UNITED STATES DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. Census Bureau
Washington, DC 20233-0001

January 9, 2012

2010 CENSUS PLANNING MEMORANDA SERIES

No. 165

MEMORANDUM FOR The Distribution List

From: Arnold Jackson *[signed]*
Acting Chief, Decennial Management Division

Subject: 2010 Census Quality Survey

Attached is the 2010 Census Quality Survey Report. The Quality Process for the 2010 Census Test Evaluations, Experiments, and Assessments was applied to the methodology development and review process. The report is sound and appropriate for completeness and accuracy.

If you have questions about this report, please contact Michael Bentley at (301)763-4306.

Attachment

December 14, 2011

2010 Census Quality Survey

U.S. Census Bureau standards and quality process procedures were applied throughout the creation of this report.

FINAL REPORT

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Contents

List of Tables

List of Figures

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Executive Summary

Study Overview

Planning for the 2020 Census is underway even as data from the 2010 Census are still being released. One particular area of interest is the use of the Internet for the 2020 Census as an alternative means for the public to respond to the census, which is expected to make the census more cost-effective and accurate. The 2010 Census Quality Survey was a census reinterview evaluation, using nearly identical content as the 2010 Census, with both a mailback and an Internet response component. The research was designed to be a first step in the 2020 Census Internet testing cycle.

A sample of 2010 Census mail respondents was selected and assigned to one of three Census Quality Survey panels, each with a different contact strategy approach:

1) **Internet Push panel**, where households were "pushed" into responding to the Census Quality Survey online, though nonrespondents received a paper questionnaire at the final mailing.
2) **Internet/Mail Choice panel**, where households had the option of responding online or by mail at each mailing.
3) **Mail Only panel**, where households were asked to respond only by mail, similar to the 2010 Census strategy.

The primary goal of the Census Quality Survey was to estimate and compare measurement error, using gross difference rates, between the paper and Internet response options. Other key goals included comparison of item nonresponse rates, household coverage analyses, and reporting various paradata measures from the Internet application (such as breakoff rates, help link usage, editing of answers, and other usability issues).

Results

As expected, the participation rates (excluding undeliverable as addressed housing units) varied between the three panels, and Internet uptake (i.e., the portion of the rate due to Internet response) was much different between the Internet Push and Internet/Mail choice panels.

- **Internet Push panel**: 46.5 percent final participation rate (24.8 percent Internet, 21.7 percent mail)
- **Internet/Mail Choice panel**: 55.1 percent final participation rate (4.6 percent Internet, 50.5 percent mail)
- **Mail Only panel**: 56.0 percent final participation rate

The next four sections provide summary results to answer the four research questions.

1) What is the measurement error, as measured by gross difference rates, for responses obtained from a census Internet questionnaire compared to a census paper questionnaire for each of the "push" and "choice" strategies?

The analysis of gross difference rates, defined as the percent of people with a different response between the 2010 Census and the Census Quality Survey, found differences by panel, by mode, and by data item.

- For the Internet responses, the Internet/Mail Choice panel had significantly lower gross difference rates for several of the items (tenure, age, race, and other residence) than the Internet Push panel. A couple of these differences were small, though the differences for tenure and other residence were noteworthy. However, the comparison is complicated somewhat by the nature of the Census Quality Survey design and the differing response populations in each panel. Some users of the Internet instrument would not ordinarily have responded online but were "pushed" into doing so. For instance, the Internet Push panel had a higher proportion of Internet responders age 65 or older than the Internet/Mail Choice panel.

- Within the Internet/Mail Choice panel, we found that there were several significant differences between the Internet and mail respondents (for tenure, sex, and age). The Internet gross difference rates were lower compared to mail responses, which is unexpected since one would think that a reinterview using the same mode (mail) as the census would have fewer differences than a reinterview using a different mode (Internet). One explanation for this is that the use of soft edits in the Internet instrument enabled respondents to provide more accurate answers. Another reason is that the populations that opted to respond by Internet instead of mail are different in some ways. The Internet response population (including all people in the household) was more likely than the mail responders to be younger, White, have a mortgage on their home, and live in larger households.

- For the mail responses, there was one significant (but negligible) difference (Hispanic origin) between the Mail Only and the Internet/Mail Choice panels. None of the other items were statistically different.

In conclusion, the gross difference rate analysis suggests that both the Internet and mail respondents provided consistent responses to the Census Quality Survey compared to the 2010 Census. The gross differences for the Internet respondents were not higher than those of the mail respondents, and in some cases lower, suggesting that responses to an Internet census instrument would have similar measurement error compared to the census paper questionnaire.

2) What are the item nonresponse rate differences between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

The analysis of item nonresponse rates was done to evaluate the Census Quality Survey data completeness across each panel and response mode.

- For the Internet responses, as expected, the data were found to have significantly lower item nonresponse compared to the mail respondents. This was not surprising since soft edits were built into the Internet instrument which warned respondents once if an item was left blank. In some cases the difference was large; for Internet responses, the tenure nonresponse in each panel was 0.1 percent or less, and for mail responses, the tenure nonresponse was 2.1 percent or higher in each panel.

- Due to an Internet server issue that arose during the first few days of the survey period, some respondents had problems accessing the survey and others were not able to fully complete the survey. This impacted item nonresponse, among other things, as the nonresponse was artificially inflated due to the problem. This should serve as a caution that even though Internet surveys are capable of eliciting significantly lower item nonresponse than traditional paper questionnaires responses, the instrument is susceptible to operational issues that could impact quality.

- For the mail responses, the item nonresponse rates were significantly higher in the Internet/Mail Choice panel compared to the Mail Only panel for several items (tenure, relationship, sex, Hispanic origin, and race). We do not have any valid hypotheses to explain this, but do note that most of these differences were small and may not be meaningful.

- Like previous studies, we found that item nonresponse to the race question from the mail responses was higher for Hispanics than for those not of Hispanic origin. Interestingly, though, this was not the case for the Internet responses. In fact, for Internet responders, of those who provided any response to the Hispanic origin question, less than 1 percent did not also provide a response to the race question.

In conclusion, the item nonresponse rate analysis showed that the use of soft edits contributed to the lower rates of missing data for the Internet responses. This is a major benefit of online surveys and could improve the overall data quality of an online census.

3) What are the differences in within-household coverage between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

Due to the complex nature and timing of the within-household coverage analysis, most of the detailed results will be presented in a separate memorandum, but we did find some interesting results.

- We determined that a higher percentage of people added at the second roster screen ("Any additional people") were later determined to be deletions from the final roster after their residency disposition was determined, compared to those initially added to the roster.

- Also, people listed in Roster 1 were less likely than those listed in Roster 2 to indicate sometimes living or staying elsewhere. Further, among those who indicated a reason for being away, there were several differences between Roster 1 and Roster 2, including

higher seasonal and child custody rates among Roster 1 people in both panels and higher college and "another reason" rates among Roster 2 people for the Internet Push panel.

4) What are the paradata for the Internet questionnaire, such as break-off rates, use of help screens or links, changing of answers, access failures, completion times, etc.?

The analysis of Internet paradata was done in order to provide for a high-level understanding of respondent's experiences with the online survey instrument.

- The majority of respondents were able to successfully log in and submit data, despite an initial setback due to the server error.

- Respondents who needed to provide a personal identification number for re-entry were generally able to do so without problems.

- While several respondents broke off within the first couple of screens, those that continued the survey appeared to have little difficulty, as evidenced by the infrequent use of Help, Instructions, or Frequently Asked Questions.

- Most respondents who completed the entire instrument did so within the expected amount of time (ten minutes).

- The frequency of error messages was higher than anticipated, but this was mostly due to questions being left blank.

- The highest rate of error messages due to invalid data were caused by the age and date of birth questions, which were complicated by the fact that we asked for age as of a reference date which was approximately five to six months in the past.

In conclusion, the paradata analysis suggests that, in general, the Census Quality Survey instrument was well understood and easily navigated by respondents.

Nonresponse analysis

Though it was not a formal research question, in order to study the potential for bias in the Census Quality Survey results, we compared the 2010 Census mail response distributions for each item between the Census Quality Survey respondents and nonrespondents. As expected, there were differences. In general, compared to the Census Quality Survey nonrespondents, the Census Quality Survey respondents tended:

- to not be of Hispanic, Latino, or Spanish origin (5.5 percent of respondents compared to 11.0 percent of nonrespondents);
- to be White (82.1 percent compared to 69.8 percent);
- to own their home (80.5 percent compared to 62.8 percent);
- to be older (20.3 percent were age 65 or over compared to 9.4 percent);
- to have smaller households (2.38 persons per residence compared to 2.71 people on average).

The overall response distributions, for both respondents and nonrespondents, were similar across the three study panels.

Recommendations

Based on the results of the Census Quality Survey we recommend several areas for future research and development:

- In-depth household coverage analysis by mode;
- National mailout test, including mail and Internet response modes, designed to study response rates and optimal contact strategies;
- Strategic frame development in order to enhance the use of Internet as a response option, including possibly targeting specific populations or incorporating email addresses;
- Testing Internet response mode in other languages.
- Testing Internet response on mobile devices.

We also recommend several refinements and improvements to the Internet instrument to consider for 2020 Census web development, such as question wording, security and access issues, and usability.

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1. Introduction

Planning for the 2020 Census is underway even as data from the 2010 Census are still being released. One particular area of interest is the use of the Internet for the 2020 Census as an alternative means for the public to respond to the census, which is expected to make the census more cost-effective and accurate. The 2010 Census Quality Survey (CQS), a reinterview evaluation with both a mailback and an Internet response component, was implemented as a research component under the 2010 Census Program for Evaluations and Experiments (CPEX). Projects under the 2010 CPEX will guide future census design, as well as benefit other ongoing programs conducted by the Census Bureau, such as the American Community Survey.

The decision to exclude the Internet as a response option for the production 2010 Census was based on various factors including data security concerns and overall response rate expectations. The information that fed into the decision was, in part, the result of Census Bureau research conducted during the 2010 Census testing cycle. The 2010 CQS seeks to build on previous Internet data collection research in order to set the stage for the 2020 Census Internet testing cycle.

1.1 Purpose of Study

The main objective of the 2010 CQS is to estimate measurement error from a census Internet questionnaire compared to that from a census paper questionnaire. In addition to estimating measurement errors, a key objective of the evaluation is to collect data related to respondent interaction with a census Internet questionnaire such as break-off rates and completion times. Laboratory usability testing provided navigational data, such as eye-tracking, keystroke analysis, and mouse-tracing results for the personal computer environment, which is covered in a separate report (Ashenfelter et al., 2011).

Note that the main design goal of the 2010 CQS was to develop the most effective census Internet questionnaire, given the time and resource constraints, and then evaluate its associated measurement error and usability issues. The Internet instrument was not intended to simply replicate the 2010 Census paper questionnaire in an electronic mode. Rather, the goal was to evaluate measurement error associated with an Internet questionnaire that exploits the advantages of the electronic technology, while still retaining the meaning and intent of the questions and response options from the paper form.

This evaluation plays an early role in 2020 Census planning. The intent is to use the 2010 CQS quantitative survey results, in combination with the usability laboratory results, to focus the Census Bureau's Internet development/design resources for early decade testing. This questionnaire design work is intended to be integrated with response option and contact strategy research within the 2020 Census testing cycle to establish the optimal Internet data collection strategy for the 2020 Census.

1.2 Research Questions

The research questions that guide the design of the evaluation are provided below.

1) What is the measurement error, as measured by gross difference rates, for responses obtained from a census Internet questionnaire compared to a census paper questionnaire for each of the "push" and "choice" strategies?

2) What are the item nonresponse rate differences between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

3) What are the differences in within-household coverage between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

4) What are the paradata for the Internet questionnaire, such as break-off rates, use of help screens or links, changing of answers, access failures, completion times, etc.?

An overview of the analysis that was conducted in order to answer each of the research questions is provided in Section 3.5.

2. Background

The 2010 CQS is intended to provide estimates of measurement error associated with the design and content of a self-administered, census Internet questionnaire. This evaluation is not intended to evaluate public compliance (as measured by unit-level response rates).[1] An Internet response rate strategy study within the 2010 Census production cycle (or shortly after) would have been critically limited by the 2010 Census Integrated Communication Program messages stating that there was no Internet data collection option for the 2010 Census. However, in recent years, much work has been done on evaluating response strategies for census Internet data collection, the highlights of which are provided in Section 2.1.

In terms of questionnaire content studies that focus on measurement error, much research is available for paper data collection modes (both self- and enumerator-administered questionnaires). A census content reinterview study aimed at measuring simple response variance for paper and other data collection modes has been conducted by the Census Bureau for over four decades. There are fewer studies on measurement error that directly relate to a census Internet data collection instrument. However, interesting studies have been conducted by internal and external researchers, which may be relevant to the design of a census Internet instrument (see Section 2.2).

[1] Although the unit-level reinterview response rates are not evaluated in this study, these rates are reported to assist in designing future reinterview studies.

2.1 Internet Response Option and Contact Strategy Research

In the 2003 National Census Test (NCT), several response option strategies were tested, including the use of Internet "push" and "choice" methods (Brady et al., 2004). Multiple panels tested a push strategy in which respondents *did not* initially receive a paper questionnaire but instead received a letter that described how to respond using either the Internet or by Interactive Voice Response (on the telephone). Note that this study did not include a panel that tested the push strategy for the Internet mode alone since it was not a realistic alternative census contact strategy at that time in the planning cycle. With the choice strategy, respondents *did* initially receive a paper questionnaire, but were also offered the option of responding using the Internet or by Interactive Voice Response. The results indicated that households that were pushed to use the electronic modes were significantly less likely to respond to the survey (about 5.7 percentage points less), which was even more evident in the low response stratum.[2] There was no difference in response for the households offered a choice of alternative modes, with some of the responses simply shifting from paper to either Internet or Interactive Voice Response. For the choice panels offering Internet as a response option, the Internet response rate was less than 7 percent. Finally, the item nonresponse rates for the Internet responses were significantly lower for almost all items than for the paper returns. This was assumed to be due to the design of the Internet application, in which respondents were given a one-time edit message if they failed to initially respond to a question.

In the 2005 NCT, one of the experiments tested the encouragement of Internet response for households as part of the replacement mailing (Bentley and Tancreto, 2006). Unlike the 2003 NCT, all households in the 2005 test were given the option to respond using the Internet. However, in lieu of a paper replacement questionnaire, a letter was sent which told potential respondents to use the Internet if they had not already responded or to return their initial paper questionnaire. The results showed that households who were encouraged to use the Internet at the replacement mailing were significantly less likely to respond overall (about 3.7 percentage points less).

External research projects on Internet response rates have limited relevance to the use of a census Internet response mode option since the Census environment, including the sizable advertising campaign and mandatory participation requirement, is unique in the survey world. However, studies conducted on the Canadian Census apply more closely to a U.S. Decennial Census in that it is conducted within a similar survey environment. The 2006 Canadian Census obtained an Internet response rate of 18.3 percent of the private occupied dwellings when given a choice of paper and Internet response options (Laroche and Grondin, 2008). The 2004 Canadian Census Test involving four provinces yielded an Internet response rate of 9.5 percent for the "short form" which included mainly demographic items (Roy and Laroche, 2004). These response rates are encouraging in terms of the use of a census Internet response option in a decennial census in the United States; however, the survey populations are somewhat different considering the geographic and demographic differences between the two countries.

[2] Prior to sample selection, census tracts were stratified into two groups that reflect differences in Census 2000 mail return rates, as well as anticipated differences in the race/Hispanic origin and tenure composition (owner vs. renter-occupied housing units) of the population (Brady et al., 2004). These were the low and high response strata.

The Census Bureau also conducted an Internet experiment for the American Community Survey (ACS) in early 2011. The 2011 ACS Internet Test focused on response rates associated with various response options/contact strategies. The experimental response options/contact strategies included the Internet choice method with "prominent" and "not prominent" invitations. Also included was the Internet push method with regular and accelerated (where the paper questionnaire was sent one week sooner) mailing schedules. The 2011 ACS test was designed to test the impact of an Internet response option before including it in the production process. When the Internet response option was previously tested in 2000 in the ACS, researchers found that offering Internet as a choice during the mail phase of data collection actually decreased the overall response rates by about 5.8 percentage points (Griffin et al., 2001). Note that the sample stratification for the ACS test was similar to that of the CQS sampling (see Section 3.2.3) and focused on the relative likelihood of Internet usage by geographic area (DSSD, 2009).

2.2 Internet Questionnaire Design Research

In the 2005 NCT, an experiment was conducted to compare the results from two different Internet application designs: one using a person-based design (requesting data for one person at a time, similar to the paper questionnaires) and the other using a topic-based design (requesting data for the entire household one question at a time on a single screen for each item) (Zajac et al., 2007). The results were mixed. The person-based design had a higher break-off rate, which meant data were collected for fewer people, and so potentially more households would need to be sent to a coverage followup interview. On the other hand, the topic-based design resulted in significantly higher item nonresponse rates for almost all person items (item nonresponse rates for the relationship item were comparable). The research also looked at other paradata, such as break-off rates at each individual question and completion times. No significant differences in completion time were found.

Various studies were conducted by Statistics Canada this decade with the goal of researching mode effects associated with the Canadian Census Internet instrument. For the first time, in 2006, Canadian households had the option of responding to the Census via Internet. The 2006 Census Internet Mode Effects Study evaluated 2006 Census data from those who chose to respond via the paper questionnaire and those who chose to respond via the Internet questionnaire (Grondin and Sun, 2008). This study did not have an experimental design. Rather the assessment compared item nonresponse rates, item distributions, followup rates, and navigational data for the self-selected paper and Internet respondents. In order to group cases from the different response populations so that they are more comparable, researchers used a propensity score method. This method involved a regression model for estimating the probability of using Internet with covariates, such as geography, urban indicator, household size, and age, and then making comparisons within each of ten Internet response propensity groups. The researchers identified mode effects, although the usefulness of the results was limited by several factors, including self-selection bias, despite efforts to adjust the data. For the 2011 Canadian Census, an attempt was made to obtain as many responses as possible by Internet. In 2011, in lieu of receiving a paper questionnaire, 60 percent of Canadian households received a letter providing the website address, a secure access code, and a toll-free number to call for a questionnaire. Statistics Canada anticipated a 40 percent Internet response rate using this

methodology (Cote and Laroche, 2009). Complete results of the 2011 Canadian Census were not yet available at the release of this report.

3. Methodology

The general methodology for this evaluation focuses on the use of a self-administered Internet reinterview. Internet reinterview data were compared to 2010 Census paper questionnaire data for the same households to estimate gross difference rates. A similar comparison was made for the mail reinterview to estimate gross difference rates for the paper mode. These gross difference rates were compared to estimate the measurement error that arises from Internet compared with paper questionnaires.

Measurement error can arise from various sources, such as questionnaire design features and response mode. These design features include format (topic- or person-based), navigational flow (one question per screen), response category presentation (list or banked categories), visual design elements (such as item numbering and logos), and other questionnaire components. Measurement error can also be a function of the respondent, via different experiences, feelings, attitudes, change over time, and differing interpretations of the meaning of questionnaire items. To supplement the interpretation of the survey results, laboratory data from usability and cognitive testing were also evaluated.

The reinterviews were conducted with a sample of 2010 Census mail respondents in order to provide estimates of measurement error associated with the design and content of a self-administered census Internet questionnaire. Since the measurement error structure may have differed depending on whether a respondent has only one response mode option (i.e., mail or Internet) compared with having a choice between the two modes, we tested both "push" and "choice" strategies. A sample of 2010 Census mail respondents was selected and assigned to one of three CQS reinterview panels, each with a different contact strategy approach:

1) **Internet Push panel**, where households were "pushed" into responding to the CQS online, though nonrespondents received a paper questionnaire at the final mailing.
2) **Internet/Mail Choice panel**, where households had the option of responding online or by mail at each mailing.
3) **Mail Only panel**, where households were asked to respond only by mail, similar to the 2010 Census strategy.

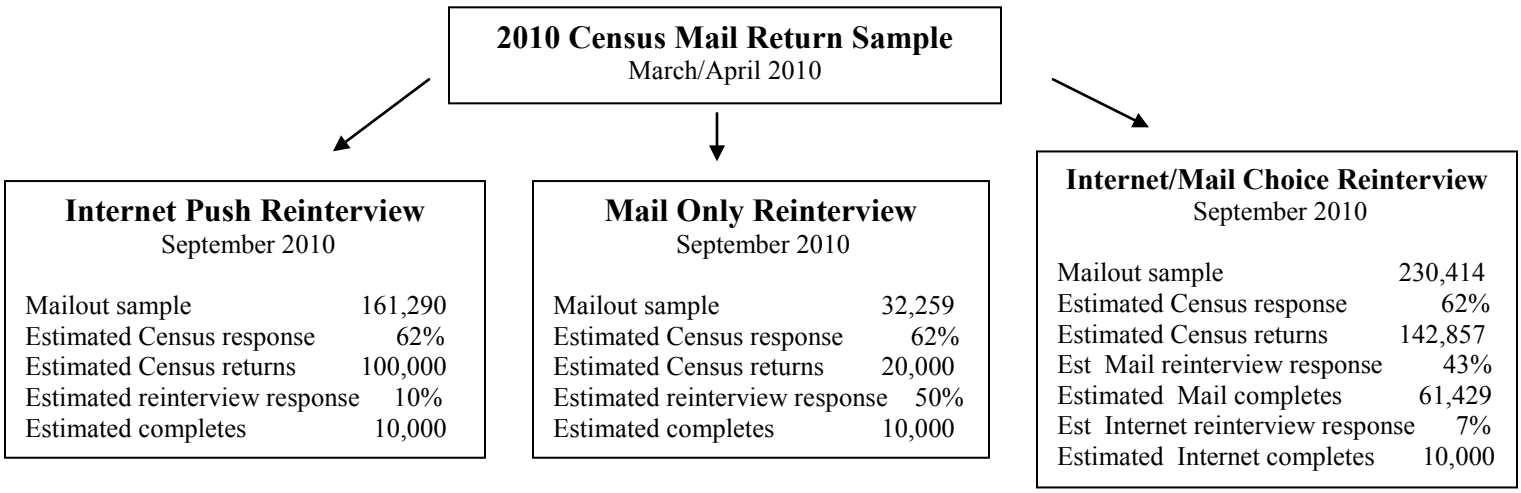
The Internet and mail reinterviews were conducted in late summer of 2010, after the Census enumeration activities had been completed, in order to minimize the risk to 2010 Census data collection. However, the reinterviews were conducted as close to the census enumeration as feasible in order to effectively compare reinterview results to the 2010 Census self-administered paper questionnaire. The reinterview used the Census reference date of April 1, 2010. Presumably, the results collected within the census environment reflect a more generalizable measurement error structure than results from a mid-decade census test instrument given that there is considerably more publicity and broader participation in a decennial census. In addition, we hoped to capitalize on respondents' awareness of the 2010 Census to obtain higher response to the reinterviews than would be possible in the absence of the 2010 Census environment.

However, for the Internet reinterview, compliance may have suffered to some extent from messages informing potential respondents that there was no Internet response option in the 2010 Census (See Section 4.5).

3.1 Survey Design

In order to effectively evaluate the measurement error from a web-based census data collection, three separate reinterview samples were selected from 2010 Census mail questionnaire respondents. The general survey design is shown in Figure 1, below.

Figure 1. Overview of the 2010 Census Quality Survey Reinterview Design



The estimates shown above were based on an estimated 62 percent response rate[3] for the 2010 Census for English-only forms in mailback areas. In actuality, the 2010 Census response rate was about 65 percent (Letourneau, 2011), which slightly increased our reinterview sample sizes. Additional detail on estimating the CQS response rates is provided in Section 3.2.2.

By comparing the Internet responses with 2010 Census paper questionnaire data for the Internet Push panel, we get estimates of the gross difference rates for each data item (i.e., tenure, relationship, sex, age/date-of-birth, Hispanic origin, race).[4] Similarly, we compare the mail reinterview responses from the Mail Only panel with 2010 Census paper questionnaire data to get estimates of the gross difference rates for the same data items. Then, we compare the gross difference rate estimates for the two reinterview modes to assess measurement error differences between the administration of the census Internet questionnaire and the census paper questionnaire using the push strategy. We also compare the gross difference rates within each

[3] The 2010 Census response rate is defined as the number of mail returns divided by the number of housing units to which we mailed or delivered questionnaires.

[4] Note that gross difference rates cannot be computed for the within-household population count item since the current Internet reinterview rostering approach did not ask for a count of the total number of people in the household, as does the paper questionnaire. See Section 3.3.2 for more information on the Internet rostering approach.

reinterview mode for the push and choice strategies, as well as compare gross difference rates for the Internet and mail modes within the Internet Choice panel.

3.2 Sample Design

3.2.1 Survey Population

The initial sample was preselected from housing units in mailout/mailback areas of the 50 U.S. states and the District of Columbia. The sampling frame excluded housing units in mailout/mailback areas that were mailed a Spanish/English bilingual questionnaire.[5] In addition, group quarters and housing units in any other types of enumeration areas were excluded from the sampling frame. Further, any housing units selected for the 2010 CPEX mailback experiments, the Content Reinterview Survey (CRS), the Census Coverage Measurement operation, or the 2010 ACS sample (for all of 2010) were also excluded from the sampling frame.

Although the sampling frame consists of those units that were mailed a 2010 Census paper questionnaire, only those households who responded to the Census by June 14 using the regular D-1 mailout/mailback form were invited to complete the CQS. (In order to accommodate survey operational issues such as printing and labeling of the correct addresses, we needed to create the final workload about six weeks prior to the initial mailout.)

The survey population for the CQS is made up of those mailout/mailback households who choose to respond to a self-administered reinterview within a census year (and had already responded to the 2010 Census in the paper mode). For the Internet reinterview component of the CQS, the population of inference is those households who choose to respond by Internet mode in a census (including all respondents from the Internet Push panel and the Internet respondents from the Internet/Mail Choice panel).[6] For the mail reinterview part of this evaluation, the population of inference is those mailout/mailback households who choose to respond by paper mode in a census (including the Internet Push panel respondents who responded via the paper replacement questionnaire, the mail respondents from the Internet/Mail Choice panel, and all respondents from the Mail Only panel). For each of the two parts of this evaluation (i.e., Internet and mail reinterview modes), the population of inference and the survey population are not an exact match, so the results are subject to coverage error and nonresponse error (Groves, 1989).

Nonresponse error affects survey statistics through two components: the nonresponse rate and the difference between nonrespondents and respondents to the survey (Groves, 1989). In terms of nonresponse error associated with the CQS reinterview estimates; there is useful information

[5] For the 2010 Census, the Census Bureau delivered a bilingual Spanish/English questionnaire to all housing units in selected blocks that, in our estimation, were most likely to need Spanish language assistance (approximately 11.5 million). This bilingual questionnaire had a swim-lane design. This was a substantial change from the format of the mailout English only questionnaire and associated reinterviews, which would have presumably affected measurement error estimates. For this study, it was not operationally feasible to develop and implement reinterview instruments in Spanish (See Section 4.3).

[6] For this survey, we are implicitly treating the population of inference as if it is also the target population. The target population is the set of persons of finite size who will be studied (Groves, 1989).

available since we have data from the 2010 Census on most of the survey population. We attempted to estimate an indication of the magnitude of nonresponse bias by comparing demographic characteristics of reinterview respondents and nonrespondents based on data from their 2010 Census paper questionnaire responses. The nonrespondents are those who were mailed an invitation to respond to the CQS and did not respond.

The CQS estimates were also subject to coverage error since the sampling frame does not cover the entire population of interest. It is difficult to estimate expected coverage error for a statistic since it is a function of both the proportion not covered by the frame and the difference on the survey statistic between those covered and not covered (Groves, 1989). We assume that the proportion of non-coverage was relatively small since our frame included much of the 2010 Census mailout/mailback area. However, housing units in the 2010 Census mailout/mailback bilingual blocks were excluded. We plan to use the 2010 CRS data to determine how gross difference rates for census questionnaire items vary for different types of enumeration (Dusch and Rothhaas, 2009). For example, if sample size permits, we plan to compare the measurement error of responses from the bilingual questionnaires to those from English only questionnaires within the mailout/mailback areas (CRS results are presented in a separate report).[7] Even with this assessment, we generally do not have good indicators of how all excluded cases would differ in their measurement error results.

As noted previously, the estimates derived from the mail reinterview are also subject to coverage and nonresponse error. The nature of these errors corresponding to the mail reinterview estimates are similar to those discussed above for the Internet reinterview estimates.

3.2.2 Sample Sizes and Power Analysis

The goal of the sample design for this evaluation was to be able to detect gross error rate differences of less than one percent. Thus, after a robust statistical power analysis was conducted, a conservative sample size of 10,000 completed reinterview cases for each reinterview mode was chosen to ensure adequate sample for national estimates (Hill et al., 2010). As a result of the sample size needed for 10,000 Internet completes in the Internet/Mail Choice panel, we expected to obtain well over the required 10,000 completed paper reinterview cases (the estimated total number of paper completes was 61,429). Working backward from those counts, we then conducted a literature review to determine our expected response rates and thus our final sample sizes.

Response rates for the self-administered reinterviews were difficult to predict since the 2010 CQS was unique in many ways (e.g., it was a reinterview, as opposed to an initial survey request, and it was conducted within a census environment). The expected 10 percent response rate for the Internet Push panel reinterview was a rough estimate since the literature on reinterview response rates for web-based surveys is essentially nonexistent. The 2005 NCT design used a similar contact strategy with reminders (although the initial questionnaire contact included a response mode choice of paper and Internet). The 2005 NCT Internet application obtained a national self-response rate of 7.2 percent (Zajac et al., 2007). However, the 2010 CQS Internet

[7] The 2010 CRS offered a telephone reinterview in both English and Spanish.

reinterview strategy more closely resembled the push strategy from the 2003 NCT. When pushed to respond by an electronic mode in the 2003 NCT, that is, by Internet or Interactive Voice Response, the Internet response rate was 18.8 percent (Brady et al., 2004). Given the increase in Internet accessibility and usage in the last half of the decade and considering various factors that could negatively affect compliance, we conservatively estimated a 10-percent response rate for the Internet Push panel reinterview. For the Internet/Mail Choice panel, we estimated a seven-percent response rate based directly on the 2005 NCT results since that design implemented an Internet/Mail choice strategy.

The expected 50-percent mail reinterview response rate for the Mail Only panel was mainly based on the mail response rate for the CQS in 2001 since the survey design and questionnaire were similar. In June 2001, the Census Quality Survey included the mailing of paper questionnaires similar in content to the Census 2000 questionnaire for the purpose of studying race responses (Bentley et al., 2003).[8] A replacement questionnaire was mailed out in July 2001. About 54 percent responded by mail to the survey. Since the 2001 CQS was over a year after Census Day 2000 and the 2010 CQS mail reinterview is about five months after Census Day 2010, the response rates are not directly comparable. The 2003 National Survey of College Graduates (NSCG) obtained a 62 percent response rate for the mail portion of the reinterview (Singer, 2005). However, these results may not be directly comparable since the target population for the NSCG is likely more compliant compared to those who would be invited to respond to the 2010 Mail Only panel reinterview. Considering these results, we conservatively estimated a 50-percent response rate for the Mail Only panel reinterview. For the Internet/Mail Choice panel, we estimated a 43 percent mail response rate since the choice of Internet as a response option is expected to yield about seven percent in the Internet response mode.

Thus, prior to 2010 Census data collection, a total of 161,290 Census housing units were pre-selected for the Internet Push panel initial sample; 32,259 were pre-selected for the Mail Only panel initial sample; and 230,414 were pre-selected for the Internet/Mail Choice panel initial sample. Of those, we expected roughly 62 percent to return the 2010 Census paper questionnaire.[9] For more information on the final sample sizes by panel and for each sample stratum, refer to Section 3.2.3.

3.2.3 Stratification and Allocation

The evaluation used a stratified random sample which was selected prior to the start of the 2010 Census data collection[10]. Similar to the design for the 2011 ACS Internet Test, the stratification was based on the audience segmentation clusters that were identified for the 2010 Census

[8] The 2001 CQS was a split-panel test involving different versions of the race question instruction, one of which was identical to the Census 2000 race question.

