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**2010 CENSUS PLANNING MEMORANDA SERIES**

**No. 232**

MEMORANDUM FOR        The Distribution List

From:                     Burton Reist *[signed]*  
                              Acting Chief, Decennial Management Division

Subject:                  2010 Census Coverage Measurement Recall Bias Study

Attached is the 2010 Census Coverage Measurement Recall Bias Study 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 any questions about this document, please contact Kyra Linse at 301-763- 9280, Travis Pape at 301-763-5744, Lora Rosenberger at 301-763-3447, or Graciela Contreras at 301-763-5284.

Attachment

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# **The 2010 Census Coverage Measurement Recall Bias Study**

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

## **Final Report**

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**Decennial Statistical Studies Division**



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## Table of Contents

Executive Summary .....	ix
1 Introduction.....	1
1.1 Scope.....	2
1.2 Intended Audience .....	2
2 Background.....	2
3 Methodology.....	5
3.1 Questions to be Answered .....	5
3.2 Methods .....	10
4 Limitations .....	12
5 Results.....	13
REVIEW OF RECALL BIAS ERROR.....	13
5.1 <i>What were the response rates and contact rates for the Recall Bias Study across panels? .....</i>	<i>13</i>
5.2 <i>Is there a significant change in the percentage of people who reported moving in March or April of 2010 in the first panel compared to each subsequent panel? .....</i>	<i>17</i>
5.3 <i>Is there a significant increase in the number of people who cannot recall a move date in 2010 from one panel to another?.....</i>	<i>24</i>
5.4 <i>Is there a significant change in the certainty of move date reported in March or April of 2010 from one panel to another?.....</i>	<i>27</i>
5.5 <i>Does the completeness of alternate addresses reported significantly change from one panel to another? .....</i>	<i>28</i>
REVIEW OF THE NATIONAL CHANGE OF ADDRESS FILE .....	35
5.6 <i>What percentage of households contacted in the National Change of Address Match Sample at least reported an alternate address? .....</i>	<i>35</i>
5.7 <i>What percentage of households contacted in the National Change of Address Match Sample reported at least one person moving sometime in 2010?.....</i>	<i>37</i>
5.8 <i>How accurate are the type of move indicators on the National Change of Address file? .....</i>	<i>39</i>
5.9 <i>What percentage of households contacted in the National Change of Address Match Sample reported a move in March or April of 2010?.....</i>	<i>41</i>
5.10 <i>How many cases (telephone numbers) ended up contacting either the corresponding name or address on the National Change of Address file? .....</i>	<i>43</i>
5.11 <i>How did the person match, address match and mover status overlap in the National Change of Address Match Sample? .....</i>	<i>49</i>
COMPARISON OF LANDLINE AND CELLULAR PHONES.....	54
5.12 <i>What are the differences in the types of interview outcomes by sample? .....</i>	<i>54</i>
5.13 <i>Did we reach the respondent at their sampled way of contact?.....</i>	<i>55</i>
5.14 <i>Did the respondents have an alternate mode of contact?.....</i>	<i>56</i>
5.15 <i>Did it take more call attempts to reach cellular phone respondents than landline telephone respondents?.....</i>	<i>57</i>
5.16 <i>Is there a length of interview time difference between each strata? .....</i>	<i>58</i>
5.17 <i>Did we reach cellular phone respondents at different times of day than landline respondents? .....</i>	<i>59</i>
5.18 <i>Do the people who completed the interviews on cellular phone have different demographic characteristics than those who completed the interviews via landline?....</i>	<i>62</i>

6	Related Evaluations, Experiments, and/or Assessments .....	68
7	Key Lessons Learned, Conclusions, and Recommendations.....	68
7.1	Conclusions.....	68
7.2	Recommendations.....	72
8	Acknowledgements.....	73
9	References.....	73
	Appendix A: Detailed Tables.....	75
	Appendix B - List of Acronyms .....	95

## LIST OF TABLES

<i>Table 1: Recall Bias Study Panel Descriptions.....</i>	4
<i>Table 2: Random Digit Dialing Sample: Distribution of Interview Outcomes by Panel.....</i>	14
<i>Table 3: Mover Sample: Distribution of Interview Outcomes by Panel.....</i>	15
<i>Table 4: Response Rates by Sample and Panel.....</i>	16
<i>Table 5: Contact Rates by Sample and Panel.....</i>	17
<i>Table 6: Percentage of Households Reporting any Move in 2010 by Sample by Panel, Weighted.....</i>	17
<i>Table 7: Percentage of Households Reporting a 2010 March or April Move by Sample by Panel, Weighted.....</i>	18
<i>Table 8: Random Digit Dialing Sample: Percentage of Whole Household Mover and Non-Whole Household Movers for March/April Movers by Panel, Weighted.....</i>	21
<i>Table 9: Mover Sample: Distribution of Whole Household Mover and Non-Whole Household Movers for March/April Movers by Panel, Weighted.....</i>	22
<i>Table 10: Random Digit Dialing Sample: Percentage of 2010 March and April Movers by Tenure by Panel, Weighted.....</i>	23
<i>Table 11: Mover Sample: Percentage of 2010 March and April Movers by Tenure by Panel, Weighted.....</i>	24
<i>Table 12: Random Digit Dialing Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted.....</i>	25
<i>Table 13: Mover Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted.....</i>	25
<i>Table 14: Mover Sample: Percentage of Alternate Address Completeness Levels for 2010 March or April Movers, Weighted.....</i>	29
<i>Table 15: National Change of Address Match Sample: Percentage of Households that Reported an Alternate Address.....</i>	35
<i>Table 16: National Change of Address Match Sample: Percentage of People Reported to have Alternate Addresses.....</i>	36
<i>Table 17: National Change of Address Match Sample: Percentage of Household Final Move Status by Panel.....</i>	37
<i>Table 18: National Change of Address Match Sample: Percentage of Final Household Mover Status by Panel for Owner Households.....</i>	38
<i>Table 19: National Change of Address Match Sample: Percentage of Final Household Mover Status by Panel for Non-Owner Households.....</i>	38
<i>Table 20: National Change of Address Match Sample: Percentage of Household Mover Status by Permanency Flag.....</i>	39
<i>Table 21: National Change of Address Match Sample: Percentage of Family Move Flag by Type of Move Reported for Movers and Long-Term Cyclers.....</i>	40
<i>Table 22: National Change of Address Match Sample: Percentage of Reported Move Month by Panel for Households with a Mover or Long-term Cycle Status.....</i>	41
<i>Table 23: National Change of Address Match Sample: Percentage of Key Move Date by Household Move Status.....</i>	42
<i>Table 24: National Change of Address Match Sample: Distribution of Household Person Matches by Panel.....</i>	43
<i>Table 25: National Change of Address Match Sample: Distribution of Household Mover Status by Household Person Match Codes.....</i>	44

<i>Table 26: National Change of Address Match Sample: Overall Distribution of Households by Household Move Status and Household Person Match Code .....</i>	<i>45</i>
<i>Table 27: National Change of Address Match Sample: Distribution of Match Results for "To" Addresses by Panel .....</i>	<i>46</i>
<i>Table 28: National Change of Address Match Sample: Distribution of Match Results for "From" Address by Panel .....</i>	<i>47</i>
<i>Table 29: National Change of Address Match Sample: Distribution of "To" Address Match Codes by Household Person Match Code .....</i>	<i>48</i>
<i>Table 30: National Change of Address Match Sample: Distribution of "From" Address Match by Household Person Match Code .....</i>	<i>49</i>
<i>Table 31: Random Digit Dialing Sample: Cellular Phone Sample Interview Outcome Distribution by Panel .....</i>	<i>54</i>
<i>Table 32: Random Digit Dialing Sample: Distribution of Landline Telephone Sample Interview Outcome by Panel .....</i>	<i>55</i>
<i>Table 33: Random Digit Dialing Sample: Respondent's Interview Type by Sample .....</i>	<i>56</i>
<i>Table 34: Random Digit Dialing Sample: Response Rates by Telephone Strata by Panel ...</i>	<i>57</i>
<i>Table 35: Random Digit Dialing Sample: Call Attempts by Telephone Strata .....</i>	<i>58</i>
<i>Table 36: Random Digit Dialing Sample: Interview Times per Telephone Strata .....</i>	<i>59</i>
<i>Table 37: Random Digit Dialing Sample: Race Distribution of Respondents by Telephone Strata .....</i>	<i>65</i>



**LIST OF FIGURES**

*Figure 1: Mover Sample: Distribution of the Move Month Reported.....* 20

*Figure 2: Random Digit Dialing Sample: Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted .....* 26

*Figure 3: Mover Sample: Move Date Knowledge for Whole Household and Non-Whole Household Moves by Panel, Weighted .....* 27

*Figure 4: Mover Sample Alternate Address Completeness Level for 2010 March or April Moves (Totally Complete) by Whole Household Type, Weighted .....* 30

*Figure 5: Random Digit Dialing Sample: Alternate Address Completeness Knowledge by Lapsed Time, Weighted .....* 31

*Figure 6: Random Digit Dialing Sample: Alternate Address Completeness Knowledge for Totally Complete Addresses by Lapsed Time, Weighted .....* 32

*Figure 7: Mover Sample: Alternate Address Completeness Knowledge by Lapsed Time, Weighted.....* 33

*Figure 8: Mover Sample: Alternate Address Completeness Knowledge for Totally Complete Addresses by Lapsed Time, Weighted .....* 34

*Figure 9: Non-mover Households - Perfect Match Component Overlap .....* 50

*Figure 10: Mover Households - Perfect Match Component Overlap.....* 51

*Figure 11: Non-mover Households - Component Match (Perfect and Possible) Overlap .....* 52

*Figure 12: Mover Household - Component Match (Perfect and Possible) Overlap .....* 53

*Figure 13: Random Digit Dialing Sample: Percent of Completed Interviews by Day and Time per each Telephone Strata.....* 60

*Figure 14: Random Digit Dialing Sample: Sex Distribution of Recall Bias Study Respondents by Telephone Strata.....* 63

*Figure 15: Random Digit Dialing Sample: Hispanic Origin Distribution of Respondents...*  64

*Figure 16: Random Digit Dialing Sample: Respondents Age Distribution by Telephone Strata .....* 66

*Figure 17: Random Digit Dialing Sample: Mover Distribution by Telephone Strata.....* 67

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## Executive Summary

This document provides a record of the results of the 2010 Census Coverage Measurement Recall Bias Study. The Recall Bias Study was conducted to obtain initial results to validate the hypothesis about the existence and increase of recall bias with respect to reporting residence around Census Day (April 1, 2010) in operations that happen over the several months following Census Day. This study aims to determine if future research is needed into the influences and reasons for recall bias as it pertains to the timing of the Census Coverage Measurement Person Interview and Person Followup operations. The second part of this report reviews how well administrative data obtained from the United States Postal Service National Change of Address file worked as a tool in identifying households with people who moved around March and April of 2010. Finally, the third part of the report examines some results and characteristics of contacts made using a cellular phone random digit dialing sample compared to a standard landline telephone random digit dialing sample.

The 2010 Census Coverage Measurement was a large, complex survey conducted independently of the census. Two of the five field operations conducted were Person Interview, conducted mid-August to early October 2010, and Person Followup, conducted late January to mid-March 2011. The purpose of the Person Interview was to obtain information about the residents of the sample housing unit at the time of the interview. This included non-movers and people who had moved into the selected housing unit since Census Day (inmovers). In addition, it collected information about certain persons who moved out of the sample housing unit between Census Day and the time of the interview (outmovers). The late interview in the Person Followup operation collected information to help resolve Census Day residence status, enumeration status, match status, or potential person duplication found when matching census and Person Interview person records.

For the 2010 Census Coverage Measurement operations, both the Person Interview and Person Followup operations were conducted later than in previous post-enumeration surveys. As a review of the 2010 Census Coverage Measurement results and for consideration in planning the timing of the 2020 Census Coverage Measurement operations, we reviewed if this change in timing affected the respondent's ability to report timing and addresses related to potential moves around Census Day as time between the move event and the interview increases.

