

American Community Survey Technical Training

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CaSDC General Update Meeting
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Overview

- Sample Design
- Sample Disposition
- Weighting and Controls
- Migration Flow Data



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SAMPLE DESIGN

Starting Points of Sample Design

- We have a fixed budget to design an annual survey to satisfy the needs of decennial long form
- Driven by reliability parameter called coefficient of variation which measures variability compared to size of estimate.
- Target is the 5-year estimates
- 1- and 3-year estimates are by-products

Goals of Sample Design

- Produce reliable estimates for:
 - Small areas including census tracts, governmental units
 - Small populations as a by-product
- Reduce the disparity in reliability across size of area
- Reduce response burden on the public



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Response Burden

- Early in the history of the ACS, there was concern about the burden on the public
- Thus, it is built into the sample design that an address is only eligible to be in sample once in a 5-year period



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Ensuring Reliability for Small Areas

- Important concept:
 - The reliability of an estimate is based on its sample size not its sampling rate
- Thus, large area can be sampled at a lower rate than smaller areas to get the same level of reliability
- This allows us to use different sampling rates to improve reliability for small areas

History of Varying sampling rates

- 1980 Census had 2 sampling rates
- 1990 Census had 3 sampling rates
- 2000 Census had 4 sampling rates
- 2005-2010 ACS had 7 sampling rates
- 2011+ ACS has 16 sampling rates

Why So Many Rates?

- More rate categories allows greater fine tuning of the sample
 - Less disparity in reliability across size classes
 - Less sudden jumps for areas near the boundaries of the size classes
- However, there is a trade-off
 - Improves reliability for target areas
 - May decrease reliability in higher geo areas
- Optimum is a question of balance

How are our rates defined?

- Items to note:
 - Total sample size is fixed not sampling rate
 - Sampling rates for smallest areas are fixed
 - Remainder are parameterized as a function of our base rate (BR)
 - Rates are dependent on measure of size (MOS) for the area and response rate
 - Sampling rate for a census block is based on smallest governmental unit or tract that contains it

Sampling Entities

- Governmental Units
 - Counties
 - Minor Civil Divisions
 - Places
 - School Districts
 - American Indian Areas including Chapters
- Tracts



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Sampling Rates for Blocks based on their Governmental Units Measure of Size (Gov't Unit MOS)

STRATUM	BLOCK MOS CRITERIA	Sampling Rates
1	0 < Gov't Unit MOS ≤ 200	15% (fixed)
2	200 < Gov't Unit MOS ≤ 400	10% (fixed)
3	400 < Gov't Unit MOS ≤ 800	7% (fixed)
4	800 < Gov't Unit MOS ≤ 1,200	2.8 × Base Rate

- Measure of size (MOS) is defined as estimated occupied housing units for area
- Fixed rates for strata 1-3, only stratum 4 has a parameterized sampling rate
- If Gov't Unit MOS > 1,200 use next slide



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Sampling Rates for Blocks based on their Tract Measure of Size (Tract MOS)

Stratum	Block MOS Criteria	Sampling Rates
5	0 < Tract MOS ≤ 400	3.5×Base Rate
6	0 < Tract MOS ≤ 400 High Resp.	0.92×3.5×Base Rate
7	400 < Tract MOS ≤ 1,000	2.8×Base Rate
8	400 < Tract MOS ≤ 1,000 High Resp.	0.92×2.8×Base Rate
9	1,000 < Tract MOS ≤ 2,000	1.7×Base Rate
10	1,000 < Tract MOS ≤ 2,000 High Resp.	0.92×1.7×Base Rate
11	2,000 < Tract MOS ≤ 4,000	Base Rate
12	2,000 < Tract MOS ≤ 4,000 High Resp.	0.92×Base Rate
13	4,000 < Tract MOS ≤ 6,000	0.6×Base Rate
14	4,000 < Tract MOS ≤ 6,000 High Resp.	0.92×0.6×Base Rate
15	6,000 < Tract MOS	0.35×Base Rate
16	6,000 < Tract MOS High Resp.	0.92×0.35×Base Rate



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Simulated Reliability of Tract-Level Estimates by Size Class

