The American Community Survey:
Developing a Continuous Measurement Application in the United States

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Presented at a Workshop on Alternative Approaches to Population and Housing Censuses
Instituto Brasileiro de Geografia e Estatistica

Rio de Janiero, Brazil
October 2004

Overview of Session

- Evolution of the American Community Survey
- Current Design
- Current Status, Issues and Challenges

Evolution of the American Community Survey (ACS)

Stages of ACS Development

- 1981 - 1993 Design Origins and Early Proposals
- 1994 - 1996 Development of Continuous Measurement Prototype
- 1994 on Consultations

Stages of ACS Development

- 1996 - 1998 Operational Testing
- 1999 - 2004 Demonstration Period
- 2005 on Full implementation
- 2005 on Survey Improvement

Design Origins and Early Proposals

- Concept of “rolling sample design”
- Mid-decade census
- Proposed “Decade Census Program”
- Continuous measurement alternatives to the Census 2000 long form

Development of Continuous Measurement Prototype

- Continuous Improvement Frame
- Intercensal Long Form Survey
- Integrated Estimates Program
- General Purpose Frame
- Drastic Reduction of 2000 Census Content

Intercensal Long Form Survey
Design Elements

- Monthly samples
- Mail, phone and personal visit data collection
  - with subsampling
- Reference period should be date of interview

Intercensal Long Form Survey
Design Elements

- Ratio adjustments to independent estimates
- All survey estimates will be averages
  - 12 months
  - 36 months
  - 60 months

Consultations

- Congressional briefings
- Technical workshops
- User meetings
- Advisory committee and oversight group meetings
- Information meetings with federal government agencies

Consultations

- Resulted in additional changes to basic design
- Cost and accuracy tradeoffs debated

Operational Testing

- Conducted initial testing in 4 sites, later expanded to additional sites
- Priority given to develop and evaluate critical methods for housing unit universe
- Revisions made to prototype and additional research identified

Demonstration Period

- Goal to provide critical assessments of
  - Feasibility
  - Quality
  - Comparability with Census 2000

Full implementation

- Plan to expand to full sample in 2005
  - All states and Puerto Rico
- Plan to delay expansion until 2006 to include population living in places other than housing units (group quarters population)
- Critical for the ACS to continue to monitor quality and operational efficiency

Survey Improvement

- Continuous improvements have been made in the design of the ACS since its inception
- Larger-scale research projects expected after survey in place

Current Design

- Sample design
- Data collection and capture
- Data processing
- Weighting and estimation
- Data products

Sample Design

- Survey designed to include
  - U.S. Stateside and Puerto Rico
  - Population in both housing units and group quarters (group quarters delayed until 2006)
- Survey designed to produce annually updated single-year and multi-year estimates

Sample Design

- Unclustered one-stage systematic sample selected as initial sample each month
- Subsample of nonrespondents selected after mail and phone attempts for personal visit follow-up

Sample Design

- Initial sampling rate
  - about 2.5% each year
  - about 12.5% over 5-year period

- Results in an initial sample of about
  - 250,000 addresses each month
  - 3 million addresses each year
  - 15 million addresses over 5-year period

Sample Design

- Variable sampling rates are used to ensure sufficient sample sizes in the smallest governmental units

- Initial sampling rates range from
  - about 1.7% to about 10% each year
  - about 8.5% to about 50% over a 5-year period

Sample Design

- About 2.2 million interviewed units expected per year due to
  - subsampling prior to personal visit interviewing
  - elimination of commercial or nonexistent addresses from initial address sample
  - noninterviews

Sample Design

- Sample is cumulated over TIME to produce lowest levels of geographic detail to replace census sample
- Five years of data are required for areas with less than 20,000 population

Sample Design

- Sample is cumulated over SPACE to produce
  - 3-year estimates for areas with populations of 20,000 or greater
  - single-year estimates for areas with populations of 65,000 or greater

