4. CASE STUDIES FOR RURAL AREAS

Today, the American Community Survey (ACS) puts up-to-date information about important social issues at the fingertips of people who need it, including local government officials and planners, program directors and managers, businesses, federal policymakers, researchers, nongovernmental organizations, journalists, teachers and students, and the public.

Here are some examples of how ACS data are being used for decision-making:

- The Kaiser Family Foundation published a 2017 issue brief examining how changes to Medicaid coverage would affect health care access of rural residents.[21]
- Researchers used ACS data to assess the availability of services in rural areas with aging populations.[22]
- The U.S. Department of Veterans Affairs used ACS data to examine the characteristics of the veteran population in rural areas.[23]
- The Appalachian Regional Commission (ARC) uses ACS data to assess the status of both metropolitan and nonmetropolitan (in micropolitan statistical areas or outside metropolitan and micropolitan statistical areas) counties in the Appalachian Region on a host of social and economic measures, which in turn enables the ARC to develop strategies to improve conditions in Appalachia.[24]
- U.S. News and World Report used ACS 5-year data (2011–2015) to show that disability rates were noticeably higher outside of metropolitan statistical areas than within them.[25]

The case studies below provide some more detailed examples of how ACS data are being used to highlight issues in rural (and other) areas.

---

[21] Julia Foutz et al., "The Role of Medicaid in Rural America," 2017, <www.kff.org/medicaid/issue-brief/the-role-of-medicaid-in-rural-america/>.

[22] Brian C. Thiede et al., "Access to Services Diminishes in Rural America as Populations Age," Brief No. 04-16, December 2016, <https://w3001.apl.wisc.edu/b04_16>.

[23] National Center for Veterans Analysis and Statistics, U.S. Department of Veterans Affairs, "Characteristics of Rural Veterans: 2014," August 2016, <www.va.gov/vetdata/docs/SpecialReports/Rural_Veterans_ACS2014_FINAL.pdf>.

[24] The Appalachian Regional Commission, "The Appalachian Region: A Data Overview from the 2014-2018 American Community Survey," June 2020, <www.arc.gov/report/the-appalachian-region-a-data-overview-from-the-2014-2018-american-community-survey/>.

[25] Brian Thiede et al., "The Divide Between Rural and Urban America, in 6 Charts," U.S. News and World Report, March 20, 2017, <www.usnews.com/news/national-news/articles/2017-03-20/6-charts-that-illustrate-the-divide-between-rural-and-urban-america>.

Case Study #1: RTC: Rural Disability Counts Data Finder

Skill Level: Introductory/Intermediate
Subject: Disability
Type of Analysis: Comparison of American Community Survey (ACS) data across counties
Tools Used: Data.census.gov, spreadsheets, computer programing tools
Author: Lillie Greiman, Project Director/Research Associate, RTC: RURAL

The RTC: Rural at the University of Montana is a research and training center, funded by the National Institute on Disability, Independent Living and Rehabilitation Research (NIDILRR) to improve the ability of people with disabilities to engage in rural community living.[26] We conduct research across the focus areas of health, employment, and independent living. Our work has led to the development of health promotion programs, disability and employment policy and support, and education for providers who serve people with disabilities.

We developed the Disability Counts data lookup tool to provide accessible data about disability in rural areas and communities across the nation.[27] This site uses data from the ACS matched with information about rural definitions to provide a one-stop shop for downloading disability data for every county across the United States and Puerto Rico.

We pull a range of disability data tables from the ACS 5-year estimates (using data.census.gov) to feed the data lookup tool. (Due to the small population size of many rural counties, we must use ACS 5-year estimates for our analysis.) In addition, we bring in county-level classifications from the Office of Management and Budget's (OMB's) metropolitan statistical area designations. These designations classify counties as metropolitan or micropolitan (classified as core-based statistical areas), or outside of metropolitan and micropolitan statistical areas. Table 4.1 shows the data.census.gov tables we use to produce the county-level estimates.

Table 4.1. **List of Disability Tables Downloaded From Data.census.gov**

Variable	Table	Data set
Disability estimates and rates	S1810: General Disability Characteristics	ACS 5-year estimates
Disability types	S1810: General Disability Characteristics	ACS 5-year estimates
Disability and poverty	C18130: Age by Disability by Poverty Status	ACS 5-year estimates
Veterans with disabilities	C21007: Age by Veteran, Poverty and Disability Status	ACS 5-year estimates
Disability and employment	C18120: Employment by Disability Status	ACS 5-year estimates

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

[26] University of Montana, RTC: Rural, <http://rtc.ruralinstitute.umt.edu/>.
[27] University of Montana, Disability Counts: Disability Data Lookup, <http://rtc.ruralinstitute.umt.edu/geography/>.

To build the data look-up tool, we first download data from data.census.gov using the Advanced Search option.

Step 1. Use the data.census.gov "Advanced Search" option, as follows:

- Go to the data.census.gov Web site at <https://data.census.gov>.
- Select "Advanced Search" below the search bar (see Figure 4.1).

Figure 4.1. **Selecting Advanced Search in Data.census.gov**

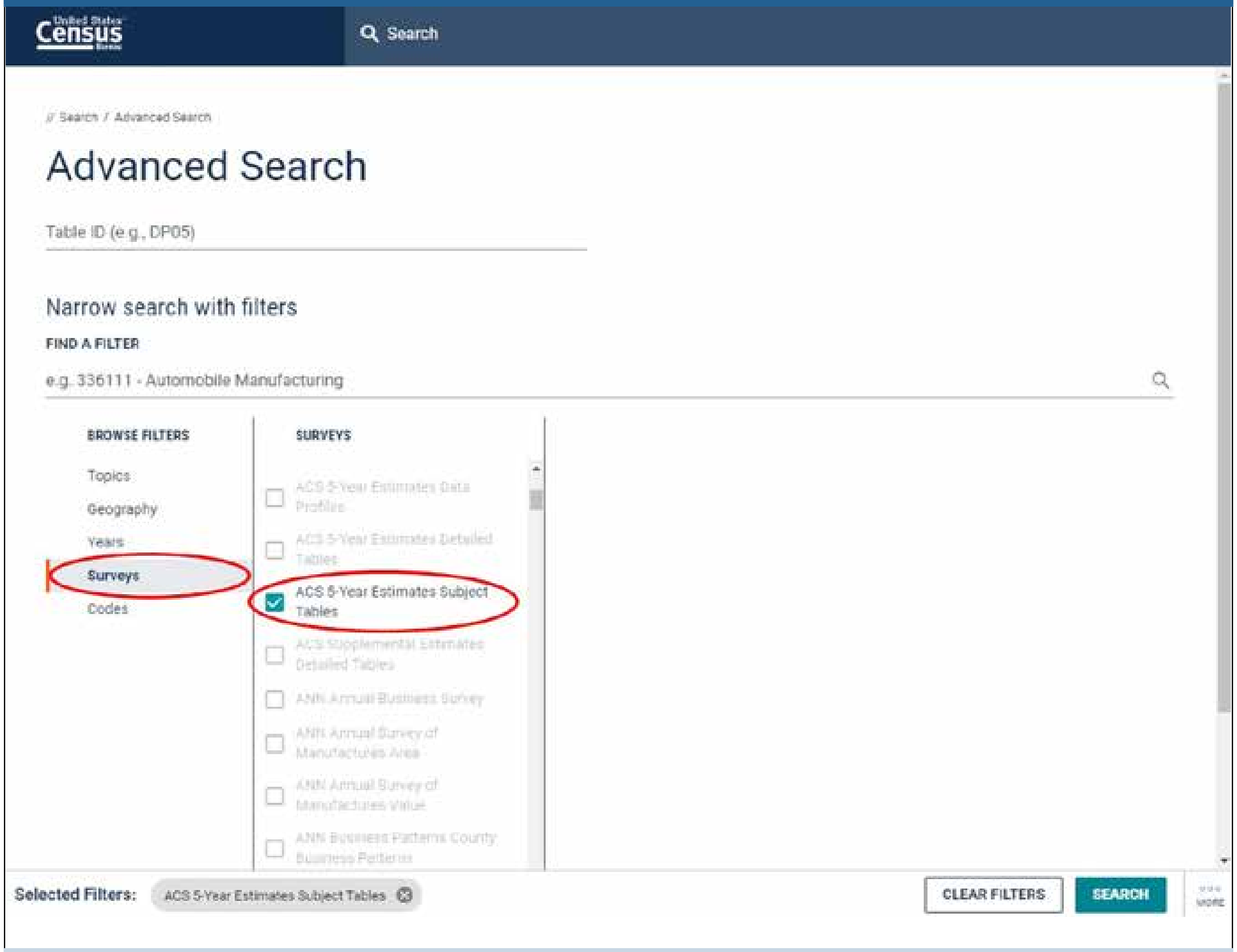
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 2. Select your data set

In order to ensure that you are accessing the most current data, you must first specify the data set.

- Select "Surveys" in the navigation pane on the left side of the screen to display a list of available surveys.
- Select "ACS 5-Year Estimates Subject Tables." This survey should appear in the "Selected Filters" at the bottom of the page (see Figure 4.2).

