

Measuring Survey Nonresponse by Race and Ethnicity

Deborah H. Griffin, United States Bureau of the Census
Bureau of the Census, 4700 Silver Hill Road, Washington, DC 20233-8700

1. Introduction

The ACS is being designed to take the place of the decennial census long form. In lieu of collecting detailed demographic, social, economic and housing data once-a-decade, the ACS would continuously collect such data, providing annual and multi-year estimates on an ongoing basis. It is critical that the ACS demonstrate the ability to maintain high rates of survey response in order that the data be recognized as a sound replacement for the decennial long form. Census 2000 used an intensive advertising and outreach campaign to gain public cooperation. Stackhouse (2002) documents that these efforts led to a national overall mail response rate of over 64 percent. The rate was about 54 percent for decennial long forms. Nonresponse follow-up activities were designed to collect data for all nonresponding households and the decennial census usually does collect, at least minimal data, for all housing units in the nation.

Surveys do not usually have the benefit of extensive advertising, outreach and promotion programs and therefore rely largely on advance letters, reminder notices, other printed materials, and well-trained interviewers to convince respondents to respond. In order for the ACS to produce high quality data, rates of survey response must remain high - not just overall, but for all population groups and geographic areas.

This study was designed to assess if the methods that are currently being developed for the ACS are leading to high rates of survey response across the country - particularly for areas with high concentrations of persons reporting a race or ethnicity of Black, American Indian or Alaska Native (AIAN), Asian, Native Hawaiian or Other Pacific Islander (NHOPI), or Hispanic.

2. Background

2.1 Methods Planned for the ACS

The methods and procedures that have been developed for the ACS were first tested in 1996. Continuous testing since then has led to methodological refinements and the inclusion of new procedures. Data are collected in continuous, three-month cycles using a combination of mailout/mailback, telephone, and personal visit interviews. The telephone and personal visit interviews are computer-assisted. A sample of addresses is selected each month and questionnaires are received by sample households in month one. Advance letters, reminder cards

and a second, targeted, mailing package are used to increase mail response. Mail returns are accepted throughout a 90-day period. Nonrespondents to the mailout are eligible for telephone interviewing when a telephone number is available. Telephone interviewing takes place in month two. Nonrespondents after mail and telephone attempts are subsampled for personal visit interviewing which occurs in month three. Because a new sample is selected each month, at any point in time, all three modes are functioning - for three different monthly samples.

As part of the research program for Census 2000, a national feasibility test of ACS methods, called the Census 2000 Supplementary Survey (C2SS), was conducted. A similar test was conducted in 2001 - the 2001 Supplementary Survey (01SS). In those tests, this combination of data collection activities resulted in a final two year average weighted survey response rate of 95.9 percent. Data were collected on mail returned forms for about 51.7 percent of the sample. Telephone interviews accounted for 8.3 percent. After weighting for subsampling, personal visit interviews represented 36.0 percent of the sample. This study will assess if this distribution across modes and this weighted survey response rate were similar for areas with high concentrations of persons reporting a race or ethnicity of Black, AIAN, Asian, NHOPI, or Hispanic.

2.2 Survey Nonresponse

Survey nonresponse is the failure to obtain complete data from a unit in sample and may occur for a variety of reasons. Unit nonresponse - the failure to collect sufficient data to qualify as an interview - may occur in the ACS because households are unwilling or unable to participate, or because an interviewer may be unable to make contact with a respondent for a sample unit. In contrast, item nonresponse occurs when a responding unit fails to provide complete and usable information for all required items. A respondent may complete a mail form in error and omit sections or questions, unintentionally. Interviewers may find otherwise cooperative respondents unwilling to provide them with personal responses such as income. Survey nonresponse results in estimates that represent a population short of the true population. Traditional methods for dealing with unit nonresponse involve weighting up respondents to reduce nonresponse bias. Item nonresponse is frequently handled through imputation techniques. Weighting and imputation methods are appropriate, but can

This paper reports the results of research and analysis undertaken by Census Bureau staff. It has undergone a Census Bureau review more limited in scope than that given to official Census Bureau publications. This report is released to inform interested parties of ongoing research and to encourage discussion of work in progress. The author acknowledges significant contributions from Barbara Diskin, Chip Alexander, David Raglin and Theresa Leslie.

introduce error when the nonresponding universe differs from the responding universe used in these weighting and imputation processes.