[9] The expected 2010 Census mail mode response rate of 62 percent was used for workload assumptions for field operations.

[10] Ideally we would prefer to select the sample directly from the population of census mail responses. However, due to time constraints and other operational impediments, this was not feasible. Therefore the sample was pre-selected based on an expected mail response rate of 62 percent.

Integrated Communication Program and results from the Census Barriers, Attitudes, and Motivators Survey. Each census tract was assigned to a segmentation cluster based on a cluster analysis of various response characteristics (Bates and Mulry, 2008; Bates and Mulry, forthcoming). The 2011 ACS Internet Test targeted tracts in two of the clusters ("Advantaged homeowners" and "Single/unattached/mobiles"), both of which were estimated to contain a higher proportion of households that have Internet access and regularly use the Internet.

Table 1 lists each of the eight clusters and provides estimates of mail return and Internet usage for each cluster. Note the Census 2000 mail return rate is the number of occupied mail returns divided by the number occupied housing units.

Table 1. Summary of High and Low Internet Strata and Audience Segmentation Clusters.

Stratum	Segmentation Cluster	Number of Housing Units	Census 2000 Mail Return Rate	Internet Access at Home	Online at Home 6+ Times in 7 Days
High Internet	Advantaged homeowners	27 million	83%	86.8%	53.0%
	Single/unattached/mobile	8 million	67%	83.2%	51.7%
Medium Internet	All Around Average I (homeowner)	37 million	77%	78.9%	43.5%
	All Around Average II (renter)	17 million	74%	79.8%	45.9%
Low Internet	Econ. Disadvantaged I (homeowner)	7 million	66%	72.0%	27.6%
	Econ. Disadvantaged II (renter)	3 million	58%	69.8%	31.6%
	Ethnic enclave I (homeowner)	3 million	70%	68.8%	29.6%
	Ethnic enclave II (renter)	3 million	64%	69.6%	34.2%

Source: Bates and Mulry (2008) and Simmons Summer 2008 National Hispanic Consumer Study (NHCS) data.

The CQS sampling stratification was based on the audience segmentation clusters as defined in Table 1. The stratification was driven by data correlated with key survey measures (e.g., percentage Internet access at home, Internet home usage frequency).

The 2010 CQS sampled units at the highest selection rate in the "High Internet Use Stratum," which was composed of two of the tract clusters ("Advantaged homeowners" and "Single/unattached/mobiles")[11], both of which were estimated to contain a higher proportion of households that have Internet access and regularly use the Internet. Sample was also selected in the "Medium Internet Use Stratum" and the "Low Internet Use Stratum" at progressively lower selection rates. All housing units in each tract were placed in their corresponding stratum.

The CQS design over-sampled housing units from the two segmentation clusters with expected high Internet usage (i.e., High Internet Use Stratum). For the High Internet Use Stratum, the sampling rate was 2.25 times that for the Low Stratum and included approximately 49 percent of the population. The Medium Internet Use Stratum encompassed approximately 46 percent of the population and had a sampling rate that was 1.5 times that for the Low Stratum.

[11] As defined in Bates and Mulry (2008).

The selected sample sizes by panel and stratum are shown in Table 2 below. Note that the sample households were pre-selected before 2010 Census returns had been received. Thus, the number of households included in the survey mailout was smaller than the total shown below.

Table 2. Selected Sample Sizes by Panel and Stratum

	Stratum			
Panel	**High Internet**	**Medium Internet**	**Low Internet**	**Total**
Internet Push	78,372	74,640	8,278	161,290
Internet Choice	112,018	106,583	11,813	230,414
Mail Only	15,669	14,933	1,657	32,259
Total	206,059	196,156	21,748	423,963

Households that mailed back their completed census form by June 14 were included in the CQS workload. The final CQS mailout sample counts are shown in Table 3. For reference, the 2010 Census response rates as of the cutoff date of June 14, measured by the CQS mailout size divided by the pre-selected sample size, are shown in parentheses. As expected, there were some differences in the response rates by stratum, though the panel-level response rates were very similar ranging from 67.7 percent in the Internet Push panel to 67.2 percent in the Mail Only panel.

Table 3. Final Mailout Sample Sizes and Census Response Rates by Panel and Stratum

	Stratum			
Panel	**High Internet**	**Medium Internet**	**Low Internet**	**Total**
Internet Push	56,325 *(71.9%)*	48,181 *(64.6%)*	4,611 *(55.7%)*	109,117 *(67.7%)*
Internet Choice	80,032 *(71.5%)*	68,727 *(64.5%)*	6,623 *(56.1%)*	155,382 *(67.4%)*
Mail Only	11,213 *(71.6%)*	9,569 *(64.1%)*	898 *(54.2%)*	21,680 *(67.2%)*
Total	147,570 *(71.6%)*	126,477 *(64.5%)*	12,132 *(55.8%)*	286,179 *(67.5%)*

3.3 Contact Strategy and Questionnaire Development

This section contains design and implementation details for the Internet and mail reinterviews. This includes contact strategies (Section 3.3.1), Internet instrument development and design (Section 3.3.2), Internet reinterview instrument and contact materials testing (Section 3.3.3), and mail reinterview materials testing (Section 3.3.4).

3.3.1 Reinterview Contact Strategies

The CQS design included four mailings to the sampled households:

1) Advance letter, dated August 23, 2010
2) Initial mailing, dated August 30, 2010
3) Reminder postcard, dated September 7, 2010

4) Final (replacement) mailing, dated September 20, 2010

For the Internet Push panel reinterview, the eligible Internet sampled households were sent letters to inform them of the survey and to provide details about how to respond online (see Section 3.3.2 for Internet questionnaire details). The Internet Push panel reinterview contact strategy had the same number of contacts as the mail contact strategy that was used for the 2010 Census. This included an advance letter, initial Internet survey request, reminder postcard, and a final survey request sent only to nonrespondents. The initial survey request included an instruction card (in place of a questionnaire) containing information on how to access the survey online. The letter that was included in the initial survey request asked the recipient to respond to the survey online, but told them that we would send a paper questionnaire if they were unable to respond online. The final survey request included information about how to respond online, as well as a paper questionnaire to accommodate respondents who were unable or unwilling to respond online. Questionnaire content assistance was provided to Internet reinterview respondents within the automated survey instrument via item-specific "Help" links (see "Respondent Assistance" in Section 3.3.2).

For the Mail Only panel reinterview, the eligible mail reinterview sample received a paper questionnaire in the mail to complete and mail back. This mail reinterview questionnaire was similar in content to the 2010 Census mail questionnaire but had a different title, color, and had a "thank you" that was customized for reinterview respondents. In addition, a question about whether the reinterview respondent is the same household member who had completed the census form replaced the 2010 Census phone number question. The mail reinterview questionnaire was yellow to avoid being confused with the blue 2010 Census paper questionnaire. The header included a title of "2010 Census Quality Survey" instead of the 2010 Census title or "hand" logo to avoid being confused with the Census questionnaire. The full implementation contact strategy that was used for the 2010 Census was implemented for the mail reinterview, which included an advance letter, initial questionnaire, reminder postcard, and replacement paper questionnaire sent only to nonrespondents. Finally, a toll-free telephone number was provided to mail reinterview respondents for questionnaire content assistance; this was provided in the form of a menu-driven series of prerecorded messages.

The Internet/Mail Choice panel reinterview contact strategy was similar to the Mail Only panel contact strategy. This included an advance letter, initial questionnaire, reminder postcard, and targeted replacement paper questionnaire; the contact materials offered a choice of Internet and paper response modes. The toll-free telephone assistance was provided for this panel as well.

The reinterview contact materials benefited from expert consultation. The invitations and reminders were developed in collaboration with internal and external survey methodologists.

3.3.2 Internet Reinterview Instrument Development

The design of the CQS Internet questionnaire built on that of the design for the 2011 ACS Internet Experiment instrument, which had started its design phase before CQS and benefited from external consultation. However, the design of the 2010 Internet reinterview had some different design features, which were tailored to the 2010 CQS objectives. Recall that an

overarching design goal for this survey was to develop an effective census Internet questionnaire, given the time and resource constraints, and then evaluate its associated measurement error and usability issues. The study objective was to measure mode differences from an Internet questionnaire that exploited the advantages of the electronic technology, while still retaining the meaning and intent of the question and response options from the paper form. In addition, substantial differences in survey length and residence rules resulted in some design differences between the CQS and the 2011 ACS Internet instruments.

Two rounds of usability testing were completed on the CQS Internet reinterview instrument (Ashenfelter et al., 2011). The reinterview instrument design also benefitted from expert consultation. The instrument flow, content, appearance, and other design features were reviewed by internal and external survey methodologists. Screenshots of the Internet instrument are provided in Appendix D.

Access/Authentication:

Respondents accessed the Internet reinterview by using a ten-digit access code,[12] which was provided to the respondent in the initial survey request via mail. Each CQS mailing (initial mailing, reminder postcard, final mailing) had a unique number so that we could later determine which mailing responses came from. The ten-digit access code was mapped back to the original 2010 Census ID for analysis purposes[13]. A four-digit personal identification number (PIN) was auto-generated to allow respondents to come back and finish the survey at a later login time.

Note that the instrument developers worked with internal security experts, as well as usability experts, to ensure that the access strategy met current security standards and existing requirements (Stokes, 2010).

Questionnaire Appearance:

The appearance of the Internet reinterview questionnaire was designed to anticipate the look and feel of the 2020 Census online questionnaire in terms of an "official" federal survey sponsorship, while making use of eye-catching features which sought to encourage response. One of the challenges of the Internet reinterview design was to have connectivity to the 2010 Census paper questionnaire (as it likely would in the 2020 Census as part of the original data collection, provided there is a paper questionnaire) but not cause respondents to think that the reinterview was a duplicate 2010 Census questionnaire.

The Internet reinterview instrument, similar to the mail reinterview questionnaire, had yellow shading to set it apart from the blue 2010 Census paper questionnaire. The header included a title of "2010 Census Quality Survey" instead of the 2010 Census title or "hand" logo to avoid

[12] The ten-digit access code contained a check digit to reduce the likelihood of a respondent entering another household's access code.

[13] Since security procedures in the 2020 Census are expected to be much more advanced, no attempt was made to replicate the Census 2000 process of using the relatively long Census ID as the access code.

confusion since 2010 Census messaging stated that there was no Internet data collection option for the 2010 Census.

Topic-Based Format:

The Internet reinterview instrument was designed with topic-based ordering of person items instead of person-based, as presented on the 2010 Census paper (and reinterview) questionnaire. As mentioned in Section 2.2, the 2005 NCT compared designs for the Census short form and found mixed results (Zajac et al., 2007). While the topic-based design resulted in higher item nonresponse rates for most items, the person-based design had a higher rate of break-offs, meaning that some people in the household had less or no data provided. We ultimately decided to go with a topic-based design approach since cognitive research showed that respondents preferred a topic-based approach (Childs, 2008). Additionally, the ACS Computer-Assisted Telephone Interviewing (CATI) and Computer-Assisted Personal Interviewing (CAPI) instruments successfully use a topic-based approach for their demographic items and topic-based was the plan had Nonresponse Followup (NRFU) been conducted on hand-held computers for the 2010 Census. The 2010 Census Telephone Questionnaire Assistance (TQA) data collection instrument was also topic-based. Although these differ from the Internet reinterview in that they are interviewer-administered data collection instruments, they all displayed one item per screen.[14]

Same Respondent Identification:

The reinterview questionnaire contained an explicit question about the respondent's Census participation, that is, "Did you fill out the 2010 Census form for [address]?" The response choices were "Yes. I filled out the form myself."; "Yes. I filled out the form along with somebody else."; and "No." These data were used for analysis purposes to identify whether or not the same person responded to both the Census questionnaire and the reinterview.

Rostering:

To build a roster for the household, we asked respondents to list the names of usual residents and then followed up with a probing question that referred to several situations we knew generally lead to omissions (e.g., young children, relatives, or people staying there temporarily). If respondents had anybody to add to the roster, they were able to list those names on the following screen. At the end of the instrument, respondents were asked if any household members sometimes lived or stayed elsewhere; this probe was used to identify erroneous enumerations. If so, specific followup questions were asked, such as the reason (e.g., group quarters situations such as college students or military, seasonal residences, child custody), the location, and the information about where the person was staying around April 1, 2010. This was intended to gather necessary information from the Internet reinterview so that the Census Bureau could determine whether people in certain situations were Census Day residents. Rather than having

[14] Note that the topic-based Internet instrument used in the 2005 NCT had a different topic-based format in that each question was displayed on one screen for the entire household using a different line for each person, as opposed to one question per person, per screen.

the respondents determine who are Census Day residents, the Census Bureau added residents and removed those who were not Census Day residents during data processing.

This approach takes advantage of the interactive nature of the Internet as an automated application. As the National Academies suggest in Once, Only Once, and in The Right Place, "…we recommend an approach based on asking guided questions—and multiple questions, as necessary—to elicit residence data. This approach would shift the burden of deciding what constitutes "usual residence" from respondents to the Census Bureau" (National Research Council, 2006).

The approaches for the TQA data collection for the 2010 Census, as well as the planned approach for NRFU on the hand-held computers, were similar in that the roster tasks and coverage questions were combined. Although specific responses did not lead to resolution of the correct household roster during the interview (but rather triggered a followup telephone interview), it was thought that the shorter tasks would lead to increased comprehension of our residence rules.

The 2011 ACS Internet test used a similar approach, building a roster by a series of short probes very similar to those that they currently use with their CATI and CAPI instruments.[15] Due to the number of ACS person items and corresponding respondent burden, data were not requested for those who were rostered in the ACS instrument but were not considered residents. However, the 2010 CQS Internet reinterview instrument requested demographic data for rostered persons who were later removed as nonresidents since the added burden is presumably minimal and the data could be used for further analysis.

Since the CQS Internet rostering approach was based on multiple questions (as opposed to a single residence rules display), we were able to determine each person's usual residence within the Internet application, which is something we were unable to do through the paper data collection mode. In the future, this could lead to fewer cases needing to be sent to a coverage followup operation and would lead to cost savings and increased coverage accuracy over our current paper-based rostering approach.

In terms of the maximum number of people collected on the roster, the 2010 CQS Internet reinterview instrument initial rostering screen collected information for a maximum of 48 people, but respondents could report up to nine more people on a subsequent roster probe screen. In this way, we could examine Persons 1-6 on paper and then match those names to the names in the Internet instrument, regardless of where they were listed. The Internet instrument displayed roster name fields for six persons, to be consistent with the 2010 Census paper questionnaire, but enabled respondents to access additional name fields in multiples of six.

[15] Some of the more complicated rules in the ACS are disaggregated into smaller pieces to aid respondents in giving the information needed to determine the correct residence status for each person.

Respondent Assistance:

The respondent could click on links in the top banner of the page to access instructions and general reinterview survey Frequently Asked Questions (FAQs), which included information on navigation, privacy, and security. The logout button was also contained in the top banner. In addition, privacy, security, and accessibility information links appeared on the bottom right of every screen.

For item-specific help, a respondent could click on the "Help" link next to the question and a new window would open on the screen. This new window was not a pop-up because many people have pop-up blockers on their computers. This help window included explanatory text on how to answer the item, which was based on the help information available in TQA as well as the FAQs for the 2010 Census[16]. The window had an "X" in the upper right hand corner, as well as a "close" button at the bottom to close the window. If the window was not closed, it slipped to the background when the respondent clicked the "Next" button in the instrument or clicked anywhere on the screen. If they clicked the "Help" link again, a new help window would replace the old one and the window would again come to the foreground of the instrument. This means that the respondent would only have, at most, two screens open and the additional window would always contain the most recently requested information. The "Help" link appeared next to the question stem but not next to each response option since this would clutter the screen.

Pre-filled Data and Character Limits:

The CQS Internet reinterview made use of web-based survey technology by using pre-fills for names in the question stem for the person data items. The 2011 ACS Internet instrument design also used this strategy (e.g., "What is Sally J. Doe's age?"). The pre-fills are used to increase clarity in the presence of the topic-based format.

In a future decennial census Internet data collection instrument, there may be larger field lengths or no character limits, to the extent possible. However, since we needed to match reinterview respondents to paper questionnaire respondents, it was useful to have the same character limitations for name fields for both instruments. The rationale was that people with long names are accustomed to abbreviating them on survey forms. If we keep the same character limitations, they would likely use the same abbreviations and we would then be able to more accurately match their names and, consequently, increase the effective sample size for this study.

Automated Edits:

Most data items were subject to "soft edits." When an error was made (e.g., an item was left blank or the response was invalid), a message with red text would appear at the top of the screen, above the main questions, indicating that there was a problem with the information entered. The respondent was given the opportunity to change the information and continue. However, if nothing was changed or the error still existed and the respondent again pressed "Next," they

[16] Mail respondents also had access to help, by calling a toll-free number listed in the materials they received in the mail. The information provided in the automated messages to telephone callers was the same as the help information presented on-screen to the Internet users.

would be allowed to bypass the error and continue entering data for the next question. Note that the roster screen used a "hard edit" and required an answer for the respondent to be allowed to complete the survey.

Tenure:

The tenure question in the Internet instrument was formatted similar to the 2010 Census paper questionnaire item.

Relationship:

Past research has shown that respondents often invert relationships (e.g., report child as parent) for the relationship question that asks how the person is related to the reference person (Love and Byrne, 2005). In order to improve accuracy and reduce confusion, the relationship question for the 2010 CQS Internet reinterview instrument took advantage of the ability to fill the names of both the reference person and the person for whom the relationship information was requested. For example, the question reads, "Sally J. Doe is John L. Doe's _____" instead of the 2010 Census paper version, which read, "How is this person related to Person 1?" This revision was inspired by successful cognitive testing results during the Census NRFU automated questionnaire development (Childs, 2008)

Due to space constraints, the relationship response categories on the 2010 Census paper questionnaire were double-banked with the right column containing both relative and non-relative response categories. The Internet instrument took advantage of more display room by displaying the categories in a single column, starting with the relative categories and ending with the non-relative categories in the same order as the 2010 Census paper questionnaire. The initial design was to have double-banked columns in which the relative and non-relative categories would be in separate columns. Ultimately, it was felt that respondents would not immediately understand that the two columns contained different relationship types and would see the response layout as arbitrary. Additionally, research indicates that it may be confusing to place response options in multiple columns because some respondents will process the list horizontally and then vertically while others may process the list vertically and then horizontally (Morrison et al., 2010; Couper, 2008).

Sex:

The sex question in the Internet instrument was formatted such that the response boxes were aligned vertically, which was consistent with the formatting of other response boxes within the instrument. On the 2010 Census paper questionnaire, the response boxes were aligned horizontally due to the space constraints of the form.

Age/Date-of-Birth:

The age and date-of-birth (DOB) questions in the Internet reinterview instrument appeared on the same screen, but were not as crowded as on the 2010 Census paper questionnaire. The DOB question appeared first and age was then automatically calculated based on the respondent-

provided DOB (the respondent could revise both fields). The instruction for reporting age 0 when the child is less than one as of April 1st was placed next to the age verification. This format was different from the paper questionnaire, but took advantage of web-based survey technology to improve the accuracy of the age data. This is consistent with the universal presentation guidelines, which encourage use of technology (Martin et al., 2007).

Hispanic Origin and Race:

For both the Internet and mail modes (and the 2010 Census questionnaires), the Hispanic origin question came before the race question. On the 2010 Census paper questionnaire, there was an instruction above the Hispanic origin question which read, "NOTE: Please answer BOTH Question 8 about Hispanic origin and Question 9 about race. For this census, Hispanic origins are not races." This instruction was modified and moved for use in the Internet instrument since it had only one question per screen and items were not numbered. Instead, the race question includes an instruction that stated "You may select one or more boxes. For this survey, Hispanic origins are not races." The ACS CATI and CAPI instruments currently use a similar placement and wording.[17] We did not expect the absence of the instruction above Hispanic origin to appreciably increase item nonresponse for Hispanic origin since all questions will have an error message presented to the respondent if left blank. Note that the Hispanic origin question (with corresponding response categories) was formatted like the paper questionnaire.

The 2010 Census race question had a long list of response categories (15 categories) and write-in fields. The 2010 Census paper questionnaire had triple-banked response categories, due to space limitations, and three write-in fields (Other Asian and Other Pacific Islander shared one write-in field). The goal was to design a more user-friendly format for the Internet race question with response categories listed vertically but not so long as to scroll off the screen.[18] Usability studies have shown that people read in an "F-shaped" pattern[19] when responding to surveys on the computer, rather than left to right as on paper. There is some evidence that reading vertically is more efficient on computer screens because they require fewer horizontal eye fixations (Laarni, et al., 2002). Reducing the complexity of the text displayed on a computer screen is also a generally accepted and widely advocated usability principle (Redish, 2007). The format of the race question on the paper form, with the shared write-in boxes and banking, added unnecessary complexity. The CQS Internet questionnaire displayed the write-in fields below the corresponding response categories and had four write-in fields, since we had room to avoid sharing fields.

[17] In the ACS CATI and CAPI instruments, the instruction is, "Please answer this question about race. For this survey, Hispanic origins are not races" is only read when at least one person in the household is of Hispanic origin.

[18] On a small screen such as a smartphone, or on a window not maximized to fill the entire space, the categories may still scroll off the screen. See Section 3.3.3 for further information on the instrument testing process.

[19] Based on eye-tracking software, online reading patterns tend to be 'F-shaped.' That is, the pattern is one relatively long horizontal line, followed by a shorter horizontal line, followed by a vertical line (Nielson, 2006).

Review Screen:

A review screen option was provided at the end of the Internet reinterview instrument so that respondents could review and edit the responses they provided. Respondents could also submit their reinterview responses without review. The 2010 CQS review screen was a hybrid of the 2005 NCT and the 2011 ACS Internet review screens. The format was a table with shortened question labels on the left and the respondent-provided answers on the right. The answers were hyperlinks that took the respondent back to the screen containing the question they wished to edit; this screen had a "Return to Review" button in place of the "Previous" and "Next" buttons so that the respondent could only return to the review screen and would not lose his or her place in the instrument. The review screen had "Submit" buttons at the top and bottom of the screen. If a respondent left an item blank, the review screen would show "[NO ANSWER]" in bold font, all capitalized, and in brackets.

Thank You / Confirmation Screen:

Once respondents submitted their surveys (by pressing the "Submit" button), they were shown a confirmation page. The confirmation page thanked respondents for completing the survey, informed them that their answers had been submitted to the Census Bureau, and provided a date and time for the submission. While we had already saved all their responses throughout the survey, including any changes they might have made through the review screen; this confirmation served to ease respondents' minds and provide them with proof that they were finished with the survey.

3.3.3 Internet Reinterview Instrument and Contact Materials Testing

In the development phase, the instrument underwent comprehensive laboratory usability testing and was set in the personal computer environment[20]. Usability testing included observing participants' behaviors, noting difficulties and comments, and conducting post-testing interviews to gain qualitative feedback about potential confusion. In addition, quantitative measures were also gathered, which included the duration of time that participants took to complete the survey, their score on a post-interview satisfaction questionnaire (Chin, Diehl, and Norman, 1988), eye-tracking variables (e.g., number of fixations and durations), key-stroke analysis, and mouse-tracing analysis. Eye-tracking analysis for the Internet reinterview instrument used the Tobii T120 eye-tracker.[21]

[20] Due to resource constraints, and the expectation that it would only comprise a very small portion of the survey respondents, the Internet instrument was not formally tested on mobile devices.

[21] The participant's workstation consisted of a Dell personal computer, a 17-inch Tobii LCD Monitor equipped with cameras for eye tracking, a standard keyboard, and a standard mouse with a wheel. The operating system was Windows XP for all participants. The workstation faced one-way glass and a wall camera and was equipped with an LCD monitor equipped with an eye-tracking machine that was placed on a table at standard desktop height. Video of the application on the test participant's monitor was fed through a PC Video Hyperconverter Gold Scan Converter, mixed in a picture-in-picture format with the camera video, and recorded via a Sony DSR-20 digital Videocassette Recorder. Audio for the videotape was picked-up from one desk and one ceiling microphone near the test participant. The audio sources were mixed in a Shure audio system, eliminating feedback, and fed to the videocassette recorder.

Two rounds of testing were completed. First, a low-fidelity test of the wire-frame[22] instrument was conducted in order to detect any major usability issues and to address the CQS Team's concerns and research questions. The second round of testing evaluated the fully-programmed Internet survey instrument. This iterative testing approach was intended to improve data quality, increase fidelity, raise user-satisfaction, and generally improve the design (Genov, 2005). During usability testing, we looked for any response behavior that may increase measurement error for the Internet mode in the field test.

The second round of testing on the programmed instrument incorporated accessibility testing to check for compliance with Section 508 of the U.S. Rehabilitation Act. The accessibility testing used Jaws 11 screen-reading software to evaluate whether visually impaired users could use the instrument accurately and efficiently.

We simulated the Internet response process, to the extent possible, in the usability laboratory testing of the instrument. For Internet instrument testing, participants were given an instruction card that contained the URL and access code needed to gain entry to the web survey. The instruction card was the same one that was mailed to respondents in the Internet Push panel. For the first round of testing, five internal Census Bureau employees participated. For the second round, we recruited 36 external participants from the usability laboratory's participant database (Ashenfelter et al., 2011).

Following both rounds of testing, key qualitative and quantitative results were provided to the Methods and Development Teams so that the Internet reinterview instrument could be revised/improved in accordance with the problems or issues identified during end-user testing. Further, all associated contact materials, such as the Internet reinterview invitation and reminders, went through expert review and cognitive testing.

3.3.4 Mail Reinterview and Contact Materials Testing

The mail reinterview questionnaire was nearly identical to the mailout/mailback 2010 Census questionnaire. Thus, the mail questionnaire content had gone through comprehensive cognitive testing in preparation for the 2010 Census.

The other contact materials, such as the mail reinterview invitation and reminders, went through the same expert review and cognitive testing described above for the Internet reinterview materials.

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[22] A wire-frame instrument is a basic visual guide used in interface design to suggest the structure of an instrument and relationships between its screens. The wire-frame data collection instrument is developed for testing and does not retain data for output.

3.4 Data Capture and Processing

3.4.1 Data Capture and Coding

The mail reinterview questionnaire response data were keyed from paper. Quality control, involving two-way independent keying with adjudication, was implemented for 100 percent of the keying. We could not use the 2010 Census production data capture system since Lockheed Martin's system had been disbanded before CQS results were received.

Raw data received from the Internet and mail reinterviews were not coded through 2010 Census processing. As a result, the race and Hispanic origin items from the Internet and mail reinterviews were autocoded at Census Bureau Headquarters, with the residual write-ins requiring expert coding[23] at the National Processing Center (NPC). The residual coding process for Internet and mail reinterviews was identical. Verification coding was required at a rate of 14 percent, with non-matching cases requiring adjudication (DMD, 2009). The quality control methodology was intended to ensure that, over the coding operation, no more than one percent error remained in final residual codes forwarded back to processing for integration into general census datasets. This was an acceptance sampling technique based on the Average Outgoing Quality Limit (AOQL) statistic. The AOQL methodology requires that any batch in which the initial quality control sample produces more than a specified number of errors must have all remaining non-sample units of that batch verified (Wolfgang, 2009).

The length and type of expert coder training was similar to that provided to expert coders for 2010 Decennial production coding. Since estimates of measurement error were based on the comparison of race and Hispanic origin responses for the 2010 Census and the reinterviews, the expert coding training and procedures for the reinterviews were designed to be as similar as possible to 2010 Census production.

3.4.2 Data Processing and Matching

Data received from the Internet and mail reinterviews did not go through the 2010 Census processing flow. As a result, the data items from the Internet and mail reinterviews were processed by Headquarters staff. The processing included applying a blank form flag for records with insufficient information and minor data edits (such as for age). Since survey measures are based on pre-processed survey responses, the data that were analyzed did not go through full 2010 Census production edit and imputation systems. The integrity of the error structure is more closely maintained by examining data prior to full edit and imputation. Thus, the reinterview data were compared to the 2010 Census data from the Decennial Response Files (DRF).

After the reinterview data were prepared for analysis, the persons from the completed reinterview cases were matched to the 2010 Census persons for corresponding households. The name matching process was very successful, resulting in an overall match rate of 96.8 percent (Compton and Bentley, 2011).

[23] All write-ins requiring expert coding were up to 30 characters in length and required a three-digit code to be applied for each race and/or Hispanic origin indicated by the respondent. More than one code could be applied to a single write-in.

3.5 Data Analysis

This section provides a detailed description of the analytical methods used to answer the four primary research questions of the CQS. Namely, we studied measurement error between the 2010 Census and the CQS (Section 3.5.1); CQS item nonresponse rates (Section 3.5.2); within-household coverage differences (Section 3.5.3); and CQS Internet paradata analysis (Section 3.5.4).

In general, for purposes of statistical significance testing, the following comparisons between the three experimental panels were of interest:

- compare the estimates for the CQS **Internet** respondents in the **Internet Push panel** to the CQS **Internet** respondents in the **Internet/Mail Choice panel**

- compare the estimates for the CQS **paper** respondents in the **Mail Only panel** to the CQS **paper** respondents in the **Internet/Mail Choice panel**

- compare the estimates for the CQS **paper** respondents to the **Internet** respondents in the **Internet/Mail Choice panel**

Due to the nature of the design for the Internet Push panel, in which a paper questionnaire was not sent until the final mailing, we did not formally test for differences with the Internet Push panel mail respondents.

Note that significance testing values were adjusted to account for the multiple comparisons being made, where appropriate, using Dunn's procedure. Dunn's procedure maintained the familywise error rate at α=0.10 significance by dividing the α level by two (two-tailed test) times the number of comparisons.

3.5.1 What is the measurement error, as measured by gross difference rates, for responses obtained from a census Internet questionnaire compared to a census paper questionnaire for each of the "push" and "choice" strategies?

The 2010 CQS was designed to provide estimates of measurement error variance associated with the design of a self-administered Internet questionnaire containing the same content (i.e. questions) as the 2010 Census paper questionnaire. In addition, the experiment was designed to estimate measurement error variance associated with the 2010 Census paper questionnaire for comparative purposes.

Measurement error variance is only one source of error in the "total survey error" concept, which encompasses both random and systematic error components. For binary and polytomous discrete response variables, Biemer (2009) provides a detailed discussion of the concepts and models used in survey research to estimate measurement error variance known also as simple response variance (SRV). Simple response variance is simply defined as the random variation in answers to the same question over independent repetitions of the survey measurement process.

The measurement error analysis for the 2010 CQS focused on households with the same respondent for both the 2010 Census paper questionnaire and the corresponding reinterview (see Section 3.4.2 for the name matching results)[24].

A comparison of the Internet reinterview responses for the Internet/Mail Choice and Internet Push panels with 2010 Census paper questionnaire responses yield estimates of the gross difference rates for each data item. Similarly, we compare the mail reinterview responses for the Mail Only panel with the 2010 Census paper questionnaire responses to produce estimates of the gross difference rates for the same data items for household members that match across the two data collections.[25] We also compare the gross difference rate estimates for the two reinterview modes to assess measurement error of the census Internet questionnaire compared with the census paper questionnaire for each of the push (Internet and mail) and choice strategies.

We describe the traditional approach to estimating the simple response variance differences between modes in the next section. This method utilizes the expected value of the comparison of the gross difference rates for each mode to isolate difference in the simple response variance associated with the paper and Internet modes.

3.5.1.1 Traditional method for estimating the simple response variance associated with responses obtained from an interview/reinterview methodology

For a particular question with C response categories (C= 2 or more), the gross difference for each question category is calculated using the percentages of respondents who were classified as in category C (e.g., Hispanic) compared with those not in category C (e.g., non-Hispanic) in either the "interview" or "reinterview". An illustration of the 2x2 table is given in Table 4 below. As noted, this illustration and subsequent discussion applies to a simple random sample (SRS) of units. The CQS, however, was a stratified sample with the sample allocated disproportionately to strata. Thus the cell estimates were appropriately weighted to reflect the correct probabilities of selection.