The Recall Bias Study collected data in four separate panels in 2010 and 2011. These panels were selected to represent the approximate timing of Census Coverage Measurement operations. The study was conducted by telephone using a Computer Assisted Telephone Interview instrument. The study used the Census Bureau's 2006 Questionnaire Design Experimental Research Survey telephone data collection questionnaire. This questionnaire collects an independent roster of people currently living or staying in the contacted housing units and asks questions similar to those in the Person Interview and Person Followup operations.

The four independent panels were selected using a dual-frame design. The first frame of the study was a random digit dialing list of telephone numbers containing both landline

telephones and cellular phones. The second frame of the study was the Mover Sample and consisted of records that matched between the 2010 Master Address File<sup>1</sup> and an extract of the United States Postal Service National Change of Address file. Each of the four panels consisted of 10,000 housing units. Panel 1 (May 2010) consisted of 10,000 Random Digit Dialing<sup>2</sup> housing units. The 10,000 housing units of Panels 2 (June 2010), 3 (September 2010), and 4 (February 2011) were split between 5,500 Random Digit Dialing cases and 4,500 Mover Sample cases. Comparing the percentage of moves reported for March or April of 2010 in the control panel (Panel 1) to the percentage of March/April 2010 moves reported for the later panels should let us measure the rate of change in recalling and reporting moves as the time of interview moves away from the move date.

The Mover Sample was only implemented in the last three panels. As mentioned previous, the Mover Sample composed of records in the 2010 Census Master Address File that matched an extract of the United States Postal Service National Change of Address file. This extract of the National Change of Address file was dated May 1, 2010 and only contained records that had reported a change of address (moves<sup>3</sup>) in either March or April of 2010 by May 1<sup>4</sup> 2010. While allowing us to do some review of the National Change of Address file, this sample should have also provided greater statistical efficiency on measuring recall bias from a relatively small sample by allowing us to target in sample a larger universe of known movers.

### **Did the Recall Bias Study show any possible recall bias in the Census Coverage Measurement time frame?**

In order to measure the percentage of households reporting a move, each person included in the analysis was assigned one of four mover types for this study. These are:

- **Non-mover** - Person who did not mention any moves occurring during 2010. This includes both people with no other place where they stayed, and short-term cyclers, meaning people that had short stays at more than one address, such as children in a custody situation where they visit a parent every weekend.
- **Mover** - Person who moved from one address to another without any indications of a possible return to the previous address.
- **Long-term cyler** - Person who acted like a mover but reported a second move over a certain time (greater than 30 days) back to the original address, such as snow-birds<sup>5</sup> or

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<sup>1</sup> The 2010 Census Master Address File used for the match is a file that contains the list of all addresses in the 2010 Census last updated in March of 2010. This file included most updates from 2010 Address Canvassing operations, but all census operations and reviews may not have been complete at that time.

<sup>2</sup> The number of eligible cases for the final analysis Random Digit Dial universe was much smaller than expected. Though the study contained 26,500 Random Digit Dial telephone numbers, only approximately 25 percent (6,536) of these Random Digit Dial cases proved to be eligible and considered in the analysis. This is mainly due to a much lower than expected response rate.

<sup>3</sup> While it is possible these reported change of addresses do not necessarily imply an actual physical move from a housing unit to another, for our purposes they were classified as movers.

<sup>4</sup> There may be some people who moved in March or April of 2010 but completed the USPS form after May 1 and are therefore not part of this analysis.

<sup>5</sup> Snow-birds is a term used for people that have two homes they share throughout the year but move between them seasonally.

college students. These long-term cyclers were included in this analysis as movers because in a regular census scenario, their move date would be so close to Census Day that they would likely report like a normal mover (see above), and the census would not be able to identify them as cyclers and not movers.

- **Unknown** -People for whom we could not determine if they were movers during 2010 based on the information collected. Most of the time there is some sort of contradictory information for these people.

If the household contained at least one mover or a long-term cycler, then the household was treated as either a mover or long-term cycler household. If everyone in the household was a non-mover, then the household was a non-mover household. The remaining cases are households with an unknown move status.

Because we have a representative sample in each panel, we would expect the overall proportion of households with moves and other residences reported for March and April of 2010 to be consistent across all panels. If we measured significant changes in proportions of moves in March and April of 2010 across panels, we would conclude that the data (respondents' answers) had changed and we would measure the amount of change as a function of the time lag between the move event in March and April of 2010 and the Recall Bias Study interview date. In general, we will compare the percentage of moves reported for March and April of 2010 in the Random Digit Dialing Sample in Panel 1 (May 2010) to those percentages of 2010 March and April moves reported in later panels. This comparison should allow us to measure the rate of change in recalling and reporting moves during this time frame. For the Mover Sample, we will compare the move rates for Panel 3 (September 2010) and Panel 4 (February 2011) to the results of Panel 2 (June 2010). If this change is a decrease compared to Panel 2, we can link this change as a possible issue with the respondent's ability to report the move around Census Day.

The following table shows the distribution of results by panel of the weighted percentage of households contacted who reported at least one person who moved during the months of March or April of 2010 for the Random Digit Dialing and Mover Samples.

<i>Percentage of Households Reporting a 2010 March or April Move by Sample by Panel, Weighted</i>												
	Panel											
	1 (May 2010)			2 (June 2010)			3 (September 2010)			4 (February 2011)		
	<i>M*</i>	<i>LC**</i>	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall
Random Digit Dialing Sample	2.80 (0.19)	0.78 (0.08)	3.57 (0.21)	2.93 (0.25)	0.50 (0.09)	3.43 (0.27)	2.35 (0.21)	0.69 (0.10)	3.04 (0.23)	2.84 (0.27)	1.03 (0.14)	3.87 (0.30)
Mover Sample	N/A	N/A	N/A	28.72 (0.94)	9.63 (0.62)	38.34 (1.01)	23.76 (0.95)	8.63 (0.63)	32.39 (1.05)	18.99 (0.92)	2.61 (0.39)	21.60 (0.97)
*M is Movers    **LC is Long-term cyclers    N/A is not applicable Standard Errors are in parentheses Shaded cells have counts less than 30 Data Source: Recall Bias Study Output												

### Random Digit Dialing Sample Results

Using Panel 1 (the control panel), the expected percent of households reporting a move in March or April of 2010 across the panels should be 3.57 percent, split between 2.80 percent real movers and 0.78 percent long-term cyclers. Overall, the Random Digit Dialing Sample shows no significant difference when comparing Panel 2 to Panel 1, and Panel 4 to Panel 1 in the weighted percentage of those households reporting a move during March or April of 2010 (p-values of 0.6811 and 0.4090, respectively). The only significant difference noted when comparing the weighted percentages of households reporting a move during March or April of 2010 existed between Panel 3 and Panel 1 (p-value of 0.0876). The Random Digit Dialing Sample true mover households saw no significant differences between Panels 2, 3, and 4 compared to Panel 1 (p-values of 0.6826, 0.1103, and 0.9029, respectively). The long-term cyler households were not tested to determine significance because the analysis universe was not large enough to give sufficient power to the tests.

### Mover Sample Results

Only Panels 2, 3, and 4 were included in the Mover Sample and Panel 2 was the control Panel for this analysis. There were 38.34 percent of moves during March or April of 2010 reported in Panel 2. Overall, the Mover Sample shows a decrease in the percentage of households who reported a 2010 March or April move compared to the control panel, and this is an indication of respondents possibly having a decrease in recall ability for reporting moves during March or April of 2010 as the interviews get farther from the move date. The Mover Sample shows significant differences between Panels 2 and 3, and Panels 2 and 4 (p-values <0.0001). The proportion of moves reported for Panel 3 was 32.39 percent and Panel 4 reported 21.60 percent. Therefore, we see evidence of potential recall bias error as time elapses since Census Day. When separating the type of household move (true mover or long-term cyler) we observe significant differences of the identified true mover households between Panels 2 and 3, (38.34 percent to 32.39 percent), and Panels 2 and 4 (38.34 percent to 21.60 percent) (p-values of 0.0002 and <0.0001, respectively). For the long-term cyler households, significant differences were only observed between Panel 2 and Panel 4 (9.63 percent to 2.62 percent) (p-value <0.0001). The decrease in long-term cyclers is only slight between Panels 2 and 3 of the Mover Sample and proved not significant (p-value of 0.2583).

### Conclusion

The Random Digit Dialing Sample shows there is possible recall bias collecting information between May and September to determine a person's residence on Census Day. With more strength of the numbers in the Mover Sample, it also shows possible recall bias between June and September, and June and February of the following year. Therefore, the overall results indicate the potential existence of recall bias when using the 2010 Person Interview and Person Followup timeframes to collect information on moves in the March and April of 2010 timeframe, but moving the operations closer to Census Day (i.e., June) does not seem to eliminate the potential error (though this may minimize it).

## Recommendations

For Census Coverage Measurement operations, research aimed at resolving recall bias compared to possible contamination error if some census and coverage survey operations are conducted concurrently needs to be resolved. Dependent on this research, our main recommendation is to attempt to conduct all surveys involving collection of the number of moves and move dates around Census Day (April 1) as close to the actual event as possible. If we move the interview closer to when census operations are being conducted, we need to know if the positive gains in limiting recall bias error outweigh the possible error from contamination of Census Coverage Measurement operations being so close to census operations.

While not directly linked to recall bias, another reason to collect survey data as close to Census Day as possible is because Panel 2 (June) saw the highest percentage of response rates in both the Random Digit Dialing and Mover Samples. We believe this higher response rate in June resulted from the overlap with census media events and advertising. We also recommend research to compare conducting similar interviews late in the year instead of crossing into the new year to determine if the change in year is the main factor when differences are observed or if it is just the amount of time that has elapsed since the date of interest. The research should focus on collecting moves and move dates with emphasis on confirming the year of the move they are reporting and interviewers should record any attempt at possible reporting of future moves. It should also probe after the initial collection to make sure respondents do not underreport moves that happened early in the census year. Finally, we recommend researching respondents who are considered long-term cyclers and determine how to best ascertain their true move patterns and their ability to recall and report them. This may allow us to identify them in Census Coverage Measurement operations and help determine how to better handle them in processing their true residence.

## **Did the National Change of Address file help identify households with movers or complex living situations?**

The Census Bureau is researching possible use of administrative records to help make the census more effective with less costs and resources. One of those possible administrative records source is the National Change of Address file. For Census Coverage Measurement, a thought was that these data could help identify housing units that are more likely to have movers or cyclers and may have more complicated household living arrangements. Specifically, we hoped the Mover Sample created by matching the 2010 Census Master Address File to the National Change of Address file from May 2010 would have identified households that had movers around April 1, 2010. The following section addresses how well the reports (moves, move dates, addresses, and names) in the National Change of Address file align with what was collected in our survey.

Hence, for this question, all results are from the sample chosen with the help of the National Change of Address file. This sample is slightly larger than the analysis universe used above,

because we did not have to delete cases with missing data<sup>6</sup> as was required above with the Mover Sample for weighting purposes. For clarity, we will refer to this as the National Change of Address Match Sample. This research is only focused on how good the National Change of Address file is as a tool to identify movers and is not assessing possible recall bias. These percentages are not weighted.

## Results

Overall, the percentage of National Change of Address Match Sample households reporting a move in the interview was much lower than we expected. Below we report the overall results and occasionally, Panel 2 (June 2010) results are also reported to show the highest percentages of moves reported in the study, which were different from the overall results.

- Overall, 54.22 percent of the National Change of Address Match Sample households contacted in our survey had at least one alternate address reported. The overall percent of mover and long-term cyler households collected was 46.92 percent.
- As expected, the majority (64.74 percent) of the mover and long-term cyler households across the three panels reported a move in March or April of 2010, with the highest percentage (74.09 percent) reported in Panel 2. An additional 15.99 percent of households reported a move date in February or May. It is possible these additional moves reported before and after March and April of 2010 could represent a combination of skewed date reporting (either on the National Change of Address file or in the study) and/or the possible completion of the National Change of Address form by some people to request when they would have liked their mail to be sent to a new address and not necessarily a move date.
- When looking at the names reported in the study for the National Change of Address Match Sample, only 42.06 percent of the households reported the full name of the person listed on the National Change of Address file. There were 12.09 percent of the households that reported a portion of the person's name (first or last) and could be a possible match, and 25.24 percent of the households we could not match because they were unknown (no names given but a description like "Mister" or "Lady of the House"). For 20.61 percent of the households, the names collected in the survey did not match those on the National Change of Address file.
- The National Change of Address file provided two addresses, the "To" address and the "From" address for the move. We attempted to reach people at the "To" address, therefore the address used to do the telephone look-up was the "To" address. In theory the "To" address should have had a high match rate since a move did not need to be reported in our study for the addresses to possibly match. There was an overall match of 81.54 percent to the "To" addresses. The non-match address percentage was 1.58 percent. So the telephone number look-up was successful in getting us to the correct address we wanted to contact, which makes the lower rates in name matches and moves reporting more surprising.