Tract Size Category	Average Tract Size	CV* Using 7 Rates	CV* Using 16 Rates
0 – 400	291	59%	35%
401 – 1,000	766	36%	25%
1,001 – 2,000	1,485	26%	25%
2,000 – 4,000	2,636	23%	25%
4,000 – 6,000	4,684	17%	25%
6,000 +	8,337	13%	25%

CV = coefficient of variation (standard error / estimate)
for simulated 10% poverty estimate



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Final Comments on Sampling

- The addition of more summary rates allows us to achieve more equitable reliability across small areas
- The impact on the reliability of larger areas has been minimal
- The combination of increasing the number of sampling rates and the sample expansion in 2011 should help small area data substantially



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SAMPLE DISPOSITION



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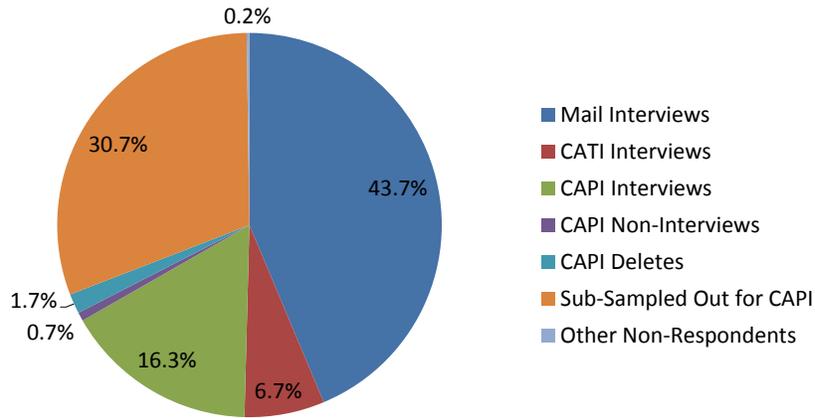
What is Sample Disposition?

- What happens to our sample once it is sent to the field?
- Modes of data collection
 - Internet (2013+)
 - Mail
 - Computer Assisted Telephone Interview
 - Computer Assisted Personal Interview

Classifications for Sample Disposition (2011 Data)

- Interviews
 - Mail Interview
 - CATI Interview
 - CAPI Interview
- Noninterviews
 - CAPI Non-Interview
 - Other Nonrespondents
- Other
 - CAPI Delete
 - Sampled Out for CAPI

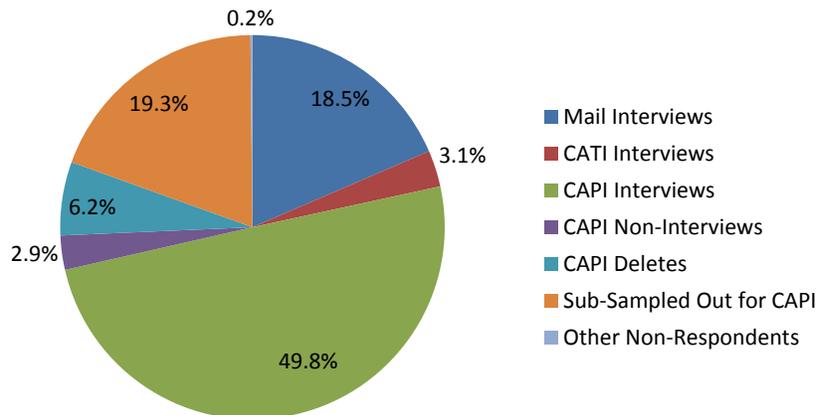
Sample Disposition for U.S.



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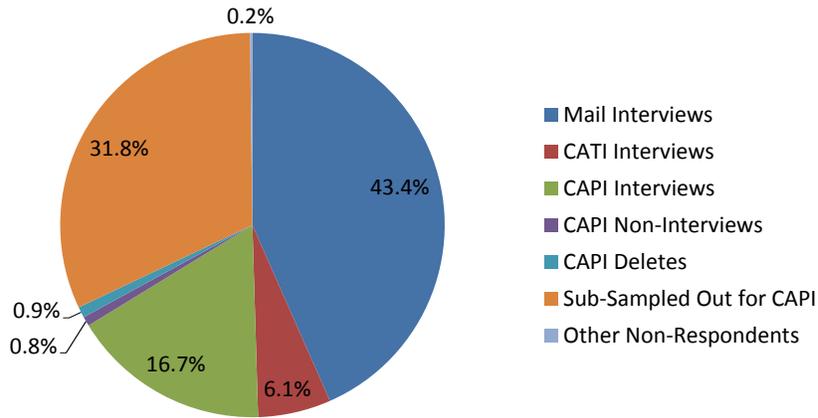
Sample Disposition for Alaska