Groves (1989) has described nonresponse error as consisting of two parts – the nonresponse rate and the degree of difference between survey respondents and nonrespondents. This study will produce unit nonresponse rates from the C2SS and comment on what the results suggest about how racial and ethnic characteristics may differ for C2SS respondents and nonrespondents. Because the ACS will produce continuous data on social, demographic, economic, and housing characteristics it is critical that nonresponse error be minimized. If nonresponse rates are high or if the characteristics of interviewed households differ substantially from noninterviewed households, the ACS will not provide the accurate pictures that it desires.

2.3 Socio-demographic correlates with nonresponse

Understanding the characteristics of nonrespondents will allow the ACS to assess the effectiveness of its noninterview adjustments. Such research will also shed light on aspects of the survey design that require attention. New or enhanced survey methods can be developed which will lead to higher quality data. Unfortunately, production of survey response rates by demographic characteristics is not a by-product of the survey. Special efforts are needed to collect such data. Household surveys and censuses have considered this issue and several approaches have been undertaken to determine if nonresponse can be linked to demographic characteristics such as race and ethnicity. Some of the available literature on this topic is summarized below.

2.3.1 Coverage Studies

It has been well documented that sociodemographic characteristics such as sex, age, race, and ethnicity are correlated with undercoverage. Post-enumeration surveys conducted in conjunction with decennial censuses have long observed differential rates of undercoverage for Blacks. In Hogan (1990) such differences are noted, recognizing higher rates for certain age and sex combinations. Similarly, survey undercoverage has been found to be higher for some age, race, sex, and ethnic subgroups. U. S. Bureau of Labor Statistics (2002) provides a fair amount of discussion of differential levels of coverage in the Current Population Survey (CPS) across racial and ethnic groups. In addition, U. S. Census Bureau (n.d.) - “Coverage Ratios” provides measures of survey coverage called, “coverage ratios.” A coverage ratio compares the estimate from the sample of the number of people who have a particular characteristic to the same estimate from updated decennial census figures. Differences are noted across racial and ethnic groups with Blacks and Hispanics being most underrepresented.

Like undercoverage, nonresponse is an error of nonobservation. These two types of survey errors are closely related and it is reasonable to believe that undercoverage and nonresponse have similar characteristics.

2.3.2 Studies of Panel Attrition

Johnson et al (2002) note that considerable research is available examining nonresponse behavior across racial and ethnic subgroups. They reviewed 26 studies, conducted between 1980 and 1999, noting varied findings. Most of these studies involve panel surveys and measures of attrition. Minority group attrition was recognized in 17 of 20 such studies. Harris-Kojetin and Tucker (1998) found significant differences between complete and partial respondents in the CPS. Partial respondents were more likely to be nonWhite, Hispanic, and between the ages of 25 and 34. While these findings suggest a connection between race/ethnicity and nonresponse, they may have limited extensions to a one-time survey such as the ACS. Studies of longitudinal survey nonresponse highlight differences in the likely nonresponse process in later waves of panel surveys when compared to initial waves. Lepkowski and Couper (2002) suggest that findings from panel attrition studies may not tell us much about the sociodemographic characteristics of initial nonrespondents.

Similarly, a set of studies have assessed racial and ethnic characteristics of nonrespondents in a reinterview setting. These findings (Broman et al, 1995; Chen and Kandel, 1995; Finkelhor et al, 1995; and Lavrakas et al, 1991) also suggest that minority groups are less likely to respond. Lavrakas et al (1991) reported that in an RDD telephone survey setting, nonWhites, the less educated, and those with lower incomes were less likely to be reinterviewed when compared to other demographic subgroups. However, like the above panel attrition research, these results may not directly answer the question about the relationship between race ethnicity and nonresponse in a household survey.