Figure 4.2. **Selecting a Survey in Data.census.gov**

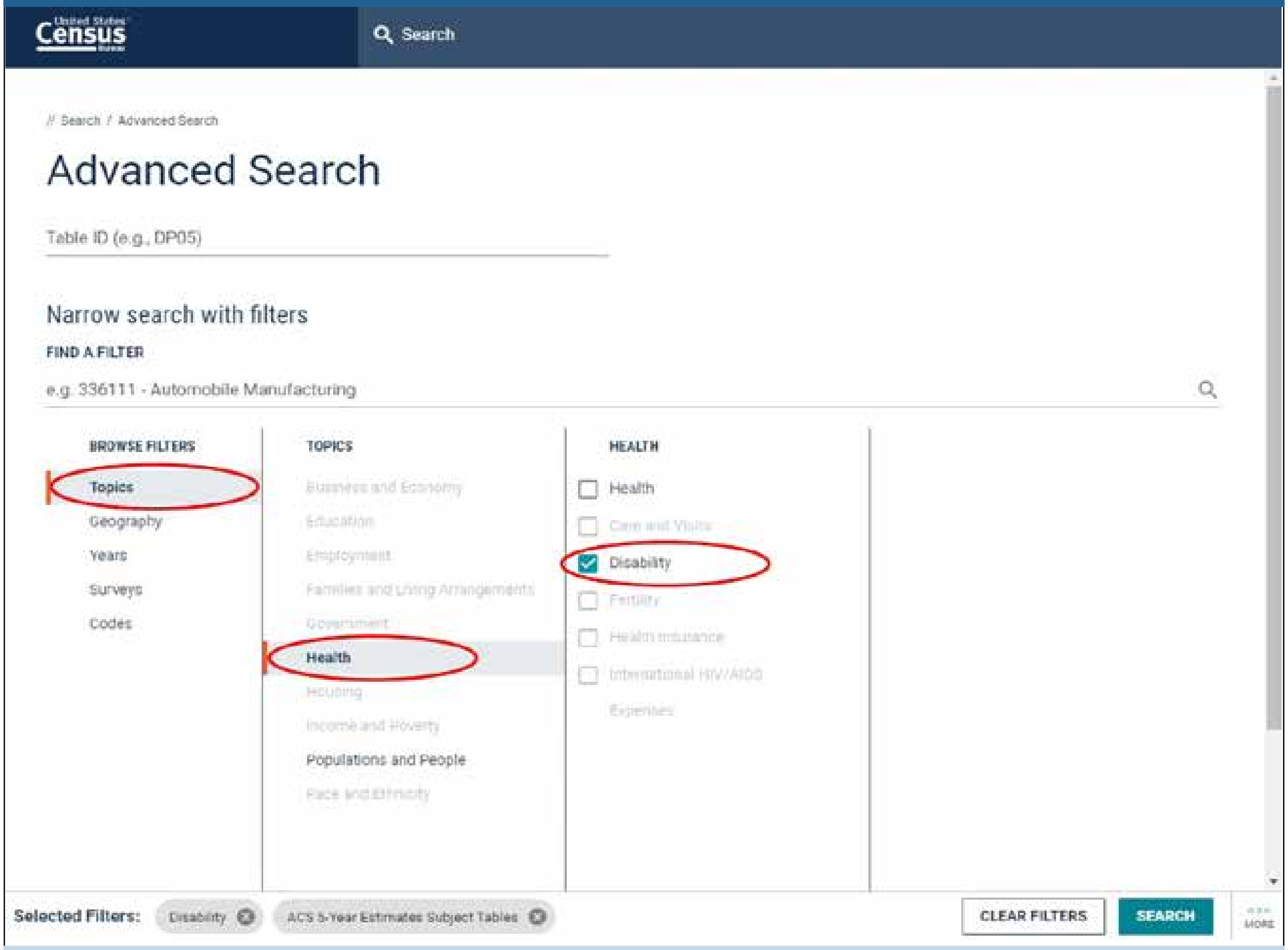


Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 3. Select disability topic

- Select “Topics” in the navigation pane on the left side of the screen. Then click on “Health” and “Disability” (see Figure 4.3).

Figure 4.3. **Selecting a Topic in Data.census.gov**



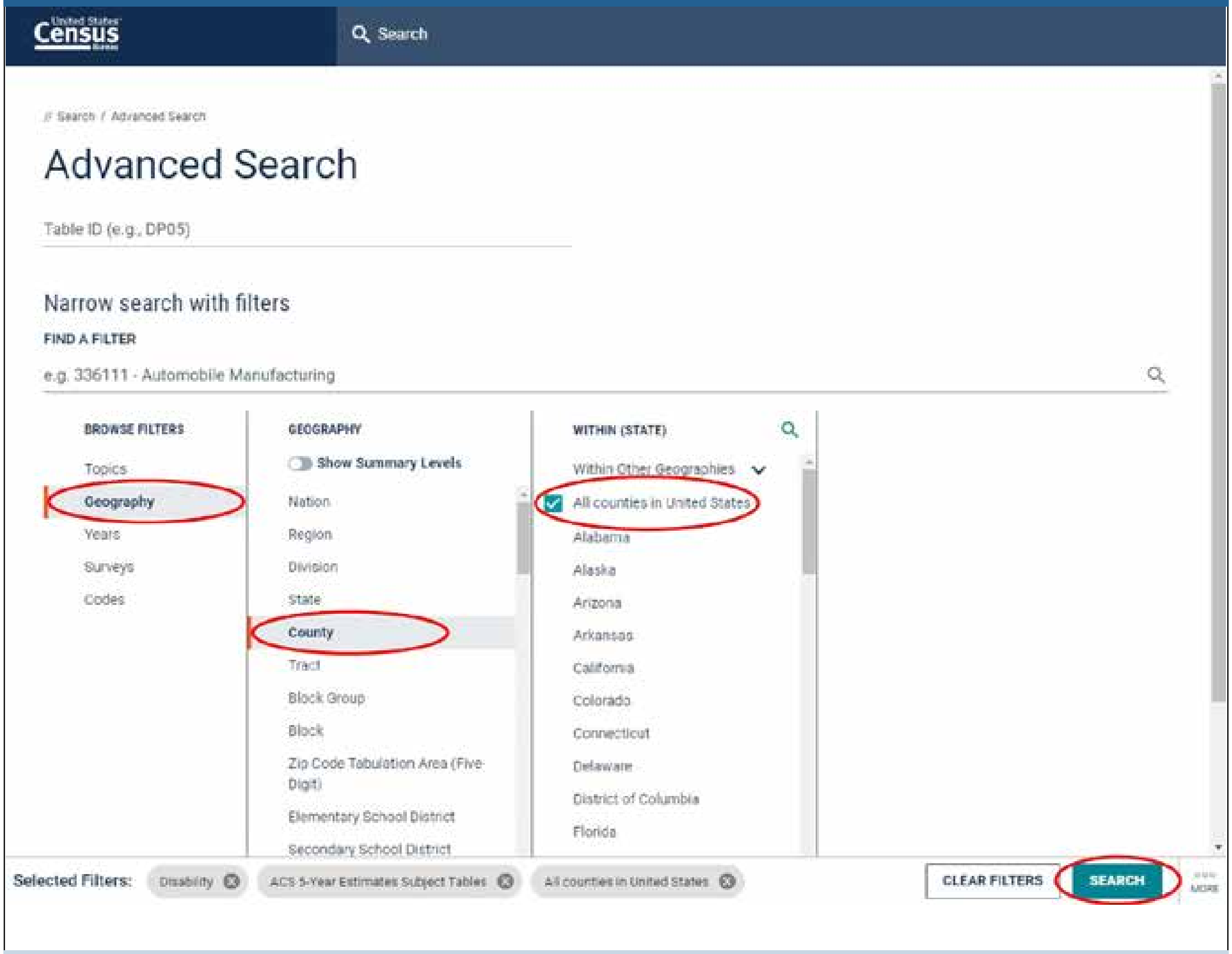
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 4. Select geographic areas

This is where you specify that you want county-level data.

- Select "Geography" in the navigation pane on the left side of the screen to display a list of available geographies.
- Then, select "County" and "All counties in United States." This geographic selection should appear in the "Selected Filters" at the bottom of the page. Then, click "Search" in the lower right corner (see Figure 4.4).

