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MEMORANDUM FOR	ACS Research and Evaluation Steering Committee
From:	James B. Treat**(signed 8/17/2011)** Chief, American Community Survey Office
Prepared by:	Deborah Griffin and David Raglin American Community Survey Office
Subject:	Quality Measures Associated with a Voluntary American Community Survey

Attached is the final American Community Survey Research and Evaluation report on Quality Measures Associated with a Voluntary American Community Survey. This project provides updated information about the quality implications associated with implementing a voluntary ACS.

If you have any questions about this report, please contact Deborah Griffin at (301) 763-2855.

Attachment

cc:
ACS Research and Evaluation Team

JULY 28, 2011

Quality Measures Associated with a Voluntary American Community Survey

FINAL REPORT

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INTRODUCTION

At the request of Congress, the U.S. Census Bureau conducted research in 2002 and 2003 to determine whether the American Community Survey (ACS) could be implemented as a voluntary, rather than a mandatory, survey. A test was designed to answer key questions on mail response, survey quality, and costs. The data for all three modes (mail, telephone, and personal visit) of the March and April 2003 ACS were collected using voluntary methods. The focus of this research was a comparison of the data collected in March and April of 2003 with data from March and April of 2002. Details of the design of this test and the findings can be found at U.S. Census Bureau (2003).

This report provides additional information about the quality of the data collected in the 2003 test of voluntary methods. Different comparisons are made in this study using fully edited data from the entire 2003 calendar year. The results supplement U.S. Census Bureau (2003) and U.S. Census Bureau (2004). The focus of this report is an assessment of the coverage of the demographic characteristics of the population that was interviewed under voluntary versus mandatory data collection in the 2003 test and the completeness of their data.

RESEARCH QUESTIONS

This report answers the first three research questions. The final research question is answered in a separate report.

1. How do unit nonresponse and mode-specific cooperation compare in a mandatory versus voluntary ACS? Do these rates vary across population groups?
2. Does item nonresponse differ in a voluntary versus mandatory ACS? Does this difference vary by population group and mode?
3. Are there differences in the demographic characteristics of the households that are interviewed in the ACS under voluntary versus mandatory methods? Are there differences by mode?
4. Are there systematic differences in key estimates from ACS from a voluntary versus mandatory method?

BACKGROUND ON THE 2003 TEST OF VOLUNTARY METHODS

Each year the Census Bureau selects the ACS sample and distributes it across all 12 months of a calendar year into sample panels. A sample panel consists of separate samples first contacted in a given month (e.g., the March 2003 sample panel had its first month mail back phase in March 2003). In 2003 the ACS used a Primary Sampling Unit (PSU)-based design for each sample panel.[1] For this reason every sample panel is nationally representative.

Three sequential modes of data collection (mail, telephone, and personal visit) are used over a 3-month time period to collect data for each ACS monthly sample panel. Figure 1 summarizes this design. Sample cases without a response after mail and phone attempts are sub-sampled prior to the final personal visit stage.

[1] In 2000 through 2004 the national ACS sample was a PSU-based design. The sample design changed when the survey moved to full implementation in 2005.

Figure 1. ACS Data Collection Design

	Calendar Month						
Sample Panel	February 2003	March 2003	April 2003	May 2003	June 2003	July 2003	August 2003
Feb 2003	Mail	Phone	Personal Visit				
March 2003		Mail	Phone	Personal Visit			
April 2003			Mail	Phone	Personal Visit		
May 2003				Mail	Phone	Personal Visit	
June 2003					Mail	Phone	Personal Visit

Yellow – Mandatory
Blue - Voluntary

The data for all modes of the March and April panels in the 2003 ACS were collected using voluntary methods.[2] In all other 2003 ACS sample panels the data were collected using mandatory methods. Figure 1 identifies the mandatory data collections in yellow and the voluntary data collections in blue. So, while the March and April sample panels were completely voluntary, in the months of March through June a mixture of methods were being used. The mail mode used voluntary methods in March and April. The interviewers in the phone mode were trained to use voluntary methods effective in April. In June they were retrained to revert to mandatory methods. The field representatives in the regional offices were trained and began to use voluntary methods in May. When they completed their June assignments they too returned to mandatory methods. Given this design, mandatory and voluntary estimates must be based on sample panels, not calendar months. Comparisons must also be made for different time periods.

A total of 103,000 addresses were in the initial sample for the combined March and April sample panels. About 60,000 completed interviews were obtained. For details on this design refer to U.S. Census Bureau (2003). It is only since 2006 that the ACS has included the population living in both housing units and in group quarters facilities. This test, conducted in 2003, was therefore limited to the housing unit population.

METHODOLOGY

Data from the 2003 test of voluntary methods were re-analyzed for this research. As noted above, in that test most of the data for the March and April sample panels were collected using voluntary methods. For this analysis two sets of 2003 ACS estimates were produced. Annualized estimates of a voluntary ACS were created from the data collected from pre-designated "voluntary" cases in the March and April sample panels and of a mandatory ACS from all other 2003 sample panels. For each of these two sets of estimates, the data were weighted for selection probabilities (including subsampling selection probabilities) only. In order to assess the quality of data received from respondents, the standard weighting that is used

[2] A small sample of addresses in the mail mode of the March and April sample panels received the mandatory treatment. They are not included in the universe for this analysis.

to adjust for noninterviews and coverage were not applied. Quality measures for the 2003 mandatory ACS estimates were compared to those from the 2003 voluntary ACS estimates.

Four quality measures were produced for each treatment – sample completeness ratios, mode-specific cooperation rates, survey response rates, and item completeness rates. Rates were produced for various demographic groups. These measures describe the quality of the housing unit population only. Each measure is described in greater detail below. Comparisons of each of these rates by treatment were conducted using a 90 percent confidence level. All differences shown are statistically significant unless noted. No adjustments were made for multiple comparisons.

Sample Completeness Ratios. Sample Completeness Ratios were calculated as the ratio of the survey estimate (weighted only for probabilities of selection) to the official population estimate from the 2003 Population Estimates Program. These ratios measure how representative the survey interviews are of the expected population before adjustments are made for nonresponse and coverage. They describe the characteristics of the interviewed population relative to our best estimate of "truth." Sample completeness ratios were calculated for each treatment after the mail mode, after the mail and phone modes, and after all three modes - mail, phone and personal visit.

