureau data products. The steps to test for a statistically significant difference between two ACS estimates are as follows:

1. Calculate the SEs for the two ACS estimates using formula (1).
2. Square the resulting SE for each estimate.
3. Sum the squared SEs.
4. Calculate the square root of the sum of the squared SEs.
5. Divide the difference between the two ACS estimates by the square root of the sum of the squared SEs.
6. Compare the absolute value of the result from Step 5 with the critical value for the desired level of confidence (1.645 for 90 percent, 1.960 for 95 percent, or 2.576 for 99 percent).
7. If the absolute value of the result from Step 5 is greater than the critical value, then the difference between the two estimates can be considered statistically significant, at the level of confidence corresponding to the critical value selected in Step 6.

Algebraically, the significance test can be expressed as follows:

$$\text{If} \quad \left| \frac{\hat{X}_1 - \hat{X}_2}{\sqrt{\left[SE(\hat{X}_1)\right]^2 + \left[SE(\hat{X}_2)\right]^2}} \right| > Z_{CL} \qquad (3)$$

then the difference between estimates $\hat{X}_1$ and $\hat{X}_2$ is statistically significant at the specified confidence level (CL)

where $\hat{X}_1$ and $\hat{X}_2$ are the estimates being compared
SE_1 is the SE for estimate $\hat{X}_1$
SE_2 is the SE for estimate $\hat{X}_2$

Z_{CL} is the critical value for the desired confidence level (1.645 for 90 percent, 1.960 for 95 percent, and 2.576 for 99 percent).

The example below shows how to determine if the difference in the estimated percentage of householders age 65 or older who live alone between Florida (estimated percentage = 12.6, MOE = 0.2) and Arizona (estimated percentage = 10.5, MOE = 0.3) is statistically significant, based on 2015 ACS data. Using formula (1) above, first calculate the corresponding standard errors for Florida (0.122) and Arizona (0.182) by dividing the MOEs by 1.645. Then, using formula (3) above, calculate the test value as follows:

$$\left|\frac{\hat{X}_1 - \hat{X}_2}{\sqrt{[SE(\hat{X}_1)]^2 + [SE(\hat{X}_2)]^2}}\right| = \left|\frac{12.6 - 10.5}{\sqrt{(0.122)^2 + (0.182)^2}}\right| = \left|\frac{2.1}{\sqrt{0.015 + 0.033}}\right| =$$

$$\left|\frac{2.1}{\sqrt{0.048}}\right| = \left|\frac{2.1}{0.219}\right| = 9.581$$

Since the test value (9.581) is greater than the critical value for a confidence level of 90 percent (1.645), the difference in the percentages is statistically significant at a 90 percent confidence level. A rough interpretation of the result is that the user can be 90 percent certain that a difference exists between the percentage of householders aged 65 or older who live alone in Florida and in Arizona.

By contrast, if the corresponding estimate for Indiana (estimated percentage = 10.8, MOE = 0.2, SE = 0.122) were compared with the estimate for Arizona, formula (3) would yield:

$$\left|\frac{\hat{X}_1 - \hat{X}_2}{\sqrt{[SE(\hat{X}_1)]^2 + [SE(\hat{X}_2)]^2}}\right| = \left|\frac{10.8 - 10.5}{\sqrt{(0.122)^2 + (0.182)^2}}\right| = \left|\frac{0.3}{\sqrt{0.015 + 0.033}}\right| =$$

$$\left|\frac{0.3}{\sqrt{0.048}}\right| = \left|\frac{0.3}{0.219}\right| = 1.369$$

Since the test value (1.369) is less than the critical value for a confidence level of 90 percent (1.645), the difference in percentages is not statistically significant. A rough interpretation of the result is that the user cannot be certain to any sufficient degree that the observed difference in the estimates between Indiana and Arizona was not due to chance.

The Census Bureau has produced a Statistical Testing Tool to make it easier for ACS data users to conduct tests of statistical significance when comparing ACS estimates.[63] This tool consists of an Excel spreadsheet that will automatically calculate statistical significance when data users are comparing two ACS estimates or multiple estimates. Data users simply need to download ACS data from the Census Bureau's AFF Web site and insert the estimate and MOE into the correct columns and cells in the spreadsheet. The results are calculated automatically. The result "Yes" indicates that estimates are statistically different and the result "No" indicates the estimates are *not* statistically different.[64]

Comparisons Within the Same Time Period

Comparisons involving two estimates from the same time period (e.g., from the same year or the same 5-year period) are straightforward and can be carried out as described in the previous section as long as the areas or groups are nonoverlapping (e.g., comparing estimates for two different counties, or for two different age groups). On the other hand, if the comparison involves a large area or group and a subset of the area or group (e.g., comparing an estimate for a state with the corresponding estimate for a county within the state, or comparing an estimate for all females with the corresponding estimate for African American females) then the two estimates may not be independent. In these cases, the data user may need to use a different approach that accounts for the correlation between the estimates in performing the statistical test of significance.

[63] U.S. Census Bureau, American Community Survey (ACS), Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

[64] This tool only conducts statistical testing on the estimates keyed in by the data user for comparison within the spreadsheet, and it does not adjust the MOE when making multiple comparisons, nor incorporate a Bonferroni correction or any other method in the results of the statistical testing.

Making Comparisons With Overlapping Multiyear Estimates

TIP: When comparing estimates from two multiyear periods, ideally comparisons should be based on nonoverlapping periods (e.g., comparing estimates from 2006–2010 with estimates from 2011–2015).

The comparison of two estimates for different, but overlapping periods is challenging since the difference is driven by the nonoverlapping years. For example, when comparing the 2010–2014 ACS 5-year estimates with the 2011–2015 ACS 5-year estimates, data for 2011 through 2014 are included in both estimates. Their contribution is subtracted out when the estimate of differences is calculated. While the interpretation of this difference is difficult, these comparisons can be made with caution. Under most circumstances, the estimate of difference should not be interpreted as a reflection of change between the last 2 years.

The use of MOEs for assessing the reliability of change over time is complicated when change is being evaluated using multiyear estimates. From a technical standpoint, change over time is best evaluated with multiyear estimates that do not overlap. At the same time, many data users will not want to wait until 2019 (when 2014–2018 ACS 5-year data will be available) to evaluate change since 2009–2013. Users who need to compare two 5-year estimates of the same geography that overlap in sample years must use a different formula to calculate the SE of this difference. To account for the sample overlap, use the following approximation to the SE:

$$\mathrm{SE}\left(\widehat{\mathrm{X}}_1 - \widehat{\mathrm{X}}_2\right) \cong \sqrt{(1-\mathrm{C})}\sqrt{\left[\mathrm{SE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{SE}\left(\widehat{\mathrm{X}}_2\right)\right]^2} \qquad (4)$$

where C is the fraction of overlapping years. For example, the periods 2009–2013 and 2010–2014 overlap for 4 out of 5 years, so C=4/5=0.8. If the periods do not overlap, such as 2006–2010 and 2011–2015, then C=0.

With this SE, data users can test for the statistical significance of the difference between the two estimates using formula (3) with the modification from formula (4):

$$\sqrt{(1-\mathrm{C})}\sqrt{\left[\mathrm{SE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{SE}\left(\widehat{\mathrm{X}}_2\right)\right]^2} \text{ for } \sqrt{\left[\mathrm{SE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{SE}\left(\widehat{\mathrm{X}}_2\right)\right]^2}$$

Substitute in the denominator of formula (3) for the significance test.

The example below shows how to test for a statistically significant difference between the estimated percentages of householders aged 65 or older who lived alone in Holmes County, Florida, in 2010–2014 (estimated percentage = 13.1, MOE = 2.3, SE = 1.398) and in 2006–2010 (estimated percentage = 13.6, MOE = 2.3, SE = 1.398). In this example, only 1 of the 5 years overlaps, so C = 1/5=0.2. Using formula (3) with the modification from formula (4) yields:

$$\left|\frac{\widehat{\mathrm{X}}_1 - \widehat{\mathrm{X}}_2}{\sqrt{(1-\mathrm{C})}\sqrt{\left[\mathrm{SE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{SE}\left(\widehat{\mathrm{X}}_2\right)\right]^2}}\right| = \left|\frac{13.1 - 13.6}{\sqrt{(1-0.2)}\sqrt{(1.398)^2 + (1.398)^2}}\right| =$$

$$= \left|\frac{-0.5}{\sqrt{0.8}\sqrt{1.955 + 1.955}}\right| = \left|\frac{-0.5}{0.894 * 1.977}\right| = \left|\frac{-0.5}{1.769}\right| = 0.283$$

Since the test value (0.283) is less than the critical value for a confidence level of 90 percent (1.645), the difference in the percentages is not statistically significant at a 90 percent confidence level.

Custom (User-Derived) Estimates

In some cases, data users will need to construct custom ACS estimates by combining data across multiple geographic areas or population subgroups, or it may be necessary to derive a new percentage, proportion, or ratio from published ACS data. For example, one way to address the issue of unreliable estimates for individual census tracts or block groups is to aggregate geographic areas, yielding larger samples and more reliable estimates. In such cases, additional calculations are needed to produce MOEs and SEs, and to conduct tests of statistical significance for the derived estimates. The section on "Calculating Measures of Error for Derived Estimates" provides detailed instructions on how to make these calculations.

Advanced users who are aggregating ACS estimates can use the Census Bureau's Variance Replicate Tables to produce MOEs for selected ACS 5-year Detailed Tables.[65] Users can calculate MOEs for aggregated data by using the variance replicates. Unlike available approximation formulas, this method results in an exact MOE by incorporating the covariance. More information about the Variance Replicate Tables is available in the section on "Calculating Measures of Error for Derived Estimates."

Some advanced data users will also want to construct custom ACS estimates from the Census Bureau's Public Use Microdata Sample (PUMS) files. Separate instructions for calculating SEs and conducting significance tests for PUMS estimates are available on the Census Bureau's PUMS Technical Documentation Web page.[66]

It is important for data users to remember that the error measures and statistical tests described in this section do not tell us about the magnitude of nonsampling errors. More information about those types of errors is available in the section on "Measures of Nonsampling Error."

Additional Background Information and Tools

Sample Size and Data Quality

<www.census.gov/acs/www/methodology/sample-size-and-data-quality/>
This Web page describes the steps the Census Bureau takes to ensure that ACS data are accurate and reliable. It also includes several measures of ACS data quality for the nation and states.