Figure 4.4. **Selecting Geographic Areas in Data.census.gov**



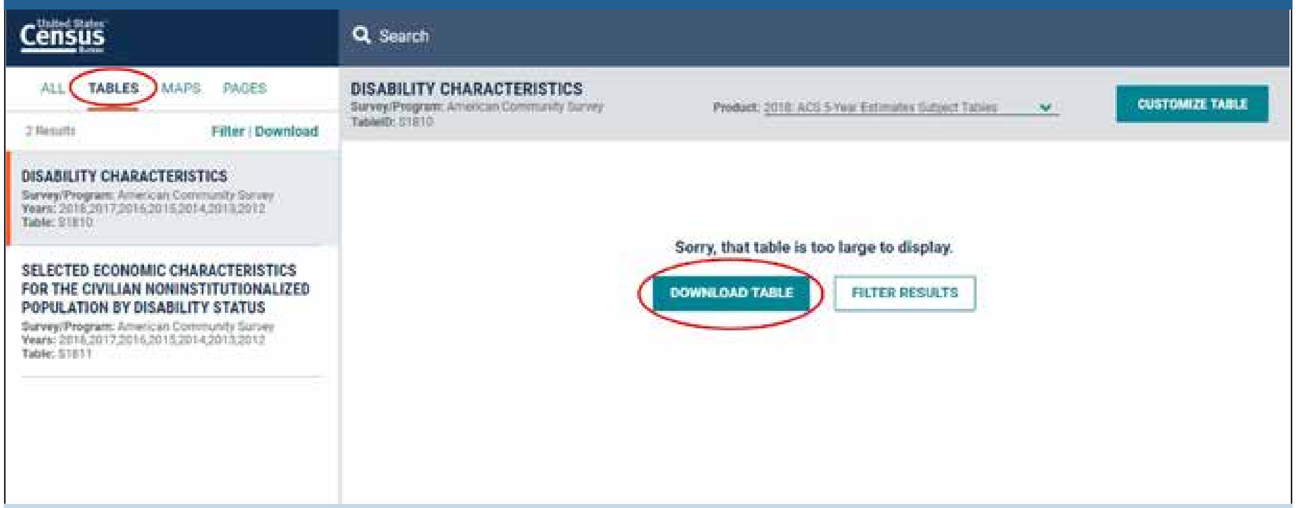
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Step 5. Select your data table(s)

Now that you have specified all the relevant parameters for the data, you can download the specific data table(s) that meet(s) your needs.

- Click "TABLES" in the upper left corner.
- For standard disability data breakdowns, Table S1810: "Disability Characteristics" should suffice.
    - o This table will likely be the first to appear in the list of data tables.
    - o This table provides disability data broken down by age, sex, disability type, and race.
- Select "Download Table" under the message that the "table is too large to display" (see Figure 4.5).

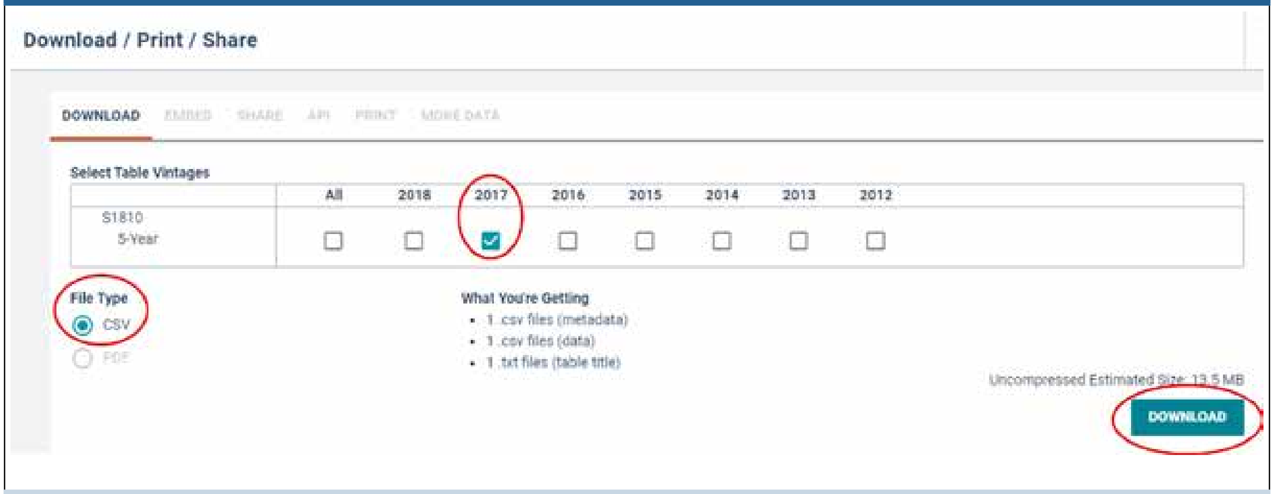
Figure 4.5. **Downloading a Table in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Use the Download Tables window to check the box for the 2017 ACS 5-year data (the most recent data available at the time of this analysis) (see Figure 4.6).
- Select "CSV" as the file type and click "Download." CSV files are compatible with spreadsheet programs such as Microsoft Excel.

Figure 4.6. **Selecting the Survey Year and File Type in Data.census.gov**



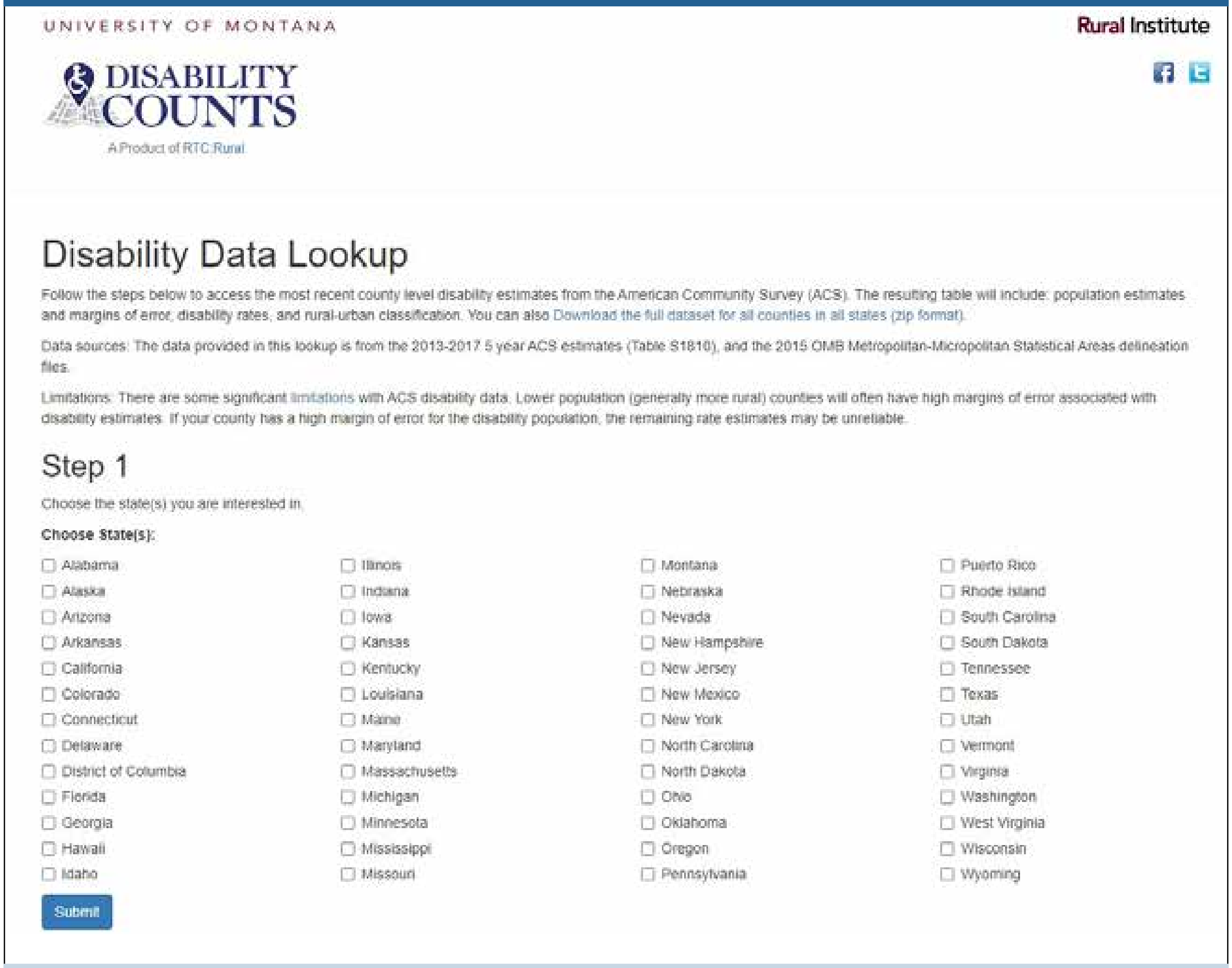
Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

For the Disability Counts data lookup tool, we downloaded the data listed in Table 4.1. In many of the ACS tables we download, disability data are disaggregated by various categories (for example, data for veterans with disabilities are available by age and poverty status) and only the counts are reported. Therefore, for some variables (veterans, poverty, and employment) we needed to calculate our own rates. We did these calculations in Excel by summing across the appropriate categories and then calculating rates for our variables of interest (poverty, veteran status, and employment).

We did not recalculate margins of error for these variables. However, margins of error are a concern for disability estimates. Counties with small populations often have large margins of error associated with disability estimates. This can make the resulting estimates and rate calculations less reliable. We include this as a disclaimer on the site and link to a more detailed report we have compiled on the issue of margins of error and county-level disability data.

After we compiled our master data sheet, including all the relevant disability data estimates, rates, and rural indicators, we worked with our programmer to create a data lookup platform where users can identify states and counties of interest (see Figure 4.7). The resulting customized table is downloadable into a CSV file.