Table 4. Two-by-Two Table of Census and Reinterview Responses: In/Not In Category C

Reinterview Response	Census Response Yes	No	Total
Yes	n_{11}	n_{12}	$n_{1\bullet}$
No	n_{21}	n_{22}	$n_{2\bullet}$
Total	$n_{\bullet 1}$	$n_{\bullet 2}$	n

[24] In order to provide a comprehensive estimate of response variance (including mode differences), one would also include results for cases where respondents were different between the original interview and the reinterview, as well as cases where the respondent was the same. In repeated trials of the survey within the super-population, there would be an effort to measure total response variability. However, for our application, which focuses on question reliability for one survey trial, we wish to hold the respondent constant in order to roughly isolate the variability due to question quality. We are not attempting to measure variability due to unclear questionnaire items across different trials of the survey (i.e., different respondents).

[25] The household rosters from the Internet reinterview and the 2010 Census paper questionnaire may not be an exact match for various reasons.

- SRS sample of n units
- The sample cell percentages are denoted by:
  $x_a = n_{11}/n$ $x_b = n_{12}/n$ $x_c = n_{21}/n$ $x_d = n_{22}/n$
- The proportion of units reporting the characteristic in the census is
  $p_1 = (n_{11+} n_{21})/n.$
- The proportion of units reporting the characteristic in the reinterview is
  $p_2 = (n_{11+} n_{12})/n.$
- The proportion of units not reporting the characteristic in the census is
  $q_1 = 1- p_1 = (n_{12+} n_{22})/n.$
- The proportion of units not reporting the characteristic in the reinterview is
  $q_2=1- p_2 = (n_{21+} n_{22})/n.$

There are two types of error: cases where a respondent reports category C in the census but reports a different category in the reinterview (estimated by n_{21}); and cases where a respondent does not report a category on the census but does report the category for the reinterview (estimated by n_{12}). The gross difference rate (GDR) is the sum of these error percentages, that is, $GDR = (x_c + x_b)$ (shown in shading in Table 4).

In general, the expected value of the gross difference rate reflects the average simple response variance (*SRV*) of the interview and reinterview measurement processes. The measurement process includes all aspects of the data collection methods including the mode of response, contact strategy, questionnaire design, question wording and formatting. As noted earlier, the calculations for the CQS are restricted to cases where we know that the same respondent answered the questions in both the original interview (2010 Census) and the CQS reinterview, either by mail or Internet.

Denoting the interview measurement process as *"A"* and the reinterview measurement process as "*B,"* then expected value of the gross difference rate is as follows:

$$E(GDR) = SRV_A + SRV_B - \rho_{AB}(SRV_A + SRV_B)^{1/2} + D_{AB}^2$$

where SRV_A and SRV_B denote the simple response variance for the interview/reinterview response modes, respectively; ρ_{AB} is the between-trial correlation; and D_{AB}^2 denotes the expected difference between the "percents in-category" for the characteristic of interest (question response category C) for the two measurement processes (Biemer, 2009).

For the mail reinterview in the Mail Only and the Internet/Mail Choice panels, the D_{AB}^2 term should, in theory, be zero if the mail reinterview is, in fact, a parallel measurement. The two measurements will be parallel if the Interview and reinterview responses can be assumed to be a simple random sample of size two from each individual's theoretical response distribution. The D_{AB}^2 term for the Internet reinterview panels will also be small if the two measurements, while not parallel, nevertheless have the same expected "true score" meaning that each measurement process has the same expectation as to the proportion "in" category C.

The D^2 term can be estimated from the data in Table 4 for a particular question using all possible 2x2 data tables depending on the value of C, the number of response categories used in the analysis. In particular, it is equal to $(p_1 - p_2)^2$. Table 5 below summarizes some of the actual percents-in-category that we observed in the CQS respondents for the Mail Only panel. The characteristic differences between the two responses were very small. For more information, refer to Appendix A, which shows the estimated difference between the percents-in-category by question, panel, and reinterview response mode. In general, it is observed that the differences (and their squared values) are small. Thus we conclude that the D^2 term is not an issue (basically zero) relative to the expectation of the gross difference rate.

Table 5. Summary of Observed Census-CQS Differences for Selected Response Characteristics (Mail Only Panel Mail Respondents)

Item	Census Estimate	CQS Estimate	Difference	D^2
Sex (Percent Male)	47.0	46.3	0.7	0.49
Tenure (Percent Owned with Mortgage)	52.4	52.1	0.3	0.09
Age (Percent 65+ Years)	21.0	20.9	0.1	0.01
Race (Percent White)	83.1	83.3	-0.2	0.04
Hispanic Origin (Percent Hispanic)	5.4	5.4	0.0	0.00

Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

The expectation of the gross difference rate by panel and CQS response mode is shown below.

Panel	**CQS Response Mode**	**Expected Value of GDR (excluding D^2 term)**
Internet Push	Internet (I)	SRV(Cen) + SRV(I) - correl(Cen,I)
Internet/Mail Choice	Internet (I)	SRV(Cen) + SRV(I) - correl(Cen,I)
	Mail (M)	SRV(Cen) + SRV(M) - correl(Cen,M)
Mail Only	Mail (M)	SRV(Cen) + SRV(M) - correl(Cen,M)

Here, SRV(Cen) is the simple response variance associated with the 2010 Census paper questionnaire.

3.5.1.2 Comparing Estimates of the Gross Difference Rate by Reinterview Response Mode

The general measurement error model theory of the expectation of a gross difference must now be applied to the expectation of differences between GDRs for each experimental panel. For example, the expected difference between the GDRs for the internet reinterview mode (*I*) for the internet push panel and the mail reinterview mode (*M*) for the mail only panel is approximately equal to:

E(GDR(I) – GDR(M)) = SRV(I) – SRV(M) , the difference in the SRV for internet compared with mail reinterview response.

The simple response variance of the initial 2010 Census questionnaire should cancel out for the two independent samples, assuming the two reinterview mode response populations are similar. The between trial correlation terms should be similar and will cancel out, given that demographic

characteristics would likely be highly correlated between measurements, regardless of how the reinterview is administered. By comparing the two gross difference rates, we can ascertain information about the comparative reliability of the Internet response mode compared with the mail response mode: whether one mode is more or less reliable, taking sampling error into account.

Note that the delivery of soft edits[26] to respondents as they complete the Internet reinterview may have affected gross difference estimates. For example, an Internet reinterview respondent may have provided an invalid age and consequently received an error message. The respondent may have changed the answer as a result of the Internet soft edit. The mail respondents were not exposed to soft edits, which may have affected measurement error estimates. However, we wish to analyze the composite effects of these implementation differences since future census Internet instruments will inevitably take advantage of soft edits to improve data quality.

3.5.1.3 Use of Overall Gross Difference Rates for Questions with More than Two Response Categories

All of the questions included on the 2010 Census paper questionnaire, *as analyzed in this report*, included more than two response options. The questions on tenure, sex, Hispanic origin and other residence include the category "both [multiple] categories marked" and we considered this a distinct response option. The specific response categories included in the GDR calculations for each question are shown below in Table 6.

Table 6. Categories for Each Item Included in Gross Difference Rates

Item	Categories
Tenure	(a) Owned with Mortgage or Loan, (b) Owned Free and Clear, (c) Rented, (d) Occupied without Payment, (e) Multiple categories marked
Sex	(a) Male, (b) Female, (c) Both categories marked
Age	(a) 0-4, (b) 5-9, (c) 10-14, (d) 15-19, (e) 20-24, (f) 25-29, (g) 30-34, (h) 35-39, (i) 40-44, (j) 45-49, (k) 50-54, (l) 55-59, (m) 60-64, (n) 65+
Hispanic Origin	(a) Not Hispanic, (b) Hispanic, (c) Both categories marked
Race	(a) White, (b) Black, (c) American Indian or Alaska Native (AIAN), (d) Asian, (e) Native Hawaiian or Other Pacific Islander (NHOPI), (f) Some other race, (g) Two or More
Other Residence	(a) Yes, (b) No, (c) Both categories marked

Rather than showing all possible 2x2 gross difference rates for each question category for each item, the overall gross difference rate was calculated. Analogous to the GDR for the 2x2 table, the overall gross difference rate is simply the percent of cases where there is a disagreement in the interview/reinterview classification across all question categories. Unfortunately, we are not aware of any survey measurement literature that provides the expectation of this statistic as it relates to the measurement error model (Biemer 2009) cited in Section 3.5.1.2 above. Biemer does provide an interpretation of the "L-fold index of inconsistency" (here L replaces C to

[26] A *soft edit* is a one-time message to the respondent that occurs when a response to a question is either invalid or blank. It does not require the respondent to change their answer.

indicate the number of question categories) in this context as the "weighted average reliability index" of a question with more than 2 categories. However, this applies to the individual 2x2 "indices of inconsistency" and not the individual 2x2 gross difference rates.

As such, the overall gross difference rates compared most likely represent an "average" category SRV for each response mode. For example, for the Mail Only panel, it represents the "average" SRV for a mail interview/reinterview response mode across the C question categories. The "averaging" parameter is, however, unknown.

3.5.2 What are the item nonresponse rate differences between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

Item nonresponse rates were computed at the item level for all occupied cases in the following manner:

$$\frac{\text{number of missing responses}}{\text{total records}} * 100 \text{ percent}$$

"Missing" refers to responses that were not reported by the respondent. For person-level items (relationship, sex, age, Hispanic origin, race, other residence), the item nonresponse rates were restricted to data-defined persons.[27] Further, for the relationship question the item nonresponse rate was restricted to records that were not the reference person. That is, for mail responses, person 1 was excluded from the relationship item nonresponse rate; and for Internet responses, the reference person (not necessarily person 1; see Section 3.3.2 for further information) was excluded from the nonresponse rate.

Note that the use of soft edits to respondents as they complete the Internet reinterview, as well as the item-level help text, was expected to lower item nonresponse rates compared to the paper questionnaire. This is an inherent benefit of the Internet data collection mode.

3.5.3 What are the differences in within-household coverage between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

For the census Internet questionnaire, we built a roster for the household by first asking for usual residents as of April 1st (Census Day); at that point, there was no mention of common situations that prove difficult for respondents. Then we provided a list of a handful of situations that we know lead to omissions and erroneous enumerations (such as young children, relatives, or people staying there temporarily) and allowed respondents to add names to the roster. At the end of the instrument, respondents were asked if any household members sometimes lived or stayed elsewhere, such as college students, and some kinds of group quarters residents. This was

[27] A person is considered data defined, or valid, if they have at least two of the person-level data items filled. The person-level data items considered for the data-defined determination include name, relationship, sex, age/date-of-birth, Hispanic origin, and race (Alberti, 2008).

intended to gather necessary information from the Internet reinterview to identify erroneous enumerations and to help the Census Bureau determine whether people in certain situations were Census Day residents. Research has shown that presenting the residence rules (as we do on the paper questionnaire) is not the most effective way to communicate the residence rules in an automated instrument (Childs, 2008). Consequently, the Census Bureau could use the probes to add residents and remove those who are not Census Day residents on the back end (i.e., the final roster of who is deemed a census resident would not be visible to the respondent). This would be done in place of having the respondents determine who are legitimately Census Day residents.

The 2010 Census paper questionnaire used a different approach to rostering and probing for omissions and erroneous enumerations, which was constrained due to mode limitations such as space and absence of automation. The paper questionnaire contained brief residence rule guidelines preceding a request for the within-household population count. There was a household-level undercount probe just below the within-household population count question. In addition, there was a person-level overcount probe placed below the data items for each person. Respondents who recorded a positive response to either the undercount or one of the overcount coverage probes were candidates for receiving a followup telephone call. During this call, a series of more detailed probes, much like those within the CQS Internet questionnaire, was asked to confirm the correct household roster.

Although the approach for rostering and using coverage probes for the Internet questionnaire was different from the paper questionnaire by design, we intend to compare population counts to determine the composite effects of these strategy differences since they will likely be inherent in future census multi-mode data collections. The intent is to roughly assess the combined effects of our 2010 Census coverage methodology as described above (i.e., paper questionnaire coverage questions with potential telephone followup), compared to the all-in-one methodology for the CQS Internet questionnaire. This enables us to begin to understand whether, in the long term, we can accomplish similar results as the Coverage Followup phone call during an initial census Internet interview by taking advantage of the functionality of the automated Internet approach for a self-response interview. The analysis will also compare the rates of positive responses to probes in the census Internet questionnaire to the rates of responses for similar topics in the undercount and overcount questions from the same household's paper 2010 Census response. However, given the complex nature and timing of the household coverage analysis, most of these results will be provided in a separate report.

3.5.4 What are the paradata for the Internet questionnaire, such as break-off rates, use of help screens or links, changing of answers, completion times, etc.?

In general, paradata enable us to learn more about how people complete a census questionnaire online and on what platform. In addition, we used paradata to supplement the interpretation of results of the measurement error portion of the analysis.

The paradata collected for this report were intended to be used for a high-level analysis of respondents' experiences with the instrument. There were no hypothesis-driven theories to necessitate a more in-depth examination. Therefore, we collected information such as completion times, breakoff rates (including logouts as well as other breakoffs), and help screen

usage. These paradata, in combination with laboratory usability results, provide additional data on the instrument, which will guide the early decade Internet instrument development. It is also likely that specific research questions will arise from the CQS experience and be examined in future census Internet tests.

4. Limitations

4.1 Nonresponse Bias

In survey reinterviews, response rates tend to be lower, relative to an initial survey request, and can vary substantially by panel and contact strategy. We attempt to get an indication of the magnitude of nonresponse bias for the CQS by comparing demographic characteristics of reinterview respondents and nonrespondents based on data from their 2010 Census paper mode responses (see results in Section 5.6). Large differences in the demographic characteristics from the nonresponse analysis may indicate substantial bias in the key survey estimates and reduce the ability to generalize to the population of inference. Although some of the differences are significant, we do not believe that they harm the results based on the key measures of gross difference rates, item nonresponse rates, household coverage, or Internet response paradata because they are relatively small (on the order of a couple percentage points).

4.2 Reference Date and Recall Problems

Since the CQS reinterview was roughly five to six months after the Census data collection, reinterview respondents may not have accurately remembered who lived at the household on the reference date. In addition to the potential recall problem, some reinterview respondents may not notice the April 1st reference date. These types of non-sampling errors would inflate gross difference rates for the age item, as well as within-household coverage error estimates.

4.3 Reinterview Questionnaires in English Only

The reinterview questionnaires were provided in English only. The optimal design would include Spanish/English bilingual questionnaires, as well as questionnaires in other languages since results may be different for respondents who might need language assistance. During the design phase, the Census Bureau lacked resources and was confronted with timing constraints with our instrument development system and, thus, could not include an Internet reinterview in languages other than English. However, we do not believe that this fatally biased the results of the evaluation, although it may have increased coverage error (since we excluded the bilingual areas from the sampling frame). Note that this research is the beginning of the 2020 Census testing cycle. Presumably, future testing will be expanded to include electronic mode data collection instruments in additional languages.

4.4 Applicability to 2020 Census Planning

The Internet reinterview instrument development philosophy was to develop an effective census Internet questionnaire, given the time and resource constraints, and then evaluate the associated measurement error and usability issues. However, technological advances in online survey

instrument development are expected to greatly improve future Internet questionnaires. In addition, Internet access and usage is expected to substantially expand within the next decade.[28] Furthermore, the platforms (e.g., mobile and handheld devices) on which respondents would access the Internet are expected to change over the next decade and would impact the 2020 Census Internet instrument design. These issues limit the ability to generalize the results from this study to the 2020 Census. Although the CQS quantitative survey and usability laboratory results are key to focusing the Census Bureau's Internet development/design resources for early decade testing, the results may not be useful in predicting measurement error for the 2020 Census Internet application.

4.5 No Internet Response Option in the 2010 Census

For the Internet reinterview, compliance may have suffered from public messaging and warnings informing potential respondents that there was no Internet response option in the 2010 Census. This may have reduced our effective reinterview sample size, but the magnitude of this specific impact is unknown. To the extent that CQS sample households do not separate the 2010 Census from the 2010 CQS, some households may have believed the CQS was not legitimate. In an effort to alleviate respondents' legitimacy concerns, the CQS survey invitation letter for the Internet panels stated that "although the 2010 Census did not use the Internet to collect data, the 2010 Census Quality Survey marks the start of our Internet testing phase for the next census." In addition, we developed a web page that provided high-level information about the 2010 CQS; this page was linked to the "Are You in a Survey?" page on the Census Bureau's main website.

4.6 Operational Issues with Internet Instrument

For the first several days that the Internet survey was active, there were major server problems that affected some respondents' ability to access the survey. The problem was due to the paradata collection, resulting from more users accessing the website than expected, which caused website load problems. This led to slowness and other access errors for users. It also impacted item nonresponse for those who were able to access the survey, as some may have encountered problems while completing the survey. Some respondents may have been able to access the instrument and provide enough data to be considered valid participants to the survey, but due to server issues may have dropped out or been unable to finish before fully completing the survey. As a result, we excluded Internet responses from the first two days of data collection from the item nonresponse rates (see Section 5.3). The problem was fixed within the first three days of data collection by increasing the server capacity.

According to the paradata (Section 5.6.3), less than two percent of respondents were unable to view any survey content after logging in. However, the true scope of the problem is unknown since it appears that several respondents were able to log in and complete survey items even though they were subjected to slow page load times, intermittent page freezes, and other issues associated with the server problem. Some respondents tried to log in repeatedly (even upwards

[28] Internet access and usage has increased significantly in the past decade, for instance an estimated 62 percent of households reported using the Internet at home in 2007 compared to 55 percent in 2003 and 50 percent in 2001 (U.S. Census Bureau, 2009). This increase is likely to continue as we approach the 2020 Census; thus the 2010 Internet evaluation survey population will cover a smaller group than in future censuses.

of 40 times, see Section 5.6). Some respondents may have given up and chosen not to respond as a result. Those in the Internet/Mail Choice panel had the option to return a completed paper questionnaire instead. Some respondents called regional offices and other census locations to report the problem, and others sent written correspondence. We processed 246 pieces of correspondence that were related to server issues, website glitches, slow website loading times, and other such problems, accounting for 11 percent of all CQS correspondence.

4.7 Reminder Postcard Issue for Two Panels

Due to an error in one of the specifications sent to NPC prior to printing, the reminder postcards for the Mail Only and the Internet/Mail Choice panels were switched. As a result, we received a small number of Internet returns from the Mail Only panel (about 2.4 percent of the Mail Only sample responded online) and the percentage of Internet returns from the Internet/Mail Choice panel was lower than anticipated (see Section 5.1 for further details on response participation). These Internet respondents were removed from the data analyses. However, since the CQS is not a response rate test, the overall impact is low.

5. Results

Before presenting the results that answer the specific research objectives, we first discuss the survey participation rates (Section 5.1). Then we discuss the gross difference rates (GDRs) for each item (Section 5.2), the item nonresponse rates (Section 5.3), household coverage analysis (Section 5.4), and nonresponse analysis comparing the CQS respondents and nonrespondents (Section 5.5). Finally, we present results from the Internet paradata analysis (Section 5.6).

5.1 Participation Rates

The final participation rates for the CQS are shown in Table 7. The participation rate is the percent of nonblank[29] responses received (by mail or online) divided by the number of households that received the survey materials. The rate excludes households from the calculation if no response was received and the survey mail was returned as undelivered as addressed (UAA). As such, the participation rate is a better gauge of survey "participation" than the response rate (the number of responses received divided by the total mailout size) since it attempts to control for household vacancies[30].

[29] In order to quality as "nonblank," a response needed to have at least two different data items completed.

[30] An even better measure would be the "return rate" (the number of responses received divided by the number of occupied households in the sample), but since the CQS did not have a field followup operation to verify the true housing unit status (occupied, vacant, other) of each unit (as is done in the decennial census), the number of UAAs is used as a proxy.

Table 7. Final Participation Rates by Panel and CQS Response Mode

	Overall			Initial Mailing		Reminder Postcard	Replacement Mailing	
	Total	Internet	Mail	Internet	Mail	Internet	Internet	Mail
Internet Push	46.5 (0.16)	24.8 (0.13)	21.7 (0.13)	18.9 (0.12)	NA	4.9 (0.07)	1.0 (0.03)	21.7 (0.13)
Internet/Mail Choice	55.1 (0.13)	4.6 (0.05)	50.5 (0.13)	3.7 (0.05)	43.2 (0.13)	<0.1 (0.00)	0.9 (0.02)	7.3 (0.07)
Mail Only	56.0 (0.35)	2.4 (0.11)	53.6 (0.35)	0.1* (0.02)	45.9 (0.35)	2.3* (0.10)	NA	7.7 (0.19)

* Internet returns were erroneously received for the Mail Only panel due to a reminder postcard issue (see Section 4.7 for more information). NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

The highest overall participation rate, significant at the 0.10 α-level, was for the Mail Only panel (56.0 percent). As noted in limitation Section 4.7, some Internet responses were received from this panel (2.4 percent) due to an operational error but these cases are removed from further analysis.

The Internet/Mail Choice panel was lower, with about 55.1 percent participation. While it is possible that the reminder postcard mix-up had a slight dampening effect on responses, the lower rate supports previous studies that have concluded that giving respondents a choice has a small negative effect on overall response (Millar and Dillman, 2011; Gentry and Good, 2008; Griffin et al., 2001). It should also be noted that fewer Internet responses were received in the Choice panel (4.6 percent of the sample) than we anticipated (about 7 percent; see Section 3.2.2). The Choice panel respondents overwhelmingly opted to respond by mail compared to Internet (50.5 percent and 4.6 percent, respectively).

Not surprisingly, the Internet Push panel had the lowest participation rate (46.5 percent). However, nearly a quarter of the Internet Push sample (and more than half of the respondents), 24.8 percent, responded online. This far exceeded our conservative estimate of 10 percent (see Section 3.2.2). The replacement mailing provided a substantial boost to the participation rate for the Internet Push panel, as those households who preferred to respond by mail were now given the option (21.7 percent response by mail).

Table 8 shows the participation rates by panel broken down for each of the three strata. As expected, the sample in the High Internet stratum had the highest participation rates and had significantly more online responses. In the Internet Push panel, 29.4 percent of households in the High Internet stratum responded using the Internet compared to 12.1 percent in the Low Internet stratum. Interestingly, the rates for the High and Medium Internet strata were relatively similar suggesting that if a similar sample design were to be used in future research within the early decade, the research should consider whether the High and Medium distinction is necessary.

Table 8. Final Participation Rates by Panel and Stratum

	High			Medium			Low		
	Total	Internet	Mail	Total	Internet	Mail	Total	Internet	Mail
Internet Push	49.8 (0.21)	29.4 (0.19)	20.4 (0.17)	46.1 (0.23)	23.1 (0.19)	23.0 (0.19)	32.0 (0.70)	12.1 (0.49)	19.9 (0.60)
Internet/Mail Choice	57.1 (0.18)	5.8 (0.08)	51.3 (0.18)	55.5 (0.19)	4.0 (0.08)	51.4 (0.19)	41.8 (0.62)	2.1 (0.18)	39.7 (0.61)
Mail Only	58.6 (0.47)	2.7 (0.16)	55.9 (0.47)	55.7 (0.52)	2.3 (0.16)	53.4 (0.52)	43.4 (1.67)	1.1 (0.36)	42.2 (1.67)

Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

5.2 Measurement Error

In this section we will answer the first research question:

What is the measurement error, as measured by gross difference rates, for responses obtained from a census Internet questionnaire compared to a census paper questionnaire for each of the "push" and "choice" strategies?

The gross difference rates are a measure of the percent of people (i.e., matched cases) with a different response between the 2010 Census and the CQS. However, for each of these results the source of the difference could be random, systematic, or perhaps not a true error but instead the result of an actual or perceived change over time.

Table 9 shows the gross difference rates for each item by panel for the Internet respondents. As might be expected, there is a wide range in the gross differences from one data item to another. The lowest is for the sex item at just 0.2 to 0.3 percent, meaning that only 0.2 to 0.3 percent of person records in the CQS had a different response to the sex question compared to the Census. In the Internet Push panel the highest gross difference rate for the Internet respondents was for the tenure question (3.7 percent), and in the Internet/Mail Choice panel the highest was for the other residence question (2.9 percent).

Table 9. Gross Difference Rates for Each Item by Panel for CQS Internet Respondents

	Tenure	Sex	Age	Hispanic	Race	Other Res.
Internet Push	3.7 (0.12)	0.3 (0.02)	1.1 (0.04)	0.8 (0.05)	2.9 (0.11)	3.4 (0.09)
Internet/Mail Choice	2.5 (0.19)	0.2 (0.03)	0.8 (0.07)	0.8 (0.10)	2.5 (0.19)	2.9 (0.17)
Mail Only	NA	NA	NA	NA	NA	NA
Difference (Push - Choice)	1.2 ** (0.27)	0.1 (0.05)	0.3 ** (0.09)	0.0 (0.08)	0.4 ** (0.15)	0.5 ** (0.17)

** Denotes statistically significant difference at α=0.10 between Internet Push and Internet/Mail Choice panels. Significance tests were adjusted to account for multiple comparisons using the Dunn method. NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Interestingly, the GDRs for four of the six data items, with the exception of sex and Hispanic origin, were higher for Internet respondents in the Internet Push panel compared to those in the Choice panel. While a couple of these significant differences were relatively small (for instance,

the rate for the age item was just three-tenths of a percentage point lower in the Choice panel), the differences for tenure and other residence gross difference rates were noteworthy. The significant difference for the race gross difference rates appears to be driven by inconsistent race responses for people of Hispanic origin (see Table 11).

We explored the large difference in the gross difference rate for tenure between the two panels (1.2 percentage points) and determined that much of the inconsistent reporting for tenure appears to be within the owner and renter categories. The rates reported in this section correspond to respondents who do not report exactly within the same tenure checkbox from one interview (2010 Census) to the next (CQS). But the four tenure categories are sometimes further collapsed into two: owners and renters. If we were to report the gross difference rates based on the two collapsed categories instead of all four, the gross difference rates would decrease to about 0.9 percent in the Internet Push panel and 0.5 percent in the Internet/Mail Choice panel (note that this decrease also holds for CQS mail respondents). Thus, a respondent may have reported "owned free and clear" during the Census but then reported "owned with mortgage or loan" during the CQS. The internal owner/renter consistency is very high but less so when all categories are considered. That said, this does not explain why the four category gross difference rate is higher in the Push panel compared to the Choice panel.

We speculate that some of the difference may be due to different populations choosing to respond by Internet in the two panels. It has been shown in numerous studies that Internet users tend to have different demographic characteristics than those who do not: higher income, more education, White, married, etc. (e.g., GAO, 2001; Madden, 2009). This may explain why household and residence items had larger gross difference rates for the Internet Push responding population. Given that, by definition, many more respondents used the Internet to provide their response in the Internet Push panel (24.8 percent, see Table 7) than in the Choice panel (4.6 percent), the responding populations are not equivalent. There is a self-selection bias affecting the comparability of the results. For instance, the population who responded by Internet in the Internet Push panel tended to be older than in the Internet/Mail Choice panel; 12.3 percent of the Internet Push panel Internet respondents were age 65 or older in the Census compared to 8.7 percent in the choice panel (see Section 5.5).

Table 10 shows the gross difference rates for each item by panel for the CQS initial mail questionnaire respondents. The analysis was restricted to initial mail questionnaire responses, rather than all mail responses, primarily because of the operational differences at the final mailing for the Internet Push panel (which did not receive a paper questionnaire until then). We compared the results for the Internet/Mail Choice panel compared to the Mail Only panel and found a couple differences. The Mail Only panel had a higher gross difference rate for the Hispanic origin item (0.8 compared to 0.7 percent). Although this difference was significant at the 0.10 α-level standard, it was relatively small and not of practical significance.

Table 10. Gross Difference Rates for Each Item by Panel for CQS Mail Respondents (Initial Questionnaires)

	Tenure	Sex	Age	Hispanic	Race	Other Res.
Internet Push	NA	NA	NA	NA	NA	NA
Internet/Mail Choice	5.2 (0.09)	0.9 (0.03)	1.7 (0.04)	0.7 (0.03)	2.4 (0.07)	4.2 (0.07)
Mail Only	5.1 (0.24)	0.8 (0.07)	1.8 (0.10)	0.8 (0.09)	2.4 (0.17)	4.0 (0.17)
Difference (Choice - Mail)	0.1 (0.17)	0.1 (0.05)	-0.0 (0.07)	-0.1 ** (0.04)	0.0 (0.08)	0.2 (0.10)

** Denotes statistically significant difference at α =0.10 between Internet/Mail Choice and Mail Only panels. Significance tests were adjusted to account for multiple comparisons using the Dunn method. NA=Not applicable.
Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Next, in Table 11, we show the gross difference rates for the race question subset by Hispanic and Not Hispanic respondents (based on their 2010 Census response). There was considerable difference in the consistency of race reporting, depending on whether the respondent was Hispanic or Not Hispanic in the Census. For people of Hispanic, Latino, or Spanish origin, upwards of 14 percent of their race responses changed from the Census return compared to the CQS response (ranging from 14.1 percent for Internet/Mail Choice panel Internet respondents to 19.6 percent of Mail Only panel respondents). On the other hand, less than 2 percent of non-Hispanic census respondents had a different race answer in the CQS. This is perhaps not too surprising since people of Hispanic origin often have difficulty identifying with one of the standard race categories since previous research shows that they tend to not view race and Hispanic origin as separate constructs. As such, it is more likely that they may have a different answer from one interview to another. None of the gross difference rates in Table 11, between CQS Internet respondents compared to mail respondents, were significantly different.

Table 11. Gross Difference Rates for Race by Hispanic Origin by Panel

	CQS Internet Respondents		CQS Mail Respondents	
	Hispanic	Not Hispanic	Hispanic	Not Hispanic
Internet Push	18.4 (1.18)	1.9 (0.09)	18.4 (1.67)	1.6 (0.09)
Internet/Mail Choice	14.1 (1.84)	1.8 (0.17)	15.6 (0.70)	1.7 (0.05)
Mail Only	NA	NA	19.6 (2.03)	1.6 (0.12)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

In addition to gross difference rate comparison by panel, we also examined the differences by mode within panel. Table 12 shows the gross difference rates for each item in the Internet Push panel for both Internet and mail respondents by mailing (initial or replacement mailing). There are some notable differences by mode. For instance, 3.7 percent of initial mailing Internet respondents had a different response for tenure compared to their census response, while the

gross difference rate for mail respondents was 6.7 percent. Due to the nature of the study design, we would expect the mail responses in the Internet Push panel to be less consistent since they were all late respondents. That is, respondents in this panel were only able to respond by mail at the final mailing while Internet response was available throughout the study period.

Table 12. Gross Difference Rates for Each Item by CQS Response Mode (Internet Push)

		Tenure	Sex	Age	Hispanic	Race	Other Res.
Initial Mailing	Internet	3.7 (0.12)	0.3 (0.02)	1.1 (0.05)	0.8 (0.05)	2.8 (0.11)	3.3 (0.10)
	Mail	NA	NA	NA	NA	NA	NA
Replacement Mailing	Internet	3.5 (0.58)	0.1 (0.05)	1.0 (0.19)	0.8 (0.23)	3.2 (0.55)	3.9 (0.50)
	Mail	6.7 (0.18)	1.1 (0.06)	2.0 (0.07)	0.7 (0.06)	2.4 (0.11)	4.7 (0.13)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Similarly, Table 13 shows the gross difference rates by mode and mailing for the Internet/Mail Choice panel. There were several statistically significant differences between respondents who chose to respond online compared to those who chose traditional mail response. Somewhat unexpectedly though, for respondents to the initial mailing, the gross difference was smaller for these items (tenure, sex, age, other residence) for Internet respondents. One would think the gross difference rate for different modes (i.e., Census mail and CQS Internet) would be greater than the gross difference rate for the same items in the same mode (i.e., Census mail and CQS mail). A similar trend held for respondents to the replacement mailing, though the difference for other residence was not significant.