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<sup>6</sup> The weighting procedures required a case to have tenure and whether the respondent had both a landline and cellular phone.



- Only movers or people with more than one address would have a “From” address to match. We expected a high percentage of people who matched, but since we got such a low percent of people reporting a move, this impacts the number of possible matches. The overall match rate for “From” addresses was 26.32 percent and the non-match rate was 55.67 percent. There were more “From” address matches in Panel 2 at 29.39 percent and 51.16 percent were non-matches.
- For the National Change of Address Match Sample households that reported a move in the study, the survey data matched (including possible matches<sup>7</sup>) to the National Change of Address file as shown below:
  - the address they moved from matching 62.22 percent of the time,
  - the move being reported in March or April of 2010 64.74 percent of the time,
  - the name matching for 69.60 percent, and
  - the current address matching 91.30 percent of the time.
 Still, there is no clear indicator on the file that differentiates which 50 percent of cases are likely to report the moves and which are not.
- In the end, only 14.22 percent of the National Change of Address Matched Sample households had matches to name, and both the “To” and “From” addresses, and reported a move in March or April of 2010 in our survey.

### Conclusions

We cannot ascertain correctly if the National Change of Address file is an accurate enough administrative record source to be used on its own as a tool to identify movers based on the results of this study. There are several limitations that may be confounding the results observed here. Even though the majority (64.74 percent) of the mover and long-term cycler households across the three panels reported a move in March or April of 2010, we expected the rate to be higher given that the Mover Sample reported the move to the Postal Service. It is possible the lower rates of moves/movers observed are due to respondent error in the Recall Bias Study reporting rather than errors in the National Change of Address file. We need to remember that these results could be affected by the following: the results of the telephone look-up operation, those reporting a change of an addresses without actually moving, Recall Bias Study respondents not reporting all moves, possibly due to recall error, maybe as a result of proxy responses for the actual mover within the household, or because they just did not want a move reported or wanted to end the interview.

On the other hand, the National Change of Address file could be very valuable as a secondary record to confirm an address or person that is more likely to have a move situation or to target mover universes as long as the limitations of the file are known.

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<sup>7</sup> We considered a name to be a match if it was an exact match (including nicknames such as Joseph Smith to Joe Smith) and a possible match if the first or last name matched. We considered an address a match if house number, street name, city, and state matched exactly and a possible match if at least the street, city and state matched or a PO Box from the National Change of Address file matched to the state collected in the survey.

## What were the differences in reporting between the Cellular Phone and Landline Telephone Random Digit Dialing Samples?

Each panel of the Recall Bias Study is a dual frame sample survey, where one frame is the universe of all households with a landline telephone and the second frame is all households for which at least one household member has a cellular phone number. Cellular phones were included in this study because we will need to include them in any telephone sample in our upcoming surveys. Therefore, here we review the results from the landline and cellular phone samples to see what we learned about these universes.

### Results

As it pertains to conducting a survey, we wanted to know how successful we would be at obtaining interviews for both cellular phones and landline telephones and if there was a difference in the effort needed to get complete interviews from the two groups. Landline telephone numbers had a larger percentage of completed cases than those contacted via cellular phone, 27.09 percent to 22.24 percent, respectively. But the most striking difference observed between cellular and landline contacts was in the unknown eligibility outcome. This outcome means that we did not get an answer at the dialed telephone number but the number was in service (i.e., no answer, possibly including phones being turned off). Cellular phones had a much higher percentage of unknown eligibility (20.60 percent) than that of landline telephones (8.47 percent). Cellular phone users did not answer their telephone at all 20.60 percent of the time.

Looking at the effort needed to get complete interviews for cellular and landlines, we found that getting complete interviews from cellular phone respondents required more effort. In this part of the research we had four strata—Landline only, Cellular/Landline, Landline/Cellular and Cellular only<sup>8</sup>. The most efficient stratum was the Landline only, with 31.22 percent completed with the first call attempt. Landline was in general more successful with 47.46 (Landline/Cellular) to 54.63 (Landline Only) percent of the respondents completing within the first and second call attempts via landline, while of the cellular phone interviews the response rates were 37.74 (Cellular/Landline) to 41.56 (Cellular Only) percent for first two attempts. Close to a quarter of the complete Cellular/Landline interviews required six or more attempts. In addition, cellular phone interviews generally had a longer average duration (p-values less than 0.0001 for all time duration categories) when compared to the landline telephone average durations.

Another study that compared cellular phone results to landline survey results reported that cellular only households were more likely to be in the 18 to 34 years of age range, Hispanic, single or never married, a student, and out of work, when compared to those from households with both landline and cellular phone access (Link et al. 2011). Our study found similar results.

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<sup>8</sup> The four strata are defined as:

Landline only – Respondent completed the interview on a landline telephone and reported they did not have a cellular phone.

Cellular/Landline - Respondent completed the interview on a cellular phone and reported they had a landline telephone.

Landline/Cellular - Respondent completed the interview on a landline telephone and reported they had a cellular phone.

Cellular only – Respondent completed the interview on a cellular phone and reported they did not have a landline telephone.

- In our study, Cellular only households had 41.95 percent of their interviews completed by respondents that were between the ages of 20 and 34, with the peak at 17.41 percent for those between 25 and 29 years of age. On the other end, Landline only households had 60.51 percent of their interviews completed by people 60 or older and 49.84 percent completed by those 65 or older.
- Of the total respondents, 11.43 percent reported they were Hispanic. Out of the Hispanics, the majority of the completed interviews were conducted via cellular phone at 52.26 percent. Looking at just race, the highest percentage of non-White respondents was recorded in the Cellular/Landline stratum (20.86 percent) and a higher percentage of non-Whites completed the interview via cellular phone (37.80 percent) than landline (33.13 percent).
- Of the Cellular only households, 21.32 percent were mover households, followed by 13.33 percent of households contacted from the Cellular/Landline stratum. For Landline only households, 95.44 percent of the interviews were non-movers. Movers are more often part of cellular phone only households when compared to those that have both types of communication.

#### Recommendations

Cellular phones are becoming more widely used as the main, if not the only, telephone type for a household. Because of this, they should be included in telephone surveys, but research has shown that some issues need to be considered.

- We recommend researching what other agencies are doing to attempt to increase their contact rates on cellular phones. For now, when using the cellular phones and “cold calling,” such as when using a random digit dialing sample, the sample sizes should be augmented to account for the fact that the response rates for cellular phone users will be lower than typically expected. Also, the survey duration period may need to be adjusted to account for extra call attempts required to get a response from cellular phones respondents.
- To help limit possible misreporting, when confirming that a person is on a cellular phone we need to be sure both questions and answers are clear that residential telephones lines are landline telephones.
- Because of the portable aspect of the cellular phones, when estimating the amount of time required to complete interviews including them, we need to realize that cellular phone contacts may need more time so that interviewers can explain the reason for contacting respondents on their cellular phones. One must also consider that there may also be natural distractions from contacting people away from their homes that could also extend interview duration.

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# **1 Introduction**

## **1.1 Scope**

This report provides a record of results of the 2010 Census Coverage Measurement (CCM) Recall Bias Study (RBS). The RBS was conducted to ascertain the potential existence of recall bias with respect to reporting Census Day residence during the 2010 Census cycle, and to determine if future research is needed into the influences and reasons for recall bias as it pertains to the timing of CCM Person Interview (PI) and Person Followup (PFU) operations.

This report also reviews how well the administrative data obtained from the United States Postal Service (USPS) National Change of Address (NCOA) file worked as a tool in identifying households with people who moved during March and April of 2010. Finally, this report examines some results of contacting a cellular phone random digit dialing (RDD) sample compared to a standard landline telephone RDD Sample.

## **1.2 Intended Audience**

The program managers and staff responsible for planning the 2020 Census should use this report for guidance on operational development for the 2020 Census operations, especially CCM. This evaluation will also be useful to anyone considering timing of operations as it relates to reporting moves and alternate addresses, anyone studying the use of the NCOA file, and anyone considering use of cellular phones as a contact mode for survey interviews.

# **2 Background**

The purpose of the 2010 CCM program was to evaluate coverage error in the 2010 Census in order to improve future censuses. CCM is designed to measure the census coverage of housing units and persons, excluding group quarters and persons residing in group quarters. CCM will provide estimates of the net coverage error and the components of census coverage, including omissions and erroneous enumerations. Since CCM is an evaluation, its results did not affect the results from the 2010 Census.

The 2010 CCM was a large, complex survey conducted independently of the 2010 Census. Two of the five field operations conducted by the 2010 CCM were PI, conducted mid-August to early October 2010, and PFU, conducted late January to mid-March 2011. The purpose of the PI interview was to obtain information about the residents of the sample housing unit at the time of the interview. This included non-movers and people who had moved into the selected housing unit since Census Day (inmovers). In addition, it collected information about certain persons who moved out of the sample housing unit between Census Day and the time of the interview (outmovers). The late interview in the PFU operation collected information to help resolve Census Day residence status, enumeration status, match status, or potential person duplication found when matching census and PI person records.

In 2010 CCM, both PI and PFU operations were conducted later than in previous post-enumeration surveys for both processing needs, and to ensure independence from ongoing census operations such as 2010 Census Coverage Followup. For consideration in planning the

2020 CCM timing, we needed to review if this delay in 2010 CCM operations affected the respondent's ability to accurately report timing and addresses related to potential moves around Census Day. The RBS is aimed at independently measuring respondents' ability to recall alternate addresses, move dates, and date certainty as time between the move event and the RBS interview increases. The RBS would then inform on the possibility of any memory decay pointing towards the existence of recall bias. The study is not looking into reasons for this decay or other factors besides recall bias; it is just trying to identify if there was a possible recall issue. The RBS was conducted in 2010 and early 2011 to best parallel the effect of the 2010 Census environment on respondents. For more on memory decay and recall bias, see Section 8 for references to other studies done on memory decay.

CCM RBS collected data in four separate panels. These panels were selected to represent approximate timing of operations within CCM. The four independent panels were selected from a dual-frame design. The first frame of the RBS was a RDD list of telephone numbers containing both landline and cellular phones. The sample provided by a commercial vendor contained 50 percent housing unit landline numbers and 50 percent cellular phone numbers. They were pulled from national telephone banks of viable numbers excluding numbers that were in Alaska and Hawaii area codes<sup>1</sup>. Cellular phones were included because expectations are that future censuses will need to include them in any national telephone sample because of the "growing number of households giving up their landline telephone and embracing a cellular phone only lifestyle" (AAPOR Cellular Phone Task Force, 2010). This sample gives us a national representation of the population. Comparing the percentage of moves reported for March or April of 2010 in the first (control) panel to the percentage of 2010 March or April moves reported for the later panels should let us measure the rate of change in recalling and reporting moves during this time frame.

The second sample frame was used only in Panels 2, 3, and 4. We call this the Mover Sample and it is composed of records in the Master Address File (MAF)<sup>2</sup> that matched an extract of the USPS NCOA file. This extract of the NCOA file was dated May 1 2010, and therefore, only contained records that had reported by May 1<sup>3</sup>, a change of address (moves) in either March or April of 2010. Using the address that the people moved to (i.e., the current address), the matched MAF record was sent to a commercial vendor source to obtain current telephone numbers for the address. Based on these results, a nationally representative sample was selected (excluding Hawaii and Alaska). The sample included a mix of households that reported that the move was temporary or permanent and a mix of households that also indicated if an individual moved or the entire household moved. While allowing us to do some review of the NCOA file, this sample should have also provided greater statistical efficiency on measuring recall bias on move reporting from a relatively small sample by allowing us to target in sample a larger universe of known movers.

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<sup>1</sup> These area codes were excluded due to the time zone differences between these regions and the Jeffersonville, Indiana call center.