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Sample Disposition for California

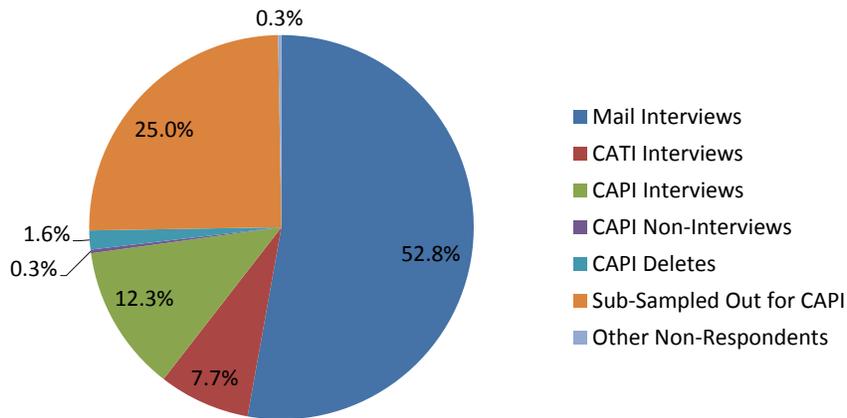


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Sample Disposition for Minnesota



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WEIGHTING AND CONTROLS

Purpose of Weighting

- We sample only a portion of universe of housing and population
- Without weights, estimates from the sample would represent only the interviewed sample
- Process of weighting allow estimates to reflect the original universe of housing units and population

Starting Points for Weighting

- Unique housing unit weight is assigned to every sample housing unit to estimate
 - Housing characteristics
 - Household characteristics
- Unique person weight is assigned to each person to estimate
 - Householder characteristics
 - Population characteristics



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Focus for Today

- General overview of housing unit and household person weighting
- Role of independent estimates of housing units and population by demographics as survey controls



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Basic HU Weighting Summary

- Assign base weights account for probability of selection
 - Adjust for nonresponse
 - Adjust for total housing unit coverage
- ...go off and do household person weighting...
- Adjust for differential coverage of housing units based on demographics of householder



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Base Weights

- Two sample selections occur for the ACS
- Initial sample selection
 - Affects all sample records
 - Rates vary from 0.5% to 15%
- Sample selection of nonrespondents for personal visit (CAPI)
 - Affects only housing units that do not respond to prior to personal visit
 - Rates vary from 1-in-3 to full followup (100%)



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Examples: Base Weights

- Weights are the inverse of the sampling rates
 - Sampling rate = 5%, weight is $1/0.05 = 20$
 - Sampling rate = 10%, weight is $1/0.10 = 10$
- If a unit does not respond via mail, internet, or telephone, it may be sampled further before being selected for personal visit (CAPI)
 - CAPI sampling rate is 1-in-3, then the weight above is multiplied by 3

Adjustment for Nonresponse

- Key assumptions of nonresponse adjustment
 - All vacant units are properly identified in the field
 - All noninterviews are assumed to be occupied
- Based on these assumptions, the nonresponse adjustment
 - Adjusts the weights of the occupied interviews to account for the noninterviews
 - Does not adjust the weights of vacant interviews
 - Weights of noninterviews are set to zero

Examples: Adjust for Nonresponse

- Consider the following:
 - Weighted occupied interviews = 81
 - Weighted noninterviews = 9
 - Weighted vacant interviews = 10
- After adjustment [factor occ. int. = $(81+9)/81$]
 - Weighted occupied interviews = 90
 - Weighted noninterviews = 0
 - Weighted vacant interviews = 10
- Note weighted vacant interviews is fixed