Cooperation Rates. Cooperation rates are the cleanest measure of respondent behavior. They are calculated as the ratio of weighted responses (in a specific mode) to the weighted estimate of households that were contacted (in a specific mode). To be contacted, a sample address ultimately had to have been classified as occupied. Vacant housing units and units determined to be out-of-scope for the survey are not included in the numerator or denominator of any cooperation rates. The mail cooperation rate is defined as the ratio of weighted mail responses to the weighted estimate of occupied sample addressees that were mailed an ACS form.[3] Telephone and personal visit cooperation rates are the ratio of weighted telephone (or personal visit) responses to the weighted estimate of occupied cases that were contacted by phone (or in person). The overall cooperation rate was defined as the ratio of weighted responses for occupied housing units by any of the three modes relative to the weighted estimate of the occupied sample addresses that were contacted by mail, phone, or in person.

Survey Response Rates. The survey response rate is the ratio of weighted responses across all modes to the weighted estimate of the sample addresses that were eligible for the survey, whether or not they were contacted. Because the ACS collects data from both occupied and vacant housing units, the survey response rates include sample addresses that were determined to be either vacant or occupied.

We chose to produce cooperation and response rates for the total population and for eight segmentation groups or strata. These segmentation groups stratify all census tracts based on social, economic, housing, and demographic characteristics and historical information about census participation. The eight groups systematically vary in their Census 2000 mail back participation. Appendix 1 provides some summary information about the characteristics of these eight segmentation groups. Refer to U.S. Census Bureau (2008) for more details about the

[3] This is likely an underestimate of the true mail cooperation rate as some mailable addresses cannot be delivered by the postal service.

methodology used to create this stratification. Because the survey response rates are weighted only for selection probabilities, they are a reasonable measure of our success in completing interviews with the total population and with the population in each of these segmentation groups. The subsampling that is done in the ACS prior to personal visit follow up reduces the number of sample interviews for those population groups that do not respond well by mail or telephone. This has a direct impact on the sampling errors associated with these populations which are evident in many of the segmentation-level quality measures.

Item Completeness Rates. Item nonresponse is assessed through the use of item completeness rates that are calculated as the percentage of all values for a specific characteristic that were either provided by the respondent or assigned in a simple algorithm based on other information provided by the respondent. For example, sex can often be assigned based on name and in those instances we would consider that we received a response for sex. All ACS items were studied and two aggregate indices of item level completeness were calculated – one for all housing items and one for all population items. Results are summarized by segmentation group and mode.

LIMITATIONS

The 2003 test was not a randomized experiment, as different months were used for each treatment. If, for example, there were changes in the population that affected the true values of ACS variables for the March and April sample panels differently that the other months, they will be confounded with the voluntary/mandatory differences. Comparisons of 2002 and 2004 quality measures for these two partitions of sample panels were reviewed and because they did not show seasonal effects, we conclude that differences between the voluntary and mandatory panels are likely attributable to the change in treatment, not the time period of data collection.

The test that was conducted in 2003 reflects respondent behavior in 2003. It also reflects respondent behavior in an environment with little associated publicity or media attention. If the ACS were changed to a voluntary survey today, the results could differ. If there were great media attention given to the transition to a voluntary implementation, we might expect different reactions from the public.

RESULTS

How do unit nonresponse and mode-specific cooperation compare in a mandatory versus voluntary ACS? Do these rates vary across population groups?

There is a drop of 20.8 percentage points in mail cooperation based on a comparison of 2003 voluntary and mandatory treatments. Telephone cooperation rates dropped by 13.3 percentage points. Personal visit cooperation rates dropped by 5.9 percentage points. The overall cooperation rate across all three modes dropped 4.4 percentage points when the survey was voluntary. These findings are largely consistent with those in Census Bureau (2003), despite using somewhat different estimation procedures and comparisons.

The 2003 report estimated that the difference between the March and April 2003 and March and April 2002 weighted survey response rates (reflecting noncontacts in the denominator) was 4.2 percentage points. In this analysis we calculated two combined survey response rates - one for March and April of 2003 and one for all other months of 2003. A comparison of these two rates

estimates the effect on response rates of a voluntary ACS to be about 3.8 percentage points. Despite the different methods, the differences are within sampling error and tell a similar story.

Tables 1 and 2 display the survey response rates and the mode-specific cooperation rates by treatment for the total population and for the eight segmentation groups. These segmentation groups provide a reasonable indication of how the response and cooperation varied by social and demographic characteristics. Two difference measures are included – percentage point differences and percent differences. The percentage point difference describes the loss relative to the full population. All statistical testing for differences were based on these percentage point differences and comparisons across treatments were found to be statistically significant for every segmentation group. The estimates of percent differences describe the loss relative to the population that would have responded under a mandatory implementation. No statistical testing was done for these differences.

To assess differential effects across populations, the 2003 analysis included estimates for high and low response areas. The findings in the 2003 analysis are consistent with the results found in studying these more detailed segmentation groups.

Table 1. Response Rates by Treatment and Segmentation Group

Segmentation Group	Survey Response Rates			
	Mandatory (percent)	Voluntary (percent)	Percentage Point Difference	Percent Difference
Total population	97.2	93.4	3.8	3.9
Average – Homeowner	97.6	94.3	3.4	3.4
Average – Renter	96.7	92.3	4.4	4.6
Economically Disadvantaged -Homeowner	97.1	94.7	2.4	2.5
Economically Disadvantaged – Renter	94.8	91.9	2.9	3.1
Ethnic Enclave - Homeowner	97.3	93.3	4.1	4.2
Ethnic Enclave – Renter	95.5	92.3	3.2	3.4
Single/Unattached/ Mobile	95.8	90.5	5.2	5.5
Advantaged Homeowners	97.9	93.5	4.4	4.5

Source: 2003 ACS

It is important to note that comparisons of survey response can only speak to differences in levels of nonresponse. Given the mixed-mode design of the ACS and the use of sub sampling prior to the final data collection mode, any treatment that shifts response from the first two modes into the final mode will suffer reductions in survey quality in the form of loss in precision. Some specific observations about response rates from Table 1 include:

- There is no evidence of a differential increase in nonresponse for traditionally hard to count populations. The drops in survey response for the economically disadvantaged and ethnic enclave groups are similar or less than the drops for the average and advantaged homeowner populations.