Sample Design

- The final sample over a 5-year period is smaller than the sample for the decennial long form
- We project that the estimates of sampling error for the 5-year ACS estimates will be about 1/3 higher than those from decennial census estimates

Sample Design
Frame

- Sample cases selected from an updated Master Address File (MAF)
- MAF updated through the use of…
  - Postal Service updates in most areas
  - Special field updating in more rural areas

ACS Content

- Demographic characteristics such as:
  - age
  - sex
  - race
  - Hispanic origin
  - relationship
- Social characteristics such as:
  - educational attainment
  - disability
  - language spoken
  - citizenship
  - fertility

ACS Content

- Economic characteristics such as:
  - income
  - poverty
  - industry, occupation and class of worker
  - employment status
- Housing characteristics such as:
  - tenure
  - year structure built
  - rent and mortgage
  - value
  - utility costs

Data Collection and Capture

- Data are collected as of the date of interview using a current residence rule
- Data are collected throughout the entire year
- Survey participation is mandatory

Data Collection and Capture

- Methodology based on best practices from decennial census and demographic surveys
- Monthly samples using overlapping multi-mode data collection methods
  - Mail
  - Telephone
  - Personal Visit

Data Collection
Sample Panels

Sample Panel	Calendar Month				
	Jan 2005	**Feb 2005**	**Mar 2005**	**Apr 2005**	**May 2005**
Nov 2004	Personal Visit				
Dec 2004	Phone	Personal Visit			
Jan 2005	Mail	Phone	Personal Visit		
Feb 2005		Mail	Phone	Personal Visit	
Mar 2005			Mail	Phone	Personal Visit

Data Collection
Monthly

Sample Panel	Calendar Month				
	Jan 2005	**Feb 2005**	**Mar 2005**	**Apr 2005**	**May 2005**
Nov 2004	Personal Visit				
Dec 2004	Phone	Personal Visit			
Jan 2005	Mail	Phone	Personal Visit		
Feb 2005		Mail	Phone	Personal Visit	
Mar 2005			Mail	Phone	Personal Visit

Data Collection
Continuous cycle

Sample Panel	Calendar Month				
	Jan 2005	**Feb 2005**	**Mar 2005**	**Apr 2005**	**May 2005**
Nov 2004	Personal Visit				
Dec 2004	Phone	Personal Visit			
Jan 2005	Mail	Phone	Personal Visit		
Feb 2005		Mail	Phone	Personal Visit	
Mar 2005			Mail	Phone	Personal Visit

Data Collection and Capture
Mail

- Four mailings used to maximize mail response
- Over 95% of sample universe eligible for mailout
- Mail response rates average about 50% each month

Data Collection and Capture
Mail

- Mailout in one language
  - U.S. stateside English
  - Puerto Rico Spanish
- Language forms available upon request
- Telephone assistance provided in English and Spanish

Data Collection and Capture
Mail

- Current capture method involves keying data from paper questionnaires
- Research planned to convert to image capture and key-from-image technology
- Data are reviewed for completeness with telephone follow-up to resolve missing and inconsistent responses

Data Collection and Capture
Telephone

- About 5 weeks after the initial mailout, most mail returns have been received
- The nonresponse workload is identified for telephone follow-up
- Commercial vendors provide telephone numbers

Data Collection and Capture
Telephone

- 3 call centers conduct interviews using computer-assisted methods
- Telephone follow-up lasts about four weeks
- Survey instruments in English and Spanish

Data Collection and Capture
Personal Visit

- Two universes for personal visit followup
  - nonrespondents to the mailout and telephone
  - cases ineligible for mailout
- Subsample selected
- Personal visit followup conducted out of our 12 regional offices

Data Collection and Capture
Personal Visit

- Interviewers are experienced, continuously employed
- Interviewers use laptops with English and Spanish translations
- Regional offices recruit bilingual staff to ensure data collection from non-English speaking households