2.3.3 Geographic Distributions of Nonresponse

The ACS will, like all other Census Bureau surveys, monitor survey nonresponse on a regular basis. The CPS reports on levels of type A noninterviews. See U.S. Census Bureau (n.d.) - “Nonresponse rates”. These data provide important information on nonresponse rates by month and by type of noninterview. Rates are also analyzed by census region. DeMaio (1980) reviewed the geographic distribution of refusals in the CPS, focusing on possible urban/rural, regional (North Central, Northeast, South and West), and division differences. She found that rural respondents were significantly more likely to cooperate than urban respondents and that significant regional and divisional differences appear in the outcomes of first month interviews. In particular, the West was least cooperative. Smith (1983) used geographic/aggregate-level analysis to

study variation in response rates to the 1980 General Social Survey across city types and regions. The General Social Survey was a household survey conducted using both personal visit and telephone methods. Smith found the lowest response rates in central cities. Regional differences tended to be highest in the South and lowest in the Northeast. Such research sheds light on variations in levels of nonresponse and helps data users understand potential data quality issues when data are produced for certain geographic areas.

2.3.4 Studies Based on Interviewer-Collected Data

DeMaio (1980) compared the characteristics of first month-in-sample refusals in the CPS to converted refusals and cooperative respondents. CPS interviewers completed a special form to record the characteristics of the refusal household. She concluded that race was not an important factor in whether or not a household refused. Race, however, was the exception. Significant differences were found between refusals and respondents on all other demographic variables studied. Smith (1983) also used data collected by interviewers on the perceived characteristics of nonrespondents in the 1980 General Social Survey. Included were assessments of race. This study found no significant differences between completed cases and estimated nonrespondents with respect to race.

2.3.5 Match Studies

Groves and Couper (1998) note that, “There is little evidence in the literature that nonWhites cooperate with survey requests at different rates than Whites.” This finding is collaborated by the results of their decennial census match nonresponse project. Data from the 1990 census and from six surveys were used to examine correlates with survey nonresponse. They calculated cooperation rates by race and ethnicity of the household’s reference person and found higher rates of cooperation for Hispanics and Black non-Hispanics than for “all others.” When they looked at the joint effects of race, Hispanic status, and household age composition, they found no evidence that minority ethnicity or race affects survey cooperation rates.

3. Methodology

3.1 Sample Design

The C2SS and 01SS selected samples of addresses each month. About 800,000 housing units in over 53,000 tracts made up each annual sample. Data collection for each monthly panel occurred over a three month period. Mail returns were collected in the first month, telephone interviews and additional mail returns in the second month, and personal visit interviews and some late mail returns in the third month. To facilitate accurate response, data are collected as of the time of interview rather than as of the time of initial mailout. For example, the cases interviewed in January consist of the early mail returns from the January

sample panel, the telephone interviews and additional mail returns from the previous December sample panel, and the late mail returns and personal visit interviews from the previous November sample panel. For purposes of survey estimation, the final January sample consists of cases whose data are collected in January, and any noninterviews from the personal visit workload in January (November sample panel). Mail returns received in January, and later determined to have insufficient data, are classified as noninterviews for January.

A total of 14 monthly panels contribute to each year’s final annual sample. For the C2SS, that included panels from November and December of 1999 and January through December of 2000. For the 01SS, that included panels from November and December of 2000 and January through December of 2001. The data summarized for the C2SS and the 01SS therefore come from all mail, telephone and personal visit interviews as well as all noninterviews recognized between January 1, 2000 and December 31, 2001.

Census 2000 data were used to identify all tracts¹ where the proportion of persons who reported a race of White, Black, AIAN, Asian, NHOPI, and Hispanic was 75 percent or more. For purposes of this analysis the race could have been reported alone or in combination with another race. Table 1 summarizes, for each racial and ethnic group, the number of tracts included in the C2SS or the 01SS that met this requirement. All C2SS and 01SS sample cases that fell into these tracts were included in this study. The sample size for the NHOPI group is too small to produce meaningful results and was dropped from this analysis. Although small, the sample sizes for the AIAN and the Asian groups will allow for a preliminary review of the rates.

Table 1: Summary of Study Sample

Stratum	Number of Tracts
Total	53,228
75% or more White	34,315
75% or more Black	3,642
75% or more AIAN	66
75% or more Asian	93
75% or more NHOPI	3
75% or more Hispanic	1,646

In order to assess how representative this sample might be for each of these racial and ethnic groups, a determination was made of the proportion of **all** persons reporting a specific race or ethnicity that fell into these “high concentration” tracts. Ratios were calculated of the total number of persons of a specific racial/ethnic group that were included in this sample of “high concentration” tracts

¹ A tract is a geographic area of between 1500 and 8000 persons.

in Census 2000 to the total number of persons in this specific racial or ethnic group in Census 2000. Table 2 summarizes these results showing that about one third of all Blacks and just under one fourth of all Hispanics live in these high concentration strata. The results of the study therefore provide a reasonable assessment of the Black and Hispanic populations. The proportion of the Asian and AIAN populations living in these areas in very small and therefore the results are quite limited.