- While it appears that the greatest drop in survey response is found in the single, unattached, mobile population, the drop of 5.2 percentage points is not statistically different from the drops found in several of the other segmentation groups. It only exceeds the drops for

average homeowners and the two economically disadvantaged groups. Due to the small sample sizes, other apparent differences are not statistically significant. The drop of 4.4 percentage points for the advantaged homeowner population is greater than the drop for both the average homeowner group and the disadvantaged homeowner group. Other apparent differences are not statistically significant.

Table 2. Cooperation Rates by Treatment, Segmentation Group and Data Collection Mode

Segmentation Group	Treatment	Cooperation Rates (percent)			Overall Cooperation Rate (percent)
		Mail	Phone	Personal visit	
Total population	Mandatory	57.8	78.8	94.7	97.3
	Voluntary	37.0	65.4	88.7	92.8
	Drop	20.8	13.3	5.9	4.4
	% Drop	35.9	16.9	6.3	4.6
Average – Homeowner	Mandatory	59.8	81.4	95.1	97.7
	Voluntary	38.3	67.0	89.6	93.8
	Drop	21.5	14.4	5.5	3.9
	% Drop	35.9	17.7	5.8	4.0
Average – Renter	Mandatory	57.7	76.5	94.1	96.7
	Voluntary	36.6	63.1	87.3	91.7
	Drop	21.1	13.4	6.8	5.0
	% Drop	36.5	17.5	7.2	5.2
Economically Disadvantaged - Homeowner	Mandatory	43.9	78.8	95.6	96.8
	Voluntary	28.5	67.6	92.1	94.0
	Drop	15.4	11.1	3.5	2.8
	% Drop	35.1	14.1	3.7	2.9
Economically Disadvantaged – Renter	Mandatory	34.6	69.4	94.6	94.1
	Voluntary	23.8	62.7	91.9	91.1
	Drop	10.8	6.7	2.7	3.1
	% Drop	31.2	9.7	2.8	3.3
Ethnic Enclave - Homeowner	Mandatory	36.8	78.8	96.6	97.3
	Voluntary	24.6	68.1	90.8	93.2
	Drop	12.2	10.7	5.7	4.1
	% Drop	33.2	13.6	6.0	4.3
Ethnic Enclave – Renter	Mandatory	29.5	65.4	95.6	95.2
	Voluntary	19.0	55.8	91.5	91.4
	Drop	10.4	9.6	4.1	3.8
	% Drop	35.4	14.7	4.3	4.0
Single/Unattached/ Mobile	Mandatory	51.5	71.5	93.8	95.6
	Voluntary	31.4	62.0	87.7	89.0
	Drop	20.2	9.5	6.0	6.6
	% Drop	39.1	13.3	6.4	6.9
Advantaged Homeowners	Mandatory	67.6	79.7	93.7	97.5
	Voluntary	43.3	64.7	86.4	93.0
	Drop	24.4	15.0	7.3	4.5
	% Drop	36.0	18.9	7.8	4.6

Source: 2003 ACS

Observations about mode-specific cooperation include:

- Wide variability in mail cooperation rates is seen across groups in both voluntary and mandatory treatments (e.g., voluntary mail cooperation was 19.0 percent for ethnic enclave-renters and 43.3 percent for advantaged homeowners) but there is a fairly consistent percent drop in mail cooperation across all groups (range of 31.2 to 39.1 percent).

- When comparing drops in telephone cooperation rates across groups, the significant differences indicate larger drops from the average homeowner and advantaged homeowner groups, not the disadvantaged groups or the ethnic enclave groups. Specifically, the drop of 14.4 percentage points in the average homeowners group is a greater drop than was found in the economically disadvantaged homeowner and renter groups and the single, unattached, mobile group. The drop of 15.0 percentage points in the advantaged homeowner group is greater than the drop in both the single, unattached, mobile and economically disadvantaged renter groups.

- The mandatory personal visit cooperation rates across segmentation groups range from 93.7 to 96.6 percent. Similar variation is seen in the voluntary rates although the range broadens a little (from 86.4 to 92.1 percent). No segmentation group under either mandatory or voluntary treatment had a cooperation rate in this final stage of data collection that indicated problems existed in obtaining respondent cooperation.

- Some homeowner groups experienced large declines in personal visit cooperation. For example, the 7.3 percentage point drop in cooperation for advantaged homeowners is statistically greater than the drops for average homeowner, the two economically disadvantaged groups and the ethnic enclave renter group. The 5.5 percentage point drop for average homeowners is statistically greater than the drops seen in the two economically disadvantaged groups.

- Some renter groups also experienced large declines in personal visit cooperation, notably average renters (6.8 percentage point drop). The single, unattached, mobile group had greater losses in cooperation rates than the economically disadvantaged and ethnic enclave renter groups.

- Levels of overall cooperation in the voluntary treatment remained high indicating that of the occupied sample addresses that were mailed a questionnaire, contacted by telephone, or visited in personal visit follow up, nearly 93 percent ultimately responded in one of the modes. This represents a drop from a mandatory overall cooperation rate of over 97 percent. This 4.4 percentage point drop isolates the proportion of contacted households that were unwilling to participate in a voluntary ACS but would have participated in a mandatory ACS. This was largely due to the continued high cooperation rates in the personal visit mode, the last mode used in the ACS.

Does item nonresponse differ in a voluntary versus mandatory ACS? Does this difference vary by population group and mode?

All item-level completeness rates were reviewed by treatment and mode and are documented in Appendixes 2 and 3.[4] There were only four housing items and two population items with higher completeness rates in the voluntary treatment.[5] These differences were, however, very small. No items had a voluntary completeness rate that was more than two percentage points higher than the mandatory rate. Table 3 identifies the specific items with a completeness rate for voluntary interviews that is at least two percentage points lower than the rate for mandatory interviews.