Statistical Testing Tool

<www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>
The Statistical Testing Tool is a spreadsheet that tests whether ACS estimates are statistically different from one another. Simply copy or download ACS estimates and their MOEs into the tool to get instant results of statistical tests.

Variance Replicate Tables

<www.census.gov/programs-surveys/acs/data/variance-tables.html>
Variance replicate estimate tables include estimates, MOEs, and 80 variance replicates for selected ACS 5-year Detailed Tables. The tables are intended for advanced users who are aggregating ACS data within a table or across geographic areas. Unlike available approximation formulas, this method results in an exact MOE by incorporating the covariance.

[65] U.S. Census Bureau, American Community Survey (ACS), Variance Replicate Tables, <www.census.gov/programs-surveys/acs/data/variance-tables.html>.

[66] U.S. Census Bureau, American Community Survey (ACS), PUMS Technical Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/pums/documentation.html>.

8. CALCULATING MEASURES OF ERROR FOR DERIVED ESTIMATES

The U.S. Census Bureau publishes a wide range of American Community Survey (ACS) estimates through the data products provided in American FactFinder (AFF) and ACS Summary Files. However, for some applications, data users may still need to construct custom ACS estimates and their associated margins of error (MOEs). For example, users may want to aggregate data across geographic areas or population subgroups, or may need to derive proportions, ratios, and percent change measures that are not provided in published ACS data products.

TIP: Data users can also aggregate data across geographic areas—or across population subgroups—to produce more reliable estimates in cases where the underlying component areas have estimates with relatively large standard errors (SEs).

When such derived estimates are generated, the user must calculate the associated MOEs. As described in the section on "Understanding Error and Determining Statistical Significance," MOEs are needed to calculate SEs and coefficients of variation (CVs) and to determine statistical significance. The steps outlined in the sections below illustrate how to calculate the MOEs for derived counts, proportions, percentages, ratios, and percent change, which can then be translated into SEs and CVs.

Calculating Measures of Error for Aggregated Count Data

Aggregating Data Across Geographic Areas

For some applications, data users may want to know the number of people with certain characteristics within a particular geographic region that is not included as a standard geographic area in ACS products. For example, a user may be interested in the number of never-married females within a tricounty area. The example below shows how to calculate the MOE, SE, and CV for such a derived estimate.

To calculate the MOE for aggregated count data:

1. Obtain the MOE of each component estimate.
2. Square the MOE of each component estimate.
3. Sum the squared MOEs.
4. Take the square root of the sum of the squared MOEs.

The result is the MOE for the aggregated count. Algebraically, the MOE for the aggregated count is calculated as:

$$\mathrm{MOE}\left(\widehat{\mathrm{X}}_1 + \widehat{\mathrm{X}}_2 + \cdots + \widehat{\mathrm{X}}_n\right) = \pm\sqrt{\left[\mathrm{MOE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{MOE}\left(\widehat{\mathrm{X}}_2\right)\right]^2 + \cdots + \left[\mathrm{MOE}\left(\widehat{\mathrm{X}}_n\right)\right]^2} \quad (1)$$

The example below shows how to calculate the MOE and SE for the estimated number of never-married females living in the three Virginia counties/independent cities that border Washington, DC (Fairfax and Arlington counties, Alexandria City) from the 2015 ACS 1-year estimates.

Table 8.1. **Data for Example 1 From Three Virginia Counties/Independent Cities: 2015**

Characteristic	Estimate	MOE
Never-married females living in Fairfax County (Component 1)	135,173	±3,860
Never-married females living in Arlington County (Component 2)	43,104	±2,642
Never-married females living in Alexandria City (Component 3)	24,842	±1,957

Source: U.S. Census Bureau, American FactFinder, Table B12001: Sex by Marital Status for the Population 15 Years and Over.

The aggregate estimate is:

$$\hat{X} = \hat{X}_{Fairfax} + \hat{X}_{Arlington} + \hat{X}_{Alexandria} = 135{,}173 + 43{,}104 + 24{,}842 = 203{,}119$$

Obtain MOEs of the component estimates:

MOE (Fairfax) = ±3,860
MOE (Arlington) = ±2,642
MOE (Alexandria) = ±1,957

Using formula (1), calculate the MOE for the aggregate estimate:

$$MOE\left(\hat{X}_1 + \hat{X}_2 + \hat{X}_3\right) = \pm\sqrt{(3{,}860)^2 + (2{,}642)^2 + (1{,}957)^2} = \pm\sqrt{25{,}709{,}613} = \pm 5{,}070$$

Thus, the derived estimate of the number of never-married females living in the three Virginia counties/independent cities that border Washington, DC, is 203,119, and the MOE for the estimate is ±5,070.

The SE of this derived estimate can be calculated from the SEs of the component estimates as follows:

1. Calculate the SE of each component estimate from its MOE using:

$$SE = \frac{MOE}{1.645} \quad (2)$$

SE (Fairfax) = 3,860 / 1.645 = 2,347
SE (Arlington) = 2,642 / 1.645 = 1,606
SE (Alexandria) = 1,957 / 1.645 = 1,190

2. Calculate the SE of the aggregate estimate:

$$SE\left(\hat{X}_1 + \hat{X}_2 + \cdots + \hat{X}_n\right) = \sqrt{\left[SE\left(\hat{X}_1\right)\right]^2 + \left[SE\left(\hat{X}_2\right)\right]^2 + \cdots + \left[SE\left(\hat{X}_n\right)\right]^2} \quad (3)$$

With the three component estimates in this example, this becomes:

$$SE\left(\hat{X}_1 + \hat{X}_2 + \hat{X}_3\right) = \sqrt{(2{,}347)^2 + (1{,}606)^2 + (1{,}190)^2} = \sqrt{9{,}500{,}878} = 3{,}082$$

To assess the reliability of this derived estimate, users may find it helpful to calculate the CV as follows:

$$\mathrm{CV} = \frac{\mathrm{SE}}{\mathrm{Estimate}} * 100 \tag{4}$$

$$\mathrm{CV} = \frac{3{,}082}{203{,}119} * 100 = 0.015 * 100 = 1.5\%$$

This CV indicates that the sampling error of this estimate is very small relative to the estimate itself, so the number of never-married females residing in the Virginia tri-county area bordering Washington, DC, can be considered a very reliable estimate.

However, users should note that this method for calculating the MOE and SE for aggregated count data is an approximation, and caution is warranted because this method does not consider the correlation or covariance between the component estimates. This method may result in an overestimate or underestimate of the derived estimate's SE depending on whether the component estimates are highly correlated in either a positive or negative direction. As a result, the approximated SE may not match the result from a direct calculation of the SE that does include a measure of covariance, such as the following:

$$\mathrm{SE}\left(\widehat{\mathrm{X}}_1 \pm \widehat{\mathrm{X}}_2\right) = \sqrt{\left[\mathrm{SE}\left(\widehat{\mathrm{X}}_1\right)\right]^2 + \left[\mathrm{SE}\left(\widehat{\mathrm{X}}_2\right)\right]^2 \pm 2\mathrm{cov}\left(\widehat{\mathrm{X}}_1, \widehat{\mathrm{X}}_2\right)} \tag{5}$$

Data users should also be aware that as the number of estimates involved in a sum or difference increases, the results of the approximation formula become increasingly different from the SE derived directly from the ACS microdata. Users are encouraged to work with the fewest number of estimates possible. If there are estimates involved in a sum that are controlled in the weighting, then the approximate SE can be increasingly different. Several examples are provided to demonstrate issues associated with approximating the SEs when summing large numbers of estimates together in the latest ACS Accuracy of the Data document.[67]

Aggregating Data Across Population Subgroups

For some applications, data users may wish to combine data across population subgroups, especially in ACS tables where some groups have low counts and large MOEs. Before aggregating categories in a Detailed Table to create a derived estimate, users should check to make sure there is not a collapsed version of the same table already available in AFF or the ACS Summary Files. The MOEs in the published, collapsed tables will be more accurate than those users can approximate using the methods described in this section.

The example below illustrates the results from aggregating household income categories from a Detailed Table in AFF for Loudoun County, Virginia, from the 2015 ACS 1-year estimates. Income categories are organized into three subgroups for the purpose of this example.

[67] U.S. Census Bureau, American Community Survey (ACS), Code Lists, Definitions, and Accuracy, <www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>.

Table 8.2. **Data for Example 2 From Loudoun County, Virginia: 2015**

Household Income Category	Subgroup #	Estimate	MOE	SE	CV
Less than $10,000	–	2,163	±812	494	22.8
$10,000 to $14,999	–	1,178	±504	306	26.0
$15,000 to $19,999	1	1,502	±743	452	30.1
$20,000 to $24,999	1	1,995	±722	439	22.0
$25,000 to $29,999	2	1,756	±685	416	23.7
$30,000 to $34,999	2	1,781	±631	384	21.5
$35,000 to $39,999	3	2,708	±1,007	612	22.6
$40,000 to $44,999	3	1,981	±647	393	19.9
$45,000 to $49,999	3	2,581	±996	605	23.5
$50,000 to $59,999	–	6,590	±1,109	674	10.2
$60,000 to $74,999	–	6,861	±1,288	783	11.4
$75,000 to $99,999	–	14,391	±1,810	1,100	7.6
$100,000 to $124,999	–	14,790	±1,944	1,182	8.0
$125,000 to $149,999	–	12,735	±1,341	815	6.4
$150,000 to $199,999	–	18,167	±1,890	1,149	6.3
$200,000 or more	–	29,380	±2,053	1,248	4.2

Source: U.S. Census Bureau, American FactFinder, Table B19001: Household Income in the Past 12 Months (In 2015 Inflation-Adjusted Dollars).