<sup>2</sup> It was matched to the Master Address File last updated in March 2010. This MAF included updates from 2010 Address Canvassing but all census operations and reviews may not have been complete.

<sup>3</sup> There may be some people who moved in March or April of 2010 but completed the USPS form after May 1 and are therefore not part of this analysis.

Each of the four panels consisted of 10,000 housing units. Panel 1 (May 2010) consisted of 10,000 RDD housing units. The 10,000 housing units of Panels 2 (June 2010), 3 (September 2010), and 4 (February 2011) were split between 5,500 RDD Sample cases and 4,500 Mover Sample cases. We estimated that these panel sizes would provide sufficient power for the analyses based on probable response rates and expected mover percentages among the population. With low probability of contacting participating households of any post enumeration survey, current survey operation, or other Census Bureau ongoing interviews, no unduplication between this sample and the samples for other surveys or census experiments conducted by the Census Bureau was attempted.

Table 1 lists the dates for each panel, the samples it contained, and the timing it was replicating.

**Table 1: Recall Bias Study Panel Descriptions**

Panel	Dates	Samples	Representing timing of:
1	May 6 - May 24, 2010	RDD	The control – As close to collection of truth as possible
2	June 11 - July 3, 2010	RDD and Mover	The timing of 2000 Person Interview
3	September 10 - October 2, 2010	RDD and Mover	The timing of 2010 Person Interview
4	February 4 - 26, 2011	RDD and Mover	The timing of 2010 Person Followup
RDD = Random Digit Dialing			

An additional five days of production were allowed in Panels 2, 3, and 4 after Panel 1’s initial response rates did not reach the expected goal of 40 percent. The team believed that extending the interviewing period could increase response rates necessary to get the data needed in the smaller sample size in the later panels without skewing results from extending the interview period significantly. The study was conducted by telephone using the National Processing Center (NPC) telephone center with a Computer Assisted Telephone Interview (CATI) instrument. The RBS used the Census Bureau’s 2006 Questionnaire Design Experimental Research Survey (QDERS) telephone data collection questionnaire to independently roster people and collect the address and alternate addresses where they lived or stayed during the year. The questions were similar to those asked in the CCM PI and PFU operations. While this instrument was not initially created for the purpose of this study, there was not enough time in the study development cycle to develop a new instrument specific to our needs. The QDERS questionnaire asked questions for respondents to provide dates of stay at each residence they listed to give the maximum flexibility in data analysis. The QDERS instrument had been successfully tested and used in 2006. Only slight modifications to the reference date and an additional question to check for multiple telephone types (landline and cellular) within the household were implemented.

## 3 Methodology

### 3.1 *Questions to be answered*

We list below the questions that we plan to answer in this report. The first section of this paper is the recall bias analysis. The primary focus of these questions is to determine whether or not respondents seem to experience recall bias pertaining to reporting a move that would affect their residence status on Census Day. In addition, we attempt to measure if there is any recall bias in address completeness and date recall, and whether date certainty changes as time lapses. Part of the analysis keeps the RDD Sample and the Mover Sample (see Background Section) separate in examination.

The second section is focused on how good the NCOA file was as a tool to identify people who move. Hence for this section, all results are from the sample chosen with the help of the NCOA file. This sample is slightly larger than the Mover Sample used above, because we did not have to delete cases with missing data, as was required for the Mover Sample for weighting purposes. The results in this section are not weighted. For clarity, we will refer to this as the NCOA Match Sample. This section does not deal with recall bias.

The final section has analysis questions regarding the use of cellular phones and the ability to contact respondents. This section uses the RDD Sample. We answer all analysis questions using the CATI instrument survey output unless otherwise stated.

### **REVIEW OF RECALL BIAS ERROR**

#### **3.1.1 Did the Recall Bias Study show any possible recall bias in the 2010 Census Coverage Measurement operations time frame?**

##### *3.1.1.1 What were the response rates and contact rates for the Recall Bias Study across panels?*

The response rates and contact rates allow us to see how successful the RBS was in contacting people and collecting the necessary data. We also examined the outcome distribution for both landlines and cellular phone numbers.

Response rate is defined as Complete and Partial interviews divided by “All Cases,” (where “All Cases” include “Complete”, “Partial”, “Refusal and Break-off”, “Non-contact”, “Others”, “Unknown if household or occupied housing unit”, and “Unknown, other”).

Contact rate measures the proportion of all cases in which a person was reached to confirm that it was an eligible telephone number to contact. Contact rate is defined as “Complete”, “Partial”, “Refusals”, and “Other”, divided by “All Cases.”



*3.1.1.3 Is there a significant change in the percentage of people who reported moving in March or April of 2010 in the first panel compared to each subsequent panel?*

The RBS aimed at collecting data from respondents who reported a move, in particular those who reported a move during March or April of 2010. We began by first looking at the overall reporting of moves during 2010 to review moving patterns as time between the interview date and the move date<sup>4</sup> increases. We examined these all year move percentages to insure a consistent reporting of moves throughout the panels. We then compared the percentage of moves reported for March and April of 2010 in the RDD Sample in Panel 1 to the percentages of 2010 March and April moves reported in later panels. This comparison should allow us to measure the rate of change in recalling and reporting moves during this time frame (i.e., measure if there is a significant decrease in reporting moves for March or April of 2010 between panels). For the Mover Sample, we compared Panels 3 and 4 to the results of Panel 2 using the same comparison as in the RDD Sample. Refer to Table 1 for the details of each panel.

We also examined if the type of move or the number of people moving in the household has any effect on the respondents' ability to recall information. See Section 3.2 - Methods for definition on the types of moves and types of households.

*3.1.1.4 Is there a significant increase in the number of people who cannot recall a move date in 2010 from one panel to another?*

Examining move date knowledge may prove to be a useful characteristic in demonstrating respondents' recall bias. If there is recall bias in reporting, we would expect that as time goes by the percentage of respondents who report not knowing the move date could also increase as earlier move dates could be harder to recall.

*3.1.1.5 Is there a significant change in the certainty of move date reported in March or April of 2010 from one panel to another?*

For each address the CATI instrument collected during the interview, dates of stay were collected. Once respondents provided the dates of stay information pertaining to each address they were asked to provide a measure of how certain they were in knowing the dates. Review of these data found many limitations on the accuracy of this flag. Therefore, we excluded this question from the analysis.

*3.1.1.6 Does the completeness of alternate addresses significantly change from one panel to another?*

During the RBS interview, respondents were asked if they or anyone listed on the household roster lived at only the sample address during 2010. Additional address information was collected for people who had another place in which he or she lived during 2010. The level of

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<sup>4</sup> When considering the time between the interview and the move reported analysis was conducted by examining the first move reported. When considering whether the move occurred in March or April, all reported moves were considered.

detail a respondent provides about alternate address components might be a characteristic in determining recall ability. We reviewed address completeness level across panels for those who reported a move in March or April of 2010. We also reviewed the address completeness level related to the amount of time between the reported move date and the interview day. Due to the limitations of the sample size for RDD, this was only reviewed using the Mover Sample.

## **REVIEW OF THE NATIONAL CHANGE OF ADDRESS FILE**

### **3.1.2 How did the National Change of Address file help identify households with movers or complex living situations?**

If every record on the Mover Sample was a reachable household that contained at least one mover with the date and the “To” and “From” addresses matching what was reported in the NCOA file, then the Census Bureau could use the NCOA file as a tool to identify households with movers with a known move date. The following questions reviewed the Mover Sample survey responses to see how much of the data matched the administrative data contained in the NCOA file.

#### *3.1.2.1 What percentage of households contacted in the National Change of Address Match Sample reported at least an alternate address?*

When reviewing the NCOA file as a tool and a possible future source, we wanted to look at all aspects of what the NCOA file could provide. For example, could it possibly provide at least a way to identify households that have a person with at least one alternate address (and hence a possible complex living situation)? We reviewed all the households on the file to see how many actually reported an alternate address.

#### *3.1.2.2 What percentage of households contacted in the National Change of Address Match Sample reported at least one person moving sometime in 2010?*

Using the same definition of mover as in the RDD analysis, we looked to see how many households in the Mover Sample reported a move. We also reviewed the households by move type (as defined in Section 3.2) and tenure (owner and non-owner).

#### *3.1.2.3 How accurate are the type of move indicators on the National Change of Address file?*

The NCOA file has two types of move indicators that the person filling out the change of address form marks. The first is the temporary and permanent flag which indicates if the move is a permanent move or if the mover intends to return to the current address within a year. The second is the family<sup>5</sup> and individual flag that reports if the entire family or just one

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<sup>5</sup> Family is a term used by the Postal Service to identify anyone in that household that is moving and has the same household surname. The family flag was used in our study to indicate that the entire household was moving.

or more individuals will be moving. We reviewed both of these flags to see if there was any correspondence between the flags assigned and the case information regarding a move and the type of move reported.

#### *3.1.2.4 What percentage of households contacted in the National Change of Address Match Sample reported a move in March or April of 2010 for each panel?*

We reviewed the results of the RBS to see how well the NCOA file did as a tool at identifying households that reported a move in March or April of 2010. Remembering and reporting of the move date in that time frame directly affects where a person would be counted in the 2010 Census.

#### *3.1.2.5 How many cases (telephone numbers) ended up contacting either the corresponding name or address on the National Change of Address file?*

We did not have a current telephone number from either the MAF or the NCOA file. So a telephone number look-up was conducted. This look-up was done for all three panels at one time. We wanted to see how well this commercial look-up did at reaching the addresses that people moved to, and the proper people. We did this by matching the RBS respondent name and all addresses reported during the interview to the names and addresses reported in the NCOA file. This section reports how often they matched and how well they matched in correlation with mover status.

#### *3.1.2.6 How did the person match, address match, and mover status overlap in the National Change of Address Match Sample?*

The NCOA file could be used as a tool in various ways. For the Mover Sample, the best possible outcome would be if we were able to reach the person(s) that moved, get them to report the current address (“To”) and the move address (“From”), and find that they reported a move in either March or April of 2010. This section examines how each of the categories reviewed in the earlier questions overlap and how often we obtained the best possible outcome.

### **COMPARISON OF LANDLINE AND CELLULAR PHONES**

#### **3.1.3 What were the differences in reporting between cellular phone and landline Random Digit Dialing Samples?**

Each panel of the RDD study is a dual frame sample survey, where one frame is the universe of all households with a landline telephone and the second frame is all households for which at least one household member has a cellular phone number. For this review, all four panels were combined into one large sample and then split into four strata for comparison. They are:

1. Landline/Cellular: Interview conducted via landline telephone (per response) and the respondent indicated someone in the household had a cellular phone.

2. Landline Only: Interview conducted via landline telephone (per response) and the respondent indicated no one in the household had a cellular phone.
3. Cellular/Landline: Interview conducted via cellular phone (per response) and the respondent indicated the household has a landline telephone.
4. Cellular Only: Interview conducted via cellular phone (per response) and the respondent indicated the household does not have a landline telephone.

The universe consists of the same RDD universe as used in Section 3.1, with the exception of having to drop four cases for which a respondent was not identified. (Respondent information was needed to properly do the analysis in Section 5.3.7). For this section weighting was redone to accommodate for dropping those four cases and to properly weight the panels being combined.

#### *3.1.3.1 What are the differences in the types of interview outcomes received by sample?*

We reviewed the distribution of outcomes by panel to see if there was a difference in the results in attempting to contact the sample of cellular phones and landline telephones.

#### *3.1.3.2 Did we reach the respondent at their sampled way of contact?*

While the telephone numbers are provided to us from distinct telephone banks, we wanted to confirm that if we were calling a cellular phone, we reached a cellular phone and vice versa for landline telephones. We examined the sample with the reported type of telephone to see if there are issues in the sample for reporting type of telephone use.

#### *3.1.3.3 Did the respondents have an alternate mode of contact?*

Previous research has found that households that have both types of telephones (landline and cellular) can answer differently than those that do not, and may make up a very different demographic universe of households. We reviewed the distribution by panel of the different combinations of telephone modes the households reported. This is also important for weighting purposes.