Adjustment for HU Coverage

- The adjustment for coverage uses independent estimates of housing units (HUs)
 - Independent estimate is for total HUs only
 - No breakdown of occupied / vacant is available
- Thus, this adjustment has the following impact
 - Estimate of occupied and vacant HUs are impacted proportionally
 - Vacancy rate for HUs is not impacted

Example: Coverage Adjustment

- Consider the following:
 - Weighted occupied interviews = 90
 - Weighted vacant interviews = 10
 - Total weighted HUs = 100, Independent Est = 110
- After adjustment (factor = $110 / 100 = 1.1$)
 - Weighted occupied interviews = 99
 - Weighted vacant interviews = 11
 - Total weighted HUs = 110 = independent estimate
- Note that the vacancy rate:
start $10/100 =$ finish $11 / 110 = 90\%$

Household Person Weighting

- Initial person weight is the housing unit weight after the HU coverage adjustment
- Already incorporated
 - Adjusting nonresponse
 - Adjusting for whole household / HU coverage
- What remains?
 - Within household coverage
 - Differential coverage by demographics

Goals of Person Weighting (Iterative Process)

- Adjust for subcounty total population coverage
- Ensure consistency between person and housing unit weights when estimating
 - Occupied housing units and householders
 - Married-spouse-present households and estimates spouse (also unmarried partners)
- Adjust for differential coverage by demographics

Subcounty Coverage

- Subcounty area (cannot cross county)
- Area must have the following population
 - 24,000 for 1-year ACS
 - 8,000 for 3-year ACS
 - 2,500 for 5-year ACS
- Collapse areas as necessary
- Must have 2x population above for controlling subcounty areas to be possible
- Entire county is the fall back method

Spouse / Householder Equalization

- Adjust person weights so that the following hold true:
 - Make estimated householders equal to estimated occupied housing units
 - Make estimated spouses + unmarried partners equal to households of same type
 - Preserve total population
- Without this step, estimates made with HU weights vs person weights would be inconsistent

Differential Person Coverage

- These adjustment are performed within a weighting area (1 or more counties)
- Adjust for coverage at weighting area by
 - Hispanic + Non-Hispanic by 5 Race (6 total)
 - Age / Sex (13 x 2 = 26 categories)
- Collapse categories as necessary
 - Maximum is 156 combinations of above
 - Realistically, collapse to approximately half

Iterative Process

- We can't achieve each of the 3 goals simultaneously
- We iterate the three steps up to 40 times
- Criteria for stopping
 - Achieve goals within 0.01% in fewer than 20 iterations (e.g., +/- 1 for subcounty pop = 10k)
 - Achieve goals within 0.1% in fewer than 40 iterations (e.g., +/- 10 for subcounty pop = 10k)
 - Reach 40 iterations



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Adjustment for Differential Householder Coverage

- Applied only to occupied HUs
- Total occupied housing units
 - Changes very little at county level
 - Can change more at the subcounty level
- Total vacant housing units
 - Unchanged at any geographic level
- Vacancy rate
 - Impacted by any change in estimated occupied
 - Impacted subcounty but very little at county level



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Example: Differential Coverage Adjustment

- Consider the following area total:
 - Estimated HUs with White Householder = 55
 - Estimated HUs with non-White householder = 44
 - Estimated vacant HUs = 11, Est. total HUs = 110
- After adjustment
 - Estimated HUs with White Householder = 53
 - Estimated HUs with non-White householder = 47
 - Estimated vacant HUs = 11, Est. total HUs = 111
- Note: estimated vacant HUs is unchanged
- Note: est. vacancy rate changes because total +1



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In summary

- Weighting assigns person and HU weights
- Weighting accounts for sampling, nonresponse, and coverage adjustments
- Use population estimates as survey controls
- Some subcounty areas (places / minor civil divisions) may be (nearly) controlled
- Published counties typically are controlled for
 - Total population
 - Possibly Hispanic / non-Hispanic, some age / sex categories
- Do not expect county race totals to match population estimates



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MIGRATION FLOW DATA



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County-to-County Migration Flows

- Derived from residence one year ago question on ACS
- In-flow estimate would list estimated population coming from all 3,142 other counties to the county of interest
- Out-flow would be the reverse of that
- Poses significant challenges to standard American Fact Finder system