Table 13. Gross Difference Rates for Each Item by CQS Response Mode (Internet/Mail Choice)

		Tenure	Sex	Age	Hispanic	Race	Other Res.
Initial Mailing	Internet	2.2 (0.20)	0.2 (0.04)	0.7 (0.07)	0.7 (0.09)	2.4 (0.22)	2.7 (0.18)
	Mail	5.2 (0.09)	0.9 (0.03)	1.7 (0.04)	0.7 (0.03)	2.4 (0.07)	4.2 (0.07)
	Difference	-2.9 ** (0.30)	-0.7 ** (0.08)	-1.0 ** (0.11)	0.0 (0.07)	0.0 (0.13)	-1.5 ** (0.17)
Replacement Mailing	Internet	3.4 (0.50)	0.2 (0.07)	1.1 (0.20)	1.3 (0.33)	2.9 (0.43)	3.8 (0.49)
	Mail	6.1 (0.26)	0.8 (0.06)	2.5 (0.11)	1.0 (0.09)	3.1 (0.18)	4.5 (0.17)
	Difference	-2.7 ** (0.69)	-0.7 ** (0.15)	-1.4 ** (0.27)	0.4 (0.18)	-0.2 (0.31)	-0.7 (0.37)

** Denotes statistically significant difference at α =0.10 between Internet and mail response modes.
Significance tests were adjusted to account for multiple comparisons using the Dunn method.
Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Since the 2010 Census responses were mail only, we would have expected the gross difference rates for the CQS mail respondents to be lower than for the Internet respondents, since a mail interview and a mail reinterview (i.e., same response mode) is akin to the classic interview-reinterview measurement error model. At the very least, we would expect the gross differences to be the same by mode and not lower for Internet respondents. There are a couple of theories that may possibly help explain these results. One is that the use of Internet soft edits enabled respondents to provide more accurate answers since the mail questionnaire did not have the same capability. However, this theory assumes that the respondent did not make the same mistake with the Census mail questionnaire (since the same "mistake" both times would be consistent reporting and not count as a difference).

The second theory is simply that the demographics of the CQS Internet and mail respondents are different. That is not necessarily a problem; it is inherent in the self-selected nature of those who chose to use the Internet option instead of the traditional paper version. Some people may just be more consistent and reliable providers of information, which is effectively what the gross difference rate represents. For instance, mail respondents in the choice panel were considerably more likely to be older (21.9 percent age 65 or older) compared to the Internet respondents in the panel (8.7 percent age 65 or older). Other notable demographic differences are that the Internet respondents were more likely to be White (83.5 percent compared to 81.6 percent), to have a mortgage on their home (66.9 percent compared to 50.8 percent), and to live in larger households (average 2.67 people compared to 2.34 people).

For more results on the gross difference rates, refer to Appendix B for gross difference rates by stratum for each data item.

5.3 Item Nonresponse Rates

In this section we will answer the second research question:

What are the item nonresponse rate differences between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

To examine the CQS item nonresponse rates we first compared the item nonresponse by mode for the Internet Push and Internet/Mail Choice panels. The results for the Internet respondents are shown in Table 14. Although soft edits warned respondents when no response was provided to a question, they could be ignored. The lowest item nonresponse was for the tenure question, which saw very little skipping (0.1 percent or less in both panels). For the person-level items, though, item nonresponse rate was more frequent. Four of the items in the Internet Push panel (age, Hispanic origin, race, and other residence) had an item nonresponse rate above 2 percent.

Table 14. Item Nonresponse Rates for Each Item by Panel for CQS Internet Respondents

	Tenure	Relationship	Sex	Age	Hispanic	Race	Other Residence
Internet Push	0.1 (0.02)	1.0 (0.08)	0.4 (0.06)	2.1 (0.11)	2.3 (0.13)	2.3 (0.13)	2.4 (0.13)
Internet/Mail Choice	0	0.8 (0.12)	0.2 (0.08)	1.0 (0.14)	1.1 (0.16)	1.1 (0.17)	1.1 (0.17)
Mail Only	NA	NA	NA	NA	NA	NA	NA
Difference (Push - Choice)	0.1 (0.04)	0.3 (0.13)	0.2 ** (0.07)	1.1 ** (0.14)	1.2 ** (0.15)	1.2 ** (0.15)	1.3 ** (0.15)

** Denotes statistically significant difference at α=0.10 between Internet Push and Internet/Mail Choice panels.
Significance tests were adjusted to account for multiple comparisons using the Dunn method. NA=Not applicable.
Note: Excludes Internet respondents from the first two days of CQS operation due to server problem.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

In general, the Internet Push respondents tended to have higher item nonresponse than the Choice panel respondents. We believe that this result is due to the different demographics between the two panels. There were likely to be some users of the online survey instrument in the Push panel who would not ordinarily have responded using the Internet if not "pushed" into it. For instance, as previously mentioned, the population of Internet respondents in the Internet Push panel tended to be older (12.3 percent age 65 or greater) than in the Internet/Mail Choice panel (8.7 percent age 65 or greater). In addition, there are significant tenure differences between the two panel's Internet populations: 66.9 percent owned with a mortgage in the Choice panel and 62.7 percent in the Internet Push panel (see Section 5.5).

Table 15 shows the item nonresponse rate results for each panel for the CQS initial questionnaire mail respondents. For mail returns, the highest item nonresponse was for the Hispanic origin question, ranging from 3.8 percent in the Mail Only panel to 4.1 percent in the Internet/Mail Choice panel. The lowest item nonresponse was for the age and other residence questions, ranging from 1.0 to 1.1 percent. Several of the differences were statistically significant (at α=0.10) between the Internet/Mail Choice and Mail Only panels: tenure, relationship, sex, Hispanic origin, and race questions. We do not have any valid hypotheses to explain these results, and the demographics between the two panels are very similar. Note that most of these item nonresponse differences are relatively small and may not be of practical significance.

Table 15. Item Nonresponse Rates for Each Item by Panel for CQS Mail Respondents (Initial Questionnaires)

	Tenure	Relationship	Sex	Age	Hispanic	Race	Other Residence
Internet Push	NA	NA	NA	NA	NA	NA	NA
Internet/Mail Choice	2.4 (0.06)	1.7 (0.05)	2.1 (0.04)	1.1 (0.04)	4.1 (0.08)	1.6 (0.05)	1.0 (0.04)
Mail Only	2.1 (0.15)	1.2 (0.11)	2.0 (0.10)	1.0 (0.09)	3.8 (0.20)	1.4 (0.12)	1.0 (0.10)
Difference (Choice - Mail)	0.3 ** (0.11)	0.5 ** (0.08)	0.2 ** (0.07)	0.1 (0.05)	0.3 ** (0.09)	0.2 ** (0.06)	0.0 (0.05)

** Denotes statistically significant difference at α =0.10 between Internet/Mail Choice and Mail Only panels.
Significance tests were adjusted to account for multiple comparisons using the Dunn method. NA=Not applicable.
Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Next, we report the item nonresponse rates for the race question for Hispanic and Not Hispanic respondents (see Table 16). It is interesting that, for the Internet respondents, nearly all who provided a valid response to the Hispanic origin question also provided a response to the race question. The item nonresponse rates were less than 0.4 percent, regardless of Hispanic origin status. This is likely attributable, in part, to the Internet soft edits for those who initially did not provide a response. However, among those who did not provide a valid response to the Hispanic origin question using the Internet survey, the vast majority (82.9 percent in the Internet Push panel and 79.1 percent in the Internet/Mail Choice panel) also did not provide a race response. For the mail respondents, the percent who did not answer either race or Hispanic origin was between 10.2 percent and 11.8 percent by panel. None of the panel differences were statistically significant.

Table 16. Item Nonresponse Rates for Race by Hispanic Origin by Panel

	CQS Internet Respondents		CQS Mail Respondents	
	Hispanic	Not Hispanic	Hispanic	Not Hispanic
Internet Push	0.4 (0.16)	0.1 (0.02)	14.6 (1.23)	0.7 (0.06)
Internet/Mail Choice	0.3 (0.29)	0.1 (0.03)	13.5 (0.61)	0.5 (0.02)
Mail Only	NA	NA	13.0 (1.57)	0.5 (0.06)

Note1: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Note2: Excludes Internet respondents from the first two days of CQS operation due to server problem.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

For the CQS mail respondents, the race nonresponse was much higher for those of Hispanic, Latino, or Spanish origin (between 13.0 percent in the Mail Only panel and 14.6 percent in the Internet Push panel) compared to those who were not Hispanic (between 0.5 percent and 0.7 percent item nonresponse). This is not surprising, as people of Hispanic or Latino origin historically have chosen not to answer the race question.

Tables 17 and 18 show the item nonresponse rates for each item by response mode and mailing for the Internet Push and Internet/Mail Choice panels, respectively. As previously noted we did not intend to formally compare the results for the Internet and mail respondents in the Internet Push panel due to the survey design, since the Push panel sample did not receive a paper questionnaire until the final ("replacement") mailing.

Table 17. Item Nonresponse Rates for Each Item by CQS Response Mode (Internet Push)

		Tenure	Relationship	Sex	Age	Hispanic	Race	Other Residence
Initial Mailing	Internet	0.1 (0.02)	1.0 (0.08)	0.4 (0.06)	2.1 (0.12)	2.3 (0.13)	2.3 (0.13)	2.5 (0.14)
	Mail	NA	NA	NA	NA	NA	NA	NA
Replacement Mailing	Internet	0.1 (0.11)	1.1 (0.39)	0.5 (0.30)	1.6 (0.43)	1.8 (0.47)	1.7 (0.46)	1.8 (0.47)
	Mail	3.5 (0.13)	2.2 (0.13)	2.9 (0.10)	1.6 (0.08)	5.8 (0.16)	1.9 (0.10)	1.6 (0.08)

Note1: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Note2: Excludes Internet respondents from the first two days of CQS operation due to server problem.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Finally, the item nonresponse rates for the Choice panel are included in Table 18. As expected, seemingly due to the use of soft edits and online help, the nonresponse rates for the Internet respondents were significantly lower than for the mail respondents for several items. Item nonresponse for initial mailing Choice panel Internet respondents was significantly lower for the tenure, relationship, sex, Hispanic origin, and race questions. In fact, for the tenure question, all Internet respondents in the Internet/Mail Choice panel provided a response. There was no statistical difference for the age and other residence questions.

Table 18. Item Nonresponse Rates for Each Item by CQS Response Mode (Internet/Mail Choice)

		Tenure	Relationship	Sex	Age	Hispanic	Race	Other Residence
Initial Mailing	Internet	0	0.7 (0.13)	0.2 (0.09)	0.9 (0.16)	1.1 (0.20)	1.2 (0.20)	1.2 (0.20)
	Mail	2.4 (0.06)	1.7 (0.05)	2.1 (0.04)	1.1 (0.04)	4.1 (0.08)	1.6 (0.05)	1.0 (0.04)
	Difference	-2.4 ** (0.24)	-1.0 ** (0.16)	-1.9 ** (0.14)	-0.2 (0.10)	-3.0 ** (0.20)	-0.4 ** (0.12)	0.1 (0.10)
Replacement Mailing	Internet	0	1.0 (0.29)	0.3 (0.16)	1.0 (0.29)	1.1 (0.30)	1.1 (0.32)	1.1 (0.30)
	Mail	4.2 (0.20)	2.1 (0.15)	3.0 (0.13)	1.7 (0.11)	5.2 (0.21)	2.5 (0.16)	1.7 (0.11)
	Difference	-4.2 ** (0.55)	-1.1 ** (0.30)	-2.6 ** (0.28)	-0.7 ** (0.22)	-4.1 ** (0.37)	-1.4 ** (0.26)	-0.6 ** (0.22)

** Denotes statistically significant difference at α =0.10 between Internet and mail response modes.
Significance tests were adjusted to account for multiple comparisons using the Dunn method.
Note: Excludes Internet respondents from the first two days of CQS operation due to server problem.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

For replacement mailing respondents, Internet item nonresponse was significantly lower for all data items. The greatest difference was for the tenure item; nonresponse was nonexistent in the Internet mode and was 4.2 for the replacement mailing mail respondents. The Hispanic origin question also had a large disparity in item nonresponse between the replacement mailing Internet (1.1 percent) and mail (5.2 percent) respondents. It seems likely, based on the analysis of paradata (Section 5.6), that the soft edits built into the Internet instrument greatly contributed to the lower item nonresponse rates.

5.4 Within-Household Coverage

The third research question for this evaluation was:

What are the differences in within-household coverage between a census Internet questionnaire and a census paper questionnaire for each of the "push" and "choice" strategies?

Due to the complex nature and timing of the within-household coverage analysis, most of the detailed results will be presented in a separate memorandum. We do report some results from review of the CQS Internet probes in the remainder of this section.

Table 19 contains a summary showing how many (weighted) people were rostered in the CQS Internet instrument by screen, and the percentage that resulted in deletions, by panel. As expected, the vast majority was added via the initial rostering screens (Roster 1, "List each person who was living and sleeping here"), and fewer added at the final roster screen (Roster 2, "Any additional people"). Though the proportion of additional household members produced in Roster 2 was extremely small, this extra question added a nontrivial number of people (i.e., 38,442 people in the Internet/Mail Choice panel and 347,889 people in the Internet Push panel) to the roster, a large percentage of whom remained on the final roster after their residency

disposition was determined (only 18.8 percent and 20.7 percent were deleted, respectively). No significant differences were found by panel. Note that the large difference in total number of rostered people between the two panels is due to the higher rate of Internet responses in the Internet Push panel.

Table 19. Summary of Which Screen Added People to the Roster and What Percent Resulted in Deletes by Panel

	Internet/Mail Choice		Internet Push	
	Total Rostered	Percent Deleted	Total Rostered	Percent Deleted
Roster 1	8,379,793	1.0 (0.07)	43,660,508	1.1 (0.04)
Roster 2	38,442	18.8 (4.12)	347,889	20.7 (1.71)

Source: 2010 Census Quality Survey and Coverage Followup data files, estimates are weighted with standard errors in parentheses.

The overcount question in the CQS Internet instrument included a list of situations that could lead to someone being counted in the wrong place: in college housing, in the military, at a seasonal or second residence, for child custody, in jail or prison, in a nursing home, or for another reason. As seen in the first row of Table 20 below, most people who were rostered indicated no other place to stay. For those people listed in Roster 1, just 3.6 percent of people in the Internet/Mail Choice panel indicated sometimes living or staying elsewhere, and just 3.7 percent did so in the Internet Push panel. Comparing people who were rostered on Roster 1 to those who were rostered on Roster 2, those people rostered on Roster 2 were significantly more likely to indicate that they also sometimes lived or stayed somewhere else (29.9 percent and 31.7 percent, respectively).

Table 20. Percent of People Who Indicated Living or Staying Somewhere Else and Reason by Roster Screen and Panel

	Internet/Mail Choice		Internet Push	
	Roster 1	Roster 2	Roster 1	Roster 2
Reason Indicated	3.6 ** (0.13)	29.9 (4.83)	3.7 ** (0.07)	31.7 (1.96)
College	17.6 (1.43)	36.9 (9.12)	18.2 ** (0.75)	34.5 (3.52)
Military	1.3 (0.42)	3.1 (3.28)	1.3 (0.22)	1.1 (0.77)
Seasonal	34.6 ** (1.78)	9.2 (5.46)	35.5 ** (0.93)	10.3 (2.25)
Child Custody	27.5 ** (1.67)	7.7 (5.04)	23.2 ** (0.82)	10.7 (2.29)
Jail or Prison	0.1 (0.12)	3.1 (3.28)	0.2 (0.09)	1.1 (0.77)
Nursing Home	0.3 (0.21)	0	0.3 (0.11)	1.4 (0.87)
Another reason	17.3 (1.42)	33.8 (8.94)	20.4 ** (0.79)	37.6 (3.59)
Multiple reasons	1.3 (0.42)	6.2 (4.56)	0.8 (0.17)	3.2 (1.30)
Total	100.0	100.0	100.0	100.0

** Denotes statistically significant difference at α=0.10 between Roster 1 and Roster 2 persons.
Significance tests were adjusted to account for multiple comparisons using the Dunn method.
Source: 2010 Census Quality Survey and Coverage Followup data files, estimates are weighted with standard errors in parentheses.

Among those who indicated a reason for being away, there were several significant differences between Roster 1 and Roster 2. Seasonal and child custody rates were highest among Roster 1 people for both panels. The college and "another reason" rates were highest among Roster 2 people for the Internet Push panel, though were not significant at the 0.10 α-level in the Internet/Mail Choice panel. No significant differences were found by panel.

5.5 Nonresponse Analysis

With any sample survey there is the potential for nonresponse bias in the estimates. In order to study the potential for bias in the CQS results, we compared the Census mail response distributions by demographic characteristics for the CQS respondents (for those who were matched to their census response) with the census distributions for the nonrespondents. The overall results are shown in Table 21.

As expected, there are population differences between the respondents and the nonrespondents. In general, the CQS respondents (including all people in the household) tended:

- to not be of Hispanic, Latino, or Spanish origin (5.5 percent of respondents compared to 11.0 percent of nonrespondents);
- to be White (82.1 percent compared to 69.8 percent);
- to own their home (80.5 percent compared to 62.8 percent);
- to be older (20.3 percent were age 65 or over compared to 9.4 percent);
- to have smaller households (2.38 persons per residence compared to 2.71 people on average).

Table 21. Census Responses for Matched CQS Respondents and CQS Non-Respondents

Variable	Response	CQS Respondents	CQS Non-Respondents
Sex	Male	46.8	47.2
	Female	51.4	50.2
	Blank	1.7	2.5
Hispanic Origin	Not Hispanic	90.5	83.1
	Hispanic	5.5	11.0
	Both Indicated	0.2	0.3
	Blank	3.8	5.6
Race	White	82.1	69.8
	Black	6.9	14.6
	American Indian and Alaska Native	0.4	0.7
	Asian	5.1	4.4
	Native Hawaiian and Other Pacific Islander	0.1	0.2
	Some other race	1.1	2.8
	Two or More	2.6	3.7
	Blank	1.7	3.8
Tenure	Owned With Mortgage	53.0	48.3
	Owned Without Mortgage	27.5	14.5
	Rented	16.7	32.2
	Occupied Without Payment	1.3	1.9
	Two or More	0.2	0.2
	Blank	1.4	2.9
Age	0-4	4.6	6.9
	5-9	5.0	7.0
	10-14	5.6	7.3
	15-19	5.6	7.1
	20-24	4.2	7.1
	25-29	4.6	7.3
	30-34	4.8	6.6
	35-39	5.3	6.7
	40-44	6.1	7.3
	45-49	7.6	7.7
	50-54	8.5	7.2
	55-59	8.6	5.9
	60-64	8.3	4.6
	65+	20.3	9.4
	Blank	0.9	1.9
Average Household Size		2.38	2.71

Note: Data include all people listed on the 2010 Census return.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

The overall Census response distributions were fairly consistent across each of the CQS panels, as summarized below (for the full distributions by panel, please refer to Appendix C):

- For the sex item, the percentage of males ranged from 46.7 percent (Internet/Mail Choice) to 47.0 percent (Internet Push).
- For the Hispanic origin item, the percentage of people reported as Hispanic, Latino, or Spanish origin ranged from 5.1 percent (Internet Push) to 5.8 percent (Internet/Mail Choice).
- For the race item, the percentage of people reported as White ranged from 81.6 percent (Internet/Mail Choice) to 83.0 percent (Internet Push).
- For the tenure item, the percentage of owners ranged from 80.0 percent (Mail Only) to 81.5 percent (Internet Push).
- For the age item, the percentage of people age 65 or over ranged from 20.1 percent (Mail Only) to 20.7 percent (Internet/Mail Choice).
- The average household size ranged from 2.37 people (Internet/Mail Choice) to 2.39 people (Internet Push).

As expected, though the overall response distributions were similar by panel, the Census population differences by CQS response mode were more pronounced. This was a function of both the study design (using "push" and "choice" strategies) as well as the self-selecting nature of the response modes.

For instance, the population of Internet respondents (including all people in the household) in the Internet Push panel tended to be significantly older than in the Internet/Mail Choice panel; 12.3 percent of the Internet Push panel Internet respondents were age 65 or older in the Census compared to 8.7 percent in the choice panel. On the other hand, a larger proportion of CQS mail respondents (including all people in the household) were age 65 or older: 31.3 percent in the Internet Push panel and 21.9 percent in the Choice panel.

A second major difference by mode was found in the household tenure distribution. More than 60 percent of CQS Internet respondents reported owning their home with a mortgage in the 2010 Census (62.7 percent in the Internet Push panel and 66.9 percent in the Internet/Mail Choice panel). But a significantly smaller proportion reported this within the mail respondents (42.2 percent in the Push panel and 50.8 percent in the Choice panel).

Other differences by mode that we found were that the Internet response population had a higher percentage of male residents (48.1 percent compared to 48.7 percent) than in the mail response population (45.4 percent compared to 46.5 percent), and the Internet responders also tended to reside in larger households (2.60 people to 2.67 people on average, compared to 2.14 people to 2.34 people).

We decided not to adjust the sample weights or make other nonresponse adjustments to the CQS reinterview estimates because the differences in characteristics (i.e., response proportions) between the CQS respondents and nonrespondents are comparable across panels. In general the differences are less than two percentage points. Although the overall differences in characteristic proportions for respondents compared to nonrespondents may have affected estimates of the item gross difference rates, if the differences are relatively similar across panels, then the panel comparisons are meaningful and not critically affected by the reinterview nonresponse bias.

5.6 Paradata Analysis

In this section we will answer the fourth research question:

What are the paradata for the Internet questionnaire, such as break-off rates, use of help screens or links, changing of answers, access failures, completion times, etc.?

5.6.1 Overview

Paradata were collected in order to get a better understanding of respondents' experiences while filling out the online CQS instrument. Section 5.6 provides insight into navigation issues, highlights questions that might be confusing, and provides other useful pieces of information. A more detailed analysis, in which we use paradata to help explain anomalies in the data, will be published as a separate memo.

5.6.2 Paradata Limitations

Paradata can only be collected while the respondent is actively completing the survey. If any data elements are not identified before the survey launches, they will not be obtained. Likewise, if the data element was defined but improperly implemented, that information is not retrievable. The CQS instrument was the first time a full range of paradata was collected for an online Census survey. Thus, those who identified the paradata to be collected as well as those who designed the collection procedures had no prior direct experience. As a result, several aspects of the paradata collection could be improved upon. Fortunately, most of the errors in the CQS paradata file are minor. At times the analyses will be subsetted from the full dataset because certain records are compromised. These instances will be annotated. Several lessons were learned during this project and, as a result, the paradata collection for other projects has benefitted and is much improved.

The server error that caused the website to have limited functionality for the first three days it was active affected the paradata. Load tests showed that the server could handle large numbers of CQS respondents accessing the survey at once. However, the database that housed the paradata was overwhelmed. Each time a respondent pressed a button (Previous, Next, etc.), data were written to a paradata database. When so many users accessed the server at one time, the paradata database could not keep up. It caused the website to perform slower, which caused impatient respondents to click the login button (or other buttons) several times, which in turn caused the application to attempt to write the paradata to the database several times. Eventually, this cycle crippled the server and it went down. This can be seen in the data because we have some respondents who logged in upwards of 40 times, but never entered any data. Respondents were still able to access and submit surveys during this three-day period, however the process was not as smooth as expected. The error was corrected on the third day and data collection continued without incident for the remainder of the survey period. For more information on the implications of the server error, see the CQS Lessons Learned document (Stokes, 2011a).

Another limitation for paradata collection is that respondents must have JavaScript enabled on their computer in order to collect information from their computer. While there is no definitive

research on this topic, anecdotal evidence and rough estimates from browser statistics indicate that JavaScript-enabled users account for approximately 95 percent of Internet users. This is plausible considering the fact that JavaScript is necessary to run the dynamic components of many websites.

5.6.3 Logins

A total of 264,499 households were sent survey materials containing login IDs for the CQS web survey. This includes households in the Internet Push panel and the Mail/Internet Choice panel. Of these, only 14.8 percent (39,270 respondents) accessed the instrument. There is no way to determine which of the remaining 225,231 households chose not to access the website, tried to enter the website with an incorrect ID, or were unable to access the website at all. In addition, as with any mailout survey, it is possible that some households did not receive the survey materials that were sent to them.

The number of logins, per respondent, ranged from 1 to 44. Over 86 percent of respondents logged in only once and roughly nine percent logged in twice (Table 22). Based on the date of login, it is reasonable to assume that the large number of logins by some respondents was due to the server error discussed in Section 5.6.2. As explained in the previous section, load issues caused the server to slow down and some people who attempted to log in were either given an "Internal Error" message or had their survey "freeze" on the login page. This resulted in 537 respondents who logged into the instrument several times but never actually viewed any survey content. Since these respondents represent less than two percent of the total number of respondents who logged in, it appears that the impact of the server error on logins was small.

Table 22. Frequency and Percent of Logins by Respondent

# of Logins by Respondent	Frequency	Percent
Logged in once	33,950	86.5
Logged in multiple times	5,320	13.5
2 Logins	3,474	8.8
3 Logins	1055	2.7
4 Logins	385	1.0
5+ Logins	406	1.0
Total	**39,270**	**100.0**

Of the 39,270 respondents who accessed the CQS instrument, just over 87 percent (34,395) used the "Submit" button to finalize a completed survey.

It should be noted that the total number of Internet respondents for whom we have nonblank records is 35,502. The CQS instrument saved the information respondents entered every time they advanced to a new screen. This means that we have data for respondents included in the response analyses that are not counted among the "submitted surveys." In this section we are only concerned with the 34,395 respondents who used the submit button to complete a survey. In other sections of this report, the number of "completed surveys" may be higher, as some analyses include partially completed surveys in the total.

Of the 34,395 respondents who submitted a survey, the results are similar to those in Table 20. Over 87 percent of respondents completed their survey within a single session and 99 percent of respondents completed their surveys within 4 sessions. As with the number of logins in Table 22, the range of logins per submitted survey was also 1 to 44.

5.6.4 Multiple Logins with PIN

Once the survey instrument determined that the respondent was providing answers for the correct address and that there was somebody living at the residence on April 1st, the respondent was provided with an automatically generated Personal Identification Number (PIN). This PIN allowed respondents who had to leave the survey to come back at a later time. The PIN was intended to prevent unauthorized viewing of a respondent's survey data (Stokes, 2010). On subsequent logins, respondents would need to provide their CQS ID as well as their PIN[31]. As seen in Table 23, a total of 5,320 respondents attempted to log in to the CQS instrument multiple times. Due to the server error that occurred in the first two days of the study, 658 respondents were assigned a PIN but the page did not load correctly and the respondents were never able to actually view the PIN. This resulted in 658 respondents that should have been able to re-enter the survey, but could not due to the server glitch. Thus, we limit the analysis of multiple logins to the 4,662 respondents who did receive, and were able to view, their PIN. Of these, 93 percent were able to enter the correct PIN on the first try. The remaining seven percent required multiple login attempts before either entering a correct PIN or giving up. Table 21 shows the frequency and percent of times that respondents entered their PIN.

Table 23. Frequency and Percent of Times PIN was Attempted for Multiple Logins

	Frequency	Percent
Entered correct PIN on first attempt	4,338	93.0
Entered incorrect PIN on first attempt	324	7.0
Entered incorrect PIN 1 time	208	4.5
Entered incorrect PIN 2 times	68	1.5
Entered incorrect PIN 3+ times	48	1.0
Total	**4,662**	**100.0**

As shown in Table 23, the majority (93.0 percent) of respondents who logged into the survey multiple times were able to correctly enter their PIN. Of the 324 respondents that were not able to provide the correct PIN on the first try, most (208 respondents) only entered an incorrect PIN once. However, we do not know how many of those stopped trying compared with how many were able to access the instrument on the next try. Of the 324 respondents who initially entered an incorrect PIN, 71 of them (21.9 percent) logged in correctly at a later time.

There is no way to determine why people entered the incorrect PIN. Some people probably made legitimate mistakes and, after an initial typo, were able to log in successfully. It would make sense that the 21.9 percent of people who eventually logged in correctly are part of this

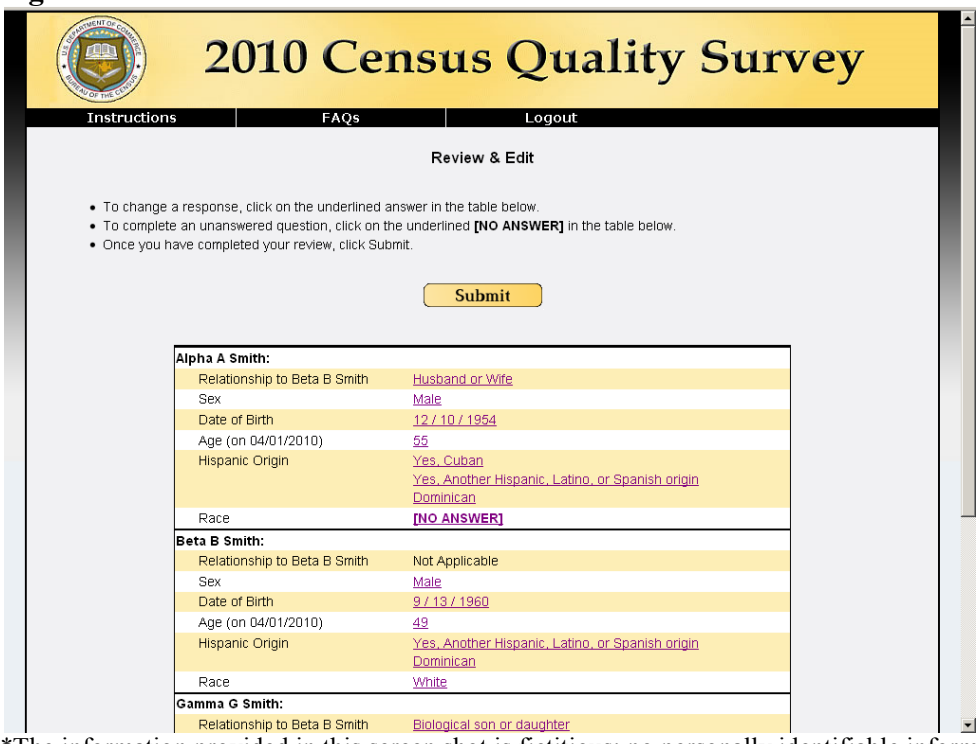
[31] Only respondents who had been given a PIN would need to use it for a re-entry. If a respondent left the survey before viewing the page that provided them with a PIN, they would be allowed to re-enter using only their CQS ID.

group. It is possible that people assumed a 4-digit PIN was easy to remember but forgot it when they were asked to provide it. An additional problem could have been that the CQS instrument automatically generated the PIN and thus it was not something respondents would easily remember because it was not something they personally entered. It could also be that respondents did not believe they would need the PIN and purposely did not write it down or commit it to memory. While the server error may have caused some people to get to the PIN screen but not actually be able to view it, it is likely that others truly did forget that they had been assigned a PIN. This issue will need to be revisited to determine the best authentication procedures for future online Census surveys. Overall, the authentication strategy used for the CQS worked well and, aside from respondents forgetting their PIN, there were no significant problems.

5.6.5 Review Screen

Once all survey questions were complete, respondents were provided with an opportunity to submit their survey before a review or go to a review screen to review/edit answers before submitting. Respondents who opted to review their data were taken to the review screen, shown in Figure 2. The review screen displayed respondent answers to the demographic "Person Information" items. Respondents could click the hyperlinked response to go back to that screen and revise the information. If a respondent did not provide a response, the review screen displayed [NO ANSWER] to indicate this.

Figure 2. Internet Instrument Review Screen



*The information provided in this screen shot is fictitious; no personally identifiable information is displayed.

Of the 34,395 submitted surveys, 6 percent (2,125 respondents) chose to review their answers before submitting. Once on the review screen, 8 percent of the 2,125 respondents (173 respondents) clicked an item link, indicating a desire to review and/or edit a previous response.