Figure 4.7. **Disability Counts Data Lookup Tool**



Source: University of Montana, Disability Counts: Disability Data Lookup, <http://rtc.ruralinstitute.umt.edu/geography/>.

This tool provides two main benefits to data users. First, like data.census.gov, it is screen reader accessible, meaning that someone who is blind or visually impaired can access the information using specialized technology. Second, the disability data presented have already been distilled into key variables of interest for disability service providers. The data provided help local service organizations—like Centers for Independent Living—advocate for the needs of people with disabilities at both the local and national level.

Case Study #2: Determining Eligibility for Grants in Rural Oregon

Skill Level: Intermediate/Advanced
Subject: Place-level socioeconomic data and accompanying statistical error
Type of Analysis: Analysis of place-level American Community Survey (ACS) data, including margins of error and calculating coefficients of variation
Tools Used: Data.census.gov, spreadsheet
Author: Jason R. Jurjevich, University of Arizona (formerly at Portland State University)

For mayors and community leaders of communities across rural America, attracting retail and other forms of economic development is often challenging. In addition to having small populations spread across vast landscapes, inadequate and/or nonexistent infrastructure—water, sewer, telecommunications, and transportation—are often key obstacles. In northern Klamath County, Oregon, residents of two neighboring communities, Gilchrist and Crescent, were interested in securing grant and loan funding from the U.S. Department of Agriculture (USDA) Rural Development to build water and sewer infrastructure to secure a small grocery store. Residents of both communities were traveling up to 25 miles to La Pine, Oregon—the closest place for groceries.

To promote and facilitate economic development in rural communities, USDA Rural Development offers a number of grants and loans, including the Water and Waste Disposal Loan and Grant Program. In Oregon, communities are eligible for these grants and loans if their maximum median annual household income (MHI) was $35,000 or less. USDA Rural Development determines eligibility for grants and loans based on ACS 5-year estimates; however, this approach does not consider the accompanying margins of error.

In late 2014, a resident from Gilchrist contacted our office at Portland State University, asking about the reliability of income estimates from the ACS. They wanted to know if they would be eligible to receive USDA Rural Development funds for their project.

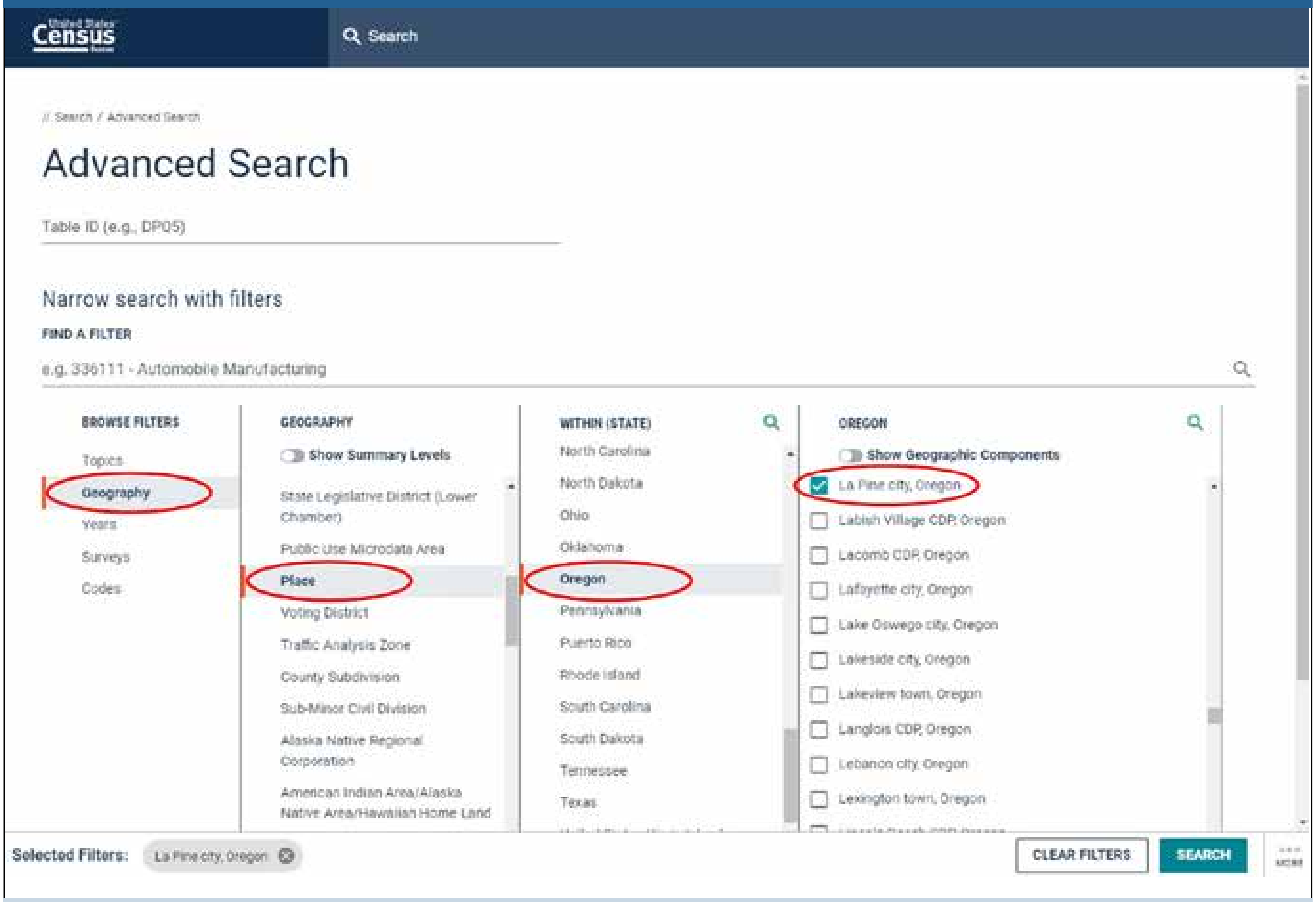
Gilchrist and Crescent, two neighboring communities of a few hundred individuals, are wholly contained in Census Tract 9701. Because these places are small unincorporated areas, the census tract is the smallest unit available for conducting geographic analysis. Given that residents of Gilchrist and Crescent often commute to the closest incorporated city—La Pine, Oregon—for basic necessities, La Pine is included for comparison purposes.

Downloading ACS Data

To download MHI data, use the data.census.gov Advanced Search tool, as follows:

- Go to the data.census.gov Web site at <https://data.census.gov/> and click on “Advanced Search” under the search bar.
- Start with the “Geography” filter and scroll to select “Place” as the geography. Then scroll to select “Oregon” from the “Within (State)” filter. Next, scroll to select “La Pine city, Oregon.”
- “La Pine city” should appear as a selected filter at the bottom of the screen (see Figure 4.8).

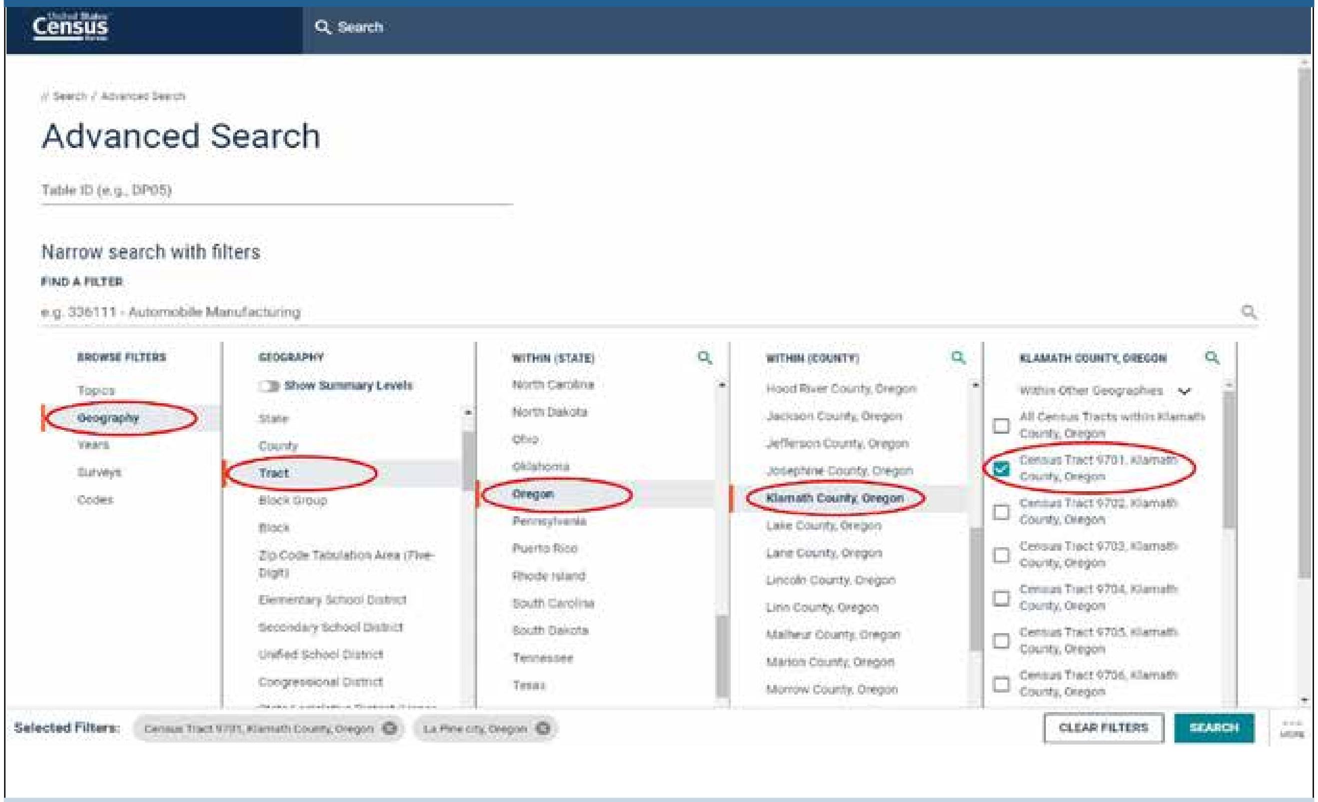
Figure 4.8. **Selecting a Geography (Place) in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Using the same “Geography” filter, scroll to select “Tract” (see Figure 4.9).
- Then select “Oregon,” “Klamath County, Oregon,” and “Census Tract 9701, Klamath County, Oregon.”