#### *3.1.3.4 Did it take more call attempts to reach cellular phone respondents than landline respondents?*

In order to most effectively reach cellular phones, we wanted to see if there was an effect on the effort needed to get a complete interview. We reviewed the number of calls needed to get a complete response for each type of telephone and compared the average number of calls.

#### *3.1.3.5 Is there a length of interview time difference between strata?*

Continuing the review on the amount of effort required by mode of telephones, we compared the time an average complete response took for each stratum and the overall average time to see if there was a difference between landline telephones and cellular phones.

*3.1.3.6 Did we reach cellular phone respondents at different times of day than landline respondents?*

Much research has been done into the best day and time of day to reach people at their homes for landlines and that has been built into established protocols for telephone centers. We wanted to investigate if there were any different patterns when getting cellular phone interviews to see if those protocols should be updated when including them in the survey. We compared cellular phone to landline telephone response patterns to see if they differed between the groups.

*3.1.3.7 Are the people who completed the interviews on cellular phone different demographically than those who completed the interviews via landline?*

While research has told us that those who we reach on cellular phones should be of a different demographic makeup than those that we do not, we wanted to look at the different demographic and household characteristics for cellular phone respondents to see if they were different than those of landline users. For demographics we compared sex, Hispanic origin, race, and age for the groups. For household characteristics, we compared tenure and mover status.

## **3.2 Methods**

After the data were collected, the Decennial Statistical Studies Division (DSSD) examined each panel's answers to the questions about moves, alternate addresses, and dates of stay. Due to the original qualitative nature of the QDERS survey, a coding operation was performed to assure that all people, moves, and dates were properly captured. During this clerical coding operation several key variables of the QDERS instrument were examined to understand and clarify the moving patterns of all individuals collected. This operation analyzed and assigned mover codes based on household member's demographics (for example, using relationship when respondent refers to daughter in notes), sample address, alternate addresses, and dates of stay at each address collected.

In addition to these variables, DSSD also examined the interview debriefing questions that were answered by the interviewer at the conclusion of the interview. These options included a variety of statements which the interviewer could pick to best describe the true living situation of each household member collected during the interview (e.g., "Person 1 lived only at one address during 2010." or "Person 1 moved back and forth between two or more addresses and spent most of the time at only one address."). The coding process also took all Mover Sample interviews completed and matched the name and two addresses (the "To" and "From" address) to the people listed and addresses reported in the NCOA file for exact or possible matches to be used in the NCOA Match Sample analysis. Due to the complexity and open-ended questions, all of this coding was done clerically within DSSD.

The RBS analysis universe consisted of those cases identified as either a complete or sufficient partial interview<sup>6</sup>. All tables and analysis were conducted using these interviews only. In addition to being a complete or sufficient partial interview, respondents had to have provided a response to a question asking whether or not he or she had another telephone type (i.e., cellular or landline, depending of how they were contacted). Cases in which the respondent answered “Don’t Know” or “Refused” to this multiple telephone type question were removed from the study so we could properly weight the sample. The multiple telephone and tenure questions allowed for a weighting of each household to adjust for the possibility of being included in both types of telephone universes. Weighting was applied to normalize the universe to one and report on proportions only (Griffin, May 2011). For person-level weighting, the calculated household weight was divided evenly by the number of people per household (Griffin, Aug 2011). When doing comparison tests between panels, Z-tests were used, unless otherwise stated.

Each person included in the analysis was assigned one of four mover types. These are:

- **Non-mover** - Person who did not mention any moves occurring during 2010. This includes both people with no other place where they stayed, and short-term cyclers that stay at more than one address in short stays, such as children in a custody situation where they visit a parent every weekend.
- **Mover** - Person who moved from one address to another without any indications of a possible return to the previous address.
- **Long-term cycler** - Person who acted like a mover but reported a second move over a certain time (greater than 30 days) back to the original address such as snow-birds<sup>7</sup> or college students. These long-term cyclers were included in this analysis as movers because, in a regular census scenario, their move date would be so close to Census Day that they would likely report like a normal mover (see above), and the census would not be able to identify them as cyclers and not movers.
- **Unknown** - People for whom we could not determine if they were movers during 2010 based on the information collected. Most of the time there is some sort of contradictory information for these people.

If the household contained at least one mover or a long-term cycler, then the household was treated as either a mover or long-term cycler household. If everyone in the household was a non-mover, then the household was a non-mover household. The remaining cases would be households with an unknown move status.

For the NCOA Match Analysis, all results are from the sample chosen with the help of the NCOA file. Since we were not weighting the data, this universe is larger than the Mover Sample analysis universe in the Recall Bias Analysis section because we deleted a few cases with missing data which were needed for weighting purposes in the Mover Sample. For clarity, we will refer to this as the NCOA Match Sample. While some of the characteristics

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<sup>6</sup> See Section 5.1.1 for definition of complete and sufficient partial interviews.

<sup>7</sup> Snow-birds is a term used for people that have two homes they share throughout the year but move between seasonally.

reviewed overlap with Section 5.1, this section's research is only focused on how good the NCOA file is as a tool to identify movers and is not reviewing possible recall bias.

For the cellular phone comparison to landline telephones, the RDD Sample was used but the four panels were combined and reweighted to represent each case in the specific strata that represented both type of telephone answered by the respondent and whether the alternate type of telephone was available for the household.

## **4 Limitations**

This is an initial study attempting to take advantage of an actual census environment to measure potential recall bias. Our goal is not to report actual recall bias, but to measure potential change in respondent reporting accuracy over time. Results will be used to discern if a more involved study for measuring recall bias will be required as part of the 2020 Census research program. This study is not a comprehensive study of the types or reasons for a change in reporting moves over time. This study cannot measure the difference in underreporting and telescoping the report of the move. It also cannot distinguish if the reason for the underreporting of moves was due to recall bias alone.

The QDERS Instrument was originally designed as part of a study examining two different questionnaires that capture residence information. Due to this the one questionnaire that the RBS used was in an open-ended answer format for many of the questions. It was also not developed to the tighter parameter of standard census questionnaires (e.g., requiring answers). This allowed for the interviewer to skip questions for which we would have expected answers. We were also at the discretion of the interviewer in collecting data for clarification in the notes fields. While all the data were reviewed and coded by hand to make it as accurate as possible, this does open up a risk of miscoding or incorrect interpretation, and we cannot correct for any missing information.

The number of eligible cases for the final analysis RDD universe was much smaller than expected. Though the study contained 26,500 RDD telephone numbers, only approximately 25 percent (6,536) of these RDD cases proved to be eligible and considered in the analysis. This is mainly due to a much lower than expected response rate (See Section 5.1.1). Some analysis could not be done using the RDD Sample. Footnotes are included in the report for those tables where the total number of cases included in the percentages was less than 30. Any test on proportions for these cells may not have enough power to definitively say if there was or was not a difference. Also some of the research questions about the RDD Sample were not answered due to limited data. All tables provided in the main report have a corresponding table in Attachment A that include their adjusted count based on weighting.

Households that reported moves in the Mover Sample are not representative of the entire U.S. population of movers. We have not studied or reviewed the type of movers that are likely to report their move to the USPS compared with those who do not. This should be taken into consideration when reading any assumptions or conclusions reported in this paper.

For this evaluation, it was assumed that the majority of the reports on the National Change of Address file were not just change of addresses from where the mail was sent but, represented the person actually moving to that address. Currently, we are not aware of any research done to determine how many change of addresses reported are for actual moves.

While much of this analysis is a review of the success of the NCOA file as a tool, it is also a review of the success of the telephone number look-up. When there are nonmatches from the study data to the NCOA file information, this study cannot distinguish if that was due to an issue in the telephone look-up or in the data reported in the NCOA file.

There are a few other issues that could affect our ability to ascertain correctly if the National Change of Address file is an accurate enough administrative record data source to be used on its own as a tool to identify movers based on the results of this study. There are several limitations that may be confounding the results observed here. It is possible the rates of moves/movers reported are affected by respondent error (intentional nonresponse, recall error, or carelessness) in the RBS reporting rather than errors in the NCOA file. Another possible error that would lower the move rates in the RBS is proxy reporting where a proxy is not fully aware of the living arrangements of all household members throughout the year.

## 5 Results

### REVIEW OF RECALL BIAS ERROR

#### **5.1 *Did the Recall Bias Study show any possible recall bias in the 2010 Census Coverage Measurement operations time frame?***

##### **5.1.1 What were the response rates and contact rates for the Recall Bias Study across panels?**

In this section, we examine the final outcomes of all cases as well as the response rates and contact rates of the RBS. The RBS final outcomes were determined by the QDERS instrument and the CATI system after examining the instrument's data and all attempted outcomes made per case.

The outcomes assigned were as follows:

- **Completed interviews** were those interviews which obtained a household roster, sample address, possible alternative addresses, and dates of stay at each listed address during 2010 for all persons listed.
- **Sufficient Partial interviews** were interviews where at least one household member (but not all) had responses for all questions.
- **Refusal and break-offs** consist of interviews in which some contact had been made with the telephoned household and an eligible household member had declined to do the interview or an initiated interview resulted in a terminal break-off.
- **Other noninterviews** represent situations in which there is a respondent who did not refuse the interview, but no interview is obtainable due to such issues as language or hearing problems and poor connection.



- **Cases of unknown eligibility** include situations in which it is not known if an eligible household exists at the sampled telephone number and those in which the number is confirmed as a residence, but it is unknown whether an eligible respondent resides there (i.e., no answers, privacy screeners).
- **Out of Scope** was primarily for telephone numbers which were out of service, but can also include telephone numbers that reach non-residences.

Table 2 is the unweighted outcome distributions for the RDD Sample by panel.

**Table 2: Random Digit Dialing Sample: Distribution of Interview Outcomes by Panel**

Outcome Category	Panel								Overall	
	1 (May 2010)		2 (June 2010)		3 (September 2010)		4 (February 2011)			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Complete	2,336	23.36	1,467	26.67	1,395	25.36	1,338	24.33	6,536	24.66
Sufficient Partial	4	0.04	0	0.00	1	0.02	0	0.00	5	0.02
Refusal/Break-Offs	1,253	12.53	608	11.05	623	11.33	642	11.67	3,126	11.80
Other Noninterview	39	0.39	14	0.25	13	0.24	17	0.31	83	0.31
Unknown Eligibility	1,334	13.34	758	13.78	923	16.78	836	15.20	3,851	14.53
Out of Scope	5,034	50.34	2,653	48.24	2,545	46.27	2,667	48.49	12,899	48.68
<b>Total</b>	<b>10,000</b>	<b>100.00</b>	<b>5,500</b>	<b>100.00</b>	<b>5,500</b>	<b>100.00</b>	<b>5,500</b>	<b>100.00</b>	<b>26,500</b>	<b>100.00</b>

Data Source: CATI Output

Table 2 shows that the majority of RDD cases (48.68 percent) consisted of telephone numbers which were out of service and, hence, were out of scope for the study. The next largest percentage of RDD cases consisted of completed interviews, 24.66 percent across all panels. We were disappointed since we expected the completion rate for the RDD Sample to be at least 30 percent<sup>8</sup>. The remaining percentage of RDD cases fell into those categories of unknown eligibility and refusal/break-off interviews. These two outcomes remained relatively consistent across all panels with respect to the panel size.

<sup>8</sup> This expected completion rate was based on other similar sample completion rates that average approximately 20 percent. Our completion rate prediction was set slightly higher in earlier panels due to the close proximity to Census Day (April 1, 2010) and because we represented the Census Bureau.

Table 3 shows the distribution of outcome codes for the Mover Sample by panel.