Table 3. Item Completeness Rates by Treatment – Items with differences

Item	Item Completeness Rates (percent)		
	Mandatory	Voluntary	Difference
Housing Items			
Yearly property insurance cost	80.3	73.2	7.1
Yearly real estate taxes	83.8	77.1	6.7
Monthly other mortgage payments	82.0	76.8	5.2
Monthly mortgage payment (MMP)	93.4	89.4	4.0
Yearly mobile home costs	76.6	73.0	3.6
Value of residence	93.1	89.9	3.2
Monthly electricity cost	95.2	92.3	2.9
Yearly water and sewer cost	93.6	90.8	2.9
Does MMP include real estate taxes	96.6	93.9	2.6
Does MMP include insurance	90.6	87.9	2.6
Year built	88.8	86.6	2.2
Monthly rent	94.0	92.1	2.0
Population Items			
Total income	82.1	73.5	8.7
Wages	88.5	82.9	5.7
Interest income	91.6	86.8	4.8
Social Security income	92.7	88.6	4.1
Retirement income	93.6	90.2	3.3
Other income	93.9	91.1	2.8
Time departed for work	91.4	88.6	2.7
Supplemental Security income	94.4	91.8	2.6
Public assistance income	94.2	91.6	2.6
Minutes to work	94.0	91.9	2.1

Source: 2003 ACS

Of the 35 housing items, 12 had such a difference. For most of these housing items the completeness rates for the mail mode (as shown in Appendix 2) were much higher than the rates for the telephone and personal visit modes in both the mandatory and voluntary treatments. Three items – insurance payment, real estate taxes, and other mortgage payments had increases of five percentage points or more. The mode-specific results in Appendix 2 indicate that the

[4] The tables in Appendix 2 and 3 are sorted by the mandatory completeness rates for all modes combined.

[5] The specific items are: type of building, business on property, number of bedrooms, heating fuel cost, race, and specific language spoken at home.

completeness rates were about 2 percentage points higher in the mail mode when compared to the interviewer-administered modes for both mandatory and voluntary treatments. Therefore, most of this decrease in overall completion rates with the voluntary group seems to be explained by more cases shifting from mail into telephone and personal visit follow up.

Ten of the 57 population items for the voluntary treatment had completeness rates that were at least 2 percentage points lower than those of the mandatory treatment. All but two of these are related to income, and the others are journey to work questions, which are also considered sensitive by some respondents. A review of the mode-specific differences in Appendix 3 suggests that some decreases in completeness are, like the housing items, due to a shift of more cases into modes with less complete responses. However, for several of the detailed income questions the voluntary ACS saw across the board drops in completeness resulting in the decrease in overall item completeness levels.

Despite the observed loss in completeness, it should be noted that none of the final item completeness rates for a voluntary ACS fell below 73 percent, with the rates for 83 of the 92 items exceeding 88 percent, and over half of the rates remaining over 95 percent. This indicates that households responding to a voluntary ACS provided very complete information.

U.S. Census Bureau (2004) used unedited data to assess levels of item nonresponse. The findings were very similar – significant, but small, differences were detected. Mortgage, income, and utilities questions were also found to be the items with the highest rates. Table 4 displays completeness indices by treatment and mode. Two indices are provided – one for all housing items and another for all population items. They should be interpreted as the percentage of values for all items that were either directly provided by the respondent or that would be easily derived from information provided by the respondent. The difference between this rate and 100 would be the allocation rate. The impact of a voluntary ACS on item-level completeness was minimal. Over all housing items the rate of completeness fell by about 1.2 percentage points. For population items the drop was about 1.4 percentage points.

Table 4 compares the completeness indices by mode. The data show that the completeness declined slightly for the voluntary treatment in each mode. The differences are greatest for the mail mode and for the population items. The larger differences for the population items seem to be largely due to the drop in the reporting of the income items.

Table 4. Completeness Indices by Treatment and Mode			
		Completeness Indices (percent)	
Mode	**Treatment**	**All Housing Items**	**All Population Items**
All modes combined	Mandatory	95.4	95.8
	Voluntary	94.2	94.4
	Difference	1.2	1.4
Mail	Mandatory	96.1	95.7
	Voluntary	95.2	93.9
	Difference	0.9	1.9
Telephone	Mandatory	93.9	95.9
	Voluntary	93.6	95.0
	Difference	0.3	1.0
Personal Visit	Mandatory	93.1	96.1
	Voluntary	92.5	95.0
	Difference	0.6	1.1

Source: 2003 ACS

Table 5 summarizes item completeness indices by treatment and segmentation group. As in Table 4 only summary measures are provided – one for all housing items and another for all population items. The results by segmentation group highlight that little variability exists in both a mandatory and voluntary ACS with respect to the completeness of responses (range is about 4 percentage points or less). The differences between the two treatments also suggest that the loss in completeness was fairly evenly spread across segmentation groups. There is no evidence that any one segmentation group was more likely to respond with a significantly less complete interview. When item nonresponse was analyzed in 2003 by race and ethnicity of the first person on the form, no significant differences were found on interviews from Black or Hispanic households although small significant differences were found for White and Non-Hispanic households.

Table 5. Completeness Indices by Treatment and Segmentation Group			
Segmentation Group	**Treatment**	**Completeness Indices (percent)**	
		All Housing Items	**All Population Items**
Total population	Mandatory	95.4	95.8
	Voluntary	94.2	94.4
	Difference	1.2	1.4
Average – Homeowner	Mandatory	95.3	96.0
	Voluntary	94.3	94.7
	Difference	1.0	1.3
Average – Renter	Mandatory	95.6	95.8
	Voluntary	94.6	94.4
	Difference	1.0	1.4
Economically Disadvantaged - Homeowner	Mandatory	93.7	94.2
	Voluntary	93.1	92.7
	Difference	0.7	1.5
Economically Disadvantaged – Renter	Mandatory	93.1	92.5
	Voluntary	92.1	91.7
	Difference	1.0	0.8 NS
Ethnic Enclave - Homeowner	Mandatory	94.0	94.7
	Voluntary	93.2	95.0
	Difference	0.9	-0.4 NS
Ethnic Enclave – Renter	Mandatory	93.5	93.5
	Voluntary	93.1	93.4
	Difference	0.5 NS	0.1 NS
Single/Unattached/ Mobile	Mandatory	95.2	95.3
	Voluntary	94.6	94.1
	Difference	0.6	1.2
Advantaged Homeowners	Mandatory	96.0	96.5
	Voluntary	94.4	94.6
	Difference	1.6	1.9

Source: 2003 ACS
NS – Differences between treatments are not statistically significant (90 percent confidence level)

Are there differences in the demographic characteristics of the households that are interviewed in the ACS under voluntary versus mandatory methods? Are there differences by mode?