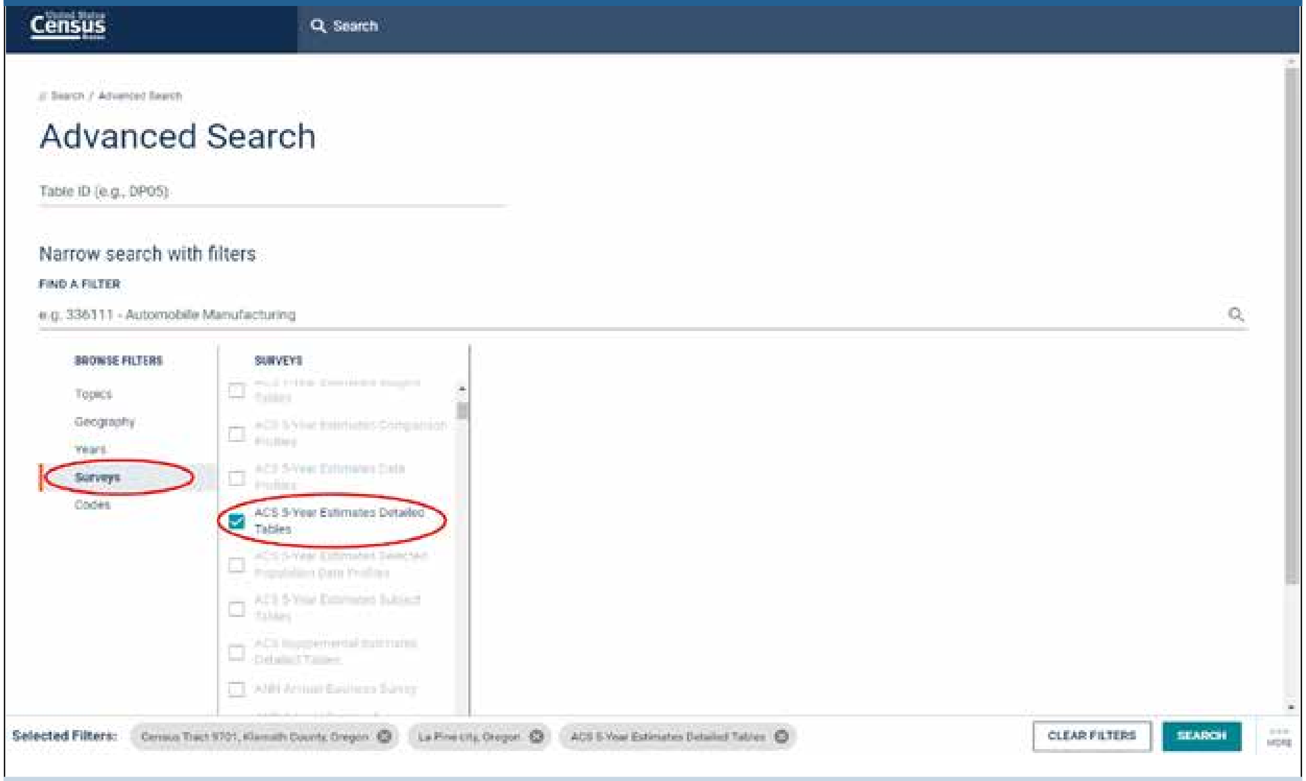
Figure 4.9. **Selecting a Geography (Census Tract) in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- Next, select “Surveys” and “ACS 5-Year Estimates Detailed Tables” (see Figure 4.10).

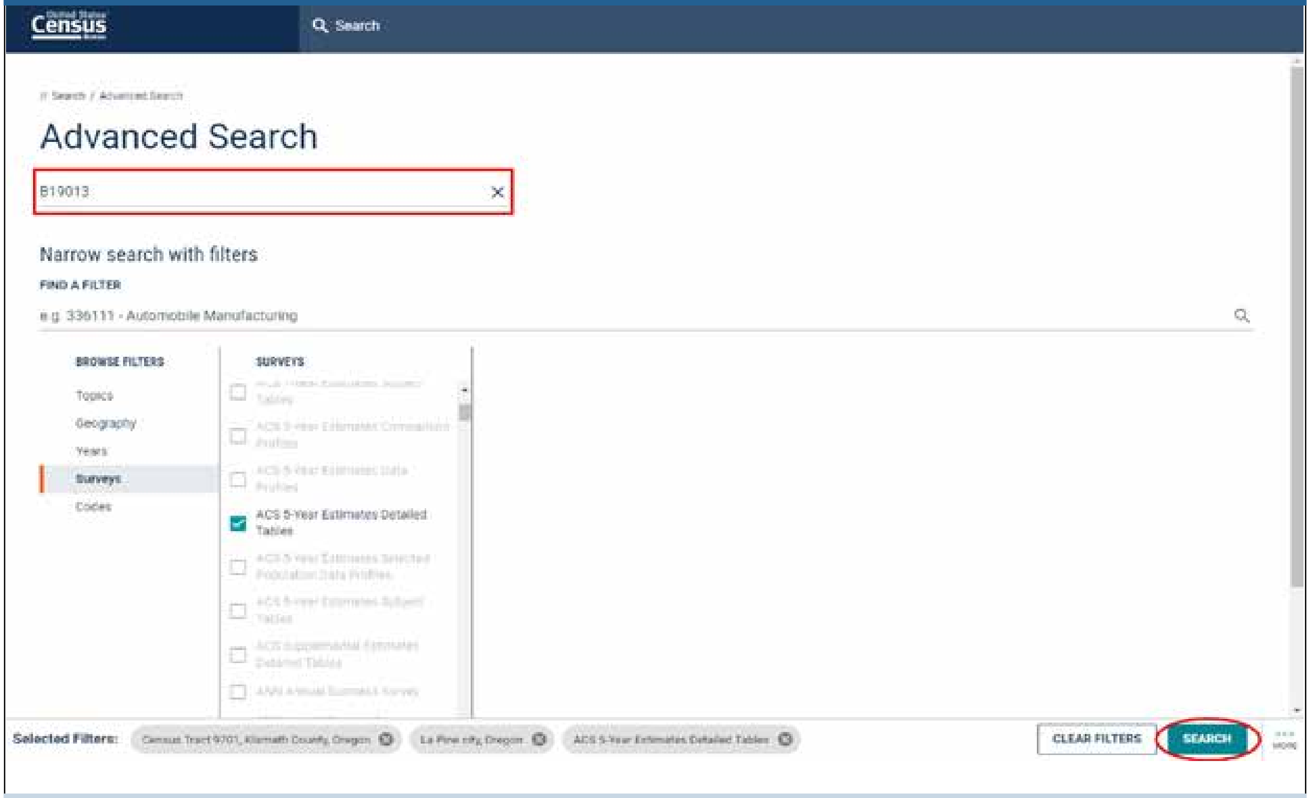
Figure 4.10. **Selecting a Data Set in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

- To download the MHI, type “B19013” in the table ID search bar. This is the table corresponding to “Median Household Income in the Past 12 Months.” Then, click “Search” in the lower right corner (see Figure 4.11).