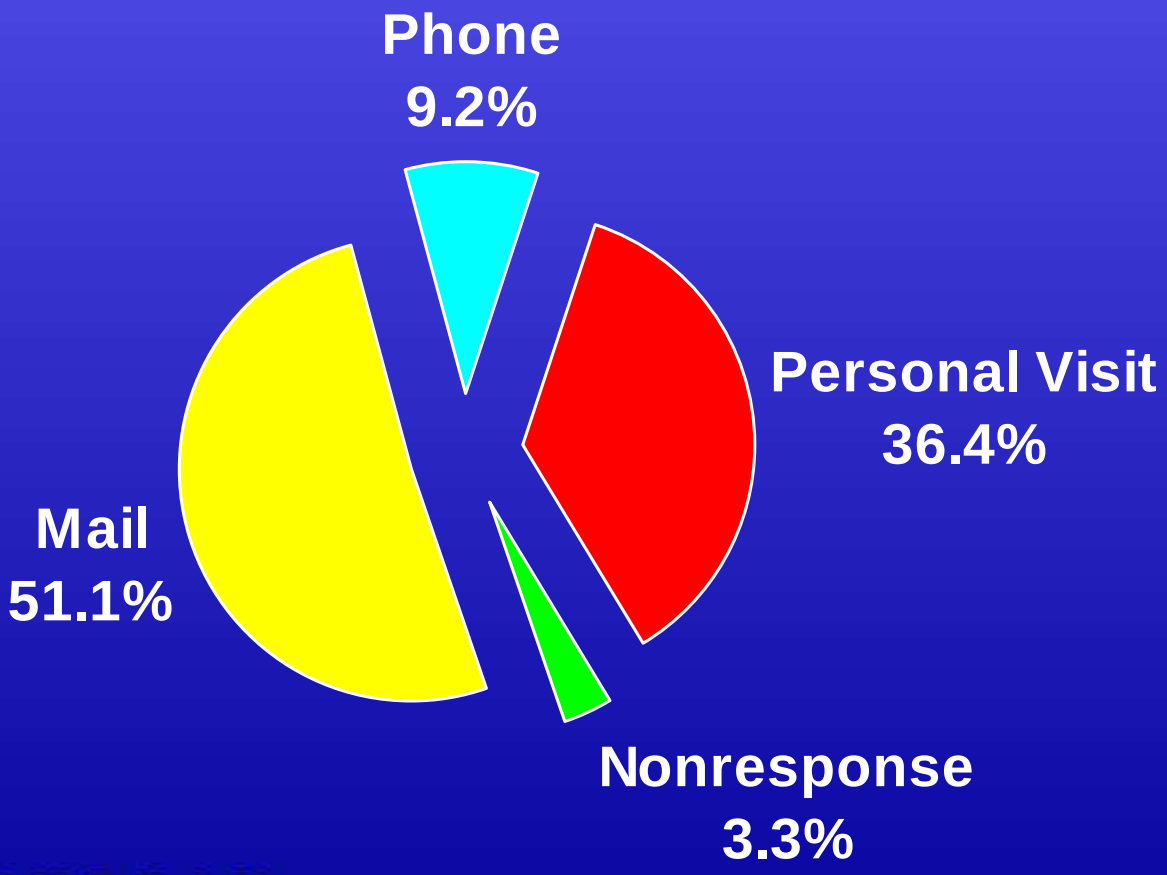
Data Collection
Response Rates

- These three sequential modes of data collection have been successful
  - response to the ACS is very high
  - true nationally and for all states

- ACS national-level response rates for 2000 - 2003 have all exceeded 95%

Data Collection

2001 interview results by mode



Data Processing
Annual accumulation

- All data collected in a given calendar year are used to produce the ACS estimates for that year
- Sample used for estimation is not the sum of the 12 sample panels for a given year

Data Collection
Monthly

Sample Panel	Calendar Month				
	Jan 2005	**Feb 2005**	**Mar 2005**	**Apr 2005**	**May 2005**
Nov 2004	Personal Visit				
Dec 2004	Phone	Personal Visit			
Jan 2005	Mail	Phone	Personal Visit		
Feb 2005		Mail	Phone	Personal Visit	
Mar 2005			Mail	Phone	Personal Visit