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Release of Migration Flow Data

- Data are released as downloadable tables

<http://www.census.gov/hhes/migration/data/acs/county-to-county.html>

- Data are also available on an interactive mapping tool

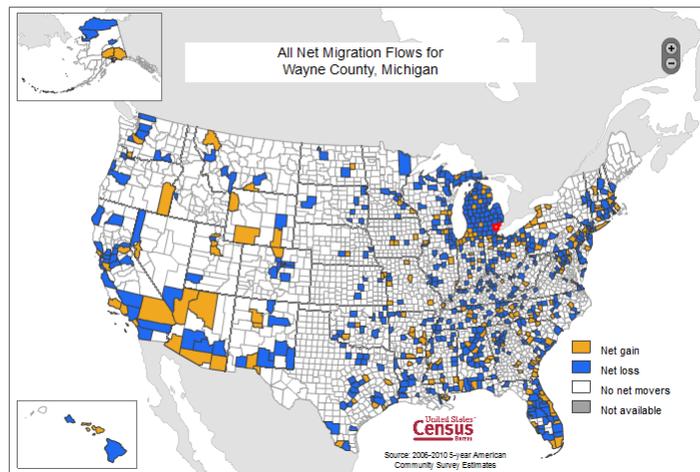
<http://flowsmapper.geo.census.gov/flowsmapper/flowsmapper.html>



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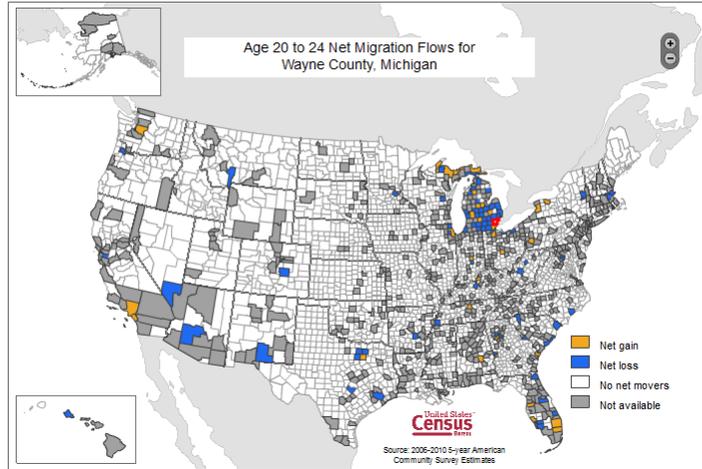
Wayne County, MI – Net Flow



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Wayne County, MI – Net Age 20-24

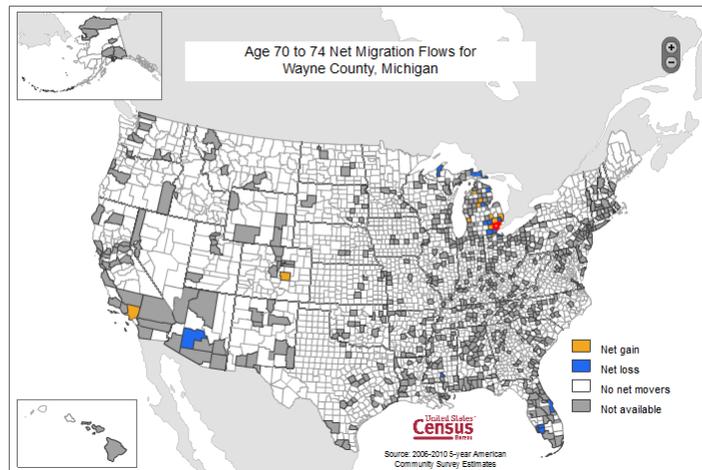


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Wayne County, MI – Net Age 70-74