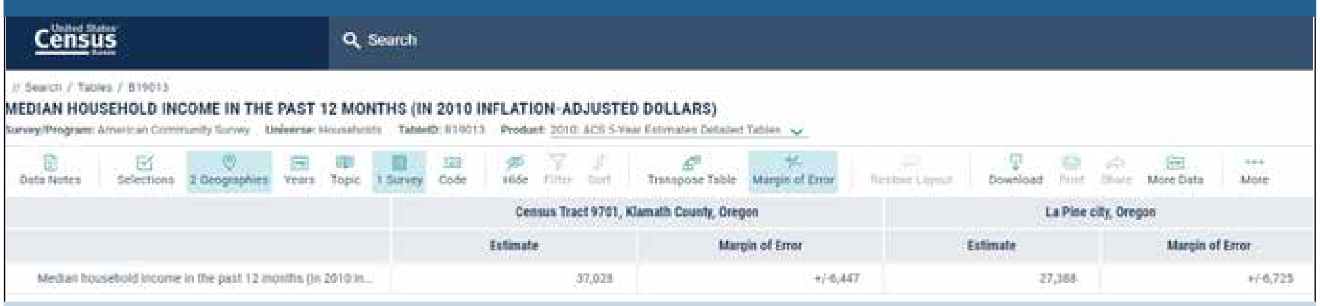
Figure 4.11. **Selecting a Table in Data.census.gov**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

According to ACS 5-year data, the MHIs were $37,028 (±6,447) and $27,388 (±$6,725) for Census Tract 9701 and La Pine during the 2006–2010 period, respectively (see Figure 4.12). To qualify for grant funding from the USDA, communities cannot have MHI figures greater than $35,000 (not considering margins of error), so communities in Census Tract 9701 (i.e., Gilchrist and Crescent) were declared ineligible.[28]

Figure 4.12. **Median Household Income Estimates for Census Tract 9701 and La Pine City, Oregon: 2006–2010**



Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

[28] If there is reason to believe that ACS data do not provide an accurate representation of MHI, the community can conduct their own income survey. However, the cost for conducting an income survey is borne by the community.

Assessing ACS Data Reliability

Correctly interpreting the ACS estimates for Census Tract 9701 and La Pine requires adding and subtracting the margins of error to/from the estimate to calculate upper and lower confidence intervals. This means the actual income figure for Census Tract 9701 is between $30,581 ($37,028 - $6,447) and $43,475 ($37,028 + $6,447), while the range for La Pine is $20,663 ($27,388 - $6,725) and $34,113 ($27,388 + $6,725). ACS estimates are reported at 90 percent statistical confidence, which means there is a 10 percent chance that the actual income figure lies outside of this range.

To determine whether or not an ACS estimate is reliable, the U.S. Census Bureau recommends calculating the coefficient of variation (CV) statistic. The CV is a relative measure of uncertainty and expresses uncertainty as a percentage of the census estimate. To calculate the CV, the first step involves calculating the standard error (SE), which is the margin of error divided by 1.645 (column F in Figure 4.13). The final step, dividing the SE value by the estimate and expressing the value as a percentage, yields the CV statistic (column G in Figure 4.13).

Figure 4.13. **Data.census.gov (Table B19013) Standard Error and Coefficient of Variation Calculations, 2006–2010 5-Year Estimates**

	A	B	C	D	E	F	G
1	GEO.id	GEO.id2	GEO.display-label	HD01_VD01	HD02_VD01		
2	Id	Id2	Geography	Estimate; Median household income in the past 12 months (in 2010 inflation-adjusted dollars)	Margin of Error; Median household income in the past 12 months (in 2010 inflation-adjusted dollars)	Standard Error (SE) [MOE/1.645]	Coefficient of Variation (CV) [SE/Estimate x 100]
3	1400000US41035970100	41035970100	Census Tract 9701, Klamath County, Oregon	37028	6447	3,919	10.6
4	1600000US4141050	4141050	La Pine city, Oregon	27388	6725	4,088	14.9

Source: U.S. Census Bureau, data.census.gov, <https://data.census.gov>.

Lower CV values indicate greater reliability. A 2014 report from Esri (a company that provides GIS mapping software) proposes that CV values smaller than 12 percent indicate a high degree of reliability, values between 12 percent and 40 percent indicate moderate reliability, and CVs greater than 40 percent indicate low reliability.[29] Based on these guidelines, the MHI estimate for Census Tract 9701—with a CV of 11 percent—is reliable, while the estimate for La Pine (CV of 15 percent) is moderately reliable.

The principal reason for the difference in reliability between the two estimates is because statistical uncertainty is magnified for smaller geographic areas (for example, census tracts), subpopulations (e.g., poverty rate for children), and for cross-tabulations (e.g., race/ethnicity by income level). In this example, the City of La Pine is a smaller geographic area than the census tract and contains a smaller population. According to the 2006–2010 ACS 5-year data, the estimated population is 3,082 (±476) and 1,679 (±675) for Census Tract 9701 and La Pine, respectively.

This example shows some of the challenges in working with any data—from the ACS or other surveys—that are derived from a sample of the population. In this case, residents of Gilchrist, Crescent, and La Pine were not able to use ACS estimates to demonstrate eligibility for a USDA Rural Development grant or loan. But as the only source of detailed social, economic, housing, and demographic data for small communities, the ACS is the best place to start for determining program eligibility.

[29] Esri, American Community Survey (ACS), Understanding Margin of Error, <https://doc.arcgis.com/en/esri-demographics/data/acs.htm#ESRI_SECTION1_805FF6F174ED48059E26696F0A440571>.

Case Study #3: Minnesota State Demographic Center Analysis of the Age Distribution of Residents in Rural and Urban Areas

Skill Level: Advanced
Subject: Age Distribution, Rural-Urban Geographic Areas
Type of Analysis: Making comparisons across geographic areas and creating custom geographic areas from census tracts
Tools Used: Variance Replicate Tables, spreadsheet, Statistical Testing Tool
Author: Susan Brower, State Demographer of Minnesota

Susan is the State Demographer of Minnesota. She wants to study how the age distribution of residents differs across geographic regions of the state. To do this, she uses a rural-urban typology that corresponds to the characteristics of individual census tracts.

Susan uses Rural-Urban Commuting Area (RUCA) classification codes developed by the U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) to examine economic characteristics of Minnesota residents living in a range of settings—from remote, rural areas to dense, urban cities. RUCA codes classify census tracts using measures of population density, urbanization, and commuting patterns. She aggregates characteristics of residents across the state based on the RUCA code of the census tract in which they live. (More information about RUCA codes can be found on the ERS Web site.)[30]

Census tracts are roughly equivalent to neighborhoods. They contain between 2,500 and 8,000 people per tract. Since detailed American Community Survey (ACS) 1-year estimates are only available for geographic areas with at least 65,000 residents, Susan uses ACS 5-year estimates, which she downloads from <https://data.census.gov>.[31] There are approximately 1,300 census tracts in Minnesota. Susan aggregates these tracts into four RUCA-based areas—Rural, Small Town, Large Town, and Urban.

Susan also estimates how much uncertainty is associated with the new Rural, Small Town, Large Town, and Urban estimates she has created. The U.S. Census Bureau provides a number of formulas that can be used to estimate uncertainty—margins of error—for estimates that are aggregated from smaller geographic components. However, the Census Bureau cautions against using these formulas when the number of geographic components is greater than four.

Because she wants to aggregate a large number of census tracts together into her four geographic regions, she uses the Variance Replicate Tables that are made available on the Census Bureau's site for selected ACS data tables.[32] Using these tables allows her to calculate new margins of error for her estimates. Susan begins her analysis by reviewing the Documentation for the ACS Variance Replicate Tables.[33] She selects the 2015 data page because she has chosen to analyze data from the 2011–2015 ACS 5-year data set. These were the most current data available at the time of the analysis. The 2015 page has the information that she needs to find the most appropriate data table for her analysis and to calculate new margins of error for her custom geographic areas.

[30] U.S. Department of Agriculture, Economic Research Service, "Rural-Urban Commuting Area Codes," <www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/>.
[31] 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.
[32] U.S. Census Bureau, American Community Survey, Variance Replicate Tables, <www.census.gov/programs-surveys/acs/data/variance-tables.html>.
[33] U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.html>.

- On the Variance Replicate Tables Documentation Web page, she first looks at the spreadsheet of Table Shells to select a table that contains age distribution data—preferably by 5-year age groups. She finds that table B01001 "SEX BY AGE" meets her needs. She then checks the 2011–2015 Variance Replicate Estimates Table and Geography List and sees that table B01001 is available at the census tract level. On the second page of the same spreadsheet, Susan sees that the geographic summary level code for census tracts is 140 (see Figure 4.14). This is important when she is looking to locate the data file she needs.