However, only a little over half (96 respondents) of those who clicked on an item link actually changed a previous response. When an item was changed, the majority (63.5 percent) of respondents only changed a single item.

Of the six items that could be changed from the review screen, relationship (to householder) and sex were changed the least. The more complicated concepts like Hispanic origin and race were changed more often and age was changed most often. Note that the CQS was a reinterview that collected age as of April 1st (approximately 5-6 months prior), making the age and date of birth items more complicated than they would normally be. Table 24 shows the number of times a response was changed by item from the review screen. The table represents the number of items changed (163) as opposed to the number of respondents who changed items (96) because a single respondent could change responses to multiple items.

Table 24. Frequency and Percent of Items Changes from the Review Screen

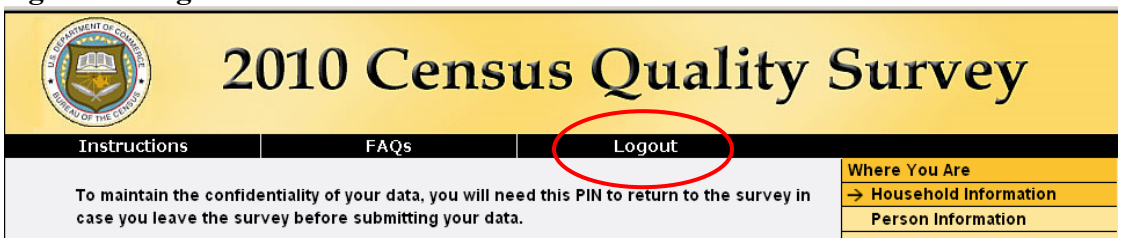
Item	Frequency	Percent
Relationship	8	4.9
Sex	6	3.7
Date of Birth	35	21.5
Age	42	25.8
Hispanic Origin	31	19.0
Race	41	25.2
Total	**163**	**100.0**

In order to fully understand the nature of response changes, the analysis would need to include changes made from the review screen as well as changes made throughout the instrument. This detailed analysis will be published as a separate memo.

5.6.6 Logouts

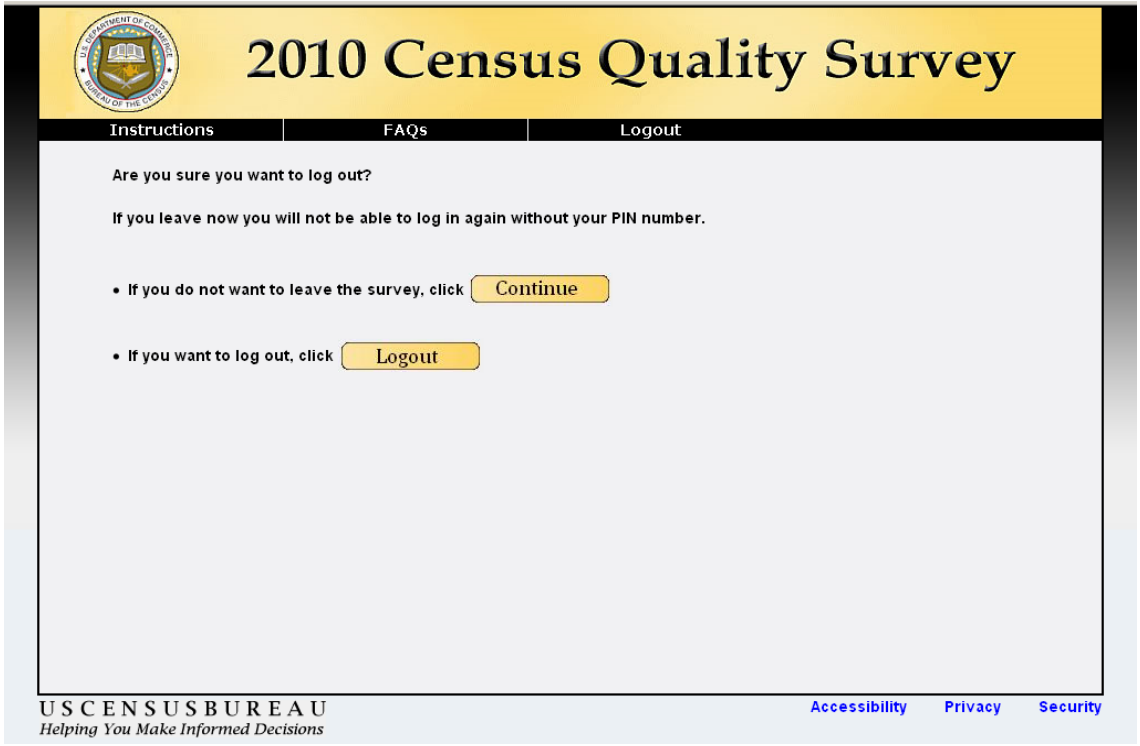
Once respondents were provided with a PIN, a "Logout" button appeared on the menu bar (see Figure 3). This was meant to inform respondents that they were allowed to leave the survey.

Figure 3. Logout Button on the Internet Instrument Menu Bar



Clicking on the logout button on the menu bar would take respondents to a screen that would verify whether or not the respondent really intended to leave the survey. This screen, seen in Figure 4, also reminded respondents that their PIN would be needed for re-entry. At this point, respondents could log out and leave the survey or choose to continue and be brought back to the screen they were on at the time of the attempted logout.

Figure 4. Internet Instrument Logout Verification Screen



The main logout button, on the toolbar, was used 595 times by 531 respondents. This means that some respondents used the logout button multiple times, both over multiple sessions and within the same session by opting to continue with the survey instead of logging out. The logout button was used only once by 480 respondents (90.4 percent). The remaining 51 respondents used the logout button multiple times, including people who used the button multiple times within one session, as well as those who actually left the survey, came back, and logged out again during a subsequent session.

Of the 531 respondents who used the logout button from the main menu bar, only thirteen (2.4 percent) chose to continue the survey instead of logging out. A total of 518 (97.6 percent) respondents finalized the logout process and left the survey. Of the 518 who actually left the survey, about 39 percent (204 respondents) eventually came back and completed the survey. The remaining respondents never completed a survey and are considered breakoffs, which are examined in Section 5.6.7. It should be noted that this number only represents the respondents who used the logout button to leave the survey. Some respondents left the survey via other means, such as closing their browser or being timed out of the survey because they were idle for too long.

5.6.7 Breakoffs

If a respondent left the instrument, for any reason and by any means, but did not ever return to submit a completed survey, that respondent is considered a breakoff. For the CQS, there were 4,875 respondents (out of 39,270) who logged into the instrument but never submitted a survey,

for a breakoff rate of 12.4 percent[32]. Of these breakoffs, 6.4 percent (314 respondents) used the logout button to leave while the remaining 93.6 percent exited the survey in another way. For the respondents who did not use the logout button to leave the survey, we cannot differentiate between respondents who timed out of the survey or left for other reasons (e.g., closing the browser or a system crash).

One of the interesting things we can examine is the specific item the respondents were viewing when they left the survey. The CQS instrument comprises three sections:

1. Household-Level: Determined if the address for which the respondent was answering matched the sampled address, determined whether or not anybody currently living at the address also lived there on April 1st, and collected the names of all the people in the household as of April 1st.

2. Person-Level Demographic: Contained demographic questions for each person in the household. These questions included relationship to the householder, sex, age and date of birth, Hispanic origin, and race. All questions used the April 1st reference date.

3. Person-Level Residence: Asked if any of the household members lived somewhere else around April 1st. For those who lived elsewhere, this section attempted to find out the reason for the additional residence, the address or description of the additional residence, where the person was living most of the time around April 1st, and where they were living on the exact date of April 1st.

Table 25 presents the number of breakoffs that occurred in each section of the instrument due to a finalized logout or some other reason. For the "Finalized Logout" column, we computed the frequency and percent of questions that respondents were viewing when they broke off by pressing the logout button and never returning. For the "Other Reason" column, we examined the last page viewed before a respondent was never seen in the system again. This column does not include respondents who used the logout button or respondents who submitted a survey. Again, it is important to note that we cannot determine if respondents left the survey because they were angry/upset over a particular question, because they did not know the answer to a particular question, or for some other reason. The frequencies presented in Table 25 are counts of page views; it is possible that a single respondent could be responsible for multiple frequencies within a page section.

[32] We calculated the breakoff rate by subtracting the 34,395 submitted surveys from the 39,270 respondents who logged in (reported in Section 5.6.3).

Table 25. Frequency and Percent of Breakoffs by CQS Instrument Section

CQS Instrument Section	Finalized Logout (n = 314)		Other Reason (n = 4107)	
	Frequency	Percent	Frequency	Percent
Household-Level Information				
Are you completing the survey for [address]?	n/a	n/a	412	10.0
If no, please enter your ID again (for verification).	n/a	n/a	203	4.9
Were you living/staying here on April 1?	n/a	n/a	410	10.0
If yes, what is your name?	n/a	n/a	525	12.8
If no, is there anyone here who was here on April 1?	n/a	n/a	2	<0.1
If no, was anybody here temporarily away on April 1?	n/a	n/a	516	12.6
PIN screen	8	2.5	568	13.8
Names of the people living at address on April 1?*	83	26.4	299	7.3
Was anybody, such as babies, left off the roster?	14	4.5	136	3.3
If Yes, Names of those that were left off roster.	2	0.6	5	0.1
Did you complete the 2010 Census?	16	5.1	121	2.9
Tenure: Do you own, rent, or live without payment?	16	5.1	109	2.7
If owned, who owns the residence?	4	1.3	75	1.8
If rented, who rents the residence?	1	0.3	9	0.2
Household Total	**144**	**45.9**	**3,390**	**82.5**
Person-Level Demographic Information				
Relationship to Householder	13	4.1	86	2.1
Sex	7	2.2	238	5.8
Age and Date of Birth	104	33.1	179	4.4
Hispanic Origin	4	1.3	45	1.1
Race	3	1.0	45	1.1
Person Total	**131**	**41.7**	**593**	**14.4**
Person-Level Residence Information				
Did a household member live somewhere else and why?	4	1.3	68	1.7
If yes, is this place inside the United States?	1	0.3	12	0.3
If yes, what is the address/description of this place?	6	1.9	7	0.2
Where did they live most of the time around April 1?	0	0.0	1	<0.1
Where did they live on April 1?	0	0.0	3	0.1
Residence Total	**11**	**3.5**	**91**	**2.2**
Review and Submit Screens				
Option to submit now or review first	13	4.1	29	0.7
Review screen	15	4.8	4	0.7
Review/Submit Total	**28**	**8.9**	**33**	**0.8**
Grand Total	**314**	**100.0**	**4,107**	**100.0**

n/a: Not applicable; the logout button was not available on these pages.

In both instances, finalized logouts and other breakoffs, 46 percent (144 respondents) of respondents left within the first section (Household-Level Information). It is interesting that over 64 percent of the respondents left before or at the PIN screen. This makes sense as people who are uninterested in the survey are likely to leave before going too far. Additionally, the first few questions are used to confirm whether or not the respondent should be completing the CQS. It

asks them to verify the address, asks them if they lived at the address, asked who else lived at the address, etc. It is possible that respondents who answered "No" to most of these questions felt that the survey did not pertain to them and they left. The survey was designed to figure out respondents' eligibility and, if necessary, inform them that they did not need to complete the CQS. However, there was no way for respondents to know this and they might have decided to leave prematurely. Finally, the server error, which occurred in the first three days of data collection, could have been the reason why breakoff rates were higher in this section. If the server slowness was going to cause people to leave the survey, they would probably do so within the first couple of screens, which is what we see in the "Other Reason" column. Of course, part of the reason for the high breakoff rates for the first couple of screens in the "Other Reason" column is because respondents did not have the option to logoff. Prior to receiving a PIN, if a respondent wanted to leave, for whatever reason, a true breakoff (without a log out) was the only way for them to do this.

Breakoffs are examined separately for those who logged out but never returned and those who left for another reason. One could make the argument that a person who logs out of an instrument may intend to come back while a person who shuts off the computer or closes the browser may not. (Of course, this only speaks to intentional breakoffs because people who experience an emergency or a power failure may intend to come back but do not have the time or opportunity to log off.) Evidence of this is possibly seen at the roster screen, which asks the respondent to list everybody who was living at the residence. While 26.4 percent logged off at the question and never returned, there were only 7.3 percent who left for another reason. In usability testing, some respondents indicated that they felt uncomfortable providing information online about people they are not related to, such as roommates (Ashenfelter et al., 2011). A portion of the 26.4 percent of respondents who logged off and never returned (as opposed to those who broke off for other reasons) could have logged off because they wanted to make sure it was ok for them to provide the names of other household members. Another potential reason for the high number of logouts at this screen is due to the fact that the roster screen is the first time the logout button is available. It could be that people wanted to log out earlier but did not have the opportunity to. We cannot know for sure why respondents broke off, but the high percentages in this section and on particular screens warrants investigation by future studies.

For each of the remaining instrument sections, the total percentage of finalized logouts was higher than other breakoffs (e.g., 41.7 percent compared with 14.4 percent for the Person-Level demographic items). The 33 percent who logged out at the age and date of birth screen could again be due to the nature of asking questions about unrelated household members. If a respondent did not know the age and date of birth for a household member, they could have decided to log out and ask that person directly. Unfortunately, if a respondent leaves a survey before finishing there is a higher chance that the respondent will not submit a completed survey (Couper, 2008). This was found to be true for the CQS as well. Of the respondents who submitted a survey, over 87 percent did so within a single session (see Section 5.6.3) and, as the number of logins increased, the number of submitted surveys decreased.

It is interesting to note that 8.9 percent of respondent logged off at the submit and review screens. While this could be attributed to respondents wishing to verify information with other household members before submitting, it is something that should be examined in the future.

5.6.8 Completion Time

For this analysis, we defined the "start time" as the time at which respondents logged into the system with a valid ID. The "end time" is the time at which the server processed their submitted survey. Defined this way, completion time includes the entire duration that respondents were answering questions and, if applicable, reviewing/editing their responses. Completion time does not account for time spent locating the user ID, entering the survey URL, or reading the introductory text on the welcome screen.

For this analysis, we subset the data to include only respondents who completed the entire survey and then removed those that did so over multiple sessions. This allows us to examine the time it took for respondents to go through the entire instrument, without having to correct for breakoffs or piece together survey completion times over multiple sessions. An additional 64 respondents were removed from the analysis because they did not have JavaScript enabled on their computer and were missing data necessary to calculate their completion time. (See Section 5.6.2 for more information on the JavaScript requirement). The universe for the completion time analysis includes 29,978 respondents. Since larger households are asked more person-level questions and therefore have longer survey times, Table 26 presents completion times by household size.

Table 26. CQS Completion Time by Household Size

	Household Size									
	1		**2**		**3**		**4+**		**Total**	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
10 Min or Less	5,454	93.9	10,257	89.5	4,341	84.5	5,787	76.4	25,839	86.2
11 Min – 30 Min	276	4.8	980	8.6	645	12.6	1457	19.2	3,358	11.2
31 Min – 60 Min	42	0.7	137	1.2	111	2.2	229	3.0	519	1.7
61 Min – 180 Min	16	0.3	34	0.3	24	0.5	80	1.1	154	0.5
181 Min or More	21	0.4	49	0.4	14	0.3	24	0.3	108	0.4
Total	**5,809**	**100.0**	**11,457**	**100.0**	**5135**	**100.0**	**7,577**	**100.0**	**29,978**	**100.0**

The majority (86 percent) of respondents completed the survey in ten minutes or less. Even in households with four or more people, over 76 percent completed the survey in ten minutes or less. This is consistent with usability data in which the average completion time for Round 2 was eleven minutes[33] (Ashenfelter et al., 2011). The required OMB burden statement, displayed on the login screen, also stated that the survey would take approximately ten minutes to complete, including time for reviewing the instructions and answers.

Completion times of three hours or more are considered abnormally high for the amount of data required by the CQS. These times are likely due to an error in paradata collection. There are some instances in which respondents left the survey and re-entered but this re-entry was not flagged in the paradata. Therefore, an unknown proportion of the respondents in the completion

[33] It is not unusual for respondents to take slightly longer to complete a survey in a usability lab than they would at home because they tend to be very diligent and must take the time to respond to questions and prompts from the usability facilitator.

time analysis actually completed their survey over several sessions. We know this because the survey "times out" if a respondent is idle for more than 15 minutes. At this timeout, the respondent is logged out and must log back in to continue the survey. Clearly high completion times, such as those that took longer than 24 hours, would have been idle at some point and should show a re-entry login. It is impossible to know how many respondents were affected by this error, but given that over 97 percent of all respondents completed the survey within 30 minutes, the impact seems to be small.

5.6.9 Item Error Messages

Most data items were subject to soft edits. When an error was made (e.g., an item was left blank or the response was invalid), a message with red text appeared at the top of the screen, above the main question, indicating that there was a problem with the information entered. The respondent was given the opportunity to change the information and continue. However, if nothing was changed and the respondent again pressed the "Next" button, they were allowed to bypass the error and continue entering data for the next question. (It should be noted that respondents were not aware they could bypass an error unless they attempted to do so and discovered that they could move on.) One exception was the roster screen, which required an answer before the respondent was allowed to complete the survey since the person-level demographic section of the instrument was dependent on the roster.

Examining the items for which error messages were displayed can provide insight into which items were complicated or confusing to respondents. Table 27 shows the items for which error messages were displayed and the percentage, based on the number of times the item/page was viewed. It should be noted that respondents who exited the instrument while on a screen with missing or invalid information, upon re-entry, would be sent back to the same screen and asked to resolve any errors or omissions they had made. For this reason, the frequency of item views is somewhat inflated since the item view frequency increases by one each time a respondent exits the instrument and re-enters on a page that contains an error or omission.

Table 27. Frequency and Percent of Error Messages, Per Item.

Section/Item	Frequency of Item Views	Error Message Rendered	
		Frequency	Percent
Household-Level Information			
Are you completing the survey for [address]?	40,239	411	3.9
If no, please enter your ID again (for verification).	n/a	n/a	n/a
Were you living/staying here on April 1?	39,585	392	3.7
If yes, what is your name?	38,068	261	2.5
If no, is there anyone here who was here on April 1?	739	7	0.1
If no, was anybody here temporarily away on April 1?	718	47	0.4
PIN screen	n/a	n/a	n/a
Names of the people living at address on April 1?*	37,283	471	4.4
Was anybody, such as babies, left off the roster?	37,209	482	4.5
If Yes, Names of those that were left off roster.	1,033	203	1.9
Did you complete the 2010 Census?	37,334	243	2.3
Tenure: Do you own, rent, or live without payment?	37,858	271	2.5
If owned, who owns the residence?	31,366	310	2.9
If rented, who rents the residence?	5,402	46	0.4
Household Total	**306,834**	**3,144**	**29.5**
Person-Level Demographic Information			
Relationship to Householder	59,981	437	4.1
Sex	95,968	819	7.7
Age and Date of Birth	*99,221*	*2,844*	*26.7*
Hispanic Origin	*94,636*	*1,396*	*13.1*
Race	*93,716*	*1,086*	*10.2*
Person Total	**443,522**	**6,582**	**61.8**
Person-Level Residence Information			
Did a household member live somewhere else and why?	93,105	809	7.6
If yes, is this place inside the United States?	4,549	30	0.3
If yes, what is the address/description of this place?	3,881	18	0.2
Where did they live most of the time around April 1?	3,925	31	0.3
Where did they live on April 1?	3,817	36	0.3
Residence Total	**109,277**	**924**	**8.7**
Grand Total	**859,633**	**10,650**	**100.0**

n/a: Not applicable; these screens did not have any error messages that could be triggered.

*The roster screen, which asked for the names of all people living at the address on April 1st, was the only screen with a hard edit. If a respondent refused to provide any information which could be used to differentiate the people in the house, they were not allowed to continue with the survey. All other edits in the instrument were soft edits and could be ignored by the respondent if they wished to continue with the survey.

Note: Lines in italics represent items that had specific edits based on the information provided, as opposed to the other items that only provided an error if the item was left blank.

Based on the number of times each page was viewed, the overall error message rate was only 1.2 percent, indicating that respondents did quite well with completing the items.

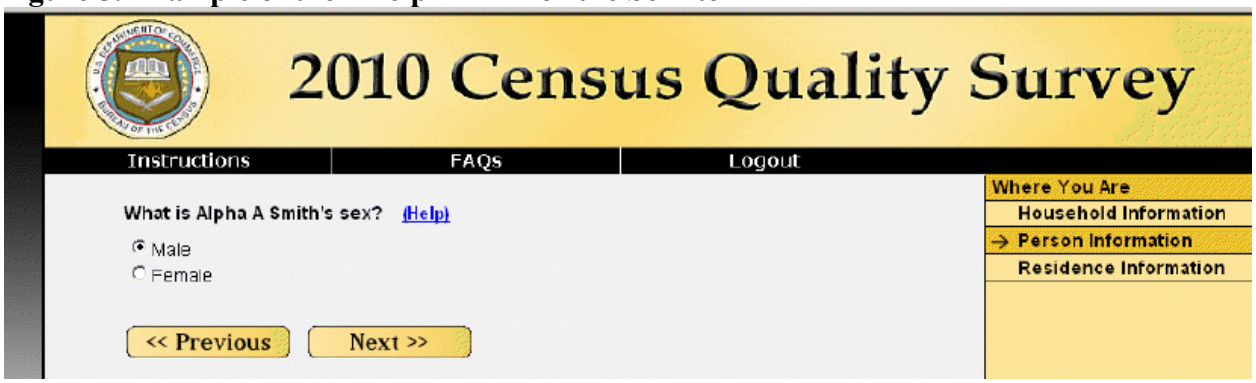
The highest percentage of error messages occurred in the Person-Level Demographic section, which makes sense because these were the only questions that had "true" errors. In the remaining sections, the only error messages that occurred were for respondents who did not answer a question. Age and date of birth had several edits to check the validity of dates and consistency between the two items. For example, a month greater than 12 would trigger an error message. The origin and race items had an edit that triggered an error message if the respondent selected an "other" category without providing anything in the "other specify" text box. These specific edits were in addition to the main edit that the other items had that triggered a message asking respondents to provide an answer if none was given. Age and date of birth had the greatest number of errors. This is likely due to the length of time between the survey and the reference date.

High error rates were also seen in the roster-related screens: the live or stay elsewhere question in the person-level residence section (7.6 percent), and the roster name screen (4.3 percent) and the roster omissions screen (4.4 percent) in the household-level section.

5.6.10 Help Links, Instructions, and FAQs

There were several ways for respondents to get information on the specific questions within the CQS as well as general information about the purpose of the CQS and data collection techniques. For item-specific help, respondents could click on a blue help link that appeared after almost every question. An example of this can be seen in Figure 5.

Figure 5. Example of the "Help" Link for the Sex Item



A respondent could click on the "Help" link and a new window would open on top of the current survey window. This help window included explanatory text on how to fill out the item. Help was provided for every demographic question, except for relationship. Item-specific help links were accessed by five percent of respondents. These 1,985 respondents clicked help links a total of 2,502 times, meaning that some respondents clicked multiple item-specific help links. Table 28 shows the frequency and percentage of time that each help link was clicked.

For help with more general CQS information, respondents could use the menu bar at the top of every CQS screen. This menu bar, seen in Figure 5, had buttons labeled "Instructions" and "FAQs" which would provide respondents with some basic instructions for completing the CQS or a list of answers to Frequently Asked Questions, respectively. Instructions and FAQs were

each accessed by less than one percent of respondents. The 113 respondents who accessed instructions did so 309 times and the 214 respondents who accessed FAQs did so 429 times. In both instances, some respondents accessed the Instructions or FAQs more than once.

The Instructions and FAQs were designed to provide general survey-related assistance and neither was useful for item-specific information. Item-specific information was provided in the form of a help link. However, it is likely that respondents who did not know where to go for help clicked on either the Instructions or FAQs button in an attempt to locate information related to a specific survey question. For this reason, we examined the page the respondent was on when they clicked either the Instructions or FAQs buttons. This information, in addition to the pages from which help links were clicked can provide insight into the types of questions with which respondents had the most difficulty. Table 28 contains the item for which the Help, Instructions, or FAQs button were accessed.

Table 28. Frequency and Percentage of Help, FAQs, or Instructions Items.

Item Viewed	Item Views	Help (n = 2502)		Instructions (n = 309)		FAQs (n = 429)	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
Household Information							
Are you completing the survey for [address]?	40,239	144	5.8	10	3.2	13	3.0
If no, please enter your ID again (for verification).	482	n/a	n/a	4	1.3	3	0.7
Were you living/staying here on April 1?	39,585	75	0.0	2	0.6	3	0.7
If yes, what is your name?	38,068	n/a	n/a	8	2.6	27	6.3
If no, is there anyone here who was here on April 1?	739	14	0.6	0	0.0	1	0.2
If no, was anybody temporarily away on April 1?	718	24	1.0	0	0.0	4	0.9
PIN screen	36,857	n/a	n/a	44	14.2	19	4.4
Names of the people living at address on April 1?	37,283	228	9.1	16	5.2	70	16.3
Was anybody, such as babies, left off the roster?	37,209	166	6.6	13	4.2	20	4.7
If Yes, Names of those that were left off roster.	1,033	33	1.3	2	0.6	3	0.7
Did you complete the 2010 Census?	37,334	110	4.4	56	18.1	24	5.6
Tenure: Do you own, rent, or live without payment?	37,858	64	2.6	4	1.3	8	1.9
If owned, who owns the residence?	31,366	289	11.6	7	2.3	9	2.1
If rented, who rents the residence?	5,402	105	4.2	3	1.0	1	0.2
Household Total	**306,834**	**1,252**	**50.0**	**169**	**54.7**	**205**	**47.8**
Person-Level Demographic Information							
Relation to Householder	59,981	n/a	n/a	18	5.8	15	3.5
Sex	95,968	62	2.5	15	4.9	15	3.5
Age and Date of Birth	99,221	367	14.7	14	4.5	62	14.5
Hispanic Origin	94,636	248	9.9	4	1.3	6	1.4
Race	93,716	355	14.2	6	1.9	13	3.0
Person Total	**443,522**	**1,032**	**41.2**	**57**	**18.4**	**111**	**25.9**
Person-Level Residence Information							
Did a HH member live somewhere else and why?	93,105	143	5.7	12	3.9	13	3.0
If yes, is the other address in the United States?	4,549	7	0.3	2	0.6	3	0.7
If yes, What is the address/description of this place?	3,881	30	1.2	1	0.3	1	0.2
Where did they live most of the time around April 1?	3,925	18	0.7	0	0.0	1	0.2
Where did they live on April 1?	3,817	20	0.8	1	0.3	1	0.2
Residence Total	**109,277**	**218**	**8.7**	**16**	**5.2**	**19**	**4.4**
Review and Submit Screens							
Gave option to submit now or review first	24443	n/a	n/a	9	2.9	24	5.6
Review Screen	2598	n/a	n/a	57	18.4	70	16.3
Review/Submit Total	**27,041**	n/a	n/a	**66**	**21.4**	**94**	**21.9**
Grand Total	**767,325**	**2,502**	**100.0**	**308**	**100.0**	**429**	**100.0**

n/a: Not applicable; no item-specific help was provided for these items.

Given the number of times each item was viewed, there are very few instances overall of links clicked for help (0.3 percent), instructions (less than 0.1 percent), and FAQs (0.1 percent). However, the section with the higher number of links clicked, for all three link types, was Household Information. Recall that this section was used to determine eligibility and asked several questions about the household members. It is not surprising that respondents would be confused or curious about these questions. One would also expect that respondents would seek information about the survey within the first few screens. It is interesting that 11.6 percent of respondents looked for help on who owns the house. This might be due to people wondering

why we are asking this question or wondering what to do if there are multiple owners. The percentage of links clicked for the names of household members is also high (9.1 percent for Help, and 16.3 percent for FAQs).

Within the Person-Level Demographic section, there were a high number of links clicked for age and date of birth, which is likely due to the April 1st reference date that has been discussed before in Section 5.6.9.

5.6.11 Accessibility, Privacy, and Security Links

Three links at the bottom of every screen provided information on Accessibility, Privacy, and Security. The Accessibility and Privacy links both opened new windows that displayed information from the main Census webpage (www.census.gov). The Accessibility link displayed the "Document Accessibility" page and provided information on how Census web pages are created to be accessible, according to Section 508 regulations[34]. The Privacy link opened the main "Data Protection and Online Privacy Policy" page. From this page, respondents could view the Census Bureau's privacy policy, learn about how the Bureau protects their data, find out how to determine if they were part of a legitimate Census Bureau study, and other relevant information. The Security link also opened a new window but did not provide information from the main Census webpage. Instead, the Security information was formatted similarly to the rest of the CQS screens. This information provided respondents with an explanation of how their data were encrypted and what measures were used to ensure their privacy. This was a standard security message that has been provided on other web surveys created by the Systems Support Division (SSD) (Stokes, 2010).

We did not expect respondents to utilize these links very often, and the data show this to be true. The accessibility link was used by 27 respondents, the privacy link by 66 respondents, and the security link by 48 respondents. Most respondents who clicked these links did so once throughout their time in the CQS instrument.

5.6.12 User Environment

If a respondent had the necessary JavaScript enabled on their computer, we were able to collect information on the user's environment. The items collected were: device on which the instrument was completed, the operating system, and the browser name. User environments were collected each time a respondent with the right software logged into the system, so some respondents were counted multiple times. However, if a respondent logged in from different computers, their metrics would most likely be different. For this reason, user environment data are provided for all 48,512 instances captured and not by unduplicated respondent. Table 29 provides the frequency and percent for each of the user environment measurements collected.

[34] Section 508 standards require alternative keyboard navigation, which is essential for people who cannot use a mouse. Standards also require access for those who rely on assistive technology, such as screen readers, to access computer-based information. Certain conventions are necessary so that these devices can "read them for the user in a sensible way.

Table 29. Frequency and Percent of User Environment Measurements

	Frequency (n=48,512)	Percent
Device		
Computer	**48,194***	**99.3**
Smart Phone	**110**	**0.2**
BlackBerry	10	<0.1
Apple iPhone	91	0.2
Other		<0.1
Other Mobile Device	**209**	**0.4**
Apple iPod	18	<0.1
Apple iPad	191	0.4
Operating System		
Microsoft Windows	42,681	88.0
Macintosh	5315	11.0
Linux	334	0.7
Other	182	0.4
Web Browser**		
Microsoft Internet Explorer (MSIE)	33,702	69.5
Mozilla	8,595	17.7
Google	2,049	4.2
Other	4,166	8.6

*It is possible that some of the records labeled as "computer" were actually completed with another device. Without having access to a list of every web capable device in existence, there is no way to definitively state how many computer devices were used. However, the vast majority of surveys were completed on a computer and any extras would represent an extremely low percentage.

**Web browser companies want their browsers to be compatible with content designed for Microsoft Internet Explorer (MSIE), because MSIE still controls a dominant share of the web browser market. Therefore, many useragent strings will include a tag for MSIE, even if that is not the browser being used by that machine. For example, a person using the Google Chrome browser will have a useragent string that lists MSIE and Google Chrome. The presence of Chrome is the only way to know that Chrome is the browser being used. While the vast majority of users did in fact use MSIE, it is possible that this total includes other browsers. Likewise, the "other" category is likely slightly under-represented because some of the "other" users are in the Microsoft category.

The user environment data clearly show a strong preference for respondents using a computer to access the CQS online survey (99 percent).[35] While the Apple iPhone users were nine times more prevalent than BlackBerry users, both numbers are small. Of the non-computer devices to be used, the most common was the Apple iPad at 0.4 percent. As expected, the majority (88 percent) of respondents used a version of the Microsoft Windows operating system. The next

[35] It is possible that the design of the CQS, which did not include an instrument optimized for smartphones and other mobile devices, may have suppressed the use of the mobile devices to complete the survey.

most common operating system was Macintosh, at 11 percent. Web browser data, again, show Microsoft as the most common, with 69.5 percent of respondents using a version of Microsoft Internet Explorer. The second most common was the Mozilla web browser suite with 17.7 percent. Within Mozilla, Firefox was the clear favorite with all but 11 Mozilla respondents using it. Those 11 respondents used Mozilla's newest browser, called SeaMonkey. Just over four percent of respondents used a Google browser.