After calculating the SEs and CVs shown in Table 8.2, a data user might want to combine some of the household income categories in the lower end of the income distribution to reduce the CVs and create more reliable estimates. For example, the income categories in Subgroup 1 ($15,000 to $19,999 and $20,000 to $24,999) could be combined to form the first new subgroup, the two in Subgroup 2 ($25,000 to $29,999 and $30,000 to $34,999) to form a second new subgroup, and the three in Subgroup 3 ($35,000 to $39,999, $40,000 to $44,999, and $45,000 to $49,999) to form a third new subgroup. Following the same steps used to combine data across three geographic areas in Example 1, derived estimates and MOEs for the three new subgroups could be calculated as follows:

1. Aggregate counts to form new subgroup estimates:

   - Subgroup 1 ($15,000 to $24,999) = 1,502 + 1,995 = 3,497
   - Subgroup 2 ($25,000 to $34,999) = 1,756 + 1,781 = 3,537
   - Subgroup 3 ($35,000 to $49,999) = 2,708 + 1,981 + 2,581 = 7,270

2. Using formula (1), calculate MOEs for each new subgroup estimate:

$$\text{MOE (Subgroup 1)} = \pm\sqrt{(743)^2 + (722)^2} = \pm\sqrt{1{,}073{,}333} = \pm 1{,}036$$

$$\text{MOE (Subgroup 2)} = \pm\sqrt{(685)^2 + (631)^2} = \pm\sqrt{867{,}386} = \pm 931$$

$$\text{MOE (Subgroup 3)} = \pm\sqrt{(1{,}007)^2 + (647)^2 + (996)^2} = \pm\sqrt{2{,}424{,}674} = \pm 1{,}557$$

3. Calculate the SE of each new subgroup estimate using formula (2):

   - SE (Subgroup 1) = 1,036 / 1.645 = 630
   - SE (Subgroup 2) = 931 / 1.645 = 566
   - SE (Subgroup 3) = 1,557 / 1.645 = 947

4. Using formula (4), calculate the CV for each new subgroup estimate:

   - CV (Subgroup 1) = (630 / 3,497) * 100 = (0.180) * 100 = 18.0 percent
   - CV (Subgroup 2) = (566 / 3,537) * 100 = (0.160) * 100 = 16.0 percent
   - CV (Subgroup 3) = (947 / 7,270) * 100 = (0.130) * 100 = 13.0 percent

Aggregating across income categories increases the reliability of the new subgroup estimates relative to the original component estimates. For example, the CV for the $15,000 to $19,999 category is 30 percent. When this category is combined with the $20,000 to $24,999 category, the CV for the derived estimate for the new Subgroup 1 drops to 18 percent—lower than the original CV for this category by itself. Similarly, the CVs for the component estimates of Subgroup 3 range from 20 percent to 24 percent, while the CV for the derived estimate for Subgroup 3 ($35,000 to $49,999) is only 13 percent.

AFF includes a collapsed income distribution within Demographic Profile DP03 that makes it possible to assess the difference in results from the approximation method illustrated above versus a direct estimation method that accounts for covariance between the component estimates of the subgroups. The relevant portion of this AFF table, from the 2015 ACS 1-year estimates, is shown in Table 8.3 below.

Table 8.3. **Data From AFF Demographic Profile DP03 for Loudoun County, Virginia: 2015**

Household income category	Subgroup #	Estimate	MOE	SE	CV
$15,000 to $24,999	1	3,497	±1,037	630	18.0
$25,000 to $34,999	2	3,537	±973	591	16.7
$35,000 to $49,999	3	7,270	±1,554	945	13.0

Source: U.S. Census Bureau, American FactFinder, Table DP03: Selected Economic Characteristics.

While the MOEs, SEs, and CVs for new Subgroup 1 and Subgroup 3 are almost identical to those derived from the approximation method, this is not the case for new Subgroup 2. The user-derived MOE is ±931 compared with the published MOE of ±973, and the derived CV is only 16.0 percent compared with a CV of 16.7 percent based on the published MOE for Subgroup 2. The approximation method slightly underestimates the MOE and SE for Subgroup 2 because it does not account for some covariance between the two component estimates. Although the differences between the user-derived and published MOE's are small in this example, they can vary substantially in other cases, particularly for linear combinations of multiple estimates. Examples illustrating this problem are provided in the ACS Accuracy of the Data document (see section on "Issues with Approximating the Standard Error of Linear Combinations of Multiple Estimates").[68]

Calculating Measures of Error for User-Derived Proportions and Percentages

When data users create derived estimates for aggregated count data, they are often interested in calculating additional measures such as proportions and percentages. For example, the user who calculated the *number* of never-married females in the tri-county area in northern Virginia might also want to know what *proportion* of all females in this region have never been married. With proportions, the numerator is a subset of the denominator. In this case, the number of never-married females is a subset of all females. This derived proportion would be calculated as the number of never-married females aged 15 and older divided by the total number of females aged 15 and older. This proportion could also be converted to a percentage by multiplying by 100. The 2015 ACS 1-year estimates of the total number of females aged 15 and older in Fairfax County, Arlington County, and Alexandria City and their respective MOEs are shown in Table 8.4.

[68] U.S. Census Bureau, American Community Survey, Code Lists, Definitions, and Accuracy, <www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>.

Table 8.4. **Data for Example 3 From Three Virginia Counties/Independent Cities: 2015**

Characteristic	Estimate	MOE
Total females aged 15 and older living in Fairfax County (Component 1)	466,037	±391
Total females aged 15 and older living in Arlington County (Component 2)	97,360	±572
Total females aged 15 and older living in Alexandria City (Component 3)	67,101	±459

Source: U.S. Census Bureau, American FactFinder, Table B12001: Sex by Marital Status for the Population 15 Years and Over.

Using the data for never-married females from Example 1 in this section with the data in Table 8.4 yields the following:

Proportion = (Never-married females / Total females)

(203,119 / (466,037 + 97,360 + 67,101)) = (203,119 / 630,498) = 0.322

To calculate the MOE of this proportion, we need the MOEs of the numerator (203,119) and the denominator (630,498). We already calculated the MOE of the number of never-married females in Example 1 in this section as ±5,070. Using formula (1), the MOE of the denominator is calculated as:

$$\mathrm{MOE}\left(\hat{X}_1 + \hat{X}_2 + \hat{X}_3\right) = \pm\sqrt{(391)^2 + (572)^2 + (459)^2} = \pm\sqrt{690{,}746} = \pm 831$$

If we define the proportion as $\hat{P} = \hat{X}/\hat{Y}$, then the MOE of this proportion is approximated as:

$$\mathrm{MOE}\left(\hat{P}\right) = \frac{1}{\hat{Y}}\sqrt{\left[\mathrm{MOE}\left(\hat{X}\right)\right]^2 - \left(\hat{P}^2 * \left[\mathrm{MOE}\left(\hat{Y}\right)\right]^2\right)} \qquad (6)$$

However, the Census Bureau provides ACS estimates as percentages rather than proportions in American FactFinder. For this example, the proportion of never-married females (0.322) can be converted to the percentage of never-married females (32.2%) by multiplying by 100. If we define this percentage as $\hat{Q}$, then the $\mathrm{MOE}\left(\hat{Q}\right) = 100\% \times \mathrm{MOE}\left(\hat{P}\right)$.

Substituting the estimates for the numerator and denominator, and their respective MOEs in formula (6), and multiplying by 100 yields:

$$\mathrm{MOE}\left(\hat{Q}\right) = 100 * \left[\frac{1}{630{,}498}\sqrt{(5{,}070)^2 - [(0.322)^2 * (831)^2]}\right] = 0.8\%$$

Users should note that if the value under the square root is negative, then the formula for calculating the MOE of a ratio should be used instead, which substitutes a "plus" for the "minus" under the square root. Calculating MOEs for ratios is described in the next section below as formula (7).

Using formula (2), the SE of the percentage estimate of never-married females is 0.80 / 1.645 = 0.488. CVs can also be calculated for derived percentages using formula (4) and are interpreted in the same way as for derived count estimates. In this example, the CV for the percentage of never-married females is (0.488 / 32.2) * 100 = 1.5 percent, indicating that this is a very reliable estimate with a standard error that is much smaller than the estimated percentage.

Calculating Measures of Error for Derived Ratios

Ratios are used to compare two estimates where the numerator is not a subset of the denominator. For example, the data user in Example 1 may want to compare the number of never-married males in the tri-county area to the number of never-married females. To do this, the user must first obtain the component estimates and MOEs for males, and calculate the derived estimate and MOE of the number of never-married males in the tri-county area. These data, from the 2015 ACS 1-year estimates, are shown in Table 8.5 below.

Table 8.5. **Data for Example 4 From Three Virginia Counties/Independent Cities: 2015**

Characteristic	Estimate	MOE
Never-married males living in Fairfax County (Component 1)	156,720	±4,222
Never-married males living in Arlington County (Component 2)	44,613	±2,819
Never-married males living in Alexandria City (Component 3)	25,507	±2,259

Source: U.S. Census Bureau, American FactFinder, Table B12001: Sex by Marital Status for the Population 15 Years and Over.

Using the derived estimate and MOE calculated in Example 1 in this section, and the data from Table 8.5, the ratio would be calculated as:

Ratio = (Never-married males / Never-married females)

Ratio = ((156,720 + 44,613 + 25,507) / 203,119) = (226,840 / 203,119) = 1.117

This means that there were approximately 112 never-married men for every 100 never-married women living in the three Virginia counties in 2015.

Using formula (1), the MOE of the derived estimate of never-married males is calculated as:

$$\mathrm{MOE}\left(\hat{X}_1 + \hat{X}_2 + \hat{X}_3\right) = \pm\sqrt{(4{,}222)^2 + (2{,}819)^2 + (2{,}259)^2} = \pm 5{,}557$$

A ratio has a slightly different estimator for the MOE than a proportion. If $\hat{R} = \hat{X}/\hat{Y}$, where $\hat{X}$ = the number of never-married males and $\hat{Y}$ = the number of never-married females, then the MOE of this ratio is approximated as:

$$\mathrm{MOE}(\hat{R}) = \frac{1}{\hat{Y}}\sqrt{\left[\mathrm{MOE}(\hat{X})\right]^2 + \left(\hat{R}^2 * \left[\mathrm{MOE}(\hat{Y})\right]^2\right)} \qquad (7)$$

Substituting the estimates for the numerator and denominator, and their respective MOEs in this formula yields:

$$\mathrm{MOE}(\hat{R}) = \frac{1}{203{,}119}\sqrt{(5{,}557)^2 + [(1.117)^2 * (5{,}070)^2]} = 0.039$$

Using formula (2), the SE of the ratio is 0.039 / 1.645 = 0.024. Using formula (4), the CV for the ratio of never-married males to never-married females is (0.024 / 1.117) * 100 = 2.1 percent, indicating that this is a very reliable estimate with an SE that is much smaller than the value of the estimated ratio.