**Table 3: Mover Sample: Distribution of Interview Outcomes by Panel**

Outcome Category	Panel						Overall	
	2 (June 2010)		3 (September 2010)		4 (February 2011)			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Complete	2,518	55.96	2,310	51.33	1,968	43.73	6,796	50.34
Sufficient Partial	3	0.07	7	0.16	3	0.07	13	0.10
Refusal/Break-Offs	710	15.78	659	14.64	543	12.07	1,912	14.16
Other Noninterview	14	0.31	16	0.36	13	0.29	43	0.32
Unknown Eligibility	420	9.33	500	11.11	580	12.89	1,500	11.11
Out of Scope	835	18.56	1,008	22.40	1,393	30.96	3,236	23.97
<b>Total</b>	<b>4,500</b>	<b>100.00</b>	<b>4,500</b>	<b>100.00</b>	<b>4,500</b>	<b>100.00</b>	<b>13,500</b>	<b>100.00</b>
Data Source: CATI Output								

Table 3 shows a higher percentage of completed interviews for the Mover Sample than the RDD Sample; as expected. These higher percentages of completed cases were expected because the Mover Sample telephone numbers were known to be connected to a residential address at the point when the numbers were looked up, in theory removing all out of scope telephone numbers. The percentage of completed cases (50.34 percent) across all Mover Sample panels was much higher than the RDD Sample, which had a completion rate of only 24.66 percent. The Mover Sample also had a dramatic difference to the RDD Sample in the percentage of out of scope cases, 23.97 percent and 48.68 percent, respectively. Another interesting observation regarding the distribution of the Mover Sample is the decreasing completeness percentage and increasing “Out of Scope” percentage across panels. We believe this to be an indication of aging telephone numbers from when they were connected to a residential address, to when an interview was actually attempted. If the use of the NCOA file is to be considered as a viable tool, we may want to conduct telephone number look-ups throughout the interviewing process (i.e., closer to when a particular case will be going to production) to limit the number of aged telephone numbers.

The formula used in order to calculate the **response rate** can be expressed as follows:

$$\frac{\text{Complete Interviews} + \text{Sufficient Partial Interviews}}{(\text{Complete Interviews} + \text{Sufficient Partial Interviews}) + (\text{Refusals/Break-offs} + \text{Non-contacts}^9 + \text{Other Noninterviews}) + (\text{Cases of Unknown Eligibility} + \text{Unknown other})}$$

The formula used to compute **contact rate** is as follows:

$$\frac{\text{Complete Interviews} + \text{Sufficient Partial Interviews} + \text{Refusals and Break-offs} + \text{Other Noninterviews}}{\text{Complete Interviews} + \text{Sufficient Partial Interviews} + \text{Refusals/Break-offs} + \text{Non-Contacts}^5 + \text{Other Noninterviews} + (\text{Cases of Unknown Eligibility} + \text{Unknown other})}$$

<sup>9</sup> Due to limited CATI final outcomes and to maintain simplicity in calculations across panels, explicit non-contact final outcomes were not calculated and instead grouped with the unknown eligibility category.

Table 4 and Table 5 provide the response rates and contact rates for the two samples (and subsamples) by panel.

**Table 4: Response Rates by Sample and Panel**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
RDD Sample	47.12	51.53	47.24	47.23
Cellular	37.15	44.57	38.71	36.31
Landline	60.28	59.82	57.55	61.62
Mover Sample	N/A	68.79	66.35	63.44
N/A is for not applicable Data Source: CATI Output				

As you can see, the overall response rates are better for those trying to contact a telephone number connected to an actual residence in the landline RDD and the Mover Samples than a cellular phone. Due to the higher completion rate, the highest response rate for RDD was in Panel 2 (in June).

Looking at Cellular and Landline RDD Samples, the higher response rate for landline is due to the high rate of unknown eligibility (meaning no response) for cellular phone RDD. From Tables 31 and 32 in Section 5.3, we can see that cellular phones had a much higher percentage of unknown eligibility (20.60 percent) than that of landlines (8.47 percent). We suspect this difference could be caused by the fact that most cellular phones can determine the source of the incoming call whereas many households cannot unless the household has caller ID included in their home telephone service. Cellular phone numbers were more likely to show the incoming call as “Unknown” where landline telephone numbers would show the incoming number as “U.S. Census Bureau” if a caller ID system was installed<sup>10</sup>. Hence, the cellular phone users are likely not even answering the telephone upon seeing a number that is not an identified source while landline telephone numbers would more likely answer with, or without a caller ID system. For further results on the effectiveness of contacting respondents via cellular phone, see Section 5.3 of this report.

<sup>10</sup> This caller ID name tag was requested by the Census Bureau to show on all telephone carriers, but it is unknown the percentage of carriers that have implemented this identifier. It is possible, though unknown, that the incoming call could have shown as “Unknown” on a landline number.

**Table 5: Contact Rates by Sample and Panel**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
RDD Sample	73.14	73.38	68.76	70.49
Cellular	64.05	67.64	62.83	62.07
Landline	85.14	80.22	75.93	81.59
Mover Sample	N/A	88.54	85.68	81.33
N/A is for Not Applicable Data Source: CATI Output				

The contact rates between Landline RDD and Mover Samples are very similar. As expected, the contact rate is lower for the cellular phone sample than both samples contacting landlines.

**5.1.2 Is there a significant change in the percentage of people who reported moving in March or April of 2010 in the first panel compared to each subsequent panel?**

The RBS was aimed at collecting data for individuals who moved during 2010. In particular, the study was aimed at collecting movers who reported a move during the months of March or April of 2010 and whether the time elapsed since the move had an effect on the recall of that move.

Table 6 shows the distribution by sample and panel of the weighted proportions of those households where at least one member of the household had moved during 2010. We would expect that the percentage of households with moves would increase for each panel since there is more time for a household member to have moved (i.e., Panel 1 can only collect moves between January and May while Panel 4 can collect moves from January to January of the next year).

**Table 6: Percentage of Households Reporting any Move in 2010 by Sample by Panel, Weighted**

	Panel											
	1 (May 2010)			2 (June 2010)			3 (September 2010)			4 (February 2011)		
	M*	LC**	Overall	M*	LC**	Overall	M*	LC**	Overall	M*	LC**	Overall
RDD Sample	5.62 (0.28)	1.89 (0.12)	7.51 (0.30)	8.87 (0.44)	3.12 (0.22)	11.99 (0.49)	14.16 (0.56)	7.03 (0.39)	21.19 (0.66)	15.96 (0.59)	6.45 (0.35)	22.41 (0.67)
Mover Sample	N/A	N/A	N/A	37.47 (1.00)	13.84 (0.72)	51.31 (1.04)	36.68 (1.08)	14.24 (0.78)	50.91 (1.12)	33.79 (1.11)	7.75 (0.63)	41.54 (1.16)
*M is Movers **LC is Long-term cyclers N/A is for not applicable Standard Errors are in parentheses Data Source: RBS Output												

The overall mover rate is the total from the combination of the “mover” and “long-term cyclers<sup>11</sup>” percentages. The RDD Sample in Table 6 follows the expected pattern of increased reporting of a move during 2010 across panels. Because Panel 1 was conducted earlier in

<sup>11</sup> For explanation of the differences between mover types, see Section 3.2 Methods.

2010 than subsequent panels, respondents did not have as much time to move in 2010, and thus reported a lower percentage of moves during 2010 than those of later panels. There is a significant difference in the weighted percentage of those households contacted in the RDD Sample who reported a move for Panels 2, 3, and 4, compared to Panel 1 (p-values <0.0001).

However, the percentage change across panels for the Mover Sample follows a decreasing pattern. Remember that these were households which had filed a change of address with the USPS for March or April of 2010. So, even though the later panels allowed one to nine more months to report additional moves, we would expect the overall mover rate for the Mover Sample to either remain fairly static or show a small increase from the other possible moves in the longer time frame like the RDD Sample. Between Panels 2 and 3, we see the stable reporting with no increase or decrease, since there is no significance difference in the weighted percentage change (p-value of 0.7931). However, the decrease of over eight percent seen between Panels 2 and 4 is significantly different (p value <0.0001) and may possibly reflect some inability to recall a move up to a year after it happened.

In particular, the RBS was aimed at collecting and comparing moves during the months of March or April of 2010. We looked specifically at only those moves reported in March or April of 2010 for both the RDD and Mover Samples. Table 7 below is the distribution by panel of the weighted percentage of households contacted who reported at least one person who moved during the months of March or April of 2010 for the RDD and Mover Samples. Comparing the percentages of those reporting a 2010 March or April move across panels should allow us to measure if there is a decrease in reporting moves in March and April of 2010 as time between the move and the interview increases due to potential recall error. Because we have a representative sample in each panel, we would expect the overall proportions of moves and other residences reported for March and April of 2010 to be consistent across all panels. If there was a change in proportion across panels, we can conclude that the data (respondents' answers) have changed and we will be able to measure the amount of change as a function of the time lag between the reference period and interview date.

**Table 7: Percentage of Households Reporting a 2010 March or April Move by Sample by Panel, Weighted**

	Panel											
	1 (May 2010)			2 (June 2010)			3 (September 2010)			4 (February 2011)		
	<i>M</i> *	<i>LC</i> **	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall
Random Digit Dialing Sample	2.80 (0.19)	0.78 (0.08)	3.57 (0.21)	2.93 (0.25)	0.50 (0.09)	3.43 (0.27)	2.35 (0.21)	0.69 (0.10)	3.04 (0.23)	2.84 (0.27)	1.03 (0.14)	3.87 (0.30)
Mover Sample	N/A	N/A	N/A	28.72 (0.94)	9.63 (0.62)	38.34 (1.01)	23.76 (0.95)	8.63 (0.63)	32.39 (1.05)	18.99 (0.92)	2.61 (0.39)	21.60 (0.97)
*M is Movers **LC is Long-term cyclers N/A is not applicable Standard Errors are in parentheses Shaded cells have counts less than 30 Data Source: RBS Output												

Overall, the RDD Sample shows no significant difference in comparing Panel 2 to Panel 1, and Panel 4 to Panel 1 in the weighted percentage of those households reporting a move during March or April of 2010 (p-values of 0.6811 and 0.4090, respectively). The only

significant difference noted (a decrease of 0.53 percent) when comparing the RDD weighted percentages of households reporting a move during March or April of 2010 existed between Panel 3 and Panel 1 (p-value of 0.0876). The RDD true mover households (M) saw no significant differences between Panels 2, 3, and 4 compared to Panel 1 (p-values of 0.6826, 0.1103, and 0.9029, respectively). The long-term cycler households (LTC) were not tested to determine if significant because the quantity was not great enough to give power to the tests.

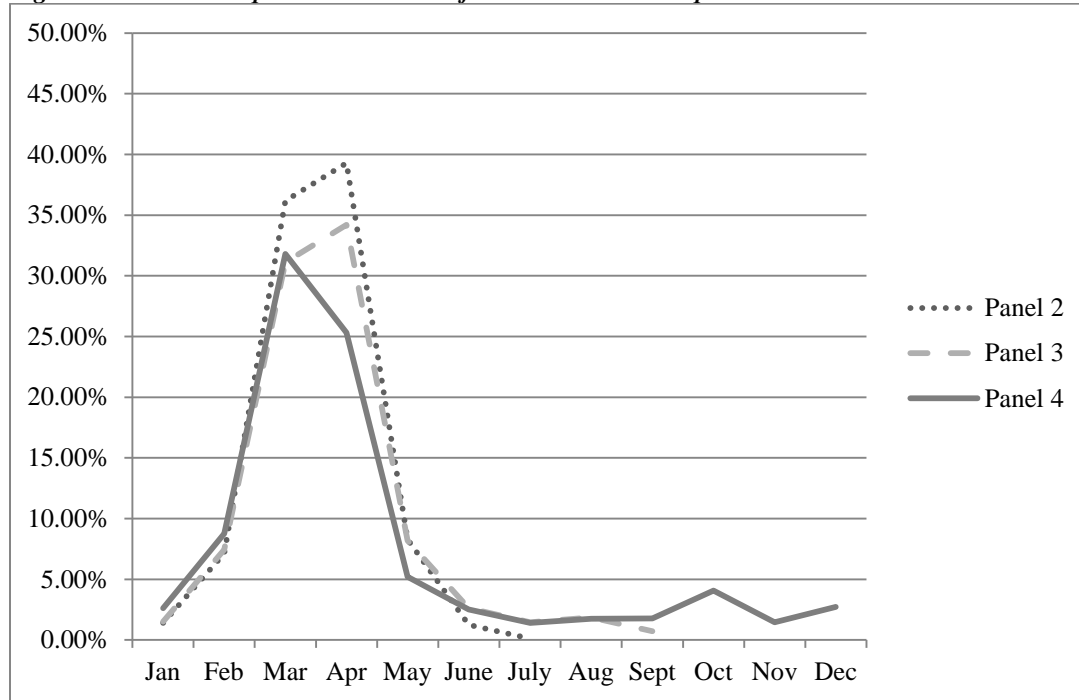
An interesting observation to note in Table 7 is the slight increase (no significant difference) in the percentage of households reporting a 2010 March or April move for Panel 4 in the RDD Sample compared to the decreasing trend seen in previous panels. One possible explanation for this increase is that the survey instrument did not correctly list the year under consideration (2010) when prefacing the initial question about having another place to live or stay, but instead simply referred to “this year.” This incorrect reference was not continued later in the other questions about alternate residences. Interviewers were trained before the panel began to change this preface to “In 2010”, but it is speculated that interviewers maybe did not correct this misunderstanding with all respondents and may have erroneously collected move date information pertaining to March or April of 2011, possibly reporting future moves as a move in 2010.