Data Processing
Annual Processing

- Coding
- Editing
- Imputation

Data Processing
Coding

- Automated and clerical coding used for write-in entries such as
  - Race, Hispanic origin
  - Language
  - Place of work
  - Ancestry
  - Industry, occupation and class of worker

Data Processing
Editing

- First step involves distinguishing between interviews and noninterviews
  - only interviews continue into edit
  - noninterviews dealt with during weighting

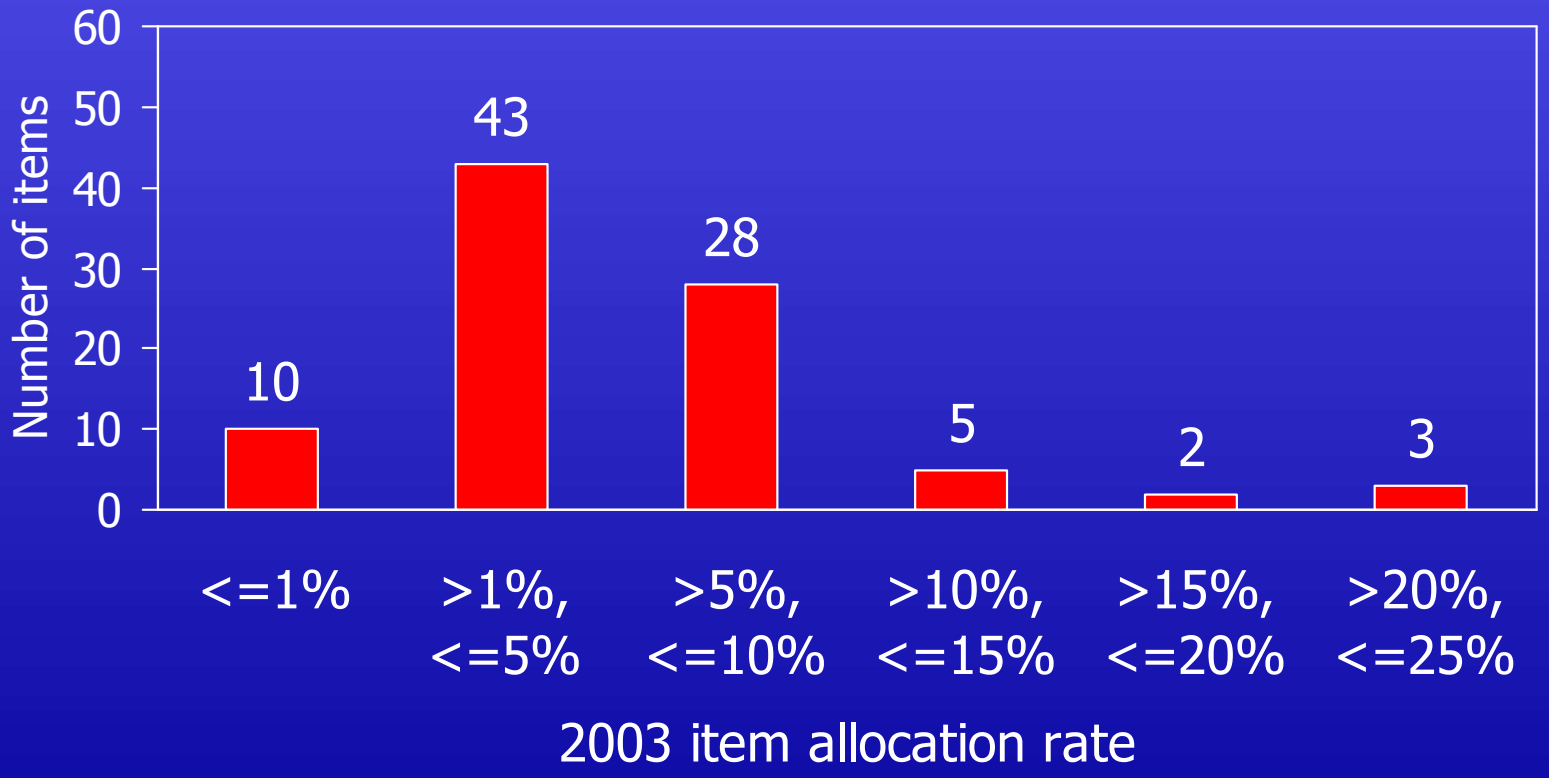
- For interviews, identify inconsistent and missing answers requiring imputation