Calculating Measures of Error for Derived Estimates of Percent Change

One of the most important benefits of annual releases of ACS estimates is the ability it provides for data users to analyze change over time. A frequent application is to calculate the percent change from one time period to another. For example, users may want to calculate the percent change from a 2005–2009 ACS 5-year estimate to a 2010–2014 ACS 5-year estimate. Normally, the current estimate is compared with the older estimate.

If the current estimate = $\widehat{X}$ and the earlier estimate = $\widehat{Y}$, then the MOE for percent change is calculated as follows:

$$\mathrm{MOE}\left(\frac{\widehat{X}-\widehat{Y}}{\widehat{Y}}*100\right)=100*\mathrm{MOE}\left(\frac{\widehat{X}}{\widehat{Y}}-1\right)=100*\mathrm{MOE}\left(\frac{\widehat{X}}{\widehat{Y}}\right) \quad (8)$$

Formula (8) reduces to a ratio, so the ratio formula (7) described in the section above should be used to calculate the MOE. As a caveat, users should be aware that this formula does not take into account the correlation when calculating a change between two overlapping time periods. To calculate standard errors for overlapping ACS multiyear estimates see the section on "Understanding Error and Determining Statistical Significance."

Calculating Measures of Error for the Product of Two Estimates

In some instances, data users may need to derive an estimate by multiplying a published count by a published percentage. For example, a data user might be interested in the number of 1-unit detached owner-occupied housing units in a geographic area. In 2015, the number of owner-occupied housing units in the United States was 74,506,512 with an MOE of 228,238, and the percent of 1-unit detached owner-occupied housing units was 82.4 (0.824) with an MOE of 0.1 percent (0.001).[69] So, the number of 1-unit detached owner-occupied housing units was 74,506,512 * 0.824 = 61,393,366. The formula to calculate the MOE of a product is:

$$\mathrm{MOE}(\widehat{X}*\widehat{Y})=\sqrt{\left(\widehat{X}^2*\left[\mathrm{MOE}(\widehat{Y})\right]^2\right)+\left(\widehat{Y}^2*\left[\mathrm{MOE}(\widehat{X})\right]^2\right)} \quad (9)$$

Substituting the estimates and their respective MOEs in formula (9) yields:

$$\mathrm{MOE}(\widehat{X}*\widehat{Y})=$$
$$\sqrt{[(74{,}506{,}512)^2*(0.001)^2]+[(0.824)^2*(228{,}238)^2]}=\ 202{,}289$$

To obtain the lower and upper bounds of the 90 percent confidence interval around 61,393,366, add and subtract the MOE from 61,393,366. Thus, the 90 percent confidence interval for this estimate is [61,393,366 – 202,289] to [61,393,366 + 202,289] or 61,191,077 to 61,595,655. Using formula (2), the SE of the product is 202,289 / 1.645 = 122,972. Using formula (4), the coefficient of variation for this derived estimate is (122,972 / 61,393,366) * 100 = 0.2 percent, indicating that the derived estimate is very reliable.

[69] U.S. Census Bureau, ACS 1-year estimates in American FactFinder, Table S2504: Physical Housing Characteristics for Occupied Housing Units.

Calculating Measures of Error Using Variance Replicate Tables

Advanced users may be interested in the Variance Replicate Tables, first released for the 2010–2014 ACS 5-year data in July 2016.[70] These augmented ACS Detailed Tables include sets of 80 replicate estimates, which allow users to calculate measures of error for derived estimates using the same methods that are used to produce the published MOEs on AFF. These methods incorporate the covariance between estimates that the approximation formulas in this document leave out.

The Variance Replicate Tables are available for a subset of the 5-year Detailed Tables for 11 geographic summary levels, including the nation, states, counties, census tracts, and block groups. These tables will be released on an annual basis, shortly after the release of the standard 5-year data products.

Variance Replicate Documentation, including lists of tables and summary levels, is available on the Census Bureau's Web site.[71]

[70] U.S. Census Bureau, American Community Survey (ACS), Variance Replicate Tables, <www.census.gov/programs-surveys/acs/data/variance-tables.html>.

[71] U.S. Census Bureau, American Community Survey (ACS), Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.html>.

9. DIFFERENCES BETWEEN THE ACS AND THE DECENNIAL CENSUS

While the main function of the U.S. decennial census is to provide counts of people for the purpose of congressional apportionment, the primary purpose of the American Community Survey (ACS) is to measure the changing social and economic characteristics of the U.S. population—our education, housing, jobs, and more.

Every 10 years since 1790, Congress has authorized the government to conduct a national census of the U.S. population, as required by the U.S. Constitution. In every decennial census from 1940 through 2000, two questionnaires were used to collect information: a "short form" with only basic questions such as age, sex, race, and Hispanic origin; and a "long form" with the basic short-form questions plus additional questions on social, economic, and housing characteristics. Only a subset of households received the long-form questionnaire—about one in every six in 2000.

After the 2000 Census, the long form was replaced by the ACS, which continued to collect long-form-type information throughout the decade. The ACS includes not only the basic short-form questions, but also detailed questions about population and housing characteristics. It is a nationwide, continuous survey designed to provide communities with reliable and timely social, economic, housing, and demographic data every year. Since its start, the ACS has been providing a continuous stream of updated information for states and local areas, and is revolutionizing the way we use statistics to understand our communities.

There are many similarities between the ACS and the 2000 Census long form. Both data sources are based on information from samples of the population, and while there are some differences in the question wording between the ACS and the 2000 Census long form, many questions in the two forms are very similar. However, there are also important differences in residence rules, reference periods, definitions, and methods between the two data sources that can impact comparability between ACS and 2000 Census data. For detailed guidance on comparing ACS and 2000 Census data, visit the U.S. Census Bureau's Web page on Comparing ACS Data.[72]

Residence Rules and Reference Periods

The fundamentally different purposes of the ACS and the decennial census and their timing led to important differences in the choice of data collection methods.

The decennial census residence rules, which determine where people should be counted, are based on the principle of "usual residence" on April 1, in keeping with the focus of the census on the requirements of congressional apportionment and state redistricting. To accomplish this, the decennial census attempts to restrict and determine a principal place of residence on one specific date for everyone enumerated.

The ACS uses a "current residence" rule to interview people who are currently living or staying in the sample housing unit as long as their stay at that address will exceed 2 months (see Box 9.1 for more information). This method is consistent with the goal that the Census Bureau produce ACS estimates based on data collected over a period of time, rather than a single point in time. ACS 1-year estimates represent data that have been collected over a 12-month period, and 5-year estimates represent data collected over a period of 60 months.

Therefore, a key difference between the ACS and the decennial census is the overall time frame in which they are conducted. The distribution of census enumeration dates are highly clustered in March and April (when most census mail returns are received) with additional, smaller clusters seen in May and June (when nonresponse follow-up activities take place). This means that the data from the decennial census tend to describe the characteristics of the population and housing in the March through June time period (with an overrepresentation of March and April), while ACS data describe the characteristics nearly every day over the full calendar year.

The differences in the ACS and census data as a consequence of the different residence rules are most likely minimal for most areas and most characteristics. However, for certain segments of the population, the usual and current residence concepts could result in different residence decisions. Appreciable differences may occur in areas where large proportions of the total population spend several months of the year in areas that would not be considered their residence under decennial census rules. In particular, data for areas that include large beach, lake, or mountain vacation areas, or large migrant worker communities may differ appreciably between the decennial census and the ACS if populations live there for more than 2 months.

Some of the specific differences in reference periods between the ACS and 2000 Census are described on the next page. Data users should consider the potential impact of these differences when comparing ACS with 2000 Census estimates.

[72] U.S. Census Bureau, American Community Survey (ACS), Comparing ACS Data, <www.census.gov/programs-surveys/acs/guidance/comparing-acs-data.html>.

Box 9.1. ***Who Counts as a "Resident" in the ACS?***

The ACS uses the concept of "current residence" to determine who should be considered residents of sample housing units. The basic idea behind this concept is that everyone who is currently living or staying at an address for more than 2 months is considered a current resident of that address.

This means that their expected length of stay is more than 2 months, not that they have been staying in the housing unit for more than 2 months at the time when the survey is conducted. A person away from their residence for 2 months or less, whether in the United States or overseas, on a vacation or on a business trip, is considered to be a "resident" at the address, and the unit is classified as occupied and eligible for inclusion in the survey. A person away from their residence for more than 2 months is considered not to be a resident. For the ACS, if no one is determined to be a current resident in the sampled housing unit, it is classified as "vacant."

There are a few exceptions to the "2-month" rule:

People Without Another Place to Stay: Anyone staying at a residence who does not have another place to stay, even if they are at the residence for 2 months or less, are always considered current residents of the residence.

Children Away at School: Children (under college age) who are away at boarding school or summer camp for more than 2 months are always considered current residents of their parents' homes. College students' current residency is established by the 2-month rule.

Children in Joint Custody: Children who live under joint custody agreements and move between residences are always considered current residents of the sampled housing unit where they are staying at the time of the interview.

"Commuter Workers": People who stay at a residence close to work and return regularly to another residence to be with their family are always considered current residents of the family residence, not the work-related residence.

Residency in group quarters facilities is determined differently. All people residing in the selected facility at the time of interview, regardless of the length of stay, are eligible to be selected to be interviewed in the ACS.

Employment Status (Compare With Caution)

The reference periods are different because of year-round ACS data collection. The ACS reference period is the week before the respondent completed the survey or the field representative conducted the interview. Because questionnaires are mailed and field interviews are conducted throughout the year, there is a revolving reference period. For the 2000 Census, the reference period was the week before Census Day (April 1, 2000).

Income and Earnings Data (Compare With Caution)

The ACS asks for a respondent's income over the "past 12 months." For example, the 2015 ACS 1-year data reflect incomes over 2014–2015, and the 2011–2015 ACS 5-year data reflect incomes over 2010–2015. The 2000 Census, however, collected the income data for a fixed period of time—"during 1999" (the last calendar year). In a comparison study between the 2000 Census income data and the 2000 ACS, income collected in the 2000 Census was found to be about 4 percent higher than that in the 2000 ACS. For more information on the differences of income in the ACS and the 2000 Census, visit the Census Bureau's Web page on Income in the American Community Survey: Comparison to Census 2000.[73]

School Enrollment (Compare)

The ACS reference period was 3 months preceding the date of interview, while the 2000 Census reference period was any time since February 1, 2000.