Table 2: Representativeness of Study Sample

Racial or Ethnic group	Percent in High Concentration Strata
Black	34.1
AIAN	6.7
Asian	2.9
Hispanic	22.7

3.2 Calculation of Survey Response Rates

Weighted survey response rates were calculated for each of the six racial and ethnic groups. The survey response rate is defined as the ratio of all completed interviews (across all modes) to the combination of interviews and noninterviews. This definition is consistent with the guidelines developed by a committee of the American Association for Public Opinion Research (AAPOR 2000). Some additional detail was produced for noninterviews.

$I(m)$ = the number of cases interviewed by mail

$I(t)$ = the number of cases interviewed by telephone

$I(p)$ = the number of cases interviewed by personal visit

R = the number of eligible cases that are noninterviews due to refusals²

NC = the number of eligible cases that are noninterviews due to noncontacts³

ID = the number of eligible cases that are noninterviews due to insufficient data⁴

L = the number of eligible cases that are noninterviews due to language problems⁵

O = the number of eligible cases that are noninterviews due to other reasons for noninterviews⁶

² These are final refusals. Mail and telephone refusals are eligible for personal interviewing.

³ These are final noncontacts. Mail and telephone noncontacts are eligible for personal visit interviewing. Included are cases that the interviewer was unable to locate, cases where no one was at home and cases where all household members were temporarily absent.

⁴ These include mail, telephone, and personal visit interviews determined during final processing to have insufficient data to qualify as a complete or sufficient partial interview.

⁵ These are final noninterviews that could not be completed due to the inability of the interviewer to speak the language required by the respondent. Telephone noninterviews due to language problems are eligible for personal visit interviewing.

⁶ These are final noninterviews due to specific reasons other than those identified above.

U = the number of cases of unknown eligibility

Let $T = I(m) + I(t) + I(p) + R + NC + ID + L + O + U$

Survey Response Rate = $[I(m) + I(t) + I(p)]/T$

Sample cases determined to be commercial, nonexistent, or demolished are considered not eligible for survey interviewing. Cases with unknown eligibility (e.g., cases that could not be located during personal visits) were considered eligible noninterviews and were classified as noncontacts. Appropriate weights were applied to account for differences in selection probabilities. This includes personal visit subsampling weights. The use of weighted rates is consistent with the recommendations included in Statistical Policy Working Paper 31 (OMB 2001). Standard errors were calculated along with 90 percent confidence intervals.

Five additional rates were calculated from the nonresponse rate to explain the reason for the noninterview. They include: refusals, noncontacts, cases with insufficient data, language problems, and other noninterviews. These rates are defined as the rates of refusals, (etc.) to the total sample. Two year average rates of survey response, refusals, noncontacts, cases with insufficient data, language problems, and other noninterviews were produced by calculating two year average estimates for the values of $I(m)$, $I(t)$, $I(p)$, R , NC , ID , L , O and U .

3.3 Calculation of Mode Distribution

To aid in interpreting these weighted survey response rates, two year average distributions of interviews by mode were produced for each of the six racial and ethnic groups. They are defined as follows:

Percent mail interviews = $I(m)/T$

Percent telephone interviews = $I(t)/T$

Percent personal visit interviews = $I(p)/T$

4. Results

4.1 Survey Response Rates

This study was designed to determine if population subgroups in the C2SS/01SS shared equally high weighted survey response rates that exist at the national level. Table 3 summarizes the two year average weighted survey response rates in the C2SS/01SS for the nation and for all tracts with 75 percent or more of the population reporting a race or ethnicity of Black, AIAN, Asian, or Hispanic. The results indicate that survey response rates remained high regardless of the dominant racial or ethnic group. The high standard errors on some estimates however, may not allow us to identify potential response rate problems for AIAN groups. We plan to explore several options to produce additional data for this group and for the NHOPI group. Differential levels of survey response were found. The estimated survey response rate of 93.2 percent, for areas with high concentrations of Blacks, is significantly lower

than the rate for areas with high concentrations of White (96.4 percent.) Significant differences were also found for areas predominantly AIAN and Hispanic when compared to areas predominantly White. This may suggest the need for additional efforts to gain cooperation – such as revised advance letters or additional training to convert noninterviews. It could suggest the need to improve our contact rates for these groups. The next section provides additional data explaining if these noninterviews were due to refusals, insufficient data being collected, noncontacts, or some other reason.