Table 6 summarizes the sample completeness ratios for each treatment after each data collection mode. Differences are displayed and differ from zero unless otherwise noted. To walk through an example using the total population, we estimate that after mail data collection we have responses from about 50.0 percent of the total population in a mandatory ACS but only about 30.7 percent in a voluntary ACS. The difference of 19.3 percentage points is significant. After mail and phone the difference is reduced to 16.6 percentage points with a mandatory ACS covering almost 61.7 percent of the total population and a voluntary ACS covering about 45.1

percent. After mail, phone and personal visit the difference is reduced to about 4.7 percentage points (still statistically significant) with mandatory responses representing about 90.9 percent of the expected total population (in other words, a sample completeness ratio of 0.909) and voluntary representing about 86.2 percent (a ratio of 0.862). These ratios are produced by sex, Hispanic Origin, and for a few specific race groups and ranges of ages.

Some observations are noted below.

- Under both voluntary and mandatory methods there is wide variability across race/ethnicity and age in completeness after mail and after mail and phone but before personal visit (e.g., ratios for mandatory mail range from 0.259 to 0.695). Variability across groups is greatly reduced after mail, phone and personal visit (range for voluntary after personal visit is 0.717 to 0.929).

- The shift to voluntary appears to have a minimal effect on the sample completeness ratios for the Hispanic, Black, and American Indian and Alaska Native populations (i.e., differences in treatments are not statistically different from zero).

- The demographic characteristics of the interviewed population in a voluntary ACS appear to be fairly similar to those of the population interviewed in a mandatory ACS with a possible differential loss in the Asian and White populations.

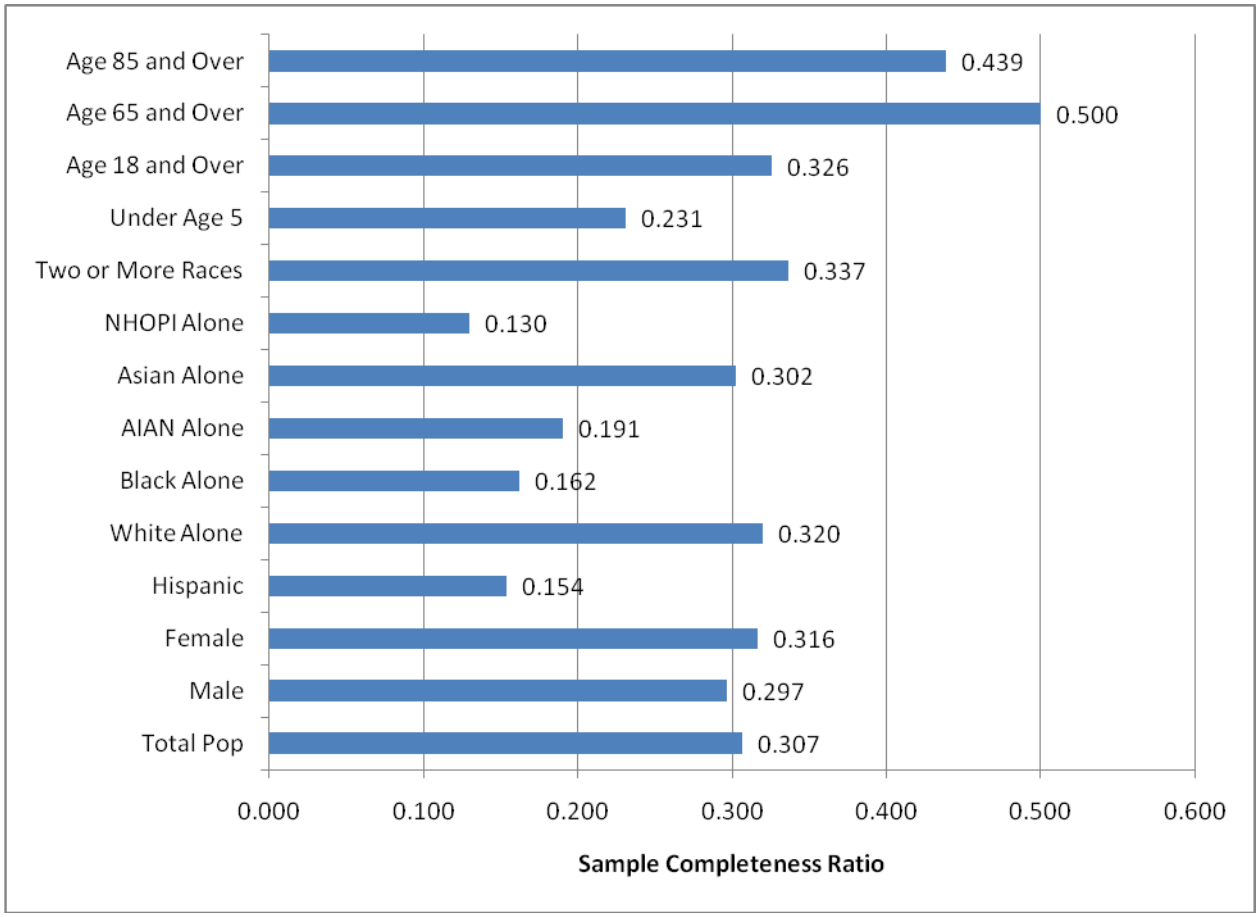
Table 6. Sample Completeness Ratios by Treatment and Data Collection Mode

Demographic Group	Treatment	Sample Completeness Ratio		
		After mail	After mail & phone	After mail, phone & personal visit
Total Population	Mandatory	0.500	0.617	0.909
	Voluntary	0.307	0.451	0.862
	Difference	0.193	0.166	0.047
Male	Mandatory	0.488	0.605	0.898
	Voluntary	0.297	0.441	0.850
	Difference	0.191	0.164	0.048
Female	Mandatory	0.512	0.628	0.919
	Voluntary	0.316	0.461	0.872
	Difference	0.195	0.168	0.047
Hispanic	Mandatory	0.259	0.400	0.872
	Voluntary	0.154	0.295	0.850
	Difference	0.105	0.105	0.022 NS
White Alone	Mandatory	0.519	0.624	0.868
	Voluntary	0.320	0.457	0.828
	Difference	0.199	0.166	0.041
Black or African American Alone	Mandatory	0.270	0.395	0.821
	Voluntary	0.162	0.294	0.821
	Difference	0.108	0.102	0.001 NS
American Indian or Alaska Native Alone	Mandatory	0.287	0.390	0.754
	Voluntary	0.191	0.318	0.717
	Difference	0.096	0.072	0.036 NS
Asian Alone	Mandatory	0.506	0.602	0.892
	Voluntary	0.302	0.416	0.804
	Difference	0.204	0.185	0.088
Under Age 5	Mandatory	0.406	0.519	0.877
	Voluntary	0.231	0.368	0.836
	Difference	0.174	0.151	0.041
Age 18 and Over	Mandatory	0.523	0.635	0.908
	Voluntary	0.326	0.467	0.858
	Difference	0.197	0.168	0.050
Age 65 and Over	Mandatory	0.695	0.799	0.962
	Voluntary	0.500	0.651	0.929
	Difference	0.195	0.148	0.034