[73] U.S. Census Bureau, Income in the American Community Survey: Comparisons to Census 2000,<www.census.gov/library/working-papers/2003/acs/2003_Nelson_01.html>.

Definitions

Many data items collected in both the ACS and the 2000 Census long form have slightly different definitions that could affect the comparability of the estimates for these items. Some of the specific differences in subject or variable definitions between the ACS and the 2000 Census are described below. For a comprehensive list, visit the Census Bureau's Web page on Subject Definitions.[74]

Group Quarters

The total group quarters (GQ) population in the ACS may not be comparable with the 2000 Census or 2010 Census counts because there are some GQ types that are out of scope in the ACS. These include domestic violence shelters, soup kitchens, regularly scheduled mobile food vans, targeted nonsheltered outdoor locations, crews on maritime vessels, and living quarters for victims of natural disasters. The exclusion of these GQ types from the ACS may result in a small bias in some ACS estimates to the extent that the excluded population is different from the included population. Furthermore, only a sample of GQ facilities throughout the United States and Puerto Rico are selected for the ACS. The ACS controls the GQ sample at the state level only. Therefore, for lower levels of geography, particularly when there are relatively few GQs in a geographic area, the ACS estimate of the GQ population may vary from the count from the decennial census.

Aggregate Gross Rent

Data on gross rent in the ACS should not be compared with 2000 Census gross rent data. For the 2000 Census, tables were not released for total renter-occupied units. The universe in the 2000 Census was "specified renter-occupied housing units," which excluded one-family houses on 10 acres or more, whereas the universe in the ACS is "renter-occupied housing units," thus, comparisons cannot be made between these two data sets.

Occupants Per Room

Data on occupants per room in the ACS should be compared with the 2000 Census with caution. This is due to: 1) differences in residence rules, 2) the absence of population controls used to adjust for undercoverage in the reported number of current residents in the ACS used in this measure, and 3) differences in the reported number of rooms because of changes in the rooms question between the 2007 and 2008 ACS.

Data Collection Modes

Until 2015, the Census Bureau sent all selected addresses an advance notification letter informing people living at that address that they had been selected to participate in the ACS. Shortly thereafter (for most U.S. addresses), instructions for completing the survey by Internet were mailed. Beginning in August 2015, the Census Bureau eliminated the advance notification letter and instead included instructions in the initial mail package for completing the survey by Internet or over the phone through a toll-free Telephone Questionnaire Assistance (TQA) line. If households do not respond by Internet or TQA, then a paper questionnaire is mailed to the address. In Puerto Rico and some hard-to-reach areas, only a paper questionnaire is mailed.

Until 2017, if no response was received by Internet, TQA, or mail within a month following the initial mailing, the Census Bureau followed up with a telephone interview when a telephone number was available. However, beginning in October 2017, the Census Bureau discontinued the telephone Nonresponse Followup operation because of declining response rates and increasing costs. Respondent data are still collected via telephone through the TQA operation.

If the Census Bureau is unable to get a response by Internet, mail, or TQA, then the address may be selected for an in-person interview. Because of the high cost per completed interview, the Census Bureau samples about one in three nonrespondent housing units for personal visit interviews. The proportion of nonresponding households selected for in-person interviews is higher in areas with lower predicted response rates. A sample of people living in group quarters facilities—such as college dorms, skilled nursing facilities, or correctional facilities—is also interviewed in person to ensure coverage of people who are not living in housing units.

Like the ACS, the primary modes of data collection in the 2000 Census and the 2010 Census were mail-out/mail-back questionnaires, telephone, and in-person visits. Unlike the ACS, enumerators for the decennial census attempted to follow up with all nonresponding households through telephone or personal interviews. Data for those who could not be contacted or who refused to participate were collected through "proxy" interviews, which means interviewers attempted to find and get a response from a knowledgeable respondent who was not a member of the household. Neither the 2000 Census nor the 2010 Census included an Internet response option, although the Census Bureau plans to provide this option in the 2020 Census.

[74] U.S. Census Bureau, American Community Survey (ACS), Code Lists, Definitions, and Accuracy, <www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>.

Sampling and Nonsampling Error

ACS data, like the data from the 2000 Census long form, are derived from a sample of the population and are therefore subject to sampling error. The 2000 Census sample—consisting of about one in six households nationwide—is larger than the 5-year aggregated ACS sample designed to replace it. Therefore, there is more sampling error associated with the ACS 5-year estimates, compared with estimates from the 2000 Census long form. However, compared with the 2000 Census, the ACS has lower levels of nonresponse error—as measured through survey response rates and item nonresponse rates. Visit the sections on "Understanding Error and Determining Statistical Significance" and "Measures of Nonsampling Error" for more information.

Additional Background Information

Design and Methodology Report
<www.census.gov/programs-surveys/acs/methodology/design-and-methodology.html>
The 2014 Design and Methodology Report contains descriptions of the basic design of the ACS and details of the full set of methods and procedures.

American Community Survey and Puerto Rico Community Survey Subject Definitions
<https://www.census.gov/programs-surveys/acs/technical-documentation/code-lists.html>
This document provides detailed definitions of population and housing variables in the ACS, as well as guidance on making comparisons with ACS data.

Comparing ACS Data
<www.census.gov/programs-surveys/acs/guidance/comparing-acs-data.html>
This Web page provides guidance on making comparisons with ACS data. It includes a link to an ACS/Census Table Comparison Tool to match ACS 5-year tables with corresponding tables from the 2000 Census.[75]

[75] U.S. Census Bureau, American Community Survey, ACS/Census Table Comparison, <www.census.gov/acs/www/guidance/comparing-acs-data/acscensus-table-lookup/>.

10. USING DOLLAR-DENOMINATED DATA

Dollar-denominated data refer to any characteristics for which inflation adjustments are used when producing annual estimates or comparing estimates across time periods. For example, income, rent, home value, and energy costs across time periods are all dollar-denominated data.

Inflation will affect the comparability of dollar-denominated data across time periods. When American Community Survey (ACS) multiyear estimates for dollar-denominated data are generated, amounts are adjusted using national Consumer Price Index (CPI) annual averages, since a regional-based CPI is not available for the entire country.

Given the potential impact of inflation on observed differences of dollar-denominated data across time periods, ACS data users should adjust for the effects of inflation. Such an adjustment will provide comparable estimates accounting for inflation. In making adjustments, the U.S. Census Bureau recommends using factors based on the All-Items CPI-U-RS (CPI Research Series).[76] Explanations follow.

Creating Single-Year Income Values

ACS income values are reported based on the amount of income received during the 12 months preceding the interview month. This is the income reference period. Since there are 12 different income reference periods throughout an interview year, 12 different income inflation adjustments are made. Monthly CPI-U-RSs are used to inflation-adjust the 12 reference period incomes to a single reference period of January through December of the interview year. Note that there are no inflation adjustments for 1-year estimates of rent, home value, or energy cost values.

Adjusting Single-Year Estimates Over Time

When comparing 1-year income, rent, home value, and energy cost value estimates from two different years, adjustments should be made as follows:

1. Obtain the All Items CPI-U-RS Annual Averages for the 2 years being compared.
2. Calculate the inflation adjustment factor as the ratio of the CPI-U-RS from the more recent year to the CPI-U-RS from the earlier year.
3. Multiply the dollar-denominated data estimated for the earlier year by the inflation adjustment factor. You can also follow this same process to calculate the corresponding margin of error of the inflation-adjusted estimate.

The inflation-adjusted estimate for the earlier year can be expressed as:

$$\widehat{X}_{Y1,Adj} = \frac{CPI_{Y2}}{CPI_{Y1}} \widehat{X}_{Y1} \qquad (1)$$

where CPI_{Y1} is the All Items CPI-U-RS Annual Average for the earlier year (Y1); CPI_{Y2} is the All Items CPI-U-RS Annual Average for the more recent year (Y2); and $\widehat{X}_{Y1}$ is the published ACS estimate for the earlier year (Y1).

The example below compares the national median value for owner-occupied mobile homes in 2014 ($38,400) and 2015 ($44,000). First adjust the 2014 median value using the 2014 All Items CPI-U-RS Annual Average (347.8) and the 2015 All Items CPI-U-RS Annual Average (348.2) as follows:

$$\widehat{X}_{2014,Adj} = \frac{348.2}{347.8} * \$38{,}400 = \$38{,}444$$

Thus, the comparison of the national median value for owner-occupied mobile homes in 2014 and 2015, in 2015 dollars, would be $38,444 (2014 inflation-adjusted to 2015 dollars) versus $44,000 (2015 dollars).

[76] U.S. Bureau of Labor Statistics, Consumer Price Index, CPI Research Series Using Current Methods (CPI-U-RS), <www.bls.gov/cpi/cpiurs.htm>.

Creating Values Used in Multiyear Estimates

Multiyear income, rent, home value, and energy cost values are created with inflation adjustments. The Census Bureau uses the All Items CPI-U-RS Annual Averages for each year in the multiyear time period to calculate a set of inflation adjustment factors. Adjustment factors for a time period are calculated as ratios of the CPI-U-RS Annual Average from the most recent year to the CPI-U-RS Annual Averages from each of the earlier years. The ACS values for each of the earlier years in the multiyear period are multiplied by the appropriate inflation adjustment factors to produce the inflation-adjusted values. These values are then used to create the multiyear estimates.

As an illustration, consider the time period 2010-2014, with hypothetical individual reference-year income values ranging from $15,000 in 2010 to $30,000 in 2014 (see Table 10.1).

Table 10.1. **Hypothetical Income Values Adjusted for Inflation: 2010–2014**

Reference Year	Income	CPI-U-RS Annual Averages	Inflation-Adjusted Income
2014	$30,000	347.8	$30,000
2013	$30,000	342.2	$30,491
2012	$25,000	337.3	$25,778
2011	$20,000	330.4	$21,053
2010	$15,000	320.3	$16,288

In this example, the multiyear income components are created from inflation-adjusted income values using the CPI-U-RS Annual Averages shown in the third column of the table. The inflation-adjusted 2013 value is the ratio of 347.8 to 342.2 applied to $30,000, which equals $30,491. The same calculation is applied to the income values from 2010 through 2012 to produce inflation-adjusted values for those years. These individual values are then used to create the multiyear estimate for the 2010-2014 time period.