As for the Mover Sample, Table 7 shows a decrease in the percentage of households who reported a 2010 March or April move from panel to panel, and this could be an indication of respondents’ decreased recall ability for reporting moves during March or April of 2010 as the time between the move and the reporting of the move increases. Although the confusion regarding the year under consideration exists in the Mover Sample as well, we believe that the targeted sample of movers outweighs any possible effects the question wording could have had on the percentage of 2010 March or April moves reported. The Mover Sample shows significant differences between Panels 2 and 3 (a decrease of 5.95 percent), and Panels 2 and 4 (a decrease of 16.74 percent) (p-values <0.0001). When separating the type of household move (true mover or long-term cycler) we observe significant differences between Panels 2 and 3, and Panels 2 and 4, of the identified true mover households (p-values of 0.0002 and <0.0001, respectively).

The decrease in long-term cyclers is only slight between Panels 2 and 3 of the Mover Sample and proved not significant (p-value of 0.2583). Panel 4 on the other hand shows dramatically lower percentages of long-term cyclers than those of previous panels with significant differences observed between Panel 2 and Panel 4 (p-value <0.0001). This could be because so much time had lapsed between when the cycle occurred that respondents did not think we cared about that alternate address information. Future research would be needed to try to determine what are the factors influencing these changes in the time frame from September to February of the next year.

Figure 1 shows the distribution of moves over 2010 reported in the Mover Sample. The figure demonstrates that the majority of Mover Sample cases contacted actually reported a move which occurred during March or April of 2010 or at least in a month near those. For more on move reporting in the NCOA cases, see Section 5.2.

**Figure 1: Mover Sample: Distribution of the Move Month Reported**



We also examined the data to see if there was any effect on reporting depending on whether the entire household moved or not. Whole household movers were identified as households where all people reported identical moving patterns during 2010. These tests separated whole household movers from non-whole household movers because we believe that respondents who moved with all members of their household at the same time are more likely to recall exact move information, than those respondents who are only reporting for a single member of the household who moved especially if the mover was not the respondent. We expect a difference in these percentages due to the nature of the two types of households. Whole households will have less chance of recall issues because by nature they only have to recall the move that affected them and there is most likely just one move to remember. The nature of non-whole household moves may mean the move was not by the respondent and thus recalling exact move specifics could prove difficult.

Table 8 displays the RDD weighted proportions of those households who reported a 2010 March or April move by panel and whether or not they were of a whole household move. For the RDD Sample, 47.5 percent of the households that moved in March or April of 2010 were whole households moves and 52.5 percent were not whole household moves.

**Table 8: Random Digit Dialing Sample: Percentage of Whole Household Mover and Non-Whole Household Movers for March/April Movers by Panel, Weighted**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Whole Household Movers	1.41 (0.14)	1.77 (0.18)	1.93 (0.20)	1.69 (0.21)
Non-Whole Household Movers	2.17 (0.16)	1.66 (0.20)	1.12 (0.12)	2.18 (0.21)
<b>Overall</b>	<b>3.57</b> (0.21)	<b>3.43</b> (0.27)	<b>3.04</b> (0.23)	<b>3.87</b> (0.30)
Shaded cells have counts less than 30 Standard Errors are in parentheses Data Source: RBS Output				

Table 8 shows a somewhat flat trend in the weighted proportion of whole household movers. The proportion of whole household movers reported in Table 8 shows similar patterns of significant differences as observed in the overall proportions of 2010 March or April movers. That is, there is no significant difference between the weighted proportions of whole household movers in Panels 2 and 1, and Panels 4 and 1 (p-values of 0.1147 and 0.2621). Although, there is a significant difference observed between Panel 3 and Panel 1 (p-value of 0.0289) with the proportion actually increasing.

The trend in proportion of non-whole household movers is decreasing across panels until Panel 4, which is not significantly different compared to Panel 1 (p-value of 0.9700). The non-whole household movers show significant differences in the weighted proportions between Panels 2 and 1, and Panels 3 and 1 (p-values of 0.0449 and <0.0001, respectively). It is possible that Panel 4's increase in proportion of non-whole household movers once again may be caused by the survey instrument error in reference to the year under consideration. More research would be needed to determine if collecting information on the previous year's move information somehow changes the result.

Table 9 shows the Mover Sample weighted percentages distribution of those households who reported a 2010 March or April move by panel and whether or not they were a whole household move. For the Mover Sample, 69.32 percent of the households that moved in March or April of 2010 were whole household movers and only 30.68 percent were individual movers. This larger proportion of whole household movers seen in Table 9 is likely the result of individuals belonging to a whole household move more often filing a change of address with the Postal Service as opposed to non-whole household movers. Unlike the RDD Sample, for the Mover Sample there is a decrease in the percentage of whole household moves and non-whole household moves across panels just like the overall reporting.



**Table 9: Mover Sample: Distribution of Whole Household Mover and Non-Whole Household Movers for March/April Movers by Panel, Weighted**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Whole Household Movers	N/A	26.36 (0.91)	23.49 (0.95)	14.05 (0.82)
Non-whole Household Movers	N/A	11.99 (0.67)	8.90 (0.64)	7.55 (0.62)
<b>Overall</b>	<b>N/A</b>	<b>38.34</b> (1.01)	<b>32.39</b> (1.05)	<b>21.60</b> (0.97)
Standard Errors are in parentheses N/A is for not applicable Data Source: RBS Output				

As with the RDD Sample, significant differences were detected also for the Mover Sample. Panel 2 contained significantly larger percentages of whole household movers than Panel 3 and Panel 4 (p-values of 0.0293 and <0.0001, respectively). When examining non-whole household movers, Panel 2 also showed significantly larger percentages of individual moves than Panel 3 and Panel 4 (p-value of 0.0009 and <0.0001, respectively).

During the interview respondents were asked a series of questions, two of which were questions related to tenure and have been used in determining whether the respondent was an owner or non-owner of the residence in question. A household is identified as an owner household if at least one person currently owns the occupied household (either with or without a mortgage.) All other situations are non-owner occupied households. Similar to investigating on the restrictions of whole household mover, we thought that information regarding tenure might demonstrate differences in respondent's knowledge. We surmised that those respondents who identified themselves as an owner will likely be able to recall move information better than those identified as non-owners. We think this because non-owners are generally renters who are more mobile (American Factfinder, Source) and recalling exact information regarding dates and addresses might prove more difficult if more dates need to be remembered.

Table 10 shows the weighted proportions of those households who reported a 2010 March or April move, by tenure. For the RDD Sample, 51.92 percent of households were occupied by an owner and 48.08 percent were not.

**Table 10: Random Digit Dialing Sample: Percentage of 2010 March and April Movers by Tenure by Panel, Weighted**

Tenure	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Owners	2.66 (0.38)	2.95 (0.51)	2.79 (0.49)	2.45 (0.47)
Non-owners	5.43 (0.61)	4.40 (0.70)	3.56 (0.67)	6.74 (0.92)
<b>Overall</b>	<b>3.57</b> (0.21)	<b>3.43</b> (0.27)	<b>3.04</b> (0.23)	<b>3.87</b> (0.30)
Shaded cells have counts less than 30 Standard Errors are in parentheses Data Source: RBS Output				

When testing for significant differences of those households identified as owners who reported a 2010 March or April move, no significant differences were noted between Panels 2, 3, or 4 compared to Panel 1 (p-values of 0.6503, 0.8375, and 0.7311 respectively). This non-significance across panels is possibly tied to the importance of purchasing a home. Owner households seem to be able to recall the move occurrence across all panels without a significant decrease. Table 10 shows that non-owners report more moves for March or April of 2010 compared to owners. Non-owners who reported a 2010 March or April move showed a significant difference only when comparing Panel 1 to Panel 3 in the RDD Sample (p-values of 0.0390). The decreasing trend through Panel 3 followed by the sudden increase in Panel 4 in moves by non-owners is similar to the trend observed when considering the overall percentage of 2010 March or April movers.

Table 11 shows the weighted proportions of those households who reported a 2010 March or April move that had identified themselves as an owner or non-owner for the Mover Sample. For the Mover Sample, 60.81 percent of households that reported moves in March or April of 2010 were occupied by owners and 39.19 percent that are non-owners.

**Table 11: Mover Sample: Percentage of 2010 March and April Movers by Tenure by Panel, Weighted**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Owners	N/A	34.96 (1.21)	29.64 (1.25)	19.26 (1.14)
Non-owners	N/A	45.19 (1.79)	37.95 (1.89)	26.33 (1.80)
<b>Overall</b>	<b>N/A</b>	<b>38.34</b> (1.01)	<b>32.39</b> (1.05)	<b>21.60</b> (0.97)
Standard Errors are in parentheses N/A is for Not Applicable Data Source: RBS Output				

For both owners and non-owners, the proportion for Panel 2 is significantly higher than proportions reported in Panels 3 and 4 (p-values of 0.0022, <0.0001, 0.0054, and <0.0001, respectively). The proportion of owners and non-owners is significantly decreasing from panel to panel in the Mover Sample which is similar to the behavior of the whole household movers. With significant differences being observed between the Mover Sample panels when separating by whole household movers and tenure, we believe these both play roles in respondent's ability to recall move information.

### 5.1.3 Is there a significant increase in the number of people who cannot recall a move date in 2010 from one panel to another?

During the RBS interview, the interviewers asked the respondent to provide the dates of stay for all addresses collected for each individual. The instrument collects dates of stay on an address basis, collecting a "From date" and a "To date" for each address provided (current and any alternate) for each household member. The ability to report a full date (or not) across panels might illustrate a recall bias over time. If the move day was unknown or the entire move date was blank, then the respondent was considered to have no move date knowledge for that particular household member and the overall household received a flag of having at least one move with an unknown date<sup>12</sup>. Table 12 shows the weighted proportion of move date knowledge that respondents were able to provide with regards to the entire household across panels for the RDD Sample.

<sup>12</sup> 47 cases were included in this analysis, but were also included in the analysis in Section 5.1.2 where the month was known as March or April of 2010 but the day was not known. (Mover Sample = 43, RDD = 4)

**Table 12: Random Digit Dialing Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Date Knowledge	91.21 (1.47)	87.25 (1.58)	81.90 (1.60)	77.64 (1.73)
No Date Knowledge	8.79 (1.47)	12.75 (1.58)	18.10 (1.60)	22.36 (1.73)
Standard Errors are in parentheses Shaded cells have counts less than 30 Data Source: RBS Output				

Table 12 shows a general decreasing trend in the percentage of RDD mover households that report move dates across panels. The percentage of date knowledge decreases slowly across panels, while the percentage of no date knowledge increases. Statistically there are significant differences noted between Panels 2, 3, and 4 compared to Panel 1 for both the “Date Knowledge” and “No Date Knowledge” categories (p-values of 0.0663 and <0.0001 ). These results follow the expected pattern of movers throughout 2010 and respondent’s ability to recall a move date. That is, those who were interviewed in Panel 1 (May) had only five months in 2010 in which they could have moved and could most likely recall the exact date they had moved, whereas those interviewed in Panel 4 (February of 2011) could have moved in any month in 2010 or even in early 2011 and might have had greater difficulty recalling the exact date of a move at that point.

Table 13 shows the weighted proportion of move date knowledge that respondents were able to provide with regards to the entire household across panels for the Mover Sample.