Data Processing
Imputation

- Assignments
  - Rule based
  - Uses other reported information from the data record
- Allocations
  - Nearest neighbor or hot-deck methods
  - Uses data from other data records

Item Allocation Rates

2003 results



Weighting and Estimation

- Initial weights reflect the probability of selection
- Adjust weights of interviewed households to account for noninterviews
- Adjust weights to independent housing unit and population estimates (controls)

Weighting and Estimation
Ratio Adjustments to Controls

- Post-census estimates are produced by updating the previous census results using various administrative records data
- In a multi-stage process, housing unit and population adjustment ratios are applied to the weights
- Applied at the county (or group of counties) level by race/ethnicity and age/sex groups

Weighting and Estimation
Single-year Estimation

- Estimates include
  - population estimates
  - rates
  - medians

- Single-year estimates are computed using current geography

Weighting and Estimation
Multi-year Estimation

- Most multi-year estimates are generated by computing an average based on combining each years' estimates

Weighting and Estimation
Single-year Estimates

- Percent foreign born population in year 1:

$$P_1 = \text{Percent Foreign Born} = \frac{\text{Number Foreign Born}}{\text{Total Population}} = \frac{N_1}{T_1}$$

Weighting and Estimation

Multi-year Estimates

- Three-year estimate of percent foreign born in years 1-3:

$$P_{1-3} = \frac{N_1 + N_2 + N_3}{T_1 + T_2 + T_3}$$

Weighting and Estimation
Multi-year Estimation

- Estimates are computed using the geography of each place as of the most recent year of the period
- Dollar valued data items are inflation adjusted to most recent year of the period

Weighting and Estimation
Multi-year Estimation

- Medians are produced using combined data records from all years, not by averaging each year's median

Data Review, Acceptance and Release

- Automated review tool
- Data released within 8 months of completion of data collection
  - August of year following data collection

Data Products
Illustration of an ACS Release schedule

Type of Data	Population Size of Area	Assuming Full Implementation in 2005, Data For The Previous Year Would be Released In The Summer Of:						
		2006	2007	2008	2009	2010	2011	2012
Annual Estimates	65,000+							
3-year averages	20,000+							
5-year averages	Down to Census Tract and Block Group							

Data Products

- Base Tables
- Ranking Tables
- Profiles
- Subject Tables

Data Products
Example of a Base Table

PCT034. SEX BY EDUCATIONAL ATTAINMENT FOR THE POPULATION 25 YEA
Universe: POPULATION 25 YEARS AND OVER
Data Set: 2002 American Community Survey Summary Tables

NOTE. Data based on twelve monthly samples during 2002. For information on confidentiality prote
nonsampling error, and definitions, see http://factfinder.census.gov/home/en/datanotes/exp_acs2