Adjusting Multiyear Estimates Over Time

When comparing multiyear estimates from two different time periods, adjustments should be made as follows:

1. Obtain the latest available All Items CPI-U-RS Annual Averages for the two periods being compared.
2. Calculate the inflation adjustment factor as the ratio of the CPI-U-RS Annual Average in formula (1) from the most recent year to the CPI-U-RS in formula (1) from the earlier year.
3. Multiply the dollar-denominated estimate for the earlier time period by the inflation adjustment factor. You can also follow this same process to calculate the corresponding margin of error of the inflation-adjusted estimate.

The inflation-adjusted estimate for the earlier year can be expressed as:

$$\hat{X}_{P1,Adj} = \frac{CPI_{P2}}{CPI_{P1}} \hat{X}_{P1} \qquad (2)$$

where CPI_{P1} is the All Items CPI-U-RS Annual Average for the last year in the earlier time period (P1).

CPI_{P2} is the All Items CPI-U-RS Annual Average for the last year in the most current time period (P2).

$\hat{X}_{P1}$ is the published ACS estimate for the earlier time period (P1).

As an illustration, consider ACS multiyear estimates for the two time periods of 2005-2009 and 2010-2014. To compare the median household income for owner-occupied mobile homes in 2005-2009 ($40,800) and 2010-2014 ($39,000), first adjust the 2005-2009 median value using the 2009 All Items CPI-U-RS Annual Averages (315.2) and the 2014 All Items CPI-U-RS Annual Averages (347.8) as follows:

$$\widehat{X}_{2005-2009,Adj} = \frac{347.8}{315.2} * \$40{,}800 = \$45{,}020$$

Thus, the comparison of the national median value for owner-occupied mobile homes in 2005-2009 and 2010-2014, in 2014 dollars, would be $45,020 (2005-2009 inflation-adjusted to 2014 dollars) versus $39,000 (2010-2014, already in 2014 dollars).

Issues Associated With Inflation Adjustment

The recommended inflation adjustment uses a national-level CPI and, thus, will not reflect inflation differences that may exist across different geographic areas. In addition, since the inflation adjustment uses the All Items CPI, it will not reflect differences that may exist across characteristics such as energy and housing costs.

11. MEASURES OF NONSAMPLING ERROR

All survey estimates are subject to both sampling and nonsampling error. In the section on "Understanding Error and Determining Statistical Significance," the topic of sampling error and the various measures available for understanding the uncertainty in the estimates due to their being based on estimates derived from a sample, rather than from an entire population, are discussed. The margins of error published with American Community Survey (ACS) estimates measure only the effect of sampling error. Other errors that affect the overall accuracy of the survey estimates may occur in the course of collecting and processing the ACS and are referred to collectively as nonsampling errors.

Broadly speaking, nonsampling error refers to any error affecting a survey estimate outside of sampling error. Nonsampling error can occur in complete censuses as well as in sample surveys, and is commonly recognized as including coverage error, unit nonresponse, item nonresponse, response error, and processing error. The U.S. Census Bureau has many procedures in place designed to reduce these sources of nonsampling error and thus improve the quality of the data. More information about these procedures is available in the section on "Improving Data Quality by Reducing Nonsampling Error" on the Census Bureau's Design and Methodology Report Web page.[77]

Types of Nonsampling Error

Nonsampling error can result in both random errors and systematic errors. Of greatest concern are systematic errors. Random errors are less critical since they tend to cancel out at higher geographic levels in large samples such as the ACS.

On the other hand, systematic errors tend to accumulate over the entire sample. For example, if there is an error in the questionnaire design that negatively affects the accurate capture of respondents' answers, processing errors are created. Systematic errors often lead to a bias in the final results. Unlike sampling error and random error resulting from nonsampling error, bias caused by systematic errors cannot be reduced by increasing the sample size.

Coverage error occurs when a housing unit or person does not have a chance of selection in the sample (undercoverage), or when a housing unit or person has more than one chance of selection in the sample or is included in the sample when they should not have been (overcoverage). For example, if the frame used for the ACS did not allow the selection of newly-constructed housing units; the estimates would suffer from errors because of housing undercoverage.

The final ACS estimates are adjusted for undercoverage and overcoverage by controlling county-level estimates to independent total housing unit controls and to independent population controls by sex, age, race, and Hispanic origin, produced by the Census Bureau's Population Estimates Program. However, it is important to measure the extent of coverage adjustment by comparing the precontrolled ACS estimates to the final controlled estimates. If the extent of coverage adjustments is large, there is a greater chance that differences in characteristics of undercovered or overcovered housing units or individuals differ from those eligible to be selected. When this occurs, the ACS may not provide an accurate picture of the population before the coverage adjustment, and the population controls may not eliminate or minimize that coverage error. For more information about coverage error visit the Census Bureau's Coverage Rates Definitions Web page.[78]

However, the process of controlling ACS estimates to the official population estimates may lead to additional errors in the ACS data. The population controls used in the ACS are midyear, point-in-time population estimates based on the decennial census, which has different residence rules than the monthly samples on which ACS estimates are based. See the section on "Residence Rules and Reference Periods" for more information.

Unit nonresponse is the failure to obtain the minimum required information from a housing unit or a resident of group quarters in order for it to be considered a completed interview. Unit nonresponse means that no survey data are available for a particular sampled unit or person. For example, if no one in a sampled housing unit is available during the time frame for data collection, unit nonresponse will result.

It is important to measure unit nonresponse because it has a direct effect on the quality of the data. If the unit nonresponse rate is high, it increases the chance that the final survey estimates may contain bias, even though the ACS estimation methodology includes a nonresponse adjustment intended to control potential unit nonresponse bias. This will happen if the characteristics of nonresponding units differ from the characteristics of responding units. For more information

[77] U.S. Census Bureau, "Chapter 15: Improving Data Coverage by Reducing Non-Sampling Error," American Community Survey Design and Methodology, 2014, <www.census.gov/programs-surveys/acs/methodology/design-and-methodology.html>.

[78] U.S. Census Bureau, American Community Survey (ACS), Coverage Rate Definitions, <www.census.gov/programs-surveys/acs/methodology/sample-size-and-data-quality/coverage-rates-definitions.html>.

about unit nonresponse, visit the Census Bureau's Response Rates Definitions Web page.[79]

Item nonresponse occurs when a respondent fails to provide an answer to a required item or when the answer given is inconsistent with other information. With item nonresponse, while some responses to the survey questionnaire for the unit are provided, responses to other questions are not obtained. For example, a respondent may be unwilling to respond to a question about income, resulting in item nonresponse for that question. Another reason for item nonresponse may be a lack of understanding of a particular question by a respondent.

Information on item nonresponse allows users to judge the completeness of the data on which the survey estimates are based. Final estimates can be adversely impacted when item nonresponse is high, because bias can be introduced if the actual characteristics of the people who do not respond to a question differ from those of people who do respond to it. The ACS estimation methodology includes imputations for item nonresponse, intended to reduce the potential for item nonresponse bias. For more information about item nonresponse, visit the Census Bureau's Item Allocation Rates Definitions Web page.[80]

Response error occurs when data are reported or recorded incorrectly. Response errors may be due to the respondent, the interviewer, the questionnaire, or the survey process itself. For example, if an interviewer conducting a telephone interview incorrectly records a respondent's answer, response error results. In the same way, if the respondent fails to provide a correct response to a question, response error results. Another potential source of response error is a survey process that allows proxy responses to be obtained, wherein a knowledgeable person within the household provides responses for another person within the household who is unavailable for the interview. Even more error prone is allowing neighbors to respond.

Processing error can occur during the preparation of the final data files. For example, errors may occur if data entry of questionnaire information is incomplete or inaccurate. Coding of responses incorrectly also results in processing error. Critical reviews of edits and tabulations by subject matter experts are conducted to keep errors of this kind to a minimum.

[79] U.S. Census Bureau, American Community Survey (ACS), Response Rate Definitions, <www.census.gov/programs-surveys/acs/methodology/sample-size-and-data-quality/response-rates-definitions.html>.

[80] U.S. Census Bureau, American Community Survey (ACS), Item Allocation Rates Definitions, <www.census.gov/programs-surveys/acs/methodology/sample-size-and-data-quality/item-allocation-rates-definitions.html>.

ACS Quality Measures

Nonsampling error is extremely difficult, if not impossible, to measure directly. However, the Census Bureau has developed a number of indirect measures of nonsampling error to help inform users of the quality of the ACS estimates: sample size, coverage rates, unit response rates and nonresponse rates by reason, and item allocation rates. These measures are available on the Census Bureau's Sample Size and Data Quality Web page.[81]

Sample size measures for the ACS summarize information for the housing unit and group quarters (GQ) samples. The measures available at the state level are:[82]

- Housing Units
  - Number of initial addresses selected
  - Number of final survey interviews
- Group Quarters People (beginning with the 2006 ACS)
  - Number of initial persons selected
  - Number of final survey interviews

Sample size measures may be useful in special circumstances when determining whether to use 1-year or 5-year estimates in conjunction with estimates of the population of interest. While the coefficient of variation (CV) can be used to determine usability, as explained in the section on "Understanding Error and Determining Statistical Significance," there may be some situations where the CV is small but the user has reason to believe the sample size for a subgroup is very small and the robustness of the estimate is in question.

Coverage rates measure the ratio of ACS population or housing estimates of geographic areas or groups to the independent estimates for those areas or groups, multiplied by 100. National coverage rates are available for the total population by six race/ethnicity categories and the GQ population. Coverage rates are also available for housing units and total population by sex at both the state and national level. Low coverage rates are an indication of greater potential for coverage error in the estimates.

Unit response and nonresponse rates for housing units are available at the county, state, and national

[81] U.S. Census Bureau, American Community Survey, Sample Size and Data Quality, <www.census.gov/acs/www/methodology/sample-size-and-data-quality/>.

[82] The sample size measures for housing units (number of initial addresses selected and number of final survey interviews) and for persons in group quarters cannot be used to calculate response rates. For the housing unit sample, the number of initial addresses selected includes addresses that were determined not to identify housing units, as well as initial addresses that are subsequently subsampled out in preparation for personal visit Nonresponse Followup. Similarly, the initial sample of people in group quarters represents the expected sample size within selected group quarters prior to visiting and sampling of residents.

level by reason for nonresponse: refusal, unable to locate, no one home, temporarily absent, language problem, insufficient data, maximum contact attempts reached, and other.

