

Margins of Error the ACS Way: Working with Variance Replicate Estimate Tables

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Motivation for Using the Variance Replicate Estimate (VRE) Tables

- Combining estimates published on data.census.gov:
 - Sum within a table
 - Sum across geographies
 - Both

	Census Tract 1, Aleutians East Borough, Alaska		Census Tract 1, Aleutians West Census Area, Alaska	
	Estimate	Margin of Error	Estimate	Margin of Error
▼ Total:	3,338	*****	975	+/-128
▼ Male:	2,049	+/-100	627	+/-102
Under 5 years	42	+/-12	28	+/-10
5 to 9 years	74	+/-16	33	+/-10

Motivation for Using the VRE Tables

- Must approximate the margin of error (MOE) if using published tables

Approximation formula for the MOE of a count estimate:

$$\text{MOE}(\text{Est}_1 + \text{Est}_2) = \sqrt{\text{MOE}(\text{Est}_1)^2 + \text{MOE}(\text{Est}_2)^2}$$

- The approximation formula does not (and cannot) account for correlation between estimates
- MOE may be large and diverge from MOE calculated from microdata

VRE Tables to the Rescue!

- VRE Tables allow you to calculate the margin of error using the same replicate variance methodology as the ACS uses

$$\text{Variance} = \frac{4}{80} \sum_{i=1}^{80} (\text{Var_Rep}_i - \text{Estimate})^2$$

- Not an approximation formula
 - Incorporates correlation between estimates
- May be used for any type of estimate
 - Counts, Percents, Means, Ratios, etc.

VRE Tables Publication Information

- Available for all 5-year periods from 2009-2014 through 2015-2019
 - Published in January after the 5-year release in December (same time as the 5-year PUMS)
 - Zipped .csv files
- Includes 113 detailed tables for 2015-2019
 - All tables sourcing ACS Data Profile count, percent, & ratio estimates, plus a few others
- Eleven summary levels:
 - Nation, state, county, county subdivision (MCD), tract, block group, place, AIAN area, metropolitan/micropolitan area, Congressional District, ZCTA

ACS VRE Table vs. Detailed Table

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	TBLID	GEOID	NAME	ORDER	TITLE	estimate	moe	CME	SE	Var_Rep1	Var_Rep2	Var_Rep3	Var_Rep4
2	B01001				SEX BY AGE								
3	B01001				Universe: Total population								
4	B01001	01000US	United States	1	Total:	321,004,407	0	*****	0	321,004,391	321,004,391	321,004,391	321,004,391
5	B01001	01000US	United States	2	Male:	158,018,753	5,582	+/-5,582	3,393	158,022,330	158,018,446	158,020,151	158,019,657
6	B01001	01000US	United States	3	Under 5 years	10,151,822	3,520	+/-3,520	2,140	10,154,087	10,152,109	10,153,832	10,151,106
7	B01001	01000US	United States	4	5 to 9 years	10,431,216	17,420	+/-17,420	10,590	10,434,084	10,431,448	10,434,956	10,431,501
8	B01001	01000US	United States	5	10 to 14 years	10,585,293	17,356	+/-17,356	10,550	10,581,975	10,586,227	10,580,133	10,585,131

SEX BY AGE		
Survey/Program: American Community Survey		Product: 2017: ACS 5-Year Estimates Detailed Tables
TableID: B01001		Universe: Total population
United States		
	Estimate	Margin of Error
▼ Total:	321,004,407	*****
▼ Male:	158,018,753	+/-5,582
Under 5 years	10,151,822	+/-3,520
5 to 9 years	10,431,216	+/-17,420
10 to 14 years	10,585,293	+/-17,356

Comparison of the Sex by Age table (table ID B01001) at the national level

Variance Replicate Estimates (VRE) data is above

ACS detailed table data is on the left

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VRE table includes 80 variance replicate estimates, Var_Rep#

They are used to calculate the margin of error

Only 4 are shown here

Useful Links for VRE Tables

- “Calculating Margins of Error the ACS Way” webinar
<https://www.census.gov/data/academy/webinars/2020/calculating-margins-of-error-ac.html>
- Variance Replicate Estimate Tables Documentation
<https://www.census.gov/programs-surveys/acs/technical-documentation/variance-tables.html>
- Variance Replicate Estimate Tables Data
<https://www.census.gov/programs-surveys/acs/data/variance-tables.html>

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