Table 3: C2SS/01SS - Two Year Average Weighted Survey Response Rates

	Rate	90 Percent Confidence Interval
All tracts	95.93	± 0.05
Tracts where 75 percent or more of the persons in Census 2000 reported a race or ethnicity of ...		
White	96.44	± 0.05
Black*	93.19	± 0.33
AIAN*	91.42	± 3.37
Asian	96.09	± 1.14
Hispanic*	96.07	± 0.31

* Significantly different from White at the $\alpha = 0.10$ level.

4.2 Reasons for Nonresponse

Survey nonresponse will occur for a variety of reasons. In the ACS, all noninterviews are coded by the reason for noninterview. From those detailed codes a set of summary reasons can be produced. Tables 4 and 5 provide refusal, and noncontact rates for all tracts and for the high concentration tracts.

The tables show that two year average C2SS/01SS refusal rates were significantly higher for tracts with 75 percent or more of the population reporting a race of Black when compared to areas predominantly White. Refusal rates for the other high concentration tracts were not significantly different from White. The noncontact rates in Table 5 indicate that tracts with high concentrations of AIANs, Blacks, and Hispanics have significantly higher rates of noninterviews due to noncontacts than tracts that are predominantly White. Due to small numbers, few important differences were found for rates of Insufficient Data, Language Problems, and Other Noninterviews. No results are presented for these reasons.

Table 4: C2SS/01SS Two Year Average Refusal Rates

	Rate	90 Percent Confidence Interval
All tracts	1.49	±0.03
Tracts where 75 percent or more of the persons in Census 2000 reported a race or ethnicity of...		
White	1.28	±0.03
Black*	2.90	±0.23
AIAN	1.82	±0.77
Asian	0.92	±0.66
Hispanic	1.30	±0.16

* Significantly different from White at the $\alpha = 0.10$ level

Table 5: C2SS/01SS Two Year Average Noncontact Rates

	Rate	90 Percent Confidence Interval
All tracts	1.08	±0.03
Tracts where 75 percent or more of the persons in Census 2000 reported a race or ethnicity of ...		
White	0.86	±0.03
Black*	2.29	±0.18
AIAN*	4.21	±2.45
Asian	0.98	±0.71
Hispanic*	1.17	±0.20

* Significantly different from White at the $\alpha = 0.10$ level

4.3 Interview Distributions

Table 6 summarizes the two year average personal visit interview distributions for all C2SS/01SS sample cases in all tracts. These data inform users on how the data were collected from sample households. It is important to note that because these data are weighted for the sample design, the personal visit interview rate reflects an approximate weight of three for each interview. These tables also display distributions for geographic areas with high concentrations of each of these five racial and ethnic groups.

These data allow us to assess differences in how mail, telephone, and personal visit modes are used to collect data in these areas. Table 6 shows marked differences for the proportion of the sample interviewed by personal visit. The implications of these findings have great significance given that the sample design for the ACS uses a 1-in-3 subsample for personal visit interviewing. In areas with high concentrations of Hispanics, about 57.0 percent of the sample is represented by personal visit interviews. The rate nationally is 36.0 percent. This indicates that in these areas a much larger proportion of the sample is subsampled, leading to a smaller final sample size. Similar results can be seen for areas with high concentrations of AIANs, Asians, and Blacks.

Table 6: C2SS/01SS Two Year Average Percent Personal Visit Interviews

	Percent Personal Visit Interviews	90 Percent Confidence Interval
All tracts	35.98	±0.16
Tracts where 75 percent or more of the persons in Census 2000 reported a race/ethnicity of ...		
White	31.68	±0.21
Black*	52.98	±0.59
AIAN*	76.29	±6.37
Asian*	35.39	±2.60
Hispanic*	57.00	±0.76

* Significantly different from White at the $\alpha = 0.10$ level.

5. Issues and Limitations

This study cannot draw conclusions about areas with high concentrations of NHOPIs. The data for AIANs and Asians are not very generalizable due to the low proportion of these populations living in “high concentration” tracts. Targeting lower levels of geography may help us to locate more geographic areas with high concentrations of these groups.