Figure 4.14. **2011–2015 Variance Replicate Estimates Table and Geography List**

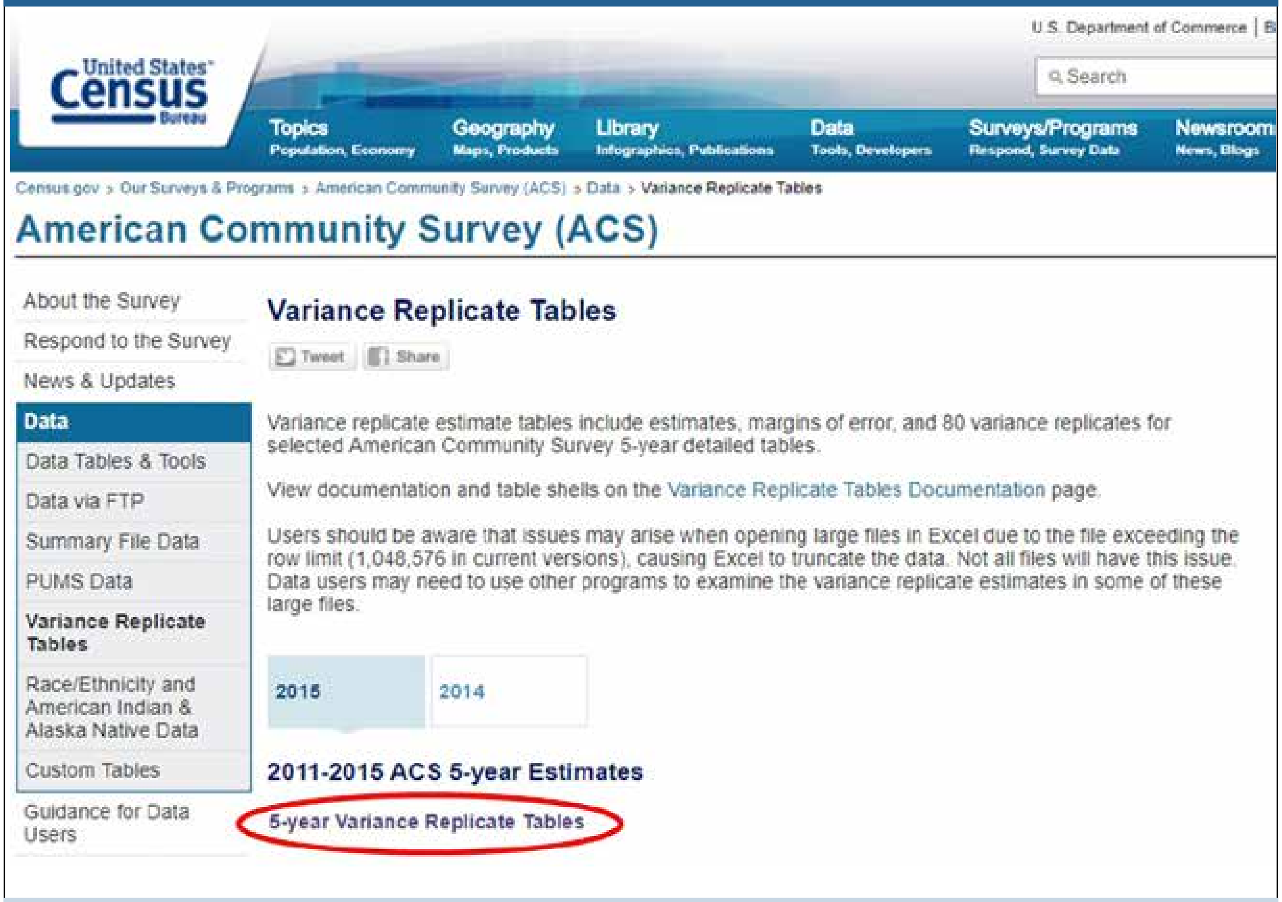
No.	Geographic Summary Level	Description
1	010	Nation
2	040	State
3	050	County
4	060	County Subdivision
5	140	Census Tract
6	150	Census Block Group
7	160	Place
8	250	American Indian Area/Alaska Native Area/Hawaiian Homeland
9	310	Metroplitan/Micropolitan Statistical Area
10	500	Congressional District
11	860	Zip Code Tabulation Area (ZCTA)

Table_List Geography_List

Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- From the Variance Replicate Tables Web page, Susan clicks on the 2011–2015 "5-year Variance Estimate Tables" link (see Figure 4.15). This takes her to a series of subfolders with names corresponding to the summary level of the data files they contain. Susan chooses folder 140, since this is the folder that contains variance tables at the census tract summary level. In this folder, she finds several zipped CSV files with names corresponding to the table number that she is looking for—B01001. She chooses table "B01001_27.csv.gz" because she knows that 27 is the FIPS code for Minnesota. She downloads this file, unzips it, and sees that it contains age data for all census tracts within her state.

Figure 4.15. **Accessing the Variance Replicate Tables**



Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- Susan decides to use SPSS (statistical software) to aggregate and analyze the data. After some light editing of the CSV file to meet SPSS requirements, she imports the data into SPSS and saves it.

- Next, she creates a second SPSS data file that contains GEOID and RUCA codes. Susan merges the two SPSS files matching on GEOID as the unique census tract identifier. Now she has all the information she needs to create new custom RUCA geographies in one file.

- Susan analyzes the age data for a collapsed version of the RUCA codes. The USDA publishes ten primary RUCA codes that delineate census tracts.[34] She recodes the ten categories into four: "Urban" for RUCA codes 1-3, "Large Town" for codes 4-6, "Small Town" for codes 7-9, and "Rural" for code 10.

[34] U.S. Department of Agriculture, Economic Research Service, Rural-Urban Commuting Area Codes, <www.ers.usda.gov/data-products/rural-urban-commuting-area-codes.aspx>.

- She uses the aggregate command in SPSS to sum age-sex estimates across census tracts within each of the four RUCA codes. This yields a new estimate for each age-sex category for Urban, Large Town, Small Town, and Rural areas. Susan exports the data into an Excel file (see Figure 4.16).

- She consults the 2011–2015 Variance Replicate Tables Documentation and follows the Census Bureau's guidance on calculating margins of error using the variance replicate estimates (see Figure 4.17).[35]

Figure 4.16. **Aggregated Estimates by Rural-Urban Category**

	A	B	C
1	ORDER	RUCA_SDC	estimate_sum
2	1	1	3,988,163
3	2	1	1,973,648
4	3	1	135,299
5	4	1	138,587
6	5	1	133,666
7	6	1	81,052
8	7	1	55,029
9	8	1	27,451
10	9	1	27,585
11	10	1	82,398

AggregatedEstimates

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

Figure 4.17. **Guidance on Calculating the Margin of Error Using Successive Differences Replicate Methodology (Excerpt From Documentation)**

Calculating the Margin of Error Using the Successive Differences Replicate Methodology

As mentioned in the introduction, the variance and standard error of an estimate must be calculated before computing the MOE. The SDR variance is calculated using the official ACS estimate and the eighty variance replicate estimates (Var_Rep1 to Var_Rep80).[2] The variance is the sum of the squared differences between the estimate and each of the eighty variance replicate estimates, multiplied by 4/80. The MOE is calculated by multiplying the standard error (the square root of the variance) by the factor 1.645 which is associated with a 90 percent confidence level.

$$\text{Variance} = \frac{4}{80}\sum_{i=1}^{80}\left(\text{Var\_Rep}_i - \text{Estimate}\right)^2 \qquad (1)$$

$$\begin{aligned}\text{Margin of Error (90\% confidence level)} &= 1.645 \times \text{Standard Error} \\ &= 1.645 \times \sqrt{\text{Variance}}\end{aligned} \qquad (2)$$

Source: U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation, <www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

[35] U.S. Census Bureau, American Community Survey, Variance Replicate Tables Documentation,<www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.2015.html>.

- She uses the aggregate command to sum the newly computed variables (i.e., the variance replicate estimates) across all census tracts within her four rural-urban groups. Then she sums across some of the age-sex categories (men and women, aged 65 and older) so that she has the ability to compare differences across geographic regions in the older adult population. Finally, she sums across the 80 variance replicate estimates and multiplies that total by 4/80.

- Next, Susan creates two new variables for each of her age-sex categories: the standard error (equal to the square root of the variance) and the margin of error at the 90 percent confidence level (equal to the standard error times 1.645) and exports them into Excel. She now has the calculated variance, standard error, and margin of error that correspond to each age group and sex by the four rural-urban geographic areas (see Figure 4.18).

Figure 4.18. **Example of Calculations in SPSS**

	A	B	C	D	E	F	G	H
1	**Order**	**Age/sex group**	**RUCA**	**Geographic area**	**Estimate**	**Variance**	**Standard error**	**Margin of error**
2	1	Total:	1	Urban	3,988,163	389,238	624	1,026
3	1	Total:	2	Large town	608,769	436,222	660	1,086
4	1	Total:	3	Small town	388,769	626,068	791	1,302
5	1	Total:	4	Rural	433,470	541,980	736	1,211
6	2	Male:	1	Urban	1,973,648	283,145	532	875
7	2	Male:	2	Large town	304,832	307,515	555	912
8	2	Male:	3	Small town	193,329	354,638	596	980
9	2	Male:	4	Rural	220,357	262,384	512	843
10	3	Under 5 years	1	Urban	135,299	62,505	250	411
11	3	Under 5 years	2	Large town	18,808	40,824	202	332
12	3	Under 5 years	3	Small town	11,637	46,254	215	354
13	3	Under 5 years	4	Rural	12,872	31,569	178	292
14	4	5 to 9 years	1	Urban	138,587	990,832	995	1,637
15	4	5 to 9 years	2	Large town	19,388	113,647	337	555
16	4	5 to 9 years	3	Small town	13,144	96,000	310	510
17	4	5 to 9 years	4	Rural	14,125	30,124	174	286
18	5	10 to 14 years	1	Urban	133,666	891,476	944	1,553
19	5	10 to 14 years	2	Large town	20,360	136,610	370	608
20	5	10 to 14 years	3	Small town	12,582	76,670	277	455

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

- Susan then calculates the percent of adults aged 65 and older in each of the four geographic areas and uses the Variance Replicate Tables Documentation to calculate margins of error for these percentages.