A low unit response rate is an indication that there is potential for bias in the survey estimates.

Missing data for a particular question or item is called **item nonresponse**. **Item allocation** involves the use of statistical procedures to impute the values for these missing data. **Item allocation rates**—the proportions of responses allocated for an item in a given geographic area—are determined by the content edits performed on the individual raw responses and closely correspond to item nonresponse rates. Overall housing unit and person characteristic allocation rates are available at the state and national levels, which combine many different characteristics. Allocation rates for individual items are published at the state and national levels. Allocation rates for other summary levels may be calculated from the B99 series of Detailed Tables in American FactFinder.

Item allocation rates differ by state, so data users are advised to examine the allocation rates for characteristics of interest before drawing conclusions from the published estimates.

Additional Background Information

Sample Size and Data Quality
<www.census.gov/acs/www/methodology/sample-size-and-data-quality/>
The quality measures provided on this Web page illustrate the steps the Census Bureau takes to ensure that ACS data are accurate and reliable.

Design and Methodology Report
<www.census.gov/programs-surveys/acs/methodology/design-and-methodology.html>
The 2014 Design and Methodology Report contains descriptions of the basic design of the ACS and details of the full set of methods and procedures.

12. GLOSSARY

Accuracy. One of four key dimensions of survey quality. Accuracy refers to the difference between the survey estimate and the true (unknown) value. Attributes are measured in terms of sources of error (for example, coverage, sampling, nonresponse, measurement, and processing).

Allocation. A commonly used approach to imputation (a statistical procedure to fill in missing responses) is known as hot-deck allocation, which uses a statistical method to supply responses for missing or inconsistent data from responding housing units or people in the sample who are similar. Certain values, such as a person's educational attainment, are more accurate when provided from another housing unit or from a person with similar characteristics. Allocation rates measure the proportion of values that required hot-deck allocation and are an important measure of data quality.

American Community Survey (ACS). The ACS is a nationwide survey designed to provide communities a fresh look at how they are changing. The ACS replaced the decennial census long form in 2010 and thereafter by collecting long-form type information throughout the decade rather than only once every 10 years. Full national implementation of the ACS began in 2005. Questionnaires are mailed to a sample of addresses to obtain information about household residents and the housing unit itself.

The Census Bureau produces social, economic, housing, and demographic estimates from the ACS in the form of 1-year and 5-year estimates based on population thresholds. The strength of the ACS is in estimating population and housing characteristics. It produces estimates for small areas, including census tracts and block groups and population subgroups.

Although the ACS provides population and housing unit estimates, the Census Bureau's Population Estimates Program produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns, and estimates of housing units for states and counties. For 2010 and other decennial census years, the decennial census provides the official counts of population and housing units.

American FactFinder (AFF). A system for disseminating Census Bureau data on the Internet. The system offers prepackaged data and user-selected data tables and maps from the ACS and many other data sources.

Application Programming Interface (API). API is a set of programs that allows an application to interact with other applications. The Census Bureau has developed the Census API, enabling developers to design Web and mobile apps to provide quick and easy access from sets of Census Bureau statistics.

Assignment. A type of imputation (a statistical procedure to fill in missing responses), assignment involves looking at other data, as reported by the respondent, to fill in missing responses. For example, when determining sex, if a person reports giving birth to children in the past 12 months, the Census Bureau verifies that the person is female. This approach also uses data as reported by other people in the household to fill in a blank or inconsistent field. For example, if the reference person is a U.S. citizen, a biological child with a blank response to citizenship is also assumed to be a citizen.

Block Group. A statistical subdivision of a census tract, generally defined to contain between 600 and 3,000 people and between 240 and 1,200 housing units, and the smallest geographic unit for which the Census Bureau tabulates sample data. A subdivision of a census tract (or, before 2000, a block numbering area), a block group is a cluster of blocks having the same first digit of their four-digit identifying number within a census tract.

Census Geography. A collective term referring to the types of geographic areas used by the Census Bureau in its data collection and tabulation operations. This Web page shows the geographic entities for which data are available from the ACS, which provides information down to the block group level.[83]

With connecting lines, the diagram in the "Geographic Hierarchy" section shows the hierarchical relationships between geographic types. For example, a line extends from states to counties because a state is comprised of many counties, and a county can never cross a state boundary.

If no line joins two geographic types, then an absolute and predictable relationship does not exist between them. For example, many places do not cross a county boundary (that is, only one county). However, some places extend over more than one county like New York City. Therefore, an absolute hierarchical relationship does not exist between counties and places, and any tabulation involving both of these geographic types may represent only a part of one county or one place.

[83] U.S. Census Bureau, American Community Survey (ACS), Concept & Definitions <www.census.gov/programs-surveys/acs/geography-acs/concepts-definitions.html>.

Census Tract. A small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for presenting data. Census tracts nest within counties and their boundaries normally follow visible features, but may follow legal geography boundaries and other nonvisible features in some instances. Census tracts ideally contain about 4,000 people and 1,600 housing units.

Coefficient of Variation (CV). The ratio of the standard error (square root of the variance) to the value being estimated, usually expressed in terms of a percentage (also known as the relative standard deviation). The lower the CV, the higher the relative reliability of the estimate.

Comparison Profiles (CP). The Comparison Profiles show ACS data side-by-side from different data releases, indicating where there is a statistically significant difference between estimates. Comparison Profiles are currently available for 1-year estimates and 5-year estimates starting with the release of the 2011–2015 ACS 5-year data. The 5-year Comparison Profiles will compare data between two nonoverlapping 5-year periods. ACS Comparison Profiles begin with the letters "CP."

Confidence Interval. The sample estimate and its margin of error permit the construction of a confidence interval that represents the degree of uncertainty about the estimate. A 90 percent confidence interval can be constructed by adding and subtracting the published margin of error from the ACS estimate. A 90 percent confidence interval can be interpreted roughly as providing 90 percent certainty that the true number falls between the upper and lower bounds.

Confidentiality. The guarantee made by law (Title 13, U.S. Code) to individuals who provide census information regarding nondisclosure of that information to others. By law, the Census Bureau cannot disclose any private information that identifies a person or a business. Under federal law, the penalty for unlawful disclosure is a federal prison sentence of up to 5 years, a fine of up to $250,000, or both.

Consumer Price Index (CPI). The CPI program of the Bureau of Labor Statistics produces monthly data on changes in the prices paid by urban consumers for a representative basket of goods and services.

Controls. During the ACS weighting process, the official county-level population and housing unit estimates are used as controls. Weights are adjusted so that ACS estimates conform to these controls (but do not necessarily exactly match). This is done to improve person and housing unit coverage and to reduce the variability of the ACS estimates.

Certain published estimates, such as total population estimates for states, do exactly match the controls. These estimates, which have five asterisks (*****) in the Margin of Error column on American FactFinder, are by definition fixed, and can be considered to have no sampling error.

Current Residence. The ACS uses a "current residence" concept to determine who should be considered a resident of a sample household. Everyone who is currently living or staying at a sample address is considered a resident of that address, except people staying there for 2 months or less. People who have established residence at the sample unit and are away for only a short period of time are also considered to be current residents.

Custom Tabulations. The Census Bureau offers a wide variety of general purpose data products from the ACS. These products are designed to meet the needs of the majority of data users and contain predefined sets of data for standard census geographic areas, including both political and statistical geographic areas. These products are available through American FactFinder and the ACS Web site.

For users with data needs not met through the general purpose products, the Census Bureau offers Custom Tables on a cost-reimbursable basis, through the ACS Custom Tabulation program.[84] Custom tables are created by tabulating data from ACS microdata files. They vary in size, complexity, and cost depending on the needs of the sponsoring client.

Data Profiles (DP). Data Profiles provide summaries of ACS data for various social, economic, housing, and demographic characteristics for the United States, regions, divisions, states, counties, county subdivisions, places, metropolitan areas, American Indian and Alaska Native areas, and other geographic areas. These profiles are similar in content to the demographic profiles from the decennial censuses. ACS Data Profiles begin with the letters "DP."

Decennial Census. The census of population and housing, taken by the Census Bureau in years ending in 0 (zero). Article I of the Constitution requires that a census be taken every 10 years for the purpose of reapportioning the U.S. House of Representatives. Title 13 of the U.S. Code provides the authorization for conducting the census in Puerto Rico and the Island Areas.

[84] U.S. Census Bureau, American Community Survey (ACS), Custom Tables, <www.census.gov/programs-surveys/acs/data/custom-tables.html>.

Derived Estimates. One of the benefits of working with ACS data is the ability to develop unique estimates called derived estimates. These derived estimates are usually based on aggregating estimates across geographic areas or population subgroups for which combined estimates are not published in American FactFinder tables (e.g., aggregate estimates for a three-county area or for four age groups not collapsed).

Detailed Tables. Detailed Tables provide access to the most comprehensive ACS data tables on all topics and geographic areas. Tables include totals and subtotals. Users may choose more than one geographic area and more than one table that display in a scrolling list, but only what displays on the width of the screen will print.

ACS Detailed Tables begin with the letters "B" for base tables and "C" for collapsed tables. The "collapsed" tables cover the same topics as the base table, but with fewer categories.

Disclosure Avoidance. Statistical methods used before releasing data products to ensure the confidentiality of responses.

Estimates. Data for the ACS are collected from a sample of housing units and used to produce estimates of the actual figures that would have been obtained by interviewing the entire population using the same methodology.

Five-Year Estimates. Estimates based on 5 years of ACS data. These estimates are meant to reflect the characteristics of a geographic area over the entire 5-year period. These estimates are published for geographic areas down to the census block group level.

File Transfer Protocol (FTP). A process that allows a user to download large census and survey files and datasets from the Census Bureau's Web site.[85]

Geographic Comparison Tables (GCT). Allow users to compare ACS data across geographic areas in the same table (e.g., all counties in a state). ACS Geographic Comparison Tables begin with the letters "GCT."

Group Quarters (GQ) Facilities. A GQ facility is a place where people live or stay that is normally owned or managed by an entity or organization providing housing and/or services for the residents. These services may include custodial or medical care, as well as other types of assistance. Residency is commonly restricted to those receiving these services. People living in GQ facilities are usually not related to one another. The ACS collects data from people living in both housing units and GQ facilities.