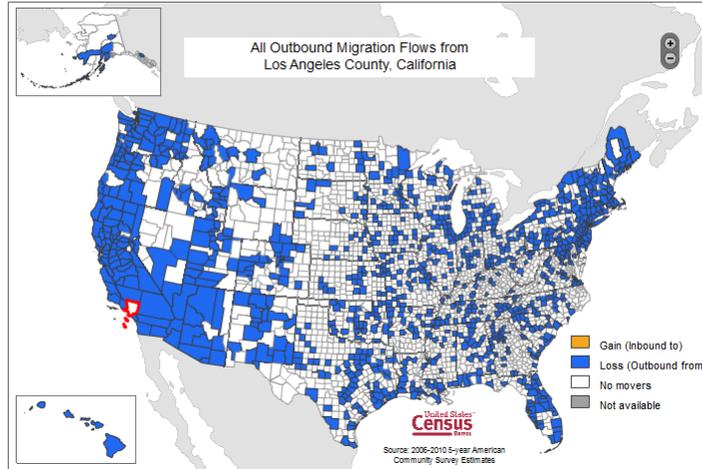


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Los Angeles - Outflow

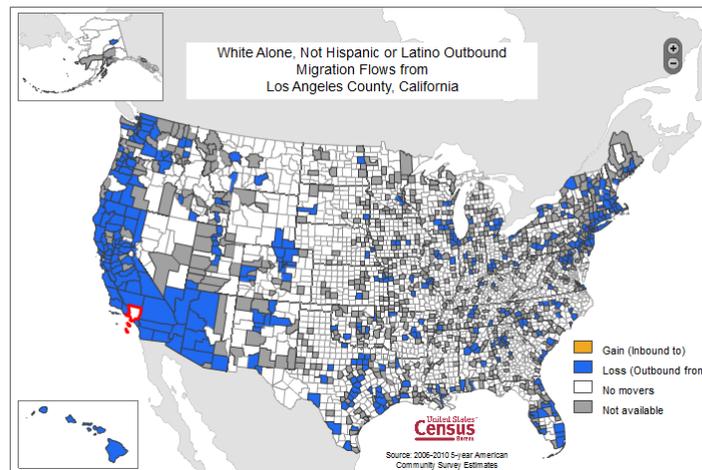


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Los Angeles – Outflow White Alone, Not Hispanic

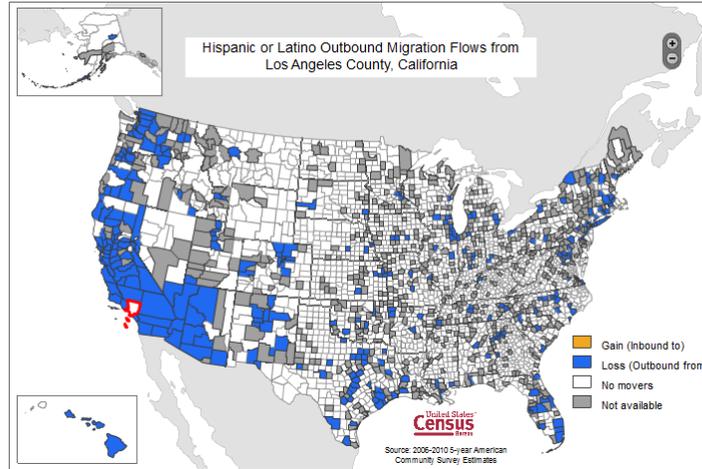


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Los Angeles – Outflow Hispanic



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What to Expect

Year	2012	Late 2012	2013	2014	2015	2016	2017
ACS Data set	05-09	06-10	07-11	08-12	09-13	10-14	11-15
File:							
County-to-County	Released	Released	X	X	X	X	X
County/MCD-to-County/MCD	Released	Released	X	X	X	X	X
...by Age		Released					X
...by Sex		Released					X
...by Race		Released					X
...by Hispanic Origin		Released					X
...by Marital Status			?				
...by Place of Birth			?				
...by Nativity by Education				?			
...by Labor Force Status				?			
...by Industry Group					?		
...by Occupation Group					?		
...by Labor Force Status					?		
...by Poverty Status						?	
...by Tenure						?	
...by Individual Income							?



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Contact Information

- Mark.E.Asiala@census.gov
- Useful links:
 - ACS webpage:
<http://www.census.gov/acs/>
 - Design and Methodology Report:
http://www.census.gov/acs/www/methodology/methodology_main/
(working on update for 2013 and internet)



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