It is important to note that these three measures (device, operating system, and browser) are all related. If a respondent uses an Apple device, it will default to a Macintosh operating system, and an Apple web browser (e.g., Safari). While people have the option of installing and using other products, there is likely to be a correlation between products made by the same company.

6. Related Assessments, Evaluations, and/or Experiments

The 2010 Census Content Reinterview Survey included a reinterview of 2010 Census respondents by telephone; this study uses a test-retest methodology.

The 2010 Census Alternative Questionnaire Experiment Race and Hispanic Origin Experiment includes a probing reinterview that is intended to capture more accurate self-identified race and origin responses.

The 2011 American Community Survey Internet Test focused on response rates associated with various response option/contact strategies.

The 2010 Census Avoid Followup Evaluation focused on collecting enough information on the initial census return to fix coverage errors by determining true residence and avoiding further followup.

7. Lessons Learned, Conclusions, and Recommendations

7.1 Lessons Learned

This section highlights some of the major lessons learned from the CQS (Stokes, 2011a):

Positives:

- Since the 2011 ACS Internet test was being developed at the same time as the CQS instrument, members of the 2011 ACS Internet team were also on the CQS team. The two surveys were designed in tandem and any solution that benefited both surveys was implemented identically. This allowed for a reduced burden on subject matter experts, because they only had to make the decision once. It was also easier for the Internet programmers since the specifications and code could be reused.

- One team member served as a single point of contact for all of the subject matter experts, which was helpful since the team could provide suggested solutions for all content items at one time and this person could then provide answers to the relevant experts at one

time. Similarly, all design and development decisions were funneled through a single person so that stakeholders and others associated with the project had one point of contact.

- Design and testing of the Internet instrument was an iterative process in which the team would decide on changes and send those changes to the programmers on a flow basis. The process was also concurrent with usability testing due to the schedule. The team received weekly updates, and changes were implemented as soon as possible for further testing.

- Paradata collection of this magnitude was new for both the Decennial Statistical Studies Division (DSSD) and Systems Support Division (SSD), and several important lessons were learned. SSD learned more about what kinds of paradata survey developers are interested in and in what format they expect to see the paradata. As a result, paradata collection was improved for the 2011 ACS Internet Test and continues to be improved for future surveys. DSSD also learned what paradata "look like" and are more prepared to interpret the data and program the analyses.

Negatives:

- The biggest challenges in this survey were related to only a one-year inception-to-completion project duration (as initiated late in the cycle) and the extensive paradata collection. A serious technical problem occurred in the first couple of days of the survey, which ultimately had a negative impact on Internet unit response rates, item nonresponse rates, and customer satisfaction (as indicated by respondent correspondence). The large paradata load caused the server to hang up. The load was difficult to anticipate during survey planning primarily because this was the first Census Bureau Internet survey that attempted to collect large volumes of paradata. In addition, the CQS was a reinterview rather than an initial contact, therefore unit response rates were difficult to estimate. Fortunately for the CQS, the developers resolved the issue quickly and the survey results were not fatally impacted. Although this negatively impacted the CQS, future Internet tests will benefit from the response rate and paradata load data collected in this survey.

- Per respondent correspondence, survey recipients wanted to call or email for immediate assistance when they had difficulty with the website. For CQS, we provided online help for the Internet respondents and automated telephone help for the paper respondents. We opted to not provide live help due to a lack of resources and a desire to keep the help for each mode as similar as possible. As a result, calls and emails came in through the Paperwork Reduction Act office, various headquarters offices, field offices, regional offices, and even the Office of the Director. In future Internet surveys, a survey-specific email address for respondent assistance and/or a telephone line manned by live agents needs to be considered.

- One very difficult part of the project was trying to get the letters and envelopes designed, approved, and mailed in the given time frame. A particular problem with communication came in trying to relay specifications, timing requirements, and design issues to NPC.

The timing of the development of survey materials needs to be carefully integrated with the planning schedule for research projects during the 2020 Census research cycle, where the current model is focused on implementing groups of small tests in a short timeframe.

- Staffing and timing problems were related to the very tight timeframe. The programming and testing staff were not enough to implement the complex design challenges in the time allotted. Part of this was due to the fact that ACS was designing an Internet-based survey in parallel to CQS. The lesson learned for the 2020 Census testing model is that designing and testing in a very tight timeframe is possible but the instrument development and testing process is problematic and at higher risk.

- The current method of auto-generating a PIN for re-entering the survey was problematic because some respondents failed to process this information. The placement of the PIN page, several screens into the survey, may have also contributed to respondents missing this important information. Asking respondents to create their own PIN might be a way to make the process, and the PIN itself, more memorable. However, this type of authentication procedure adds additional burden (and length) which might discourage respondents from completing the survey. Authentication procedures need to be fully researched in the testing cycle leading up to the 2020 Census.

7.2 Conclusions

Participation rates:

As expected, the participation rates (excludes undeliverable as addressed housing units) varied between the three panels. The final participation rate was highest in the Mail Only panel (56.0 percent), next highest in the Internet/Mail Choice panel (55.1 percent), and lowest in the Internet Push panel (46.5 percent). Additionally, Internet uptake (i.e., the portion of the rate due to Internet response) was much different between the Internet Push (24.8 percent Internet) and Internet/Mail choice panels (4.6 percent).

Gross difference rates:

We used gross difference rates, the percent of people with a different response between the 2010 Census and the CQS, to evaluate the measurement error using Internet and mail response reinterviews. We found differences by panel, by mode, and by item.

For the Internet responses, the Internet/Mail Choice panel had significantly lower gross difference rates for several of the items (tenure, age, race, and other residence) than the Internet Push panel. A couple of these differences were small, though the differences for tenure and other residence were noteworthy. However, the comparison is complicated somewhat by the nature of the CQS design and the differing response populations in each panel. Some users of the Internet instrument would not ordinarily have responded online but were "pushed" into doing so. For instance, the Internet Push panel had a higher proportion of Internet responders age 65 or older than the Choice panel.

Within the Internet/Mail Choice panel, we found that there were several significant differences between the Internet and mail respondents (for tenure, sex, and age). The Internet gross difference rates were lower compared to mail responses, which is unexpected since one would think that a reinterview using the same mode (mail) as the Census would have fewer differences than a reinterview using a different mode (Internet). One explanation for this is that the use of soft edits in the Internet instrument enabled respondents to provide more accurate answers. Another reason is that the populations that opted to respond by Internet instead of mail are different in some ways. The Internet response population (including all people in the household) was more likely than the mail responders to be younger, White, have a mortgage on their home, and live in larger households.

For the mail responses, there was one significant (but negligible) difference (Hispanic origin) between the Mail Only and the Internet/Mail choice panels. None of the other items were statistically different.

In conclusion, the gross difference rate analysis suggests that both the Internet and mail respondents provided consistent responses to the CQS compared to the 2010 Census. But some items require additional research, such as tenure and other residence. The gross differences for the Internet respondents were not higher than those of the mail respondents, and in some cases lower, suggesting that a census Internet response (based on this instrument) would have similar measurement error compared to the census paper questionnaire.

Item nonresponse rates:

We analyzed the CQS item nonresponse rates to gauge data completeness across each panel and response mode. As expected, the Internet responses were found to have significantly lower item nonresponse than the mail responses. This was not surprising since soft edits were built into the Internet instrument which warned respondents once if an item was left blank.

However, one side effect of the Internet server issues during the first few days of the survey period was that the survey access issues forced some respondents to not be able to fully complete the survey and thus impacted item nonresponse. The item nonresponse rates were being artificially inflated. This should serve as a caution that even though Internet surveys are capable of eliciting significantly lower item nonresponse than traditional paper questionnaires responses, the instrument is susceptible to operational issues that could impact quality. We removed the CQS Internet responses during the first two days from the item nonresponse computations and concluded that the item nonresponse was indeed lower for Internet responses than the mail responses for most items.

For the mail responses, the item nonresponse rates were significantly higher in the Internet/Mail Choice panel compared to the Mail Only panel for several items (tenure, relationship, sex, Hispanic origin, and race). We do not have any valid hypotheses to explain this, but do note that most of these differences were small and may not be meaningful.

Like previous studies, we found that item nonresponse to the race question from the mail responses was higher for Hispanics than for those not of Hispanic origin. Interestingly, though,

this was not the case for the Internet responses. In fact, for Internet responders, of those who provided any response to the Hispanic origin question, less than 1 percent did not also provide a response to the race question.

In conclusion, the item nonresponse rate analysis showed that the use of soft edits contributed to the lower rates of missing data for the Internet cases. This is a major benefit of online surveys and could improve the overall data quality of an online census.

Household coverage analysis:

Due to the complex nature and timing of the within-household coverage analysis, most of the detailed results will be presented in a separate memorandum, but we did find some interesting results. We determined that a higher percentage of people added at the second roster screen ("Any additional people") were later determined to be deletions from the final roster after their residency disposition was determined, compared to those initially added to the roster. Also, people listed in Roster 1 were less likely than those listed in Roster 2 to indicate sometimes living or staying elsewhere. Further, among those who indicated a reason for being away, there were several differences between Roster 1 and Roster 2, including higher seasonal and child custody rates among Roster 1 people in both panels and higher college and "another reason" rates among Roster 2 people for the Internet Push panel.

Nonresponse analysis:

In order to study the potential for bias in the CQS results, we compared the 2010 Census mail response distributions for each item between the CQS respondents and nonrespondents. As expected, there were differences. In general, compared to nonrespondents, the CQS respondents had a higher percentage of: people not of Hispanic, Latino, or Spanish origin; people identified as White; homeowners; older people; and smaller households. However, the overall response distributions, for both respondents and nonrespondents, were similar across the three study panels.

Paradata analysis:

Paradata suggest that, in general, the CQS Internet instrument was well understood and easily navigated by respondents. The majority of respondents were able to successfully log in and submit data, despite an initial setback due to the server error. Respondents who needed to provide a PIN for re-entry were generally able to do so without problems. While several respondents broke off within the first couple of screens, those that continued the survey appeared to have little difficulty, as evidenced by the infrequent use of Help, Instructions, or FAQs. Most respondents who completed the entire instrument did so within the recommended amount of time (ten minutes). The frequency of error messages was higher than anticipated, but this was mostly due to questions being left blank. The highest rate of error messages due to invalid data were caused by the age and date of birth questions, which was complicated by the fact that we asked for age as of a reference date which was approximately 5-6 months in the past.

7.3 Recommendations

7.3.1 Future Research

Based on the results of the CQS we recommend several areas for future research and development:

- *Measurement error modeling for Internet and mail reinterviews.*

This report presents findings on the gross difference rates between the 2010 Census responses and the CQS. We recommend further statistical modeling to better understand the response characteristics and differences between the mail and Internet response modes.

- *National mailout test of response rates and optimal contact strategies.*

The CQS was a reinterview evaluation of households that had already responded to the 2010 Census and, thus, was not inherently designed to measure response rate differences between the three panels. A nationally representative sample of housing units is recommended to gain a clearer picture of the optimal contact strategies for eliciting responses to the decennial census. This study would include mail and Internet response modes, and several different contact strategies to be tested, including but not limited to:

1) Internet Push (similar to the CQS design)
2) Internet/Mail Choice (similar to the CQS design)
3) Mail Only (similar to the 2010 Census baseline)
4) Internet Push with Alternative Reminder Timing and/or Content
5) Internet Push with Two Replacement Questionnaires
6) Internet/Mail Choice with Alternative Reminder Timing and/or Content
7) Internet Push with Mail Fulfillment
8) Use of Email Contacts

Testing would also include targeting contact strategies to specific subpopulations, such as high Internet usage areas, in order to maximize internet response and minimize mailing, data capture and, nonresponse followup costs.

- *Frame development.*

Future research should explore ways of enhancing the address frame. This could include ways of designing a frame to strategically target specific populations for Internet response, since propensity for Internet response has been shown to differ significantly by strata. The frame could also incorporate email addresses to take advantage of the burgeoning mobile Internet population. For instance, even though the CQS design was not optimized for smart phones, a number of users still opted to respond on their phone or other mobile device. Proposed 2020 Census research on the use of administrative records would provide information on the availability of, and feasibility of using, email addresses in the address frame. Testing should

explore how best to optimize the inclusion of email addresses for reminder notification and/or initial contact for an Internet response mode.

- *Testing Internet response mode in other languages.*

The Internet response mode should also be tested in Spanish and other languages, as deemed necessary. Having an Internet response mode available for languages other than English could increase response rates for populations that do not speak English as their first language, thus reducing nonresponse followup costs.

- *Testing Internet response on mobile devices.*

Due to resource constraints, and the expectation that it would only comprise a very small portion of the survey respondents, the CQS Internet instrument was not formally tested on mobile devices. Future surveys and censuses that provide an Internet response option should be sure to conduct usability testing on traditional desktop and laptop computers as well as mobile devices, such as smartphones (e.g., iPhone, BlackBerry, Android) and tablet computers (e.g., iPad).

7.3.2 Considerations for Future Internet Development and Design

We also recommend several refinements and improvements to the Internet instrument to consider for 2020 Census web development, such as: question wording, security and access issues, and usability.

- For responses after Census Day (April 1st), add an age edit for babies born between Census Day and the date of response.

- Determine an optimal way to handle respondent PINs.

- Allow the survey URL to be input using lower-case or upper-case letters.

- In the CQS, it was decided that we would only collect an additional address for a person if they indicated that they lived at one other specific location in the "live elsewhere" question. The "live elsewhere" question was a mark-all-that-apply question that listed specific types of locations (summer home, jail, etc.) as response options as well as "some other reason." To cut down on the burden of reporting additional addresses, we did not collect any alternate addresses if the respondent marked more than one response category. However, theoretically, a respondent could select both a specific location and the "some other reason" response to represent one location (i.e. there are multiple reasons for the other location). In this instance we did not collect an address because it was considered a multiple response and therefore assumed to be two separate locations. In reality, the respondent used two response categories to represent one location. Although we do not know how often this occurred in the CQS data, this is an issue that will need to be revisited for future Internet tests.

- When testing the functionality of the roster screens, we discovered several problems caused by users going back through the instrument. Specifically, it was problematic for users to go back and make changes to the household roster after reaching the person-level section of the instrument. Even more problematic was when users changed the reference person (since the relationship question uses the reference person as a fill). In some instances, the survey could not keep up and either caused the respondent to go down a different path or caused names to be missing or duplicated. To address this issue in the CQS, we removed the Previous button from the *people* screen to deter respondents from moving back to the roster screens after the roster had been set. This is something that will need to be revisited for future Internet tests, as we will likely want to allow users to add/delete names from the roster.

- We may want to consider including a comments box in the online survey. It appears that people will often call or write the Census Bureau to explain their responses. Usually, these explanations are to clarify who was in the house on Census Day. If we allowed people to provide this clarification along with their online form, we could reduce the amount of mail and phone calls coming from respondents. This could also go a long way to fostering good will with the public, as it will show them that we genuinely care about their data and want them to provide the best data they can. It is also likely that whatever explanation they type into a comments box would be exactly what they told a Census Coverage Followup worker who called to clarify the data. If the explanations are clear enough to resolve data issues, we could reduce the number of outbound calls to respondents. Lastly, this would be a very simple way for respondents to provide feedback about the actual online instrument including navigation issues, ease of answering, etc.

Acknowledgements

The authors of this report would like to thank the following people who provided valuable contributions and assistance to the development, implementation, and analysis of the 2010 Census Quality Survey:

To the team that designed and developed the survey: Kristin Burnett, Elizabeth Compton, Mary Davis, Gianna Dusch, Colleen Hughes, Ashley Landreth, Heather Madray, Anne Ross, Michelle Ruiter, Dave Sheppard, Kuopei (Gwen) White, and Henry Woltman.

To the researchers and usability testing team in the Center for Survey Measurement: Kathy Ashenfelter, Jenny Hunter Childs, Temika Holland, Larry Malakhoff, and Victor Quach.

To the programmers and Internet support team in the Systems Support Division: Christopher Butler, Mohammed Chaudhry, Giuseppe (Joe) Mistichelli, Robert Shellhouse, and John Studds.

To the staff at the National Processing Center who handled the mail returns and the race and origin residual coding: Reggie Bass, Jenny Bowers, Sherry Bowman, Amanda Burns, Pamela Jenkins, Ruby Lawson, Marilyn Mink, Satish Muthuluru, Jennifer Simpson, Debbie Tevis, and countless others.

To the critical reviewers and others who provided helpful comments and assistance along the way: Nancy Bates, John Bushery, Larry Cahoon, Kevin Deardorff, Rachel Horwitz, Randall Neugebauer, Elizabeth Poehler, Jennifer Reichert, David Spindel, and Jennifer Tancreto.

To the external consultants on the development of the Internet instrument and mailing materials: Dr. Mick Couper and Dr. Roger Tourangeau of the Institute for Socail Research at the University of Michigan and the Joint Program in Survey Methodology, and Dr. Don Dillman at Washington State University.

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Appendix A: Observed Census-CQS Differences for Each Item by Panel and Mode

Table A-1. Observed Census-CQS Differences for Each Item by Response Mode (Internet Push Panel)

Item	Response Category	Internet Respondents				Mail Respondents			
		Census Estimate	CQS Estimate	Difference	D^2	Census Estimate	CQS Estimate	Difference	D^2
Sex	Male	48.1	48.2	-0.1	0.01	45.5	44.3	1.2	1.44
	Female	51.0	50.9	-0.1	0.01	53.1	53.5	-0.4	0.16
Hispanic Origin	Hispanic	5.4	5.3	0.1	0.01	4.7	4.7	0.0	0.00
	Not Hispanic	92.6	91.5	1.1	1.21	90.4	90.4	0.0	0.00
Race	White	83.3	81.3	2.0	4.00	84.1	84.5	-0.4	0.16
	Black	5.3	5.1	0.2	0.04	7.3	7.3	0.0	0.00
	American Indian and Alaska Native	0.3	0.3	0.0	0.00	0.4	0.4	0.0	0.00
	Asian	5.9	5.8	0.1	0.01	3.8	3.8	0.0	0.00
	Native Hawaiian and Other Pacific Islander	0.1	0.1	0.0	0.00	0.1	0.1	0.0	0.00
	Some other race	1.2	1.5	-0.3	0.09	0.9	0.7	0.2	0.04
	Two or More	2.8	2.9	-0.1	0.01	2.1	1.7	0.4	0.16
Tenure	Owned With Mortgage	63.0	63.1	-0.1	0.01	43.1	43.2	-0.1	0.01
	Owned Without Mortgage	20.6	21.0	-0.4	0.16	36.3	35.4	0.9	0.81
	Rented	14.8	14.9	-0.1	0.01	16.7	16.6	0.1	0.01
	Occupied Without Payment	0.8	0.9	-0.1	0.01	1.9	2.2	-0.3	0.09
Age	0-4	5.2	5.0	0.2	0.04	3.3	3.2	0.1	0.01
	5-9	5.9	5.7	0.2	0.04	3.6	3.6	0.0	0.00
	10-14	6.6	6.4	0.2	0.04	4.4	4.4	0.0	0.00
	15-19	6.2	6.1	0.1	0.01	4.4	4.4	0.0	0.00
	20-24	4.4	4.3	0.1	0.01	3.3	3.3	0.0	0.00
	25-29	5.3	5.2	0.1	0.01	3.3	3.3	0.0	0.00
	30-34	5.6	5.4	0.2	0.04	3.7	3.7	0.0	0.00
	35-39	6.4	6.2	0.2	0.04	4.0	4.1	-0.1	0.01
	40-44	7.3	7.1	0.2	0.04	4.9	4.8	0.1	0.01
	45-49	8.5	8.3	0.2	0.04	6.6	6.6	0.0	0.00
	50-54	9.2	9.0	0.2	0.04	8.1	8.0	0.1	0.01
	55-59	8.9	8.7	0.2	0.04	8.8	8.8	0.0	0.00
	60-64	8.0	7.9	0.1	0.01	9.2	9.3	-0.1	0.01
	65+	12.4	12.2	0.2	0.04	31.8	31.7	0.1	0.01

Note1: the percents within each item may not add to 100 because missing and invalid responses are excluded.
Note2: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Table A-2. Observed Census-CQS Differences for Each Item by Response Mode (Internet/Mail Choice Panel)

Item	Response Category	Internet Respondents				Mail Respondents			
		Census Estimate	CQS Estimate	Difference	D^2	Census Estimate	CQS Estimate	Difference	D^2
Sex	Male	48.7	48.7	0.0	0.00	46.6	45.7	0.9	0.81
	Female	50.4	50.3	0.1	0.01	52.2	52.4	-0.2	0.04
Hispanic Origin	Hispanic	5.6	5.5	0.1	0.01	5.6	5.6	0.0	0.00
	Not Hispanic	93.4	92.1	1.3	1.69	90.7	90.6	0.1	0.01
Race	White	83.8	82.3	1.5	2.25	82.3	82.8	-0.5	0.25
	Black	4.1	4.1	0.0	0.00	7.2	7.3	-0.1	0.01
	American Indian and Alaska Native	0.3	0.2	0.1	0.01	0.4	0.5	-0.1	0.01
	Asian	6.6	6.4	0.2	0.04	4.8	4.9	-0.1	0.01
	Native Hawaiian and Other Pacific Islander	0.1	0.1	0.0	0.00	0.1	0.1	0.0	0.00
	Some other race	1.2	1.4	-0.2	0.04	1.1	0.9	0.2	0.04
	Two or More	3.1	3.1	0.0	0.00	2.6	2.1	0.5	0.25
Tenure	Owned With Mortgage	67.1	67.4	-0.3	0.09	51.5	51.4	0.1	0.01
	Owned Without Mortgage	15.8	16.0	-0.2	0.04	28.6	28.0	0.6	0.36
	Rented	15.7	15.7	0.0	0.00	17.0	16.9	0.1	0.01
	Occupied Without Payment	0.6	0.8	-0.2	0.04	1.4	1.7	-0.3	0.09
Age	0-4	6.7	6.6	0.1	0.01	4.2	4.2	0.0	0.00
	5-9	6.7	6.6	0.1	0.01	4.7	4.8	-0.1	0.01
	10-14	6.9	6.7	0.2	0.04	5.4	5.4	0.0	0.00
	15-19	5.9	5.8	0.1	0.01	5.4	5.4	0.0	0.00
	20-24	4.3	4.2	0.1	0.01	3.9	3.9	0.0	0.00
	25-29	5.8	5.7	0.1	0.01	4.3	4.3	0.0	0.00
	30-34	7.3	7.2	0.1	0.01	4.6	4.5	0.1	0.01
	35-39	7.7	7.5	0.2	0.04	5.1	5.1	0.0	0.00
	40-44	8.2	8.0	0.2	0.04	5.9	5.9	0.0	0.00
	45-49	8.4	8.3	0.1	0.01	7.6	7.6	0.0	0.00
	50-54	8.3	8.2	0.1	0.01	8.7	8.6	0.1	0.01
	55-59	7.9	7.8	0.1	0.01	8.9	8.9	0.0	0.00
	60-64	6.9	6.8	0.1	0.01	8.6	8.6	0.0	0.00
	65+	8.7	8.6	0.1	0.01	22.3	22.2	0.1	0.01

Note: the percents within each item may not add to 100 because missing and invalid responses are excluded.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Table A-3. Observed Census-CQS Differences for Each Item by Response Mode (Mail Only Panel)

Item	Response Category	Mail Respondents			
		Census Estimate	CQS Estimate	Difference	D^2
Sex	Male	47.0	46.3	0.7	0.49
	Female	51.8	52.0	-0.2	0.04
Hispanic Origin	Hispanic	5.4	5.4	0.0	0.00
	Not Hispanic	91.1	91.2	-0.1	0.01
Race	White	83.1	83.3	-0.2	0.04
	Black	6.9	6.9	0.0	0.00
	American Indian and Alaska Native	0.3	0.4	-0.1	0.01
	Asian	5.0	5.1	-0.1	0.01
	Native Hawaiian and Other Pacific Islander	<0.1	<0.1	0.0	0.00
	Some other race	1.0	0.9	0.1	0.01
	Two or More	2.3	2.1	0.2	0.04
Tenure	Owned With Mortgage	52.4	52.1	0.3	0.09
	Owned Without Mortgage	27.8	27.5	0.3	0.09
	Rented	17.1	17.1	0.0	0.00
	Occupied Without Payment	1.3	1.4	-0.1	0.01
Age	0-4	4.5	4.4	0.1	0.01
	5-9	4.9	5.0	-0.1	0.01
	10-14	5.5	5.4	0.1	0.01
	15-19	5.4	5.5	-0.1	0.01
	20-24	3.8	3.8	0.0	0.00
	25-29	4.6	4.6	0.0	0.00
	30-34	4.8	4.7	0.1	0.01
	35-39	5.2	5.2	0.0	0.00
	40-44	5.9	5.9	0.0	0.00
	45-49	7.7	7.7	0.0	0.00
	50-54	8.8	8.8	0.0	0.00
	55-59	8.8	8.8	0.0	0.00
	60-64	8.8	8.8	0.0	0.00
	65+	21.0	20.9	0.1	0.01

Note: the percents within each item may not add to 100 because missing and invalid responses are excluded.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Appendix B: Gross Difference Rates for Each Item by Panel, Mode, and Stratum

Table B-1. Gross Difference Rates for Tenure by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	3.7 (0.12)	6.7 (0.18)	3.5 (0.15)	5.8 (0.23)	3.9 (0.19)	7.3 (0.27)	3.5 (0.81)	7.4 (0.95)
Internet/Mail Choice	2.5 (0.19)	5.3 (0.09)	2.2 (0.22)	4.5 (0.11)	2.8 (0.32)	5.7 (0.13)	1.6 (1.11)	7.2 (0.55)
Mail Only	NA	5.2 (0.23)	NA	4.4 (0.27)	NA	5.8 (0.35)	NA	6.1 (1.36)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Table B-2. Gross Difference Rates for Sex by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	0.3 (0.02)	1.1 (0.06)	0.2 (0.02)	1.1 (0.07)	0.3 (0.03)	1.1 (0.08)	0.3 (0.17)	1.7 (0.34)
Internet/Mail Choice	0.2 (0.03)	0.9 (0.02)	0.2 (0.05)	0.8 (0.03)	0.1 (0.05)	0.9 (0.04)	0	1.1 (0.15)
Mail Only	NA	0.8 (0.06)	NA	0.7 (0.07)	NA	0.9 (0.10)	NA	0.5 (0.27)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Table B-3. Gross Difference Rates for Age by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	1.1 (0.04)	2.0 (0.07)	1.05 (0.05)	1.8 (0.09)	1.1 (0.07)	2.0 (0.11)	1.2 (0.33)	2.9 (0.44)
Internet/Mail Choice	0.8 (0.07)	1.8 (0.04)	0.7 (0.08)	1.7 (0.05)	0.9 (0.13)	1.9 (0.05)	0	2.9 (0.26)
Mail Only	NA	1.9 (0.09)	NA	1.7 (0.11)	NA	1.9 (0.14)	NA	3.2 (0.68)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Table B-4. Gross Difference Rates for Hispanic Origin by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	0.8 (0.05)	0.7 (0.06)	0.8 (0.06)	0.6 (0.07)	0.8 (0.08)	0.7 (0.09)	1.1 (0.58)	0.9 (0.28)
Internet/Mail Choice	0.8 (0.10)	0.7 (0.03)	0.7 (0.10)	0.7 (0.04)	0.9 (0.16)	0.7 (0.05)	2.6 (1.55)	0.8 (0.16)
Mail Only	NA	0.8 (0.08)	NA	0.8 (0.11)	NA	0.7 (0.12)	NA	1.0 (0.42)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Table B-5. Gross Difference Rates for Race by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	2.9 (0.11)	2.4 (0.11)	2.8 (0.13)	2.1 (0.14)	2.9 (0.17)	2.4 (0.16)	4.0 (0.95)	4.4 (0.74)
Internet/Mail Choice	2.5 (0.19)	2.5 (0.06)	2.1 (0.20)	2.3 (0.08)	2.7 (0.31)	2.6 (0.09)	6.3 (2.98)	3.1 (0.38)
Mail Only	NA	2.5 (0.16)	NA	2.3 (0.20)	NA	2.6 (0.25)	NA	2.6 (0.84)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Table B-6. Gross Difference Rates for Other Residence by Panel and CQS Response Mode

	Overall		High		Medium		Low	
	Internet	Mail	Internet	Mail	Internet	Mail	Internet	Mail
Internet Push	3.4 (0.09)	4.7 (0.13)	3.35 (0.12)	4.4 (0.17)	3.3 (0.15)	4.9 (0.19)	4.6 (0.75)	5.4 (0.74)
Internet/Mail Choice	2.9 (0.17)	4.2 (0.06)	2.8 (0.21)	4.3 (0.08)	3.1 (0.30)	4.2 (0.09)	1.4 (0.87)	4.8 (0.37)
Mail Only	NA	4.1 (0.16)	NA	4.0 (0.21)	NA	4.0 (0.23)	NA	5.3 (1.16)

Note: the data for mail respondents in the Internet Push panel come strictly from the replacement questionnaires.
NA=Not applicable.
Source: 2010 Census Quality Survey data files, estimates are weighted with standard errors in parentheses.