United States	Estimate	Lower Bound	Upper Bound
Total:	182,686,266	182,610,170	182,762,362
Male:	87,163,415	87,112,255	87,214,575
No schooling completed	673,138	643,877	702,399
Nursery to 4th grade	905,534	871,080	939,988
5th and 6th grade	1,743,472	1,692,474	1,794,470
7th and 8th grade	2,586,573	2,525,893	2,647,253
9th grade	1,936,014	1,890,773	1,981,255
10th grade	2,381,551	2,326,642	2,436,460
11th grade	2,411,931	2,354,293	2,469,569
12th grade, no diploma	2,703,923	2,634,415	2,773,431
High school graduate (includes equivalency)	24,965,162	24,809,579	25,120,745
Some college, less than 1 year	5,391,307	5,317,988	5,464,626
Some college, 1 or more years, no degree	11,938,814	11,849,567	12,028,061
Associate degree	5,422,732	5,342,889	5,502,576
Bachelor's degree	14,979,405	14,865,501	15,093,309
Master's degree	5,586,393	5,518,027	5,654,759
Professional school degree	2,200,828	2,152,782	2,248,874
Doctorate degree	1,336,638	1,296,560	1,376,717
Female:	95,522,851	95,469,845	95,575,857
No schooling completed	777,852	751,091	804,613
Nursery to 4th grade	860,432	826,414	894,450
5th and 6th grade	1,740,405	1,683,784	1,797,026
7th and 8th grade	2,908,451	2,846,342	2,970,560
9th grade	2,082,006	2,029,521	2,134,491
10th grade	2,618,781	2,567,573	2,669,989
11th grade	2,653,703	2,593,135	2,714,271
12th grade, no diploma	2,733,261	2,667,903	2,798,619
High school graduate (includes equivalency)	29,100,769	28,956,445	29,245,093
Some college, less than 1 year	6,815,615	6,739,210	6,892,020
Some college, 1 or more years, no degree	13,052,522	12,957,330	13,147,714
Associate degree	6,919,731	6,839,592	6,999,870
Bachelor's degree	15,273,831	15,142,892	15,404,770
Master's degree	6,013,122	5,940,553	6,085,691
Professional school degree	1,331,872	1,299,115	1,364,629
Doctorate degree	640,498	611,087	669,909

Notes

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Data Products
Example of a Ranking Table

Ranking Tables: 2002

Median Household Income (In 2003 Inflation-adjusted Dollars)
Households (State level)

Rank	State	Median	Lower Bound	Upper Bound
	United States	**43,057**	**42,836**	**43,278**
1	New Jersey	58,759	57,332	60,186
2	Connecticut	56,543	54,850	58,236
3	Alaska	56,536	54,429	58,643
4	Maryland	55,650	54,124	57,176
5	Massachusetts	55,266	54,076	56,456
6	New Hampshire	54,225	52,324	56,126
7	Hawaii	50,565	47,859	53,271
8	Delaware	50,025	48,712	51,338
9	California	49,738	49,147	50,329
10	Minnesota	49,352	47,844	50,860
11	Virginia	48,986	47,570	50,402
12	Colorado	48,282	45,601	50,963
13	Illinois	46,528	45,291	47,766
14	Utah	46,443	45,034	47,852
15	Washington	46,041	44,403	47,679
16	Rhode Island	45,634	44,352	46,916
17	New York	44,923	44,136	45,710

Data Products
Example of a Multi-year Profile

TABLE 2. PROFILE OF SELECTED SOCIAL CHARACTERISTICS

The presence of an * notes a Significant Statistical difference between the most current year's data and the data in the marked column

	2002	2001		2000	
SCHOOL ENROLLMENT					
Population 3 years and over enrolled in school	74,649,109	73,187,876		72,556,563	
Nursery school, preschool	6.20%	6.00%		6.00%	
Kindergarten	5.40%	5.40%		5.40%	
Elementary school (grades 1-8)	44.30%	45.30%	*	45.40%	*
High school grade (grades 9-12)	21.70%	21.70%		21.70%	
College or graduate school	22.50%	21.70%	*	21.50%	*
EDUCATIONAL ATTAINMENT					
Population 25 years and over	182,686,266	179,959,220		177,532,915	
Less than 9th grade	6.70%	6.70%		7.00%	*
9th to 12th grade, no diploma	10.70%	11.20%	*	11.50%	*
High school graduate (including equivalency)	29.60%	29.60%		29.60%	
Some college, no degree	20.40%	20.40%		20.50%	
Associate degree	6.80%	6.60%		6.50%	*
Bachelor's degree	16.60%	16.30%	*	16.00%	*
Graduate or professional degree	9.40%	9.20%		9.00%	*