Source: 2003 ACS
NS – Differences between treatments are not statistically significant (90 percent confidence level)

Figure 2 displays selected sample completeness ratios after only the completion of the mail mode for the voluntary treatment. It highlights the potential for nonresponse bias that could result if mail was the sole mode of data collection. Specifically, it shows that only 30.7 percent of the total population would be included in a voluntary survey that stopped after mail data collection. But of greater importance is the wide variability in the representation of some population groups after mail. The 30.7 percent is not evenly distributed across racial and ethnic groups. Fewer than 20 percent of the Hispanic, Black, Native Hawaiian and Other Pacific Islander, and American Indian and Alaska Native populations are included in the voluntary treatment after mail. This demonstrates the critical need to conduct follow up interviews.

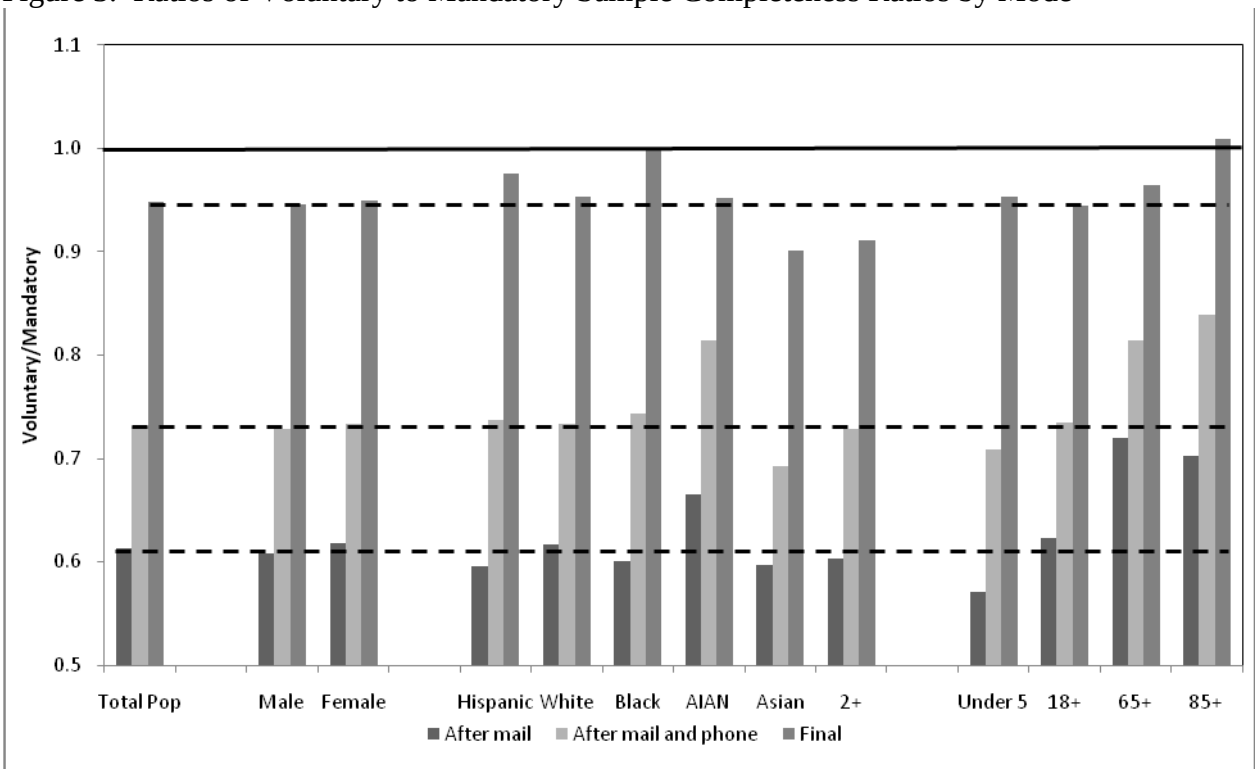
Figure 2. Sample Completeness Ratios After the Mail Mode – Voluntary Treatment 2003 ACS



Source: 2003 ACS

Figure 3 displays the ratio of the voluntary sample completeness ratio to the mandatory sample completeness ratio for a set of demographic groups. These group-specific ratios will have a value of 1.0 when a group is equally represented under voluntary and mandatory treatments. The ratio will be less than 1.0 when representation is lower in the voluntary treatment. A solid line is provided at 1.0 to indicate the loss in representativity due to the use of voluntary methods. Dotted lines display the mode-specific ratios for the total population, allowing the reader to assess differences across groups by mode.

Figure 3. Ratios of Voluntary to Mandatory Sample Completeness Ratios by Mode



Source: 2003 ACS

The final ratios (after all data collection efforts) indicate that for the total population a shift to voluntary methods results in an overall reduction in representativity. Looking across demographic groups we can see that this loss is similar for males and females but varies by race/ethnicity and age. The ratios in Figure 3 show that after all three modes of data collection the African American or Black population is similarly represented in a mandatory and voluntary survey. There is a similar loss in representativity for the total, White, and American Indian and Alaska Native populations and a potentially greater loss in representativity for the Asian and the two or more races populations. The Hispanic population appears to be more similar to the Black population. The older population is equally represented in the voluntary and mandatory treatments but losses are seen for other age groups.

When mode-level results are analyzed, the American Indian and Alaska Native population and the older population are more similarly represented in the voluntary and mandatory treatments after the mail and phone modes compared with the total population. This finding is also true after only the mail mode.

CONCLUSIONS

This additional analysis supports, and adds detail, to the findings in the two previous reports. U.S. Census Bureau (2003) found that voluntary methods had the greatest nonresponse impact on White and Non-Hispanic households. These data confirm that with respect to nonresponse and coverage error (as measured by the sample completeness ratios), the impact of a voluntary

ACS was negligible for the Black and Hispanic populations. These populations appear to be equally likely to be included in a mandatory or voluntary ACS. The nonresponse and coverage loss is far more clustered in the White, and Asian populations, although the drop was not dramatic.