Appendix C: Census Distributions for CQS Respondents and Nonrespondents by Panel

Table C-1. Census Responses for Matched CQS Respondents and CQS Non-Respondents – Internet Push Panel

Variable	Response	CQS Respondents			CQS Non-Respondents
		Overall	Internet	Mail	
Sex	Male	47.0	48.1	45.4	47.0
	Female	51.4	50.8	52.5	50.4
	Blank	1.6	1.1	2.1	2.5
Hispanic Origin	Not Hispanic	91.2	92.4	89.7	83.5
	Hispanic	5.1	5.4	4.7	10.5
	Both Indicated	0.2	0.2	0.3	0.3
	Blank	3.4	2.0	5.4	5.7
Race	White	83.0	82.9	83.2	70.2
	Black	6.3	5.4	7.5	14.5
	American Indian and Alaska Native	0.4	0.3	0.4	0.7
	Asian	5.1	6.0	3.8	4.5
	Native Hawaiian and Other Pacific Islander	0.1	0.1	0.1	0.1
	Some other race	1.1	1.2	0.9	2.7
	Two or More	2.6	2.9	2.1	3.6
	Blank	1.5	1.2	1.9	3.6
Tenure	Owned With Mortgage	53.7	62.7	42.2	48.4
	Owned Without Mortgage	27.8	20.6	36.0	15.5
	Rented	15.8	15.0	17.5	31.2
	Occupied Without Payment	1.3	0.8	2.0	1.9
	Two or More	0.2	<0.1	0.3	0.2
	Blank	1.3	0.9	2.0	2.8
Age	0-4	4.6	5.4	3.4	6.6
	5-9	5.0	6.0	3.6	7.0
	10-14	5.7	6.6	4.4	7.0
	15-19	5.6	6.3	4.5	7.0
	20-24	4.2	4.6	3.6	7.0
	25-29	4.5	5.3	3.4	6.8
	30-34	4.8	5.5	3.7	6.4
	35-39	5.4	6.3	4.0	6.7
	40-44	6.2	7.2	4.9	7.1
	45-49	7.6	8.4	6.5	7.7
	50-54	8.6	9.0	7.9	7.4
	55-59	8.6	8.7	8.5	6.0
	60-64	8.3	7.9	9.0	4.9
	65+	20.2	12.3	31.3	10.6
	Blank	0.8	0.4	1.3	1.9
Average Household Size		2.39	2.60	2.14	2.67

Note: Data include all people listed on the 2010 Census return.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Table C-2. Census Responses for Matched CQS Respondents and CQS Non-Respondents – Internet/Mail Choice Panel

Variable	Response	CQS Respondents			CQS Non-Respondents
		Overall	Internet	Mail	
Sex	Male	46.7	48.7	46.5	47.5
	Female	51.6	50.4	51.8	50.1
	Blank	1.7	1.0	1.7	2.4
Hispanic Origin	Not Hispanic	90.3	93.2	90.1	83.1
	Hispanic	5.8	5.7	5.7	11.1
	Both Indicated	0.2	0.1	0.2	0.3
	Blank	3.8	1.0	4.0	5.5
Race	White	81.6	83.5	81.6	69.4
	Black	7.2	4.2	7.4	14.9
	American Indian and Alaska Native	0.5	0.3	0.5	0.6
	Asian	5.1	6.7	4.9	4.4
	Native Hawaiian and Other Pacific Islander	0.1	0.1	0.1	0.1
	Some other race	1.1	1.2	1.1	3.2
	Two or More	2.7	3.1	2.6	3.6
	Blank	1.7	0.8	1.7	3.7
Tenure	Owned With Mortgage	52.6	66.9	50.8	48.4
	Owned Without Mortgage	27.5	15.7	28.4	13.7
	Rented	17.0	16.1	17.6	32.9
	Occupied Without Payment	1.4	0.6	1.5	1.8
	Two or More	0.2	<0.1	0.2	0.2
	Blank	1.4	0.7	1.5	2.9
Age	0-4	4.6	6.9	4.4	7.2
	5-9	5.0	6.8	4.8	7.1
	10-14	5.6	6.9	5.4	7.3
	15-19	5.5	6.0	5.5	7.1
	20-24	4.3	4.5	4.2	7.3
	25-29	4.6	5.9	4.4	7.2
	30-34	4.8	7.2	4.5	6.9
	35-39	5.3	7.6	5.1	6.9
	40-44	6.0	8.0	5.8	7.3
	45-49	7.5	8.2	7.5	7.7
	50-54	8.5	8.2	8.5	7.2
	55-59	8.6	7.8	8.7	5.9
	60-64	8.2	6.8	8.4	4.5
	65+	20.7	8.7	21.9	8.8
	Blank	0.9	0.4	0.9	1.9
Average Household Size		2.37	2.67	2.34	2.73

Note: Data include all people listed on the 2010 Census return.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Table C-3. Census Responses for Matched CQS Respondents and CQS Non-Respondents – Mail Only Panel

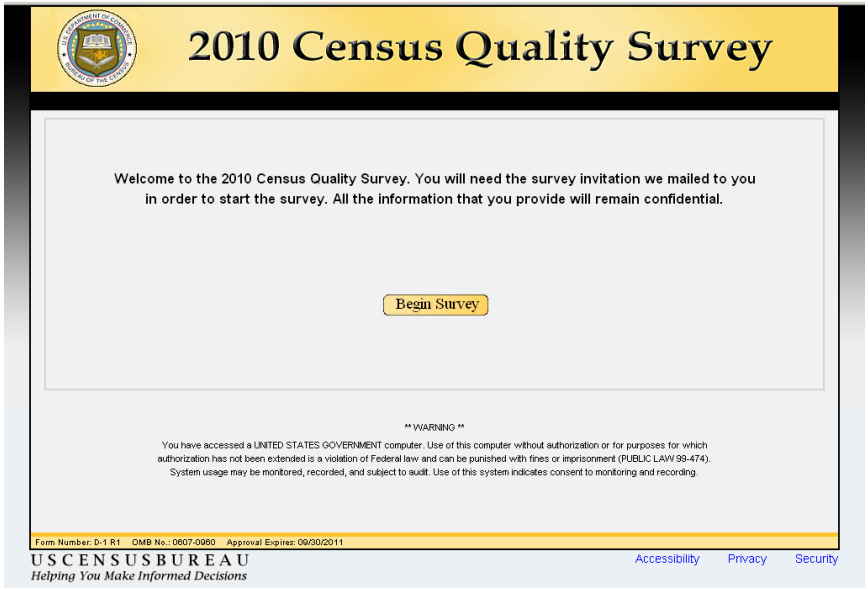
Variable	Response	CQS Respondents	CQS Non-Respondents
Sex	Male	46.9	47.2
	Female	51.2	50.2
	Blank	1.8	2.5
Hispanic Origin	Not Hispanic	90.1	82.6
	Hispanic	5.7	11.5
	Both Indicated	0.2	0.3
	Blank	4.1	5.6
Race	White	81.9	69.7
	Black	7.1	14.5
	American Indian and Alaska Native	0.4	0.7
	Asian	5.2	4.4
	Native Hawaiian and Other Pacific Islander	<0.1	0.2
	Some other race	1.1	2.6
	Two or More	2.4	3.8
	Blank	1.8	4.0
Tenure	Owned With Mortgage	52.8	48.1
	Owned Without Mortgage	27.2	14.0
	Rented	17.1	32.9
	Occupied Without Payment	1.3	2.0
	Two or More	0.1	0.2
	Blank	1.5	2.9
Age	0-4	4.7	7.1
	5-9	5.0	7.1
	10-14	5.4	7.6
	15-19	5.6	7.3
	20-24	4.2	7.2
	25-29	4.7	7.8
	30-34	4.8	6.6
	35-39	5.2	6.6
	40-44	6.0	7.4
	45-49	7.6	7.6
	50-54	8.6	7.0
	55-59	8.5	5.8
	60-64	8.4	4.4
	65+	20.1	8.7
	Blank	1.1	1.9
Average Household Size		2.38	2.74

Note: Data include all people listed on the 2010 Census return.
Source: 2010 Decennial Response File and 2010 Census Quality Survey data files, estimates are weighted.

Appendix D: Screenshots of CQS Internet Instrument[36]

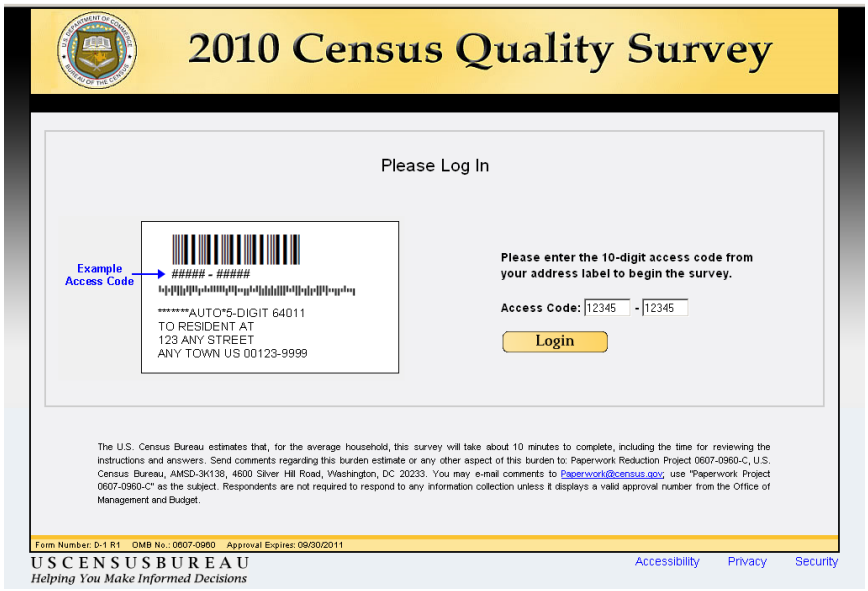
Introductory Screens

Screen 1



The welcome screen reminded respondents that they would need their survey invitation materials to begin the survey and provided them with the warning statement.

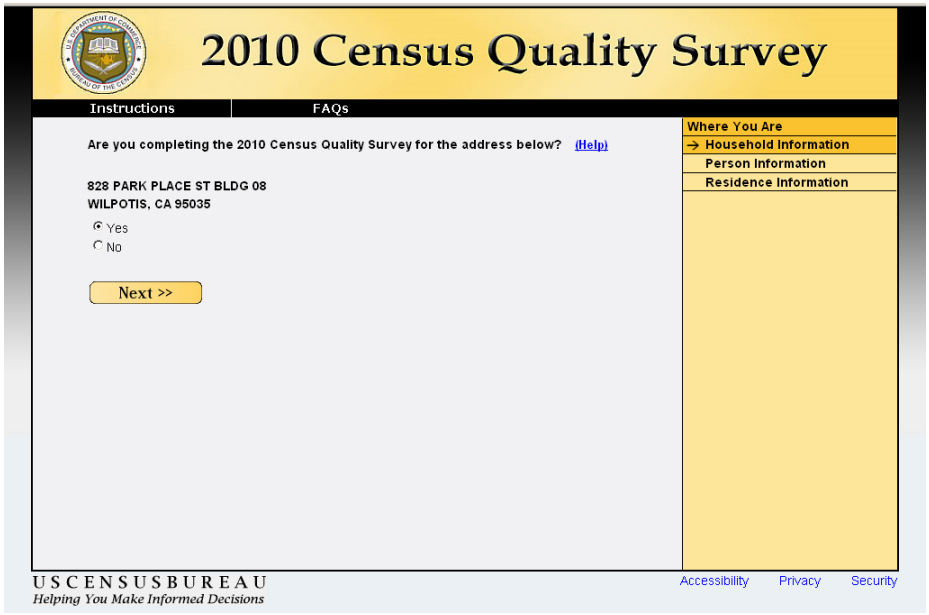
Screen 2



The login screen, where respondents needed to provide their 10-digit access code and, if applicable, their 4-digit PIN to access the survey.

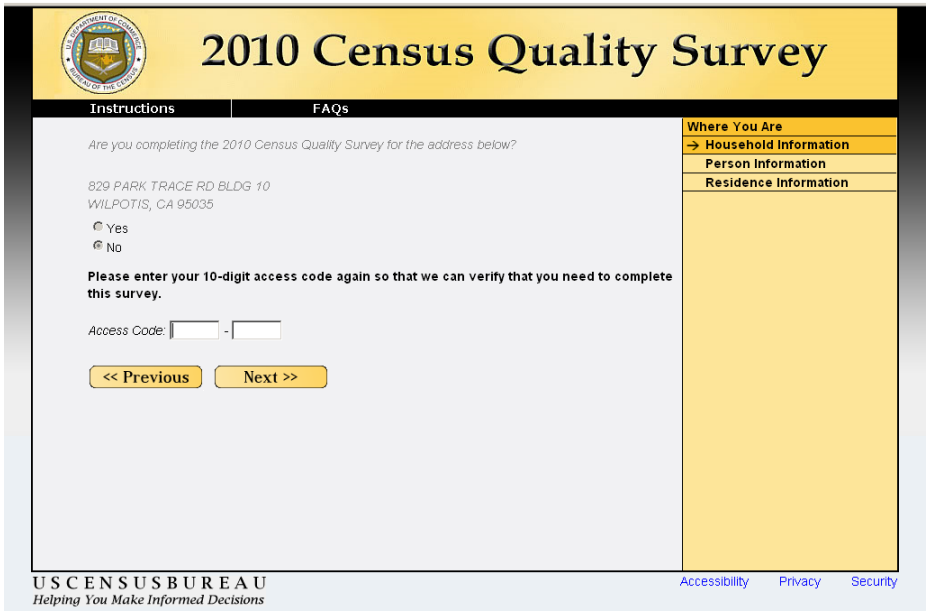
[36] For a full explanation of the design decisions behind the CQS screens as well as more detailed information on branching instructions and skip patterns, see the 2010 CQS Internet Detail Design document (Stokes, 2011b).

Screen 3



This question attempted to make sure that the person was filling out the CQS for the intended household (i.e., that the mail materials were delivered to the correct address). If respondents answered "Yes" they were taken to Screen 5 to continue with the survey. If respondents answered "No" they were taken to Screen 4 to verify their access code, in case they mis-typed it.

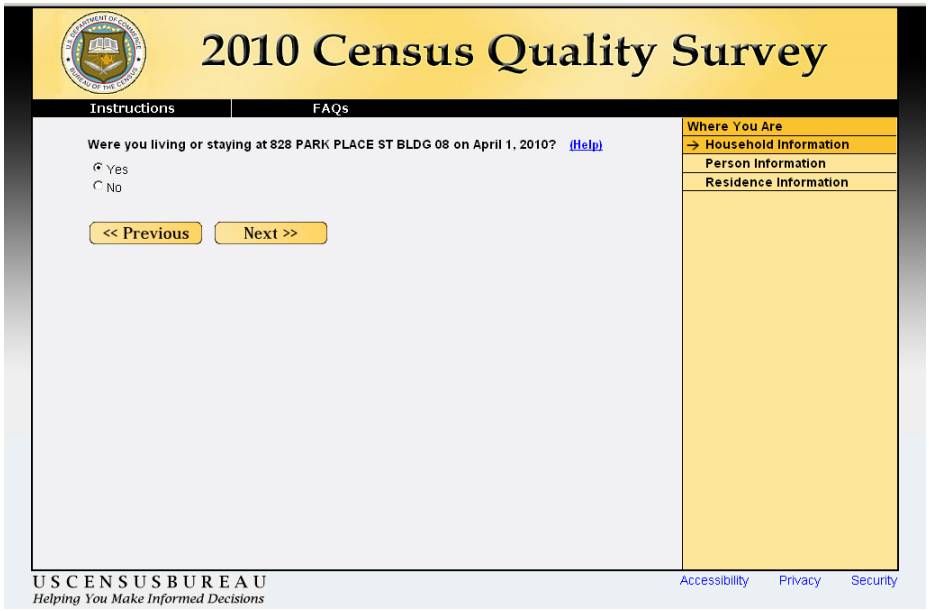
Screen 4



If respondents entered the same access code, they were told they did not need to complete the survey. Since they entered the access code on the invitation but the address did not match, it was assumed that the survey was sent to the wrong household. If respondents entered a different, but valid, access code they were taken back to Screen 3 and asked about the sample address associated with the new access code. If respondents entered a different, but non-valid, code, they were taken back to the login screen (Screen 2) and asked to log in again.

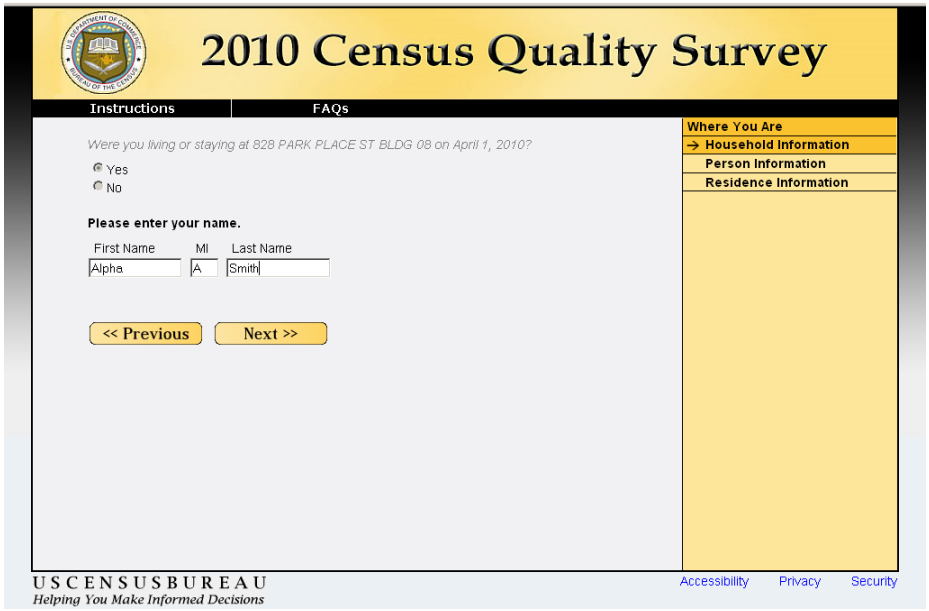
Household-Level Information Screens

Screen 5



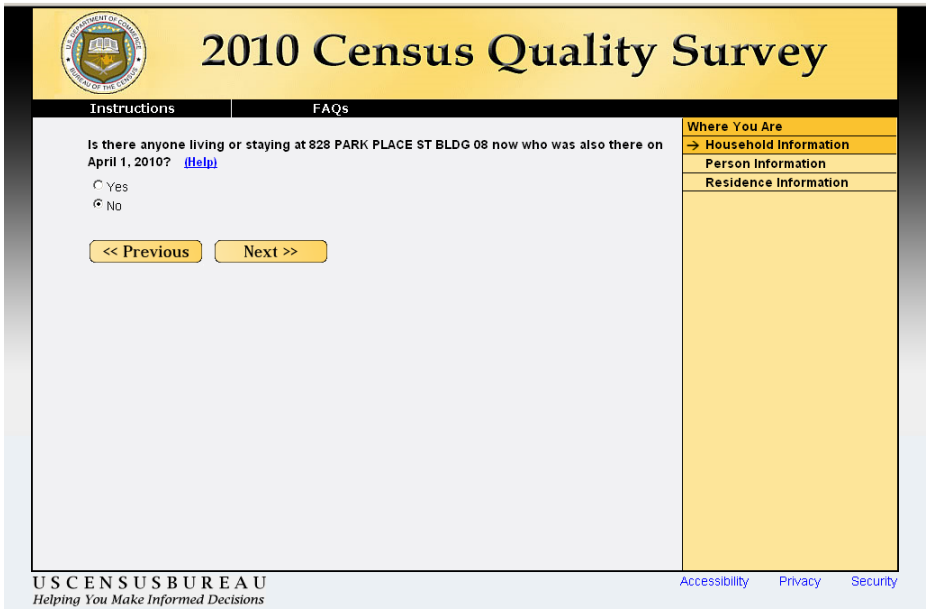
This question was the first step in determining the Census Day residents for this address. If respondents answered "Yes" they were taken to Screen 6 and asked to provide their name. If respondents answered "No" they were taken to Screen 7 to determine if anybody else in the household was a Census Day resident.

Screen 6



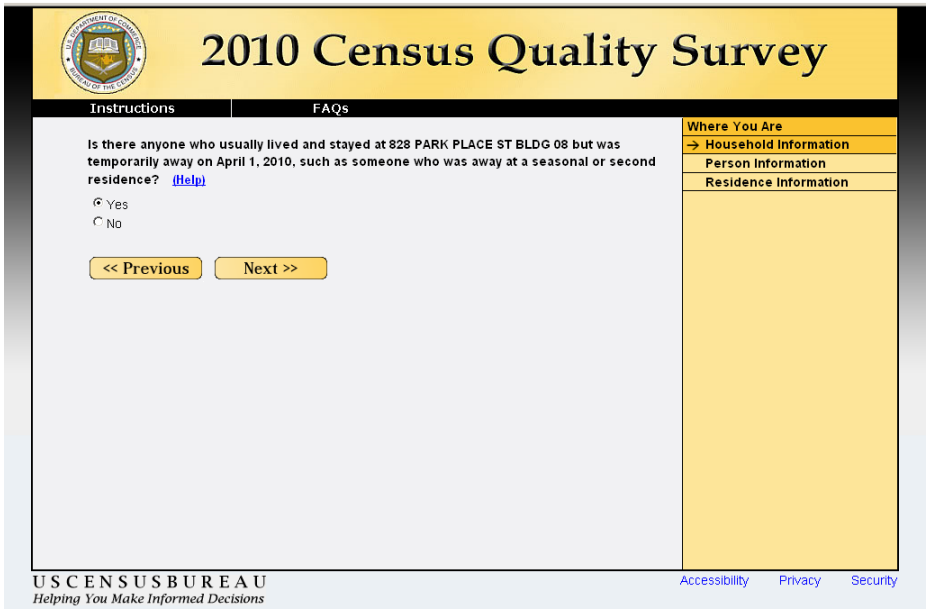
Research has shown that respondents often forget to include their own name when completing household rosters. For this reason, we collected respondents' names as soon as we determined they were Census Day residents. When the respondents got to the screen where the full roster was collected (Screen 10), the name entered here was pre-filled into the first roster slot.

Screen 7



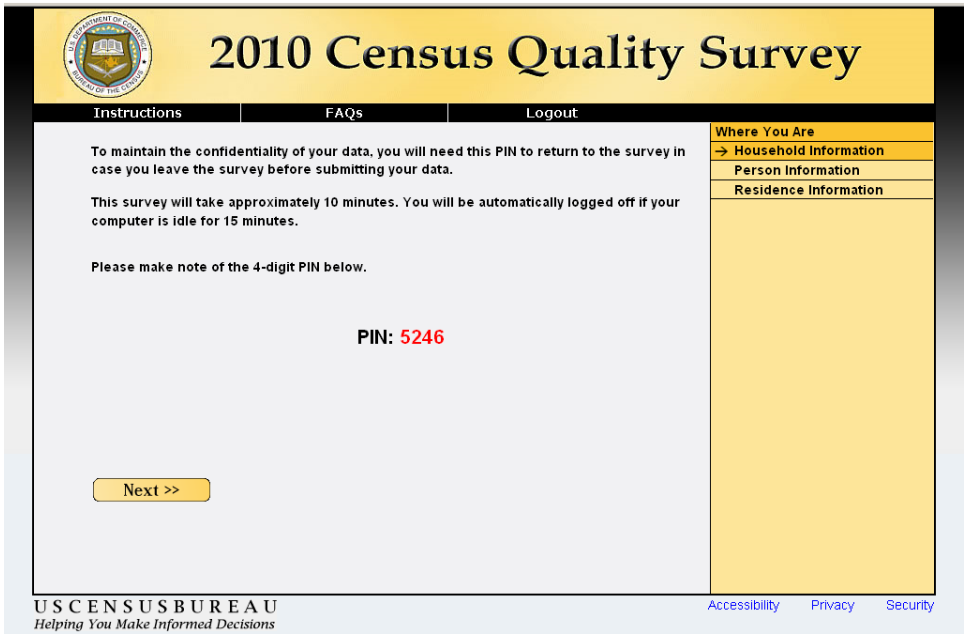
Another step in determining Census Day residents for this address. This question determined if somebody in the household was a Census Day resident, even if the person completing the survey was not. If respondents answered "Yes" they were taken to Screen 9 to continue with the survey. If respondents answered "No" they were taken to Screen 8 to determine if there was anyone who usually lived at the address who might have been temporarily away on Census Day.

Screen 8



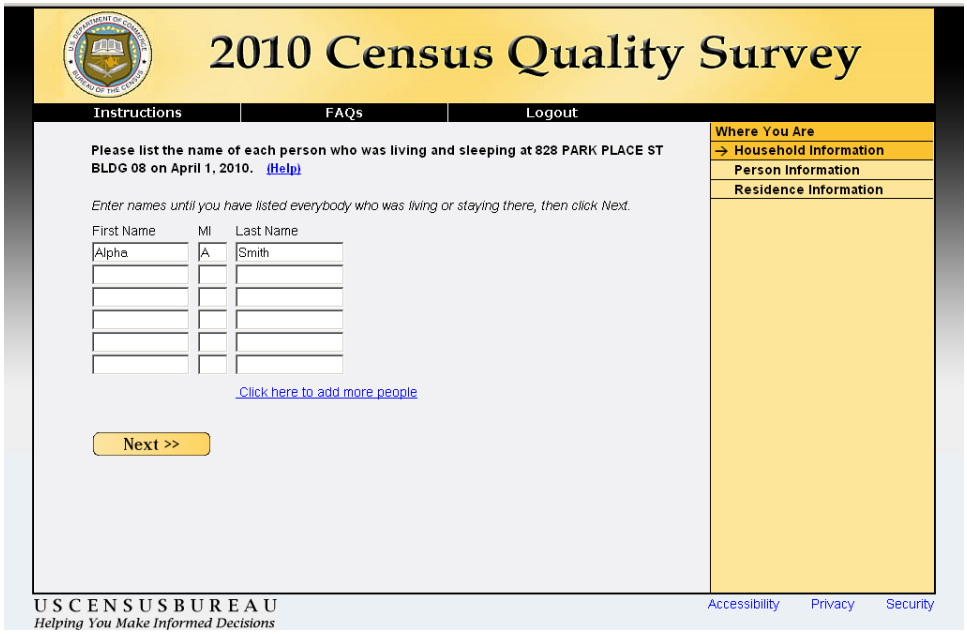
This was the last step in determining Census Day residents for this address. This question determined if anybody was a usual resident but happened to be away on Census Day. If respondents answered "Yes" they were taken to Screen 9 to continue the survey. If respondents answered "No" they were taken to a screen informing them that they did not need to complete the survey (because no one in the household was a Census Day resident).

Screen 9



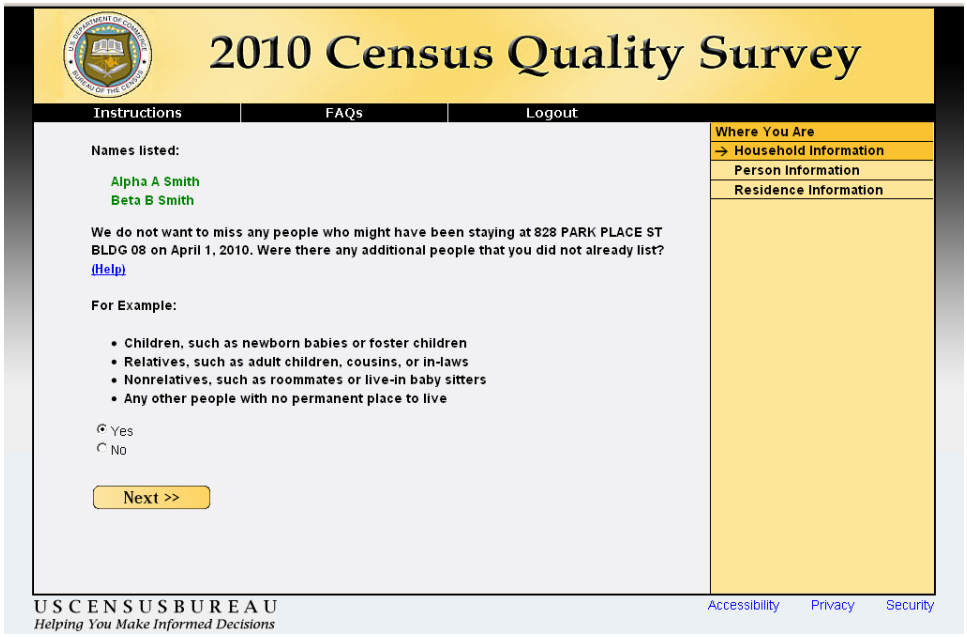
This screen provided an auto-generated PIN to respondents so that they could come back to the survey if they exited before submitting. The PIN was necessary so that other people would not be able to see a respondent's personal information if they happened to login with the respondent's access code.

Screen 10



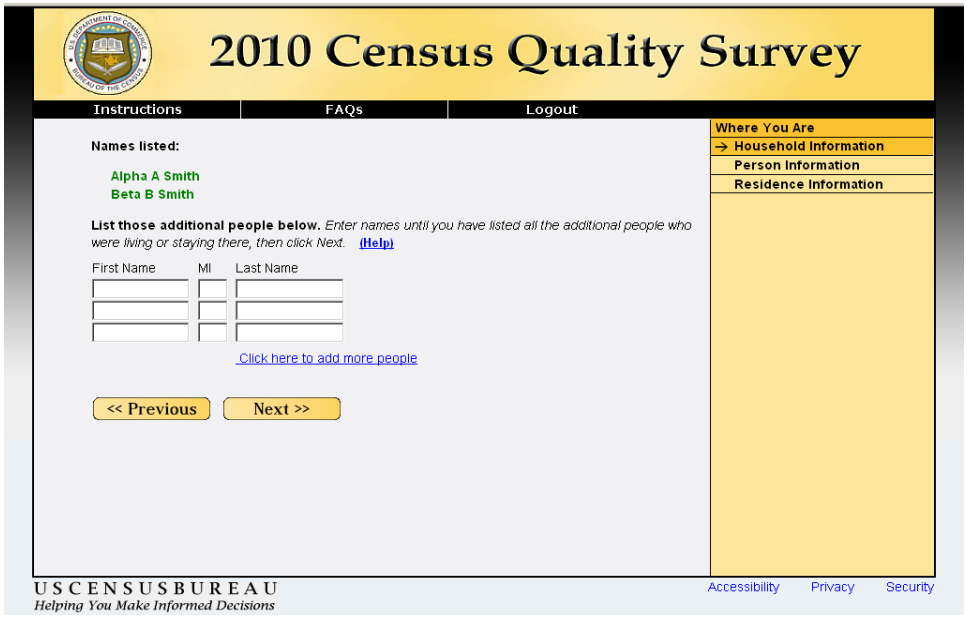
To build a roster for the household, we asked for usual residents (on this screen), and then asked a follow-up question (on Screen 11) that probed about a handful of situations we know lead to omissions and erroneous enumerations. Respondents could enter names for six persons and then use the "click here to add more people" link to get additional name fields in multiples of six, up to a maximum of 48.

Screen 11



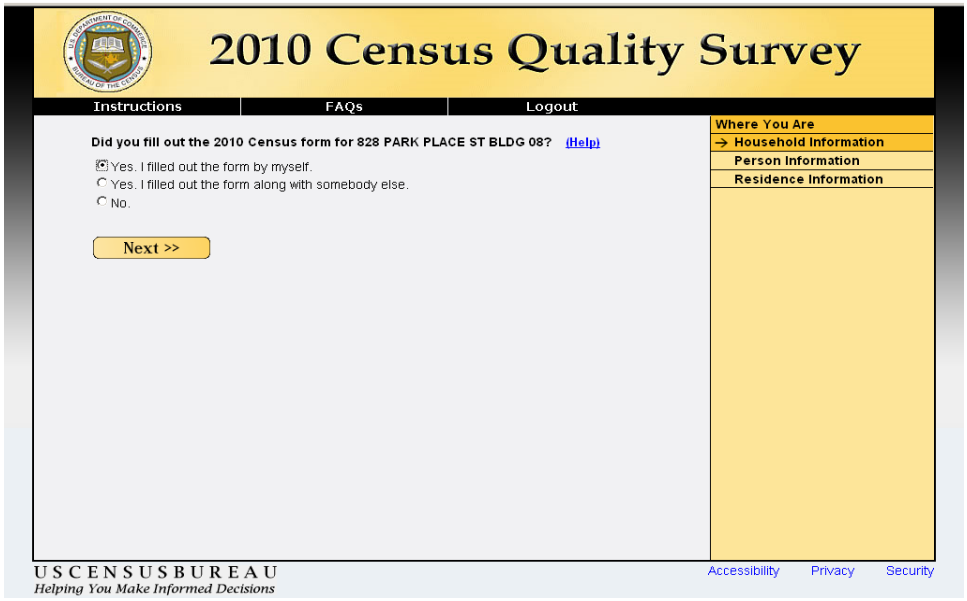
Previously entered roster names (from Screen 10) appeared in green text and respondents were reminded of a handful of situations we knew led to omissions and erroneous enumerations. If respondents answered "Yes" they were taken to Screen 12 and asked to provide the missing names. If respondents answered "No" they were taken to Screen 13 to continue the survey.

Screen 12



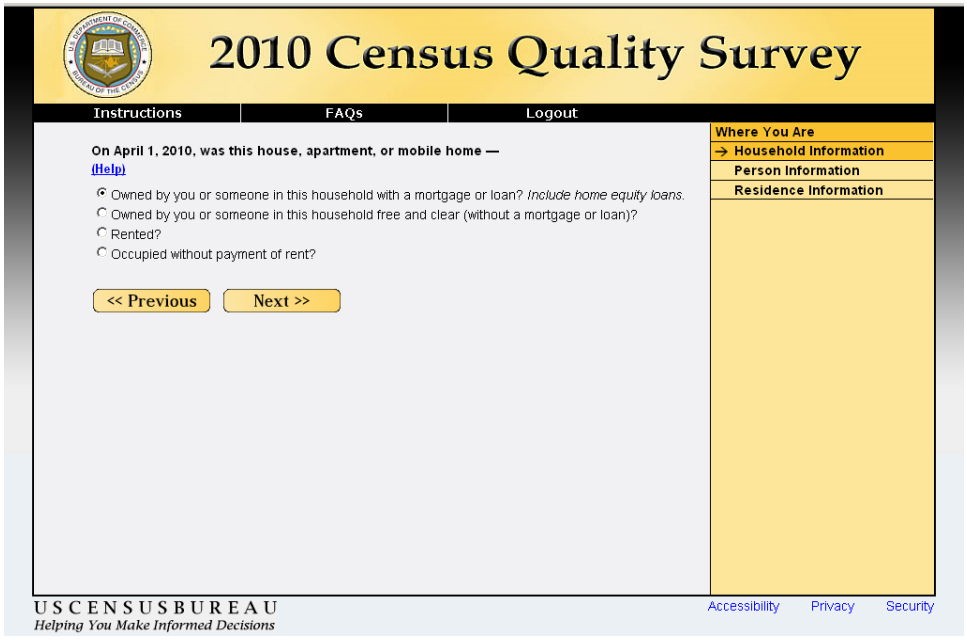
This screen allowed respondents to enter the names of household members they left off the main roster (Screen 10). For reference, the names entered on the roster were presented in green text.