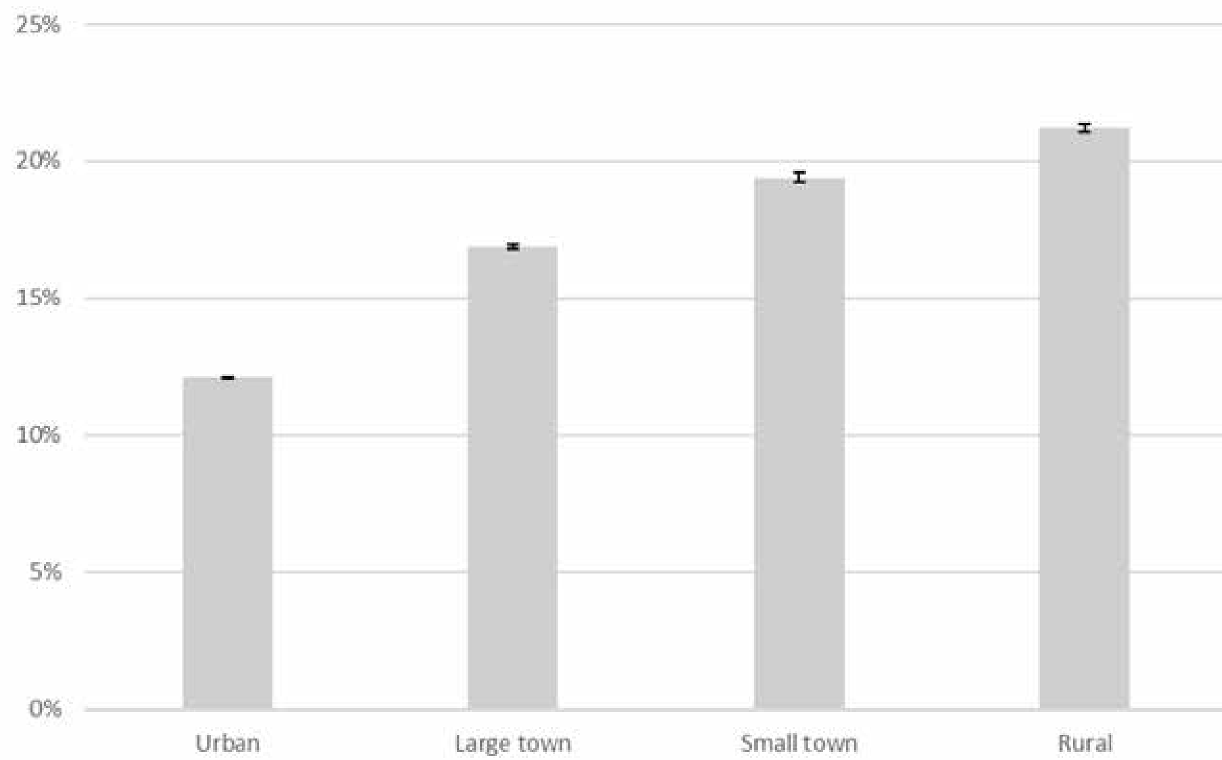
- Finally, Susan compiles the new estimates and margins of error into a single table in Excel and examines the differences in age distributions across RUCA regions. She notes that the rural areas of the state have the oldest age distribution. Twenty-one percent of all rural residents are aged 65 and older, compared with just 12 percent of urban residents (see Figures 4.19 and 4.20).

Figure 4.19. **Aggregated Estimates of Population by Age and Rural-Urban Area**

Geographic area	Estimate (total)	Estimate (65+)	Percent 65+	Standard error of percent	Margin of error of percent
Urban	3,988,163	483,396	12.121	0.009	0.014
Large town	608,769	102,756	16.879	0.053	0.087
Small town	388,769	75,460	19.410	0.110	0.180
Rural	433,470	91,917	21.205	0.089	0.147

Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

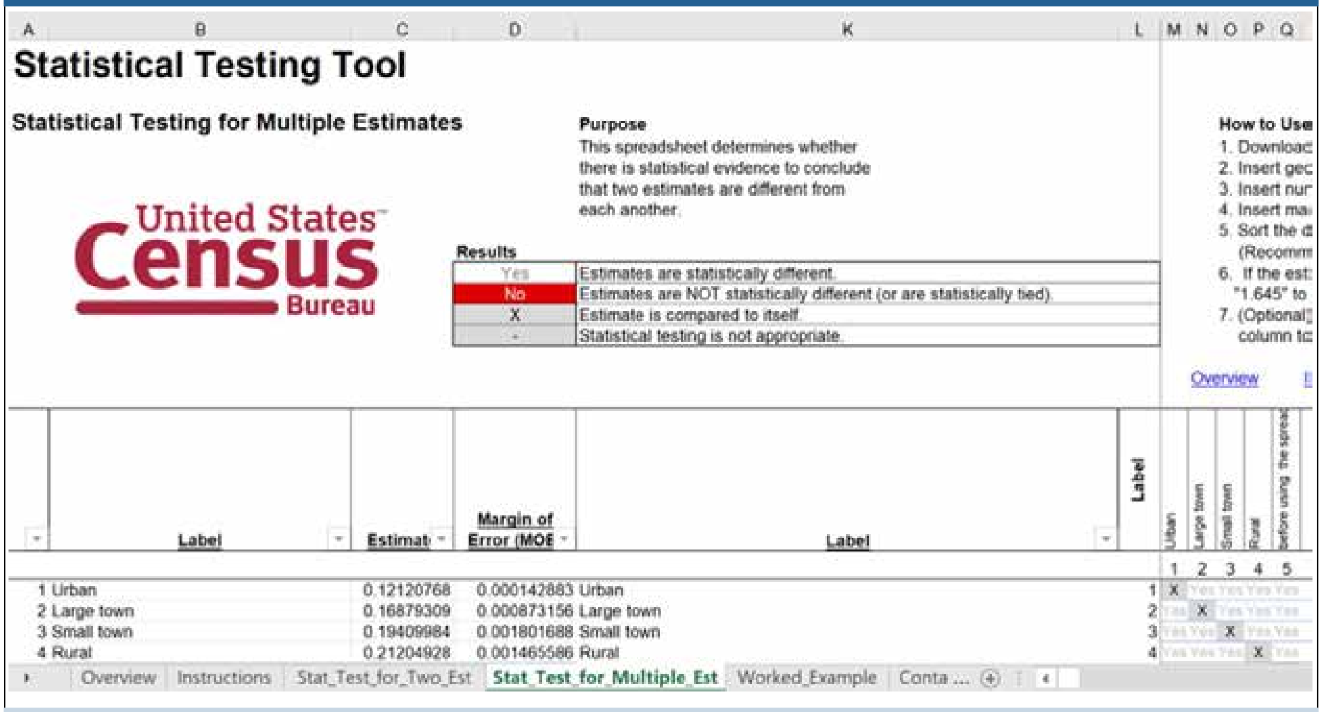
Figure 4.20. **Percentage of Population Aged 65 and Older by Rural-Urban Area (With Confidence Intervals), Minnesota: 2011–2015**



Source: Author's analysis of data from the U.S. Census Bureau, 2011–2015 American Community Survey.

- Susan then tests whether the observed differences in the percent aged 65 and older across geographic areas are statistically significant. She pastes the estimates and their associated margins of error into the Census Bureau's Statistical Testing Tool and finds that all of the differences across geographic areas are significant at the 99 percent confidence level.[36] She uses this information to convey her confidence that rural areas of the state have a significantly higher share of older adults than urban areas. She notes that as an area becomes more rural, the share of the older adult population in that area grows (see Figure 4.21).

Figure 4.21. **Testing for Significant Difference Using Statistical Testing Tool**



Source: U.S. Census Bureau, American Community Survey, Statistical Testing Tool, <www.census.gov/programs-surveys/acs/guidance/statistical-testing-tool.html>.

Susan uses this analysis to help her convey age differences of the residents of rural, small town, large town, and urban areas in reports that her office produces for state policymakers. While she does not always report the numeric results of statistical tests, knowing which differences are significant helps her know which differences she can highlight in her narrative. Conversely, knowing which differences are not statistically significant helps her know which differences she should downplay in her reporting. An example of a report that was informed by this type of analysis is Greater Minnesota: Refined and Revisited.[37] (This report was produced using 2010–2014 ACS 5-year estimates, and so the data are somewhat different, but the results are consistent with the results described here.) This report has been used by policymakers working on rural health care initiatives, on Equal Employment Opportunity activities, and by legislators working to create policies that align with current economic conditions in different areas of the state.

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

[37] Minnesota State Demographic Center, Greater Minnesota: Refined and Revisited, <https://mn.gov/admin/demography/reports-resources/greater-mn-refined-and-revisited.jsp>.