Group Quarters (GQ) Population. Includes all people living in group quarters instead of housing units. Group quarters are places where people live or stay, in a group living arrangement that is owned or managed by an entity or organization providing housing and/or services for the residents. The group quarters population lives in group quarters, of which there are two general categories:

Institutional group quarters are facilities that house those who are primarily ineligible, unable, or unlikely to participate in the labor force while resident. The institutionalized population is the population residing in institutional group quarters, such as adult correctional facilities, juvenile facilities, skilled-nursing facilities, and other institutional facilities such as mental (psychiatric) hospitals and in-patient hospice facilities.

Noninstitutional group quarters are facilities that house those who are primarily eligible, able, or likely to participate in the labor force while resident. The noninstitutionalized population lives in noninstitutional group quarters such as college/university student housing, military quarters, and other noninstitutional group quarters such as emergency and transitional shelters for people experiencing homelessness and group homes.

Housing Unit. A housing unit is a house, an apartment, a mobile home or trailer, a group of rooms, or a single room occupied as separate living quarters, or if vacant, intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants live separately from any other individuals in the building and which have direct access from outside the building or through a common hall. For vacant units, the criteria of separateness and direct access are applied to the intended occupants whenever possible.

Imputation. When data are missing, it is standard practice to use a statistical procedure called imputation to fill in missing responses. Imputation is the placement of one or more estimated answers into a field of data records that previously had no data or had incorrect or implausible data. There are two principal imputation methods to deal with missing or inconsistent data—assignment and allocation.

Margin of Error (MOE). The margin of error is the measure of sampling error published with each ACS estimate. A margin of error is the difference between an estimate and its upper or lower confidence bounds. Confidence bounds can be created by adding the margin of error to the estimate (for an upper bound) and subtracting the margin of error from the estimate (for a lower bound). All published margins of error for the ACS are based on a 90 percent confidence level.

[85] U.S. Census Bureau, American Community Survey (ACS), Data via FTP (File Transfer Protocol), <www.census.gov/programs-surveys/acs/data/data-via-ftp.html>.

Measurement Error. Also referred to as "response error," measurement error occurs when the response received differs from the "true" value as a result of the respondent, the interviewer, the questionnaire, the mode of collection, the respondent's record-keeping system(s), or other similar factors.

Multiyear Estimates. Three-year and five-year estimates based on multiple years of ACS data. ACS 5-year estimates are published for geographic areas down to the census block group level. ACS 3-year estimates have been discontinued, but are available for 2013 and earlier years for geographic areas with populations of 20,000 or more.

Narrative Profiles. Narrative Profiles provide text and bar charts to display highlights of selected social, economic, housing, and demographic estimates for a single geographic area. The topics include households and families, disability, travel to work, income, poverty, and a wide variety of other topics drawn from the ACS Data Profiles.

Nonsampling Error. Total survey error can be classified into two categories—sampling error and nonsampling error. Errors that occur during data collection (for example, nonresponse error, response error, and interviewer error) or data capture fall under the category of nonsampling error.

Overcoverage. Overcoverage exists when housing units or people have more than one chance of selection in the sample, or are included in the sample when they should not have been.

Period Estimates. An estimate based on information collected over a period of time. For ACS estimates, the period is either 1 year or 5 years. ACS 3-year estimates have been discontinued, but are available for 2013 and earlier years for geographic areas with populations of 20,000 or more.

Point-in-Time Estimates. An estimate based on one point in time. The decennial census long-form estimates for the 2000 Census were based on information collected as of April 1, 2000.

Population Estimates Program. The Census Bureau's Population Estimates Program (PEP) produces July 1 estimates for years after the last published decennial census (2010), as well as for past decades. Existing data series—such as births, deaths, federal tax returns, Medicare enrollment, and immigration—are used to update the decennial census base counts. Population estimates are used in federal funding allocations, in setting the levels of national surveys, and in monitoring recent demographic changes.

Public Use Microdata Area (PUMA). A statistical area defined to contain a population of 100,000 or greater for which the Census Bureau tabulates Public Use Microdata Sample (PUMS) data. ACS and decennial census population and housing microdata are disseminated using these defined areas.

Public Use Microdata Sample (PUMS) Files. Computerized files containing a sample of individual records of people and households that responded to the ACS (stripped of all identifying information). The PUMS files permit analysis of specific population groups and custom variables that are not available through other ACS data products.

Puerto Rico Community Survey (PRCS). The counterpart to the ACS that is conducted in Puerto Rico.

Quality Measures. Statistics that provide information about the quality of the data from the ACS. Four different measures are provided with the annual data release: 1) initial sample size and final interviews, 2) coverage rates, 3) response rates, and 4) item allocation rates for all collected variables. Details are available in the technical documentation for the ACS products.

QuickFacts. A Census Bureau site that provides quick, easy access to facts about people, businesses, and geographic areas for all states, counties, and cities and towns with more than 5,000 people.

Ranking Tables. A table or product type that orders the states according to the numeric value of the data displayed. ACS Ranking Tables begin with the letter "R."

For ACS Ranking Tables: The ordering provided by the "Rank" column is based only on the rounded value of the estimates and does not incorporate the margin of error. A difference in rankings between two states does not mean that the estimates are statistically different. Data users should use the "with statistical significance" version of the table to determine whether two estimates are statistically different.

Reference Week. The calendar week preceding the date on which the respondents completed their questionnaires or were enumerated. This calendar week may not be the same for all people since the enumeration may not be completed in 1 week.

Reference Period. Time interval to which survey responses refer. For example, many ACS questions refer to the day of the interview; others refer to "the past 12 months" or "last week."

Residence Rules. The ACS uses a "current residence" rule to interview people who are currently living or staying in the sample housing unit as long as their stay at that address will exceed 2 months. See the entry on "Usual Residence" for information about residence rules in the decennial census.

Respondent. The person supplying survey or census information about his or her living quarters and its occupants.

Respondent Errors. The respondents' failure to provide the correct answer to a survey question for any reason, such as poor comprehension of the question meaning, low motivation to answer the question, inability to retrieve the necessary information, or an unwillingness to answer the question truthfully.

Sample. Entities selected for a specific survey.

Sample Data. Population and housing information collected on a continuous basis for selected areas in the ACS and other surveys where data are gathered from a selected group of respondents. No sample data were collected in the 2010 Census.

Sample Survey. A data collection activity involving observations or questionnaires for a sample of a population. These data are used to produce estimates for the entire population.

Sampling Error. Errors that occur because only part of the population is directly contacted. With any sample, differences are likely to exist between the characteristics of the sampled population and the larger group from which the sample was chosen.

Sampling Rate. Proportion of the addresses in a geographic area, or residents of a GQ facility, who are selected for interview in a particular time period.

Sampling Variability. Variation that occurs by chance because a sample of the population is surveyed rather than the entire population.

Selected Population Profiles. Selected Population Profiles can be used to show ACS data for a specific racial or ethnic group (for example, Alaska Natives), ancestry groups, or country of birth.

Single-Year (1-Year) Estimates. Estimates based on 1 year of ACS data. They are meant to reflect the characteristics of a geographic area over an entire 12-month period. ACS 1-year estimates are published for geographic areas with populations of 65,000 or more. Starting with the 2014 ACS, the Census Bureau is also publishing 1-year Supplemental Estimates—simplified versions of popular ACS tables for areas with at least 20,000 people.

Standard Error. The standard error is a measure of the deviation of a sample estimate from the average of all possible samples.

Statistical Significance, Test of. A test of statistical significance provides statistical evidence that indicates whether an observed difference between two estimates is likely due to chance ("not statistically significant"), or likely represents a true difference that exists in the population as a whole ("statistically significant").

Statistical significance in census data products is usually reported at the 90 percent confidence level.

Note that some statistical significance results displayed in American FactFinder may be based on unrounded estimates and standard errors and users may not be able to duplicate the results using the rounded estimates and measures of error as displayed on American FactFinder.

Subject Tables. Subject Tables include ACS data organized by subject area, providing an overview of the information that analysts most often receive requests for from data users. ACS Subject Tables begin with the letter "S."

Summary Files. The ACS Summary Files are comma-delimited text files that contain all of the Detailed Tables for the ACS data releases.

Summary Level. Summary levels specify the content and hierarchical relationships of the geographic elements that are required to tabulate and summarize data. Each summary level has an assigned 3-digit summary level code to help programmers link each specific summary level to its appropriate use in a table, map, or other data summarization format. Some examples of summary levels are:

- 040: State
- 050: State-County
- 060: State-County-County Subdivision
- 150: State-County-Census Tract-Block Group
- 160: State-Place
- 314: Metropolitan Statistical Area-Metropolitan Division
- 430: Urban Area-State-County

It is important to distinguish between a summary level and a geographic area. A summary level represents the concept of a geographic level. For example, summary level 050, State-County, represents the concept of a county within a state. By comparison, a geographic area covers territory "on the ground," such as Madison County, Indiana.

Supplemental Estimates. Simplified Detailed Tables that provide access to the most recent ACS data at a lower population threshold than the standard 1-year tables. Available for selected geographic areas with 20,000 people or more. ACS Supplemental Estimates begin with the letter "K."

Thematic Maps. Thematic Maps can be used to show the geographic patterns in statistical data. Thematic maps are a complement to the Ranking Tables and are a tool to visually display on a map the geographic variability of a key summary or derived measure.

Undercoverage. The extent to which a sample does not include members of the target population thus preventing those members from having any chance of selection into the sample.

Unit Nonresponse. The failure to obtain the minimum required data from a unit in the sample.

Universe. The total number of units (e.g., individuals, households, or businesses) in the population of interest.

Usual Residence. Usual residence is a concept used in the decennial census to determine where a person should be counted in the census. Usual residence is defined as the place where a person lives and sleeps most of the time. This place is not necessarily the same as a person's voting residence or legal residence.

Variance Replicate Tables. These augmented ACS Detailed Tables include sets of 80 replicate estimates, which allow advanced users to calculate measures of error for estimates using the same methods that are used to produce the published margins of error (MOEs) in American FactFinder. These methods incorporate the covariance between estimates that approximate MOE formulas do not. They are published for a subset of the 5-year Detailed Tables and at selected summary levels. The 2010–2014 ACS 5-year estimates were the first for which these were available.