Screen 13



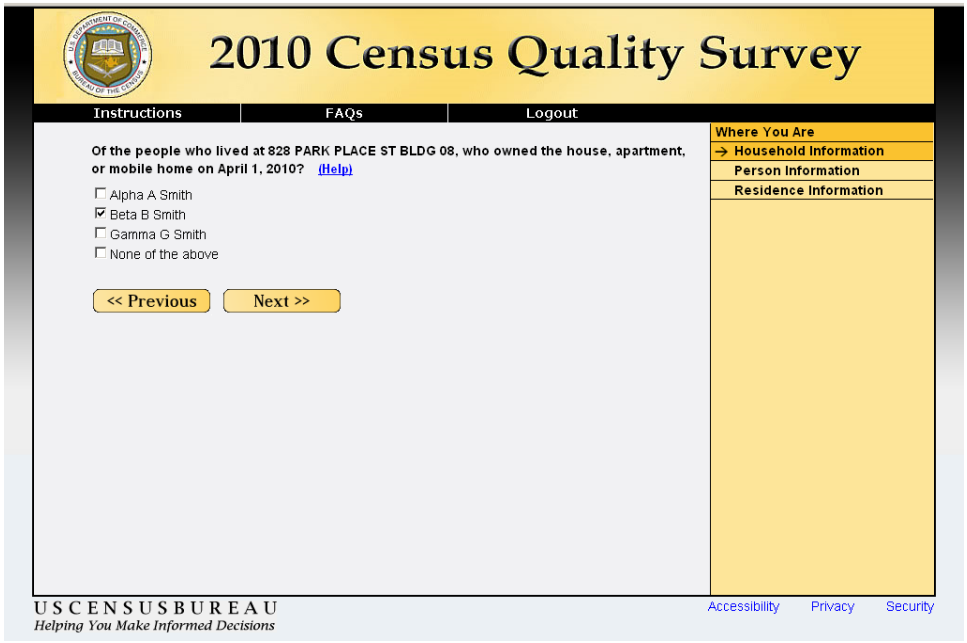
The results from this question were used for analysis purposes to identify whether or not the same respondent completed both the 2010 Census and the CQS reinterview questionnaire. The comparison of results from the same respondent was important to measurement error analysis assumptions.

Screen 14

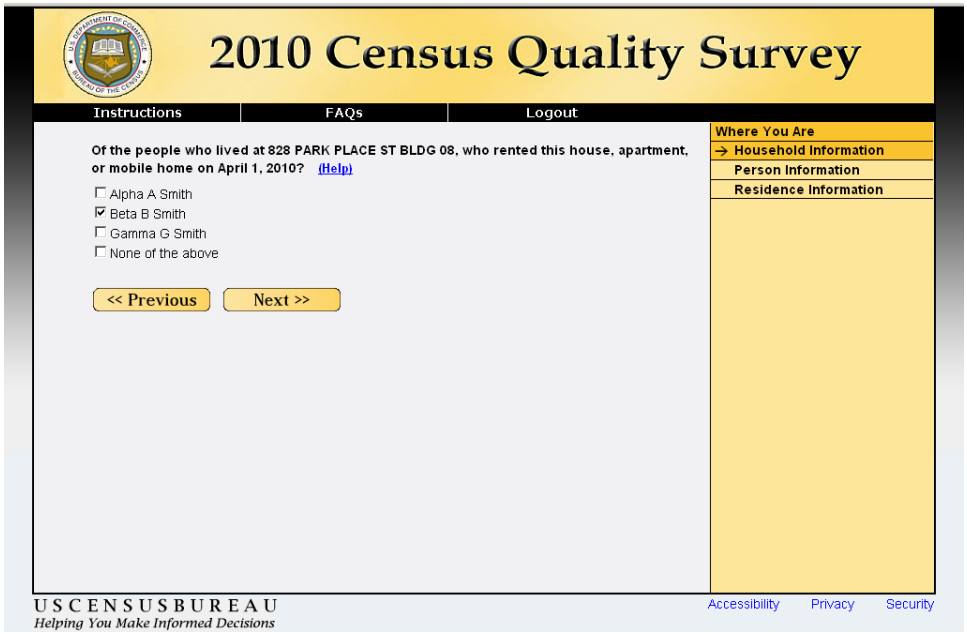


If respondents selected Option 4 (Occupied without payment or rent) or left this question blank, they skipped the question that asked who owned/rented the unit and were taken to Screen 17. Since we could not use the name of the owner/renter to determine a reference person, the reference person automatically became the first person listed on the roster. This is analogous to Person 1 on the paper form. If respondents selected Option 1 or Option 2, they were taken to Screen 15 and asked about the Owner. If respondents selected Option 3, they were taken to Screen 16 and asked about the Renter.

Screen 15



Screen 16

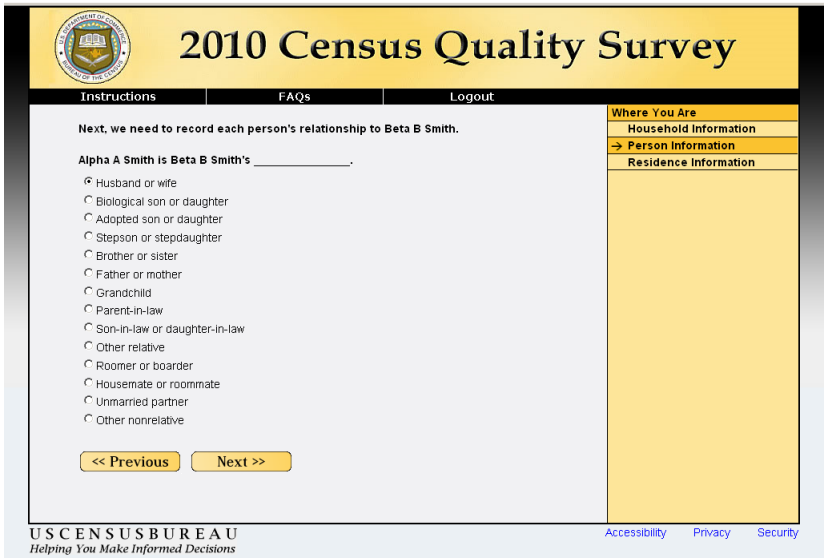


Screen 15 and Screen 16 were nearly identical and served the same purpose. Both were used to select the reference person for the remainder of the survey. The only difference between these two screens is that Screen 15 asked about the "Owner" while Screen 16 asked about the "Renter". A respondent would only see one of these screens and either would take the person to Screen 17. If one person was selected, that person became the reference person. If multiple people were selected, the first person listed - of those selected people - became the reference person. If "None of the above" is selected or the respondent did not provide an answer, the reference person became the first person on the list.

Person-Level Demographic Information Screen

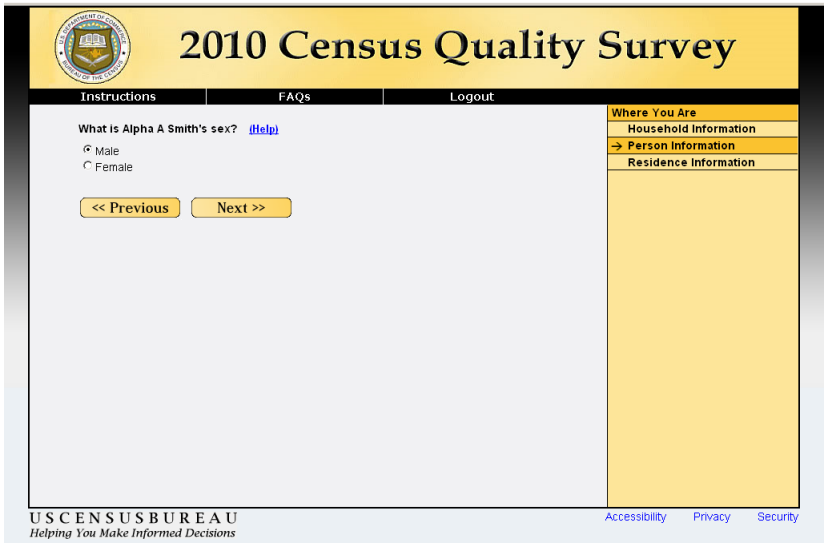
The CQS Internet instrument was designed with topic-based ordering of person items instead of person-based, as presented on the 2010 Census paper questionnaire. Since the relationship question is the first person-level item, the topic-based presentation of items begins at this screen (Screen 17). This means that respondent answered the relationship item for each household member before moving onto the next topic.

Screen 17



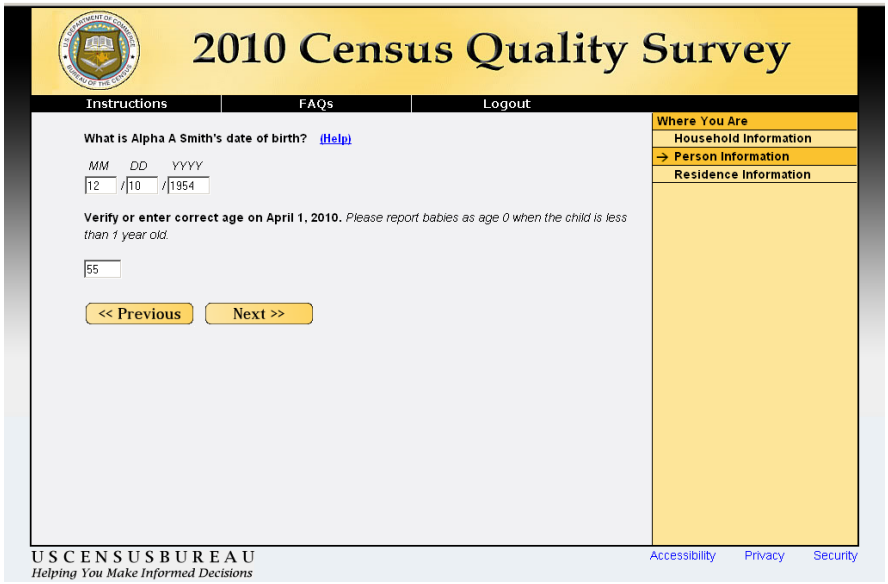
In order to improve accuracy and reduce confusion, the relationship question for the CQS Internet instrument took advantage of the ability to fill the names of both the reference person and the person for whom the relationship information was requested. More information on this can be found in Section 3.3.2 of the report.

Screen 18



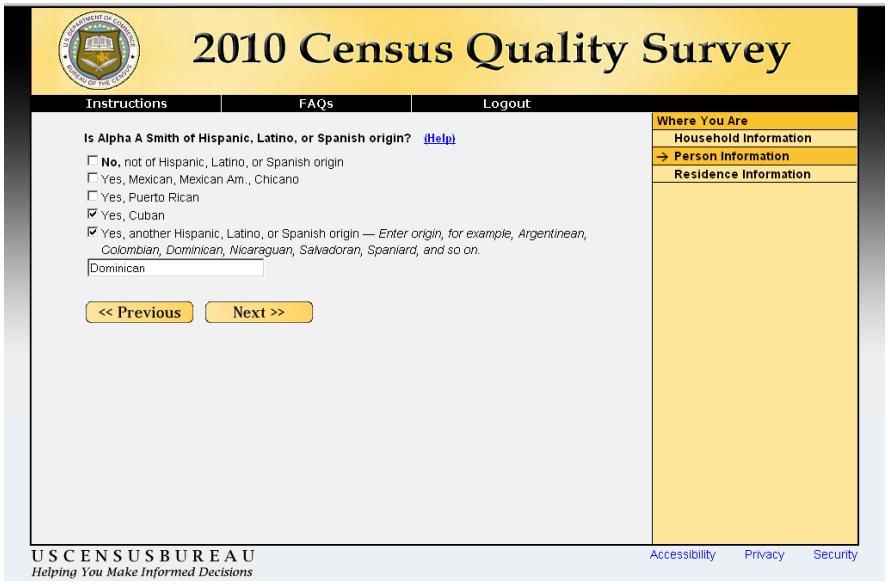
The sex question in the CQS Internet instrument was formatted such that the response boxes were aligned vertically, which was consistent with the formatting of other response boxes within the instrument. On the 2010 Census paper questionnaire, the response boxes were aligned horizontally due to the space constraints of the form.

Screen 19



The age and date-of-birth (DOB) questions in the Internet instrument appeared on the same screen, but were not as crowded as on the paper questionnaire. The DOB question appeared first and age was then automatically calculated based on the respondent-provided DOB. The age was calculated based on the reference date of April 1st.

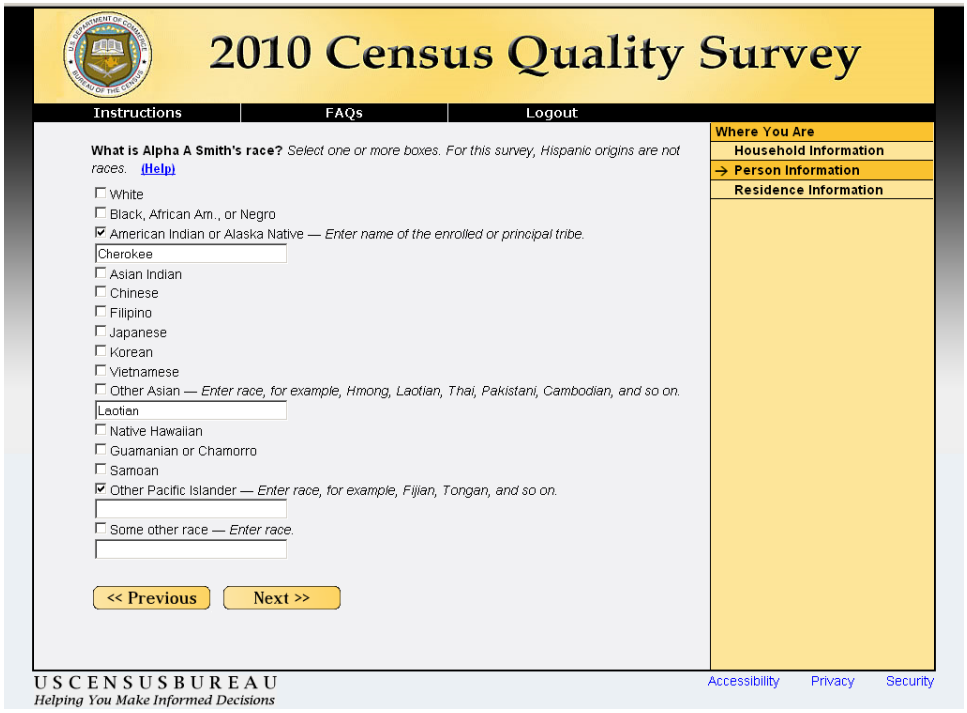
Screen 20



Note that the Hispanic origin question (with corresponding response categories) was formatted like the paper questionnaire. Like the paper form, the Internet instrument does not specifically state that the respondent could select multiple Hispanic origins. However, the response options were checkboxes that would accept multiple answers without triggering an error message.

There is evidence that respondents will provide a specific write-in wherever they have the opportunity. Given this, the check box for a category was <u>not</u> automatically marked if there was text in the write-in box. These were viewed as separate entities.

Screen 21



The paper questionnaire used banked response options due to space constraints. We chose to present all response options in a single column for this Internet instrument. Most common browser settings allowed the respondents to see all of the response options without the need for scrolling; however they may have needed to scroll to see the Next and Previous buttons. Usability results indicated that this was not problematic for users. Due to the space constraints and banked nature of the paper questionnaire, "Other Asian" and "Other Pacific Islander" both used the same write-in box. The Internet instrument was created with a single write-in box for each item.

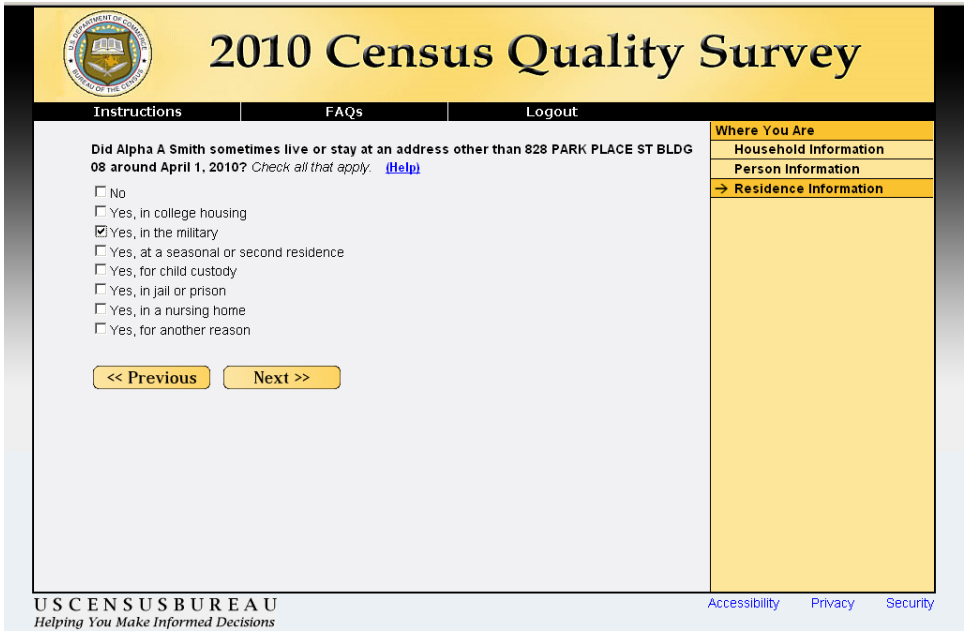
Past Census returns show that respondents used the write-in boxes to provide information that was not necessarily specific to that particular checkbox category. For example, a respondent who belonged to several American Indian tribes, and did not have enough room to indicate this in the American Indian write-in box, may have entered the remaining information into the Other Asian write-in box. For this reason, we did not consider information in a write-in box to be indicative of a "yes" response to the checkbox with which it was associated. Respondents who provided information in a write-in box but did not check the associated checkbox were not given any type of edit message and the data did not contain a "yes" response for the blank checkbox.

(Continued on next page)

Person-Level Residence Information

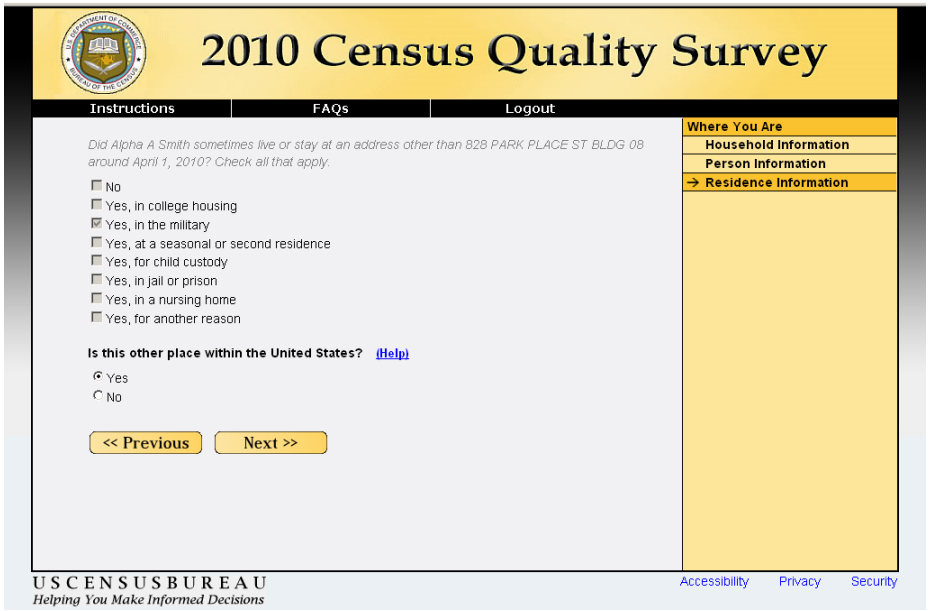
The screens in the 'Person-Level Residence Information' section were intended to provide information to help the Coverage Followup procedure. An Internet application has the ability to guide respondents through a much more complicated branching process than paper questionnaires. Given the complicated nature of this process, we opted to include a simplified version in the current survey as an initial test. For this reason, we only sought to capture one additional address. If a respondent has exactly one other place they sometimes lived or stayed, we attempt to determine where that address was and then whether or not they lived at that address most of the time on Census Day. If they had multiple other addresses or did not provide an answer, we did not attempt to collect more information. As with the previous person-level items, all items in this section were topic-based.

Screen 22



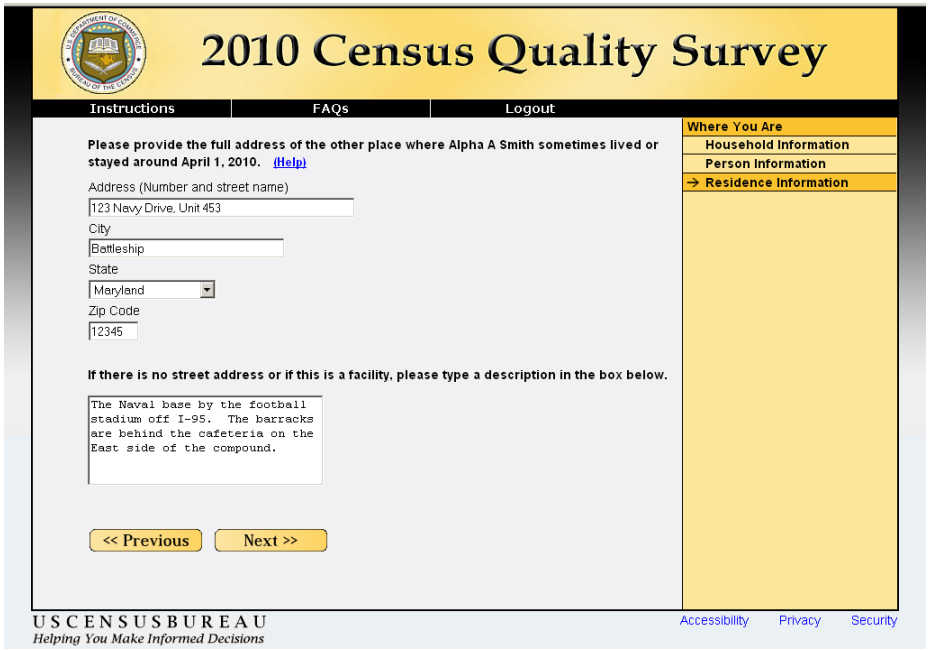
This question determined if each household member sometimes lived or stayed at a location other than the sampled address around Census Day. If respondents selected only one "Yes" response they were taken to Screen 23 to begin providing information about the additional address. If respondents selected "No", selected multiple responses, or provided no answer they would start the process over for the next household member. When all household members had been accounted for, the respondents would be taken to the review/submit screen (Screen 27).

Screen 23



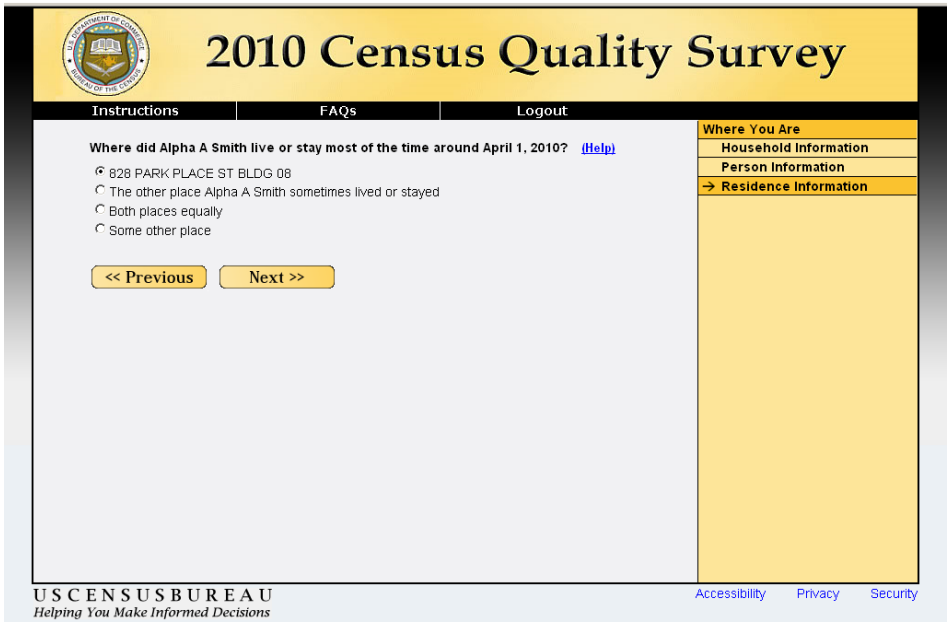
This question was used as a filter for collecting the address on Screen 24 because we did not want to collect addresses that were not in the United States. We decided to only collect United States addresses for two reasons: (1) We would never be able to follow up with a non-US address and it is, therefore, not useful; and (2) We did not want to add in the complexity of determining how to ask for foreign addresses in this initial test.

Screen 24



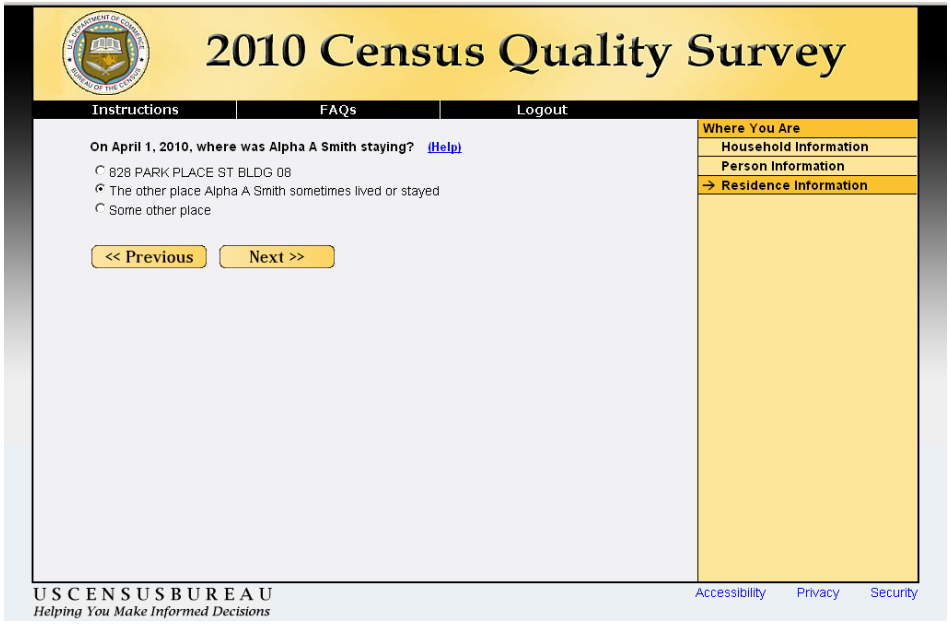
The purpose of this screen was to collect an address for the other place that the household member sometimes lived or stayed (as referenced in Screen 22). As stated earlier it is our hope that an Internet instrument will be sophisticated enough to reduce the number of cases that go to Coverage Followup.

Screen 25



This screen determined where the household member lived or stayed most of the time around Census Day. Response option 1 was the sampled address that had been referenced throughout the instrument. Response option 2 was meant to refer to the address/description provided on Screen 24.

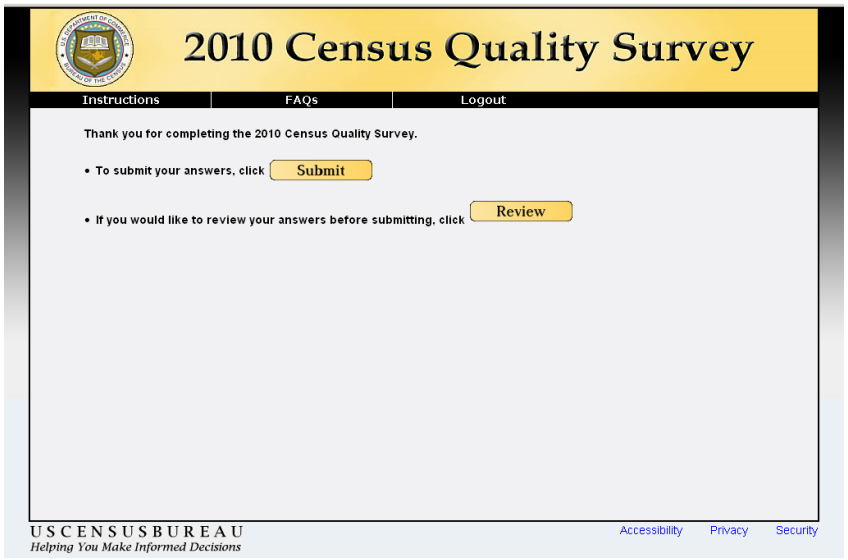
Screen 26



This screen determined where the household member was staying on Census Day. Response option 1 was the sampled address that had been referenced throughout the instrument. Response option 2 was meant to refer to the address/description provided on Screen 24. Unlike Screen 25, which had the "both places equally" option, this question required respondents to select a single location for each household member.

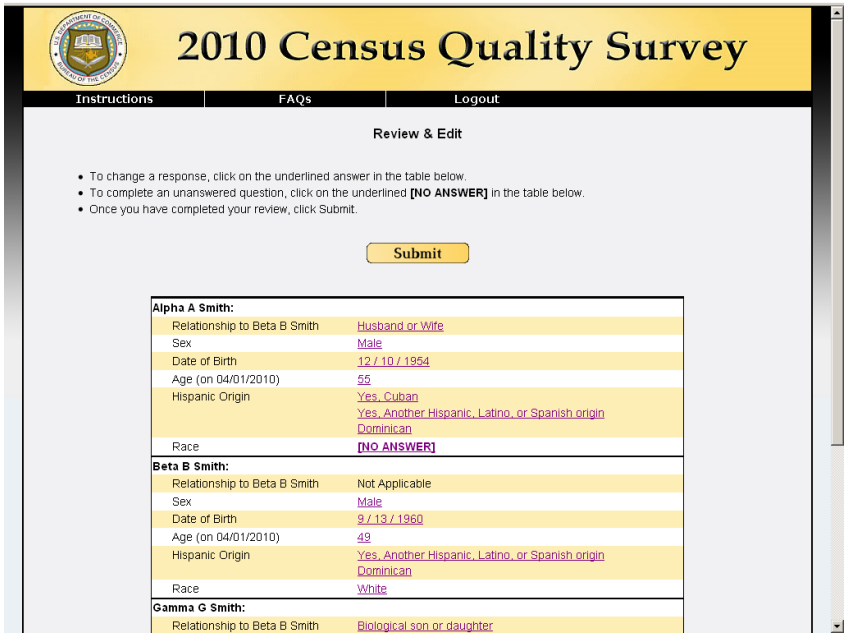
Review and Submit Screens

Screen 27



After all the data items were finished, respondents had the opportunity to review their answers before submitting. Those who wished to review were taken to Screen 28. Those who did not wish to review, and pressed the submit button, were shown a "Thank you" message and told that their survey had been successfully submitted.

Screen 28



The review screen displayed respondent answers to the 'Person-Level Demographic' items. Respondents could click the linked response to go back to that screen and alter the information. If a respondent did not provide a response, the review screen displayed [NO ANSWER]. We did not display Household-Level or Person-Level Residence questions because many of those questions had skip patterns that could not be accounted for.