This study does not tell us the survey response rates for these population groups – only for areas with high concentrations. It is possible that Asians living in a predominantly White area may have different response patterns. This study cannot answer that question. We plan to conduct a match study between the Census and the C2SS to determine the distribution of race and ethnicity for C2SS noninterviews. This will provide another important measure of potential response error for racial and ethnic groups.

6. Conclusions and Next Steps

The results show that despite low levels of mail response in some of these areas, strong personal visit efforts led to high rates of overall survey response. The data suggest that special efforts are needed to address differential survey response rates – to increase the rates for areas with high concentrations of AIANs, Blacks and Hispanics. The question that led to this research can be answered by noting that the survey response rates are all quite good but that more work needs to be done to improve response in some areas. The reasons for noninterviews suggest the need to develop tools to address noncontact problems in areas that are predominantly Black, AIAN, and Hispanic and to develop outreach and promotion tools to elicit greater cooperation (i.e., reduce refusals) in areas that are predominantly Black. These data provide a vehicle for identifying areas with mail response problems. Additional analysis using operational data is needed to determine if the low mail response might be due to problems in getting a questionnaire delivered to households in these areas. New methods to address low mail response must be developed.

The next step will be to work with Field Division staff at

the Census Bureau and our advisory committees to try to develop tools that might increase final response. One possibility could be to redesign the advance letter or consider a special advance letter to be used in low response areas prior to the start of personal visit interviewing. Specialized refusal aversion training might also be of help in some of these areas.

Although not the objective of this study, data on interview distributions highlight other areas needing attention. Based on these findings, the Census Bureau is planning to redesign the sample and oversample in areas of low mail response.

7. Bibliography

- American Association for Public Opinion Research, AAPOR (2000), “Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys”
- DeMaio, T. J. (1980), “Refusals: Who, Where and Why,” *Public Opinion Quarterly*, 44, pp.223-233.
- Groves, R. M. and Couper, M. P. (1998), *Nonresponse in Household Interview Surveys*, New York: Wiley.
- Harris-Kojetin, B. A. and Tucker, C. (1998), “Longitudinal Nonresponse in the Current population Survey (CPS),” *ZUMA Nachrichten Spezial*, 4, pp. 263-272
- Hogan, H. (1993), “The 1990 Post Enumeration Survey: Operations and Results,” *Journal of the American Statistical Association*, 88, pp. 1047-1060.
- Johnson, T. P., O’Rourke, D., Burris, J. And Owens, L. (2002), “Culture and Survey Nonresponse,” *Survey Nonresponse*, New York: Wiley, pp. 55 - 69.
- Lavrakas, P. J., Settersten, R. A., and Maier, R. A. (1991), “RDD Panel Attrition in Two Local Area Surveys,” *Survey Methodology* , 17, pp. 143-152.
- Lepkowski, J. M., and Couper, M. P. (2002), “Nonresponse in the Second Wave of Longitudinal Household Surveys,” *Survey Nonresponse*, New York: Wiley, pp 259 - 272.
- Smith, T. W. (1983), “The Hidden 25 Percent: An Analysis of Nonresponse on the 1980 General Social Survey,” *Public Opinion Quarterly*, 47, pp. 386-404
- Stackhouse, H. F. and Treat, J. B., “Census 2000 Response and Return Rates - National and State by Form Type,” DSSD Census 2000 Procedures and Operations Memorandum Series L-10, February 12, 2002.
- U.S. Bureau of Labor Statistics and U.S. Census Bureau (2002), “Current Population Survey Design and Methodology,” *Technical Paper 63RV*, pp 126-136
- U.S. Census Bureau (n.d.), “Coverage Ratios,” <http://www.bls.census.gov/cps/basic/perfmeas/coverage.htm>
- U.S. Census Bureau (n.d.), “Nonresponse Rates,” <http://www.bls.census.gov/cps/basic/perfmeas/typea.htm>
- U.S. Census Bureau (2002), “Meeting 21st Century Demographic Data Needs - Implementing the American Community Survey, Report 2: Demonstrating Survey Quality”
- U.S. Office of Management and Budget (2001), “Measuring and Reporting Sources of Errors in Surveys,” *Statistical Policy Working Paper 31*