The segmentation group analysis of response rates reinforces this finding in noting that segmentation groups associated with the hardest-to-count populations had similar or lower reductions in survey response rates when compared with segmentation groups for the easier-to-count populations. These data suggest that in the voluntary test that was conducted in 2003 the households that opted out in a voluntary setting were more likely to be Non-Hispanic and White.

A more detailed look at item nonresponse indicates only a modest increase in nonresponse to the questions on forms that were completed under voluntary methods. Financial items, both housing and population, were found to have higher levels of nonresponse in a voluntary setting. There is no evidence that respondents in a voluntary ACS provided only minimal data. The overall completeness of voluntary ACS interviews remained very high.

REFERENCES

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U.S. Census Bureau (2004). Meeting 21st Century Demographic Data Needs—Implementing the American Community Survey. Report 11: Testing the Use of Voluntary Methods – Additional Results. http://www.census.gov/acs/www/library/by_series/implementing_the_acs/.

U.S. Census Bureau (2008). 2010 Census Integrated Communications Campaign Plan.

Appendix 1

Segmentation Group Summary

Average – homeowners

- 35 percent of all occupied housing units in the U.S.
- Second highest Census mail response
- Large percent rural
- Skews homeowners
- Skews older

Average – renters

- 15 percent of all occupied housing units in the U.S.
- Average Census mail response
- Skews renter, densely populated
- Urban
- Skews younger

Economically Disadvantaged - homeowners

- 6 percent of all occupied housing units in the U.S.
- Largely urban, higher percent poverty, public assistance, unemployment, less than high school education
- Skews older , homeowner
- 36 percent with children under 18

Economically Disadvantaged - renters

- 3 percent of all occupied housing units in the U.S.
- Lowest census mail response
- Skews renters in urban multi-units
- Highest poverty, public assistance, unemployment
- 1/3 speak language other than English at home
- 35 percent with children under 18

Ethnic Enclave - homeowners

- 3 percent of all occupied housing units in the U.S.
- Above average crowding, poverty, public assistance, unemployment, low education
- Less urban and densely populated, skews homeowner, stable and married households
- 50 percent with children under 18
- 43 percent foreign-born, 58 percent speak Spanish at home

Ethnic Enclave - renters

- 2 percent of all occupied housing units in the U.S.
- 62 percent foreign-born, 54 percent speak Spanish, 20 percent speak another language other than English at home
- Higher poverty, unemployment, public assistance
- Skewed renters in urban, crowded multi-units – most densely populated
- 44 percent with children under 18

Single, Unattached, Mobiles

- 7 percent of all occupied housing units in the U.S.
- Higher education
- Highly mobile single renters in urban multi-units, densely populated
- Racial and ethnic diversity
- Skews younger and single

Advantaged homeowners

- 28 percent of all occupied housing units in the U.S.
- Highest Census mail response
- Stable, married homeowners
- Least densely populated
- Higher education
- 39 percent with children under 18

Source: U.S. Census Bureau. (2008). 2010 Census Integrated Communications Campaign Plan

Appendix 2

Completeness Rates – Housing Variables by Mode and Treatment

Variable	Mand All	Mand Mail	Mand CATI	Mand CAPI	Vol All	Vol Mail	Vol CATI	Vol CAPI
All housing items	**95.4**	**96.1**	**93.9**	**93.1**	**94.2**	**95.2**	**93.6**	**92.5**
Condo fee	99.5	99.5	99.5	99.3	99.4	99.5	99.5	99.3
Telephone service	99.5	99.3	100.0	99.6	99.4	99.0	100.0	99.6
Month moved in	99.3	99.4	99.6	98.7	99.2	99.2	99.5	98.7
Tenure	99.3	99.2	99.6	99.2	98.9	98.7	99.6	98.8
Vehicles	99.2	99.2	99.3	98.6	98.8	98.9	99.3	98.1
Plumbing facilities	99.1	99.3	99.8	97.9	99.0	99.1	99.9	98.2
Kitchen facilities	99.1	99.3	99.8	97.4	98.9	99.0	99.9	97.9
Mortgage status	98.9	99.0	99.1	98.0	98.3	98.3	98.8	97.4
Heating fuel	98.7	99.1	98.0	97.3	98.2	98.7	97.9	97.0
Type of building	98.6	99.0	98.1	97.4	98.7	98.8	98.5	98.5
Meals included in rent	98.2	97.7	99.4	98.9	98.1	96.8	99.7	98.9
Second mortgage presence	98.1	98.5	97.7	95.8	96.8	97.2	97.3	94.8
Vacancy status	98.1	96.0	100.0	98.2	97.9	95.0	100.0	97.9
Food stamps	97.9	98.0	98.4	97.2	97.8	97.6	98.8	97.1
Business on property	97.8	97.1	99.8	99.5	98.1	96.6	99.9	99.5
Home equity loan presence	97.5	98.2	96.2	94.6	95.7	96.8	95.5	92.5
Acreage	97.0	96.9	96.7	97.4	96.7	96.4	96.6	97.7
Year moved in	96.9	96.8	97.9	96.7	96.4	96.1	97.8	95.6
Number of rooms	96.6	97.0	99.0	93.2	96.6	97.0	99.1	94.0
Real estate taxes in mort	96.6	97.8	94.3	91.0	93.9	96.0	93.0	88.7
Agriculture on property	96.5	96.8	95.8	96.1	95.9	96.3	95.9	95.1
Electricity cost	95.2	97.4	90.7	88.5	92.3	95.8	89.5	86.4
Number of bedrooms	94.8	94.3	99.1	93.4	95.4	94.5	99.3	94.3
Monthly rent	94.0	96.6	92.8	89.6	92.1	95.1	92.9	88.7
Water cost	93.6	95.3	89.0	89.7	90.8	93.4	87.9	87.0
Monthly mortgage payment	93.4	95.4	89.7	84.8	89.4	92.8	87.3	81.6
Value of residence	93.1	96.0	84.5	86.4	89.9	94.6	83.6	84.2
Monthly home gas cost	90.7	91.1	89.1	90.0	89.1	89.8	88.3	88.1
Insurance in mortgage	90.6	92.8	84.2	84.2	87.9	90.7	85.4	82.9
Year build	88.8	94.2	81.8	73.7	86.6	93.4	83.1	76.5
Heating fuel cost	87.2	83.3	97.4	97.6	88.6	81.7	97.4	96.9
Real estate taxes	83.8	89.7	66.1	63.7	77.1	86.3	65.3	61.7
Second mortgage payment	82.0	84.5	74.9	66.4	76.8	81.7	72.0	62.9
Home insurance cost	80.3	85.8	63.4	63.1	73.2	82.1	61.3	59.5
Mobile home cost	76.6	76.3	77.5	77.0	73.0	70.0	77.8	74.7