Data Products

Example of a possible subject table

Sample: Subject Table - Educational Attainment

	A	B	C	D	E	F	G	H	I	J
1	**Table**	**Line**		**Stub**	**1**	**2**	**3**	**4**	**5**	**6**
2										
3	SP14	0		**EDUCATIONAL ATTAINMENT**	Total		Male		Female	
4	SP14	0.5								
5	SP14	1		**Population 18 to 24 years**						
6	SP14	2		Less than high school graduate						
7	SP14	3		High school graduate (incl. equivalency)						
8	SP14	4		Some college or associate degree						
9	SP14	5		Bachelor's degree or higher						
10	SP14	5.5								
11	SP14	6		**Population 25 years and over**						
12	SP14	7		No schooling completed						
13	SP14	8		Nursery to 4th grade						
14	SP14	9		5th and 6th grade						
15	SP14	10		7th and 8th grade						
16	SP14	11		9th grade						
17	SP14	12		10th grade						
18	SP14	13		11th grade						
19	SP14	14		12th grade, no diploma						
20	SP14	15		High school graduate (incl. equivalency)						
21	SP14	16		Some college credit, less than 1 year						
22	SP14	17		Some college, 1 or more years, no degree						
23	SP14	18		Associate degree						
24	SP14	19		Bachelor's degree						
25	SP14	20		Master's degree						
26	SP14	21		Professional degree						
27	SP14	22		Doctorate degree						
28	SP14	22.5								
29	SP14	23		**Population 25 to 34 years**						
30	SP14	24		High school graduate or higher						
31	SP14	25		Bachelor's degree or higher						
32	SP14	25.5								
33	SP14	26		**Population 35 to 44 years**						
34	SP14	27		High school graduate or higher						
35	SP14	28		Bachelor's degree or higher						
36	SP14	28.5								

Data Products
Other Products

- Special Tabulations
  - Done on a reimbursable basis
  - Special review required to ensure against disclosure
- Public Use Microdata Sample
  - Created each year from the full ACS sample

Current Status, Issues and Challenges

Current Status

- Plan to begin full 3 million sample in 2005
- Plan to begin Puerto Rico Community Survey in 2005
- Delay start of group quarters until 2006

Current Status

- Beginning survey improvement stage to address specific issues and challenges and to improve survey cost-effectiveness
- Researching stability of ACS estimates
- Comparing ACS estimates with estimates from other U.S. Census Bureau surveys

Group Quarters Population

- Developing best methods for adding group quarters population to the survey
  - sampling
  - estimation
  - data collection

Sample Design
Issues and Challenges

- Maintaining frame completeness
- Maintaining proposed sample size despite risks of
  - budget reductions
  - increases in mail, phone and overall survey nonresponse

Data Collection and Capture
Issues and Challenges

- Maintaining high levels of mail response, overall survey response and improving effectiveness of telephone follow-up
- Testing additional language tools
- Shifting to image capture technology
- Nonsampling error research

Data Collection and Capture
Issues and Challenges

- Testing of alternative questionnaire formatting and question wording

- Improving methods for -
  - Rural areas with poor addresses for mailing
  - American Indian reservations
  - Remote Alaska
  - Puerto Rico

Data Processing
Issues and Challenges

- Maintaining low item allocation rates
- Reducing item nonresponse for specific items
- Researching alternative imputation methods

Weighting and Estimation
Issues and Challenges

- Develop Puerto Rico estimation methods
- Refine estimation process as we move from the demonstration period to full implementation
- Research reliability of small area estimates

Data Products
Issues and Challenges

- Educating users on multi-year products
- Transitioning users to the ACS from the traditional once-a-decade long form

Data Products
Issues and Challenges

- Maintaining timely review and release when volume of products multiplies
- Communicating errors, especially sampling errors, to users

Summary

- Over ten years in development, the ACS is ready for full implementation

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