Appendix 3

Completeness Rates – Population Variables by Mode and Treatment

Variable	Mand All	Mand Mail	Mand CATI	Mand CAPI	Vol All	Vol Mail	Vol CATI	Vol CAPI
All population items	**95.8**	**95.7**	**95.9**	**96.1**	**94.4**	**93.9**	**95.0**	**95.0**
Sex	99.7	99.6	100.0	99.9	99.7	99.5	99.9	99.8
Citizenship	99.7	99.6	99.7	99.6	99.6	99.6	99.6	99.7
Grandchildren living in house	99.5	99.5	99.7	99.6	99.6	99.5	99.7	99.6
Relationship	99.2	99.0	99.5	99.4	99.2	98.9	99.6	99.3
Age	99.1	99.0	99.5	98.9	98.9	98.7	99.4	98.9
Place of work MCD	98.6	98.8	98.7	97.8	98.1	98.2	98.4	97.5
Marital status	98.6	98.4	99.6	98.8	98.4	97.9	99.5	98.4
Speaks another language at home (yes/no)	97.9	97.7	98.2	98.9	97.2	96.7	97.4	98.1
Fertility	97.9	97.7	98.0	98.7	97.4	97.0	97.2	98.0
Hispanic origin	97.9	97.1	99.5	99.6	97.9	96.4	99.5	99.5
Race	97.9	97.4	98.6	99.4	98.0	96.9	98.9	99.5
Migration	97.6	97.2	98.3	99.1	97.0	96.2	97.4	98.5
Difficulty remembering	97.5	97.2	97.9	98.7	96.6	95.9	97.1	97.8
Service in armed forces	97.4	97.1	98.1	98.2	96.6	96.0	97.3	97.1
School enrollment	97.4	96.9	98.0	98.6	96.7	95.9	97.3	97.8
Commuting mode	97.3	97.4	97.5	96.8	96.2	96.3	96.3	95.8
Difficulty dressing	97.3	96.9	98.0	98.7	96.5	95.7	97.1	97.8
Disability going outside	97.3	96.9	98.0	98.6	96.4	95.5	97.2	97.8
Disability seeing or hearing	97.0	96.4	98.0	98.7	96.3	95.1	97.2	97.9
Educational attainment	96.8	97.3	95.9	95.4	95.5	96.3	95.1	94.3
English proficiency	96.6	95.3	97.7	98.9	96.2	93.9	97.2	98.8
Employment status	96.6	96.0	97.8	98.2	95.7	94.5	97.0	97.4
Place of work state	96.5	96.3	97.4	96.6	95.4	95.0	96.4	95.4
Difficulty working	96.4	95.6	97.9	98.6	95.5	93.9	97.0	97.8
Total riders in commute	96.2	96.1	96.9	96.3	95.2	94.9	95.6	95.3
When last worked	96.2	95.7	97.3	97.3	94.8	93.6	96.4	96.1
Self-employment income	96.1	96.3	95.5	95.9	94.4	94.3	94.6	94.6
Physical difficulty	96.1	95.1	97.9	98.7	95.6	93.9	97.1	97.8
Place of work county	95.9	95.9	96.0	95.5	94.6	94.7	95.0	94.1
Year on active military duty	95.7	95.8	95.4	95.9	94.7	94.6	95.2	94.8
Place of work place	95.4	95.6	95.3	94.5	94.0	94.3	94.2	93.1
Residence one year ago state	95.3	94.4	94.9	97.9	94.3	92.7	94.3	96.6
School level attending	95.3	95.5	94.9	95.0	94.0	94.7	93.7	93.2
Period served in military	95.1	95.4	93.5	94.8	93.9	94.5	92.6	93.6
Class of worker	94.6	94.1	96.5	95.6	93.5	92.3	95.5	94.3
Residence one year ago county	94.4	93.9	91.6	96.6	93.3	92.4	91.4	95.1
SSI income	94.4	93.8	95.9	95.8	91.8	89.5	94.8	94.0
Residence one year ago MCD	94.3	93.8	91.4	96.4	93.2	92.3	91.3	94.9
Specific language spoken at home	94.3	91.7	97.3	98.0	94.4	90.5	96.7	98.0
Place of birth	94.3	94.1	95.0	94.1	93.4	93.7	93.8	92.2
Public assistance income	94.2	93.5	96.0	95.7	91.6	89.2	94.9	93.9
Minutes to work	94.0	94.8	92.9	91.4	91.9	93.0	91.6	89.9
Residence one year ago place	93.9	93.6	90.8	95.6	92.7	92.0	91.0	94.1
Other income	93.9	93.5	95.0	94.9	91.1	89.1	93.8	93.1
Industry	93.9	93.4	95.9	93.9	92.1	91.1	94.6	92.0

Occupation	93.7	93.3	95.4	93.4	91.8	90.8	94.3	91.6

Completeness Rates – Population Variables by Mode and Treatment

Variable	Mand All	Mand Mail	Mand CATI	Mand CAPI	Vol All	Vol Mail	Vol CATI	Vol CAPI
Retirement income	93.6	93.1	94.4	94.8	90.2	88.2	92.6	92.6
Hours worked per week	93.3	93.5	92.1	93.5	91.5	91.3	90.8	92.6
Year of entry into the USA	93.1	94.5	91.3	90.8	91.4	93.4	89.6	90.3
Weeks worked in last year	93.0	92.8	93.0	93.6	91.3	90.7	91.6	92.6
Social security income	92.7	92.8	92.1	93.4	88.6	87.2	89.7	90.9
Interest income	91.6	91.9	89.6	92.3	86.8	86.0	86.3	89.2
Time of departure to work	91.4	92.1	90.2	88.8	88.6	89.4	88.4	87.2
Months resp for grandchild	90.0	89.3	91.6	90.0	89.7	91.1	89.9	87.3
Responsible for grandchild	89.9	89.2	92.3	89.4	89.5	88.4	91.2	89.0
Wages	88.5	91.7	81.2	80.2	82.9	86.9	78.9	77.4
Total income	82.1	86.3	71.0	72.9	73.5	78.2	67.1	68.7