**Table 13: Mover Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted**

	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Date Knowledge	N/A	90.49 (0.85)	84.66 (1.13)	86.66 (1.24)
No Date Knowledge	N/A	9.51 (0.85)	15.34 (1.13)	13.34 (1.24)
Standard Errors are in parentheses N/A is for Not Applicable Data Source: RBS Output				

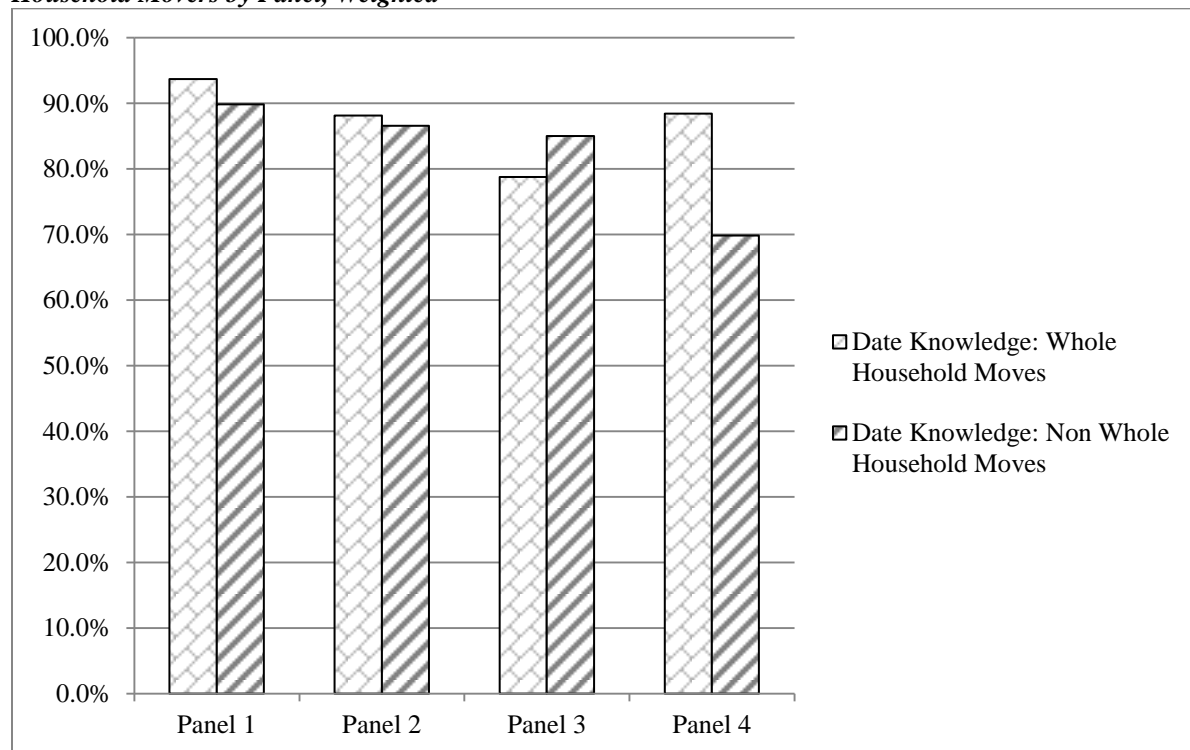
The Mover Sample shows a slight variation in the respondents’ recall ability pertaining to move date knowledge across panels. Panel 2 to Panel 3 shows the same decreasing trend seen in the RDD Sample with respect to move date knowledge. Panel 4, on the other hand, shows an unexplained increase in that trend of date knowledge. This increase could once again be related to respondents thinking of 2011 move date information instead of 2010. Significant

differences were observed between Panels 2 and 3, and Panel 2 and 4 for both the “Date Knowledge” and “No Date Knowledge” categories (p-values <0.001, and 0.0108 respectively). The major difference when examining the Mover Sample and date knowledge compared with the RDD Sample is that the majority of these respondents were expected to report a move date which occurred in or near March or April of 2010 compared with the more variable move dates seen in the RDD Sample.

In addition to examining household date knowledge for all of 2010, analysis of move day knowledge for only those moves which occurred in March or April of 2010 was planned. Due to the small number of households which met these move requirements, no conclusions or testing could be done.

Once again, we present the households by household type to see if this was a possible household characteristic affecting recall. Figure 2 displays the whole household mover date knowledge and non-whole household mover date knowledge for the RDD Sample. As mentioned previously, we believe that those households identified as whole household movers would likely have greater knowledge regarding a household move because the move involved/included the respondent.

**Figure 2: Random Digit Dialing Sample: Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted**



Standard Errors are reported in the Appendix A

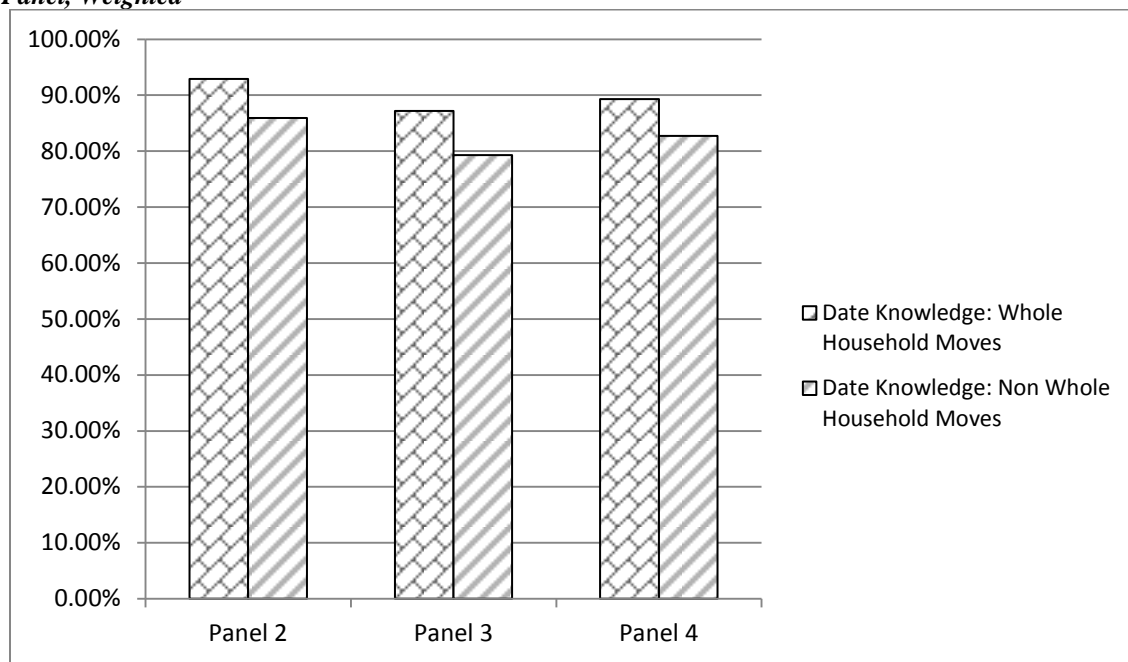
Data Source: RBS Output

Figure 2 does not disprove the whole household mover hypothesis stated above. As shown, whole household moves generally are able to report higher percentages than non-whole household movers with the exception of Panel 3 (which we cannot explain). Also whole

household movers do not follow the descending pattern and spike in Panel 4. This cannot be explained either. Finally, there is a dramatic decrease in percentage for non-whole household movers in Panel 4. This would need further research as well.

Figure 3 displays the date knowledge for the Mover Sample. Figure 3 supports the whole household mover hypothesis with greater confidence than the RDD Sample. As shown below, the whole household movers are better able to recall move dates than non-whole household movers. Also both household types follow the same pattern as the overall sample.

**Figure 3: Mover Sample: Move Date Knowledge for Whole Household and Non-Whole Household Moves by Panel, Weighted**



Standard Errors are reported in the Appendix A  
 Data Source: RBS Output

**5.1.4 Is there a significant change in the certainty of move date reported in March or April of 2010 from one panel to another?**

For each alternate address, the instrument also collected the dates of stay for that address. Once respondents provided the dates of stay information pertaining to each address, they were asked to provide their level of certainty of these dates. The questionnaire asked the respondent, “How certain are you about those dates?” This certainty level was measured using a Likert scale consisting of the following four points: Very Certain, Somewhat Certain, Somewhat Uncertain, and Very Uncertain. We had planned to use the responses to these questions to answer this research question. Through observing interviews and data review, we feel this question was not properly asked and/or understood by the respondent. Most answers are Very Certain even when the respondent did not know the date (when the questions should not have even been asked). There were observations where this question was asked, but the interviewer added leading responses to the question. Because we question the accuracy of the data, we cannot adequately address this research question.

### 5.1.5 Does the completeness of alternate addresses reported significantly change from one panel to another?

During the RBS interview respondents were asked to provide any addresses where household members may have lived or stayed during 2010. The first address collected during the interview was the place where the respondent currently lives or stays and was designated the sample address. Once the sample address was collected, the interviewer continued by asking the respondent whether they or the person in question lived at the sample address all year. If the respondent answered ‘no’ to this question the instrument asked a series of follow up questions aimed at collecting information regarding additional alternate addresses where the person could have lived during 2010. The following are the seven different types of alternate address questions asked: college addresses, relative addresses, military addresses, job addresses, seasonal (second home) addresses, other addresses, and group quarters addresses. These alternate addresses are the same type of addresses for which probes are included in the CCM PI and CCM PFU operations.

The RBS instrument collected all addresses in separate address components (i.e., House Number, Street, City, State, and Zip Codes). Examining the level to which respondents were able to provide these address components might demonstrate possibilities of recall issues across panels. Only the following addresses were reviewed:

- Those connected to a move with at least a month known in move date. (In order for the address to be linked to a time frame they are recalling.)
- Addresses that were not outside the United States since interviewers were told address components were not necessary for foreign addresses.
- Those addresses where the respondent was not currently living (since no recall is needed for their current address).
- The address had to be collected in the main interview and not reported by the interviewer in the notes section.

Address completion was grouped in the following way:

- *Totally Complete* - If the respondent was able to provide all address components without any blanks, “Don’t Knows”, or “Refusals”<sup>13</sup>.
- *Partial*- If the respondent was able to provide either the house number or street name and a city locator (i.e., City, and either State or Zip Codes).
- *Incomplete* – All other addresses were considered incomplete.

First, we looked at the alternate address completeness levels of those who reported a move that occurred in March or April of 2010. As stated before, the hypothesis is that respondents may report less complete addresses the further away from March or April of 2010 the interview is conducted (i.e., Panels 3 and 4). Due to the very small number of households with a move in March and April of 2010 in the RDD Sample, we did not review the RDD data at this lower level, but we did use the Mover Sample. Table 14 displays the distribution of

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<sup>13</sup> Don’t Know and Refusals may be a result of respondents not wanting to share the information, but we assumed that this characteristic is more likely to be consistent across panels and not affect percentages across panels.

completeness levels for alternate addresses for those Mover Sample cases who had reported a move occurring in March or April of 2010.

**Table 14: Mover Sample: Percentage of Alternate Address Completeness Levels for 2010 March or April Movers, Weighted**

Alternate Address Completeness	Panel			
	1 (May 2010)	2 (June 2010)	3 (September 2010)	4 (February 2011)
Totally Complete	N/A	68.97 (1.48)	74.47 (1.65)	67.51 (2.64)
Partial	N/A	8.03 (0.90)	7.08 (0.97)	12.09 (1.67)
Incomplete	N/A	23.00 (1.34)	18.45 (1.64)	20.40 (2.11)
Standard Errors are in parentheses N/A is for Not Applicable Data Source: RBS Output				

Table 14 shows an overall unexpected trend in the completeness levels of alternate addresses provided. Of those addresses which were identified as “Totally Complete”, a significant percentage increase was only observed between Panel 2 and Panel 3 of the Mover Sample (p-value of 0.0130). Panel 4 of the Mover Sample provided a not significant difference compared to Panel 2 of addresses which were “Totally Complete” (p-value of 0.6287). This trend is not what we expected to observe in the Mover Sample. It is unknown why respondents would provide more knowledge of alternate addresses in Panel 3 compared to Panel 2, and the same percentage of completeness in Panel 4 compared to Panel 2. More research is needed to explain the reasoning behind the observed results.

Of those addresses which were identified as “Partial” complete addresses, significant percentage increases were observed between Panel 2 and Panel 4 (p-value of 0.0322). The percentage change observed between Panel 2 and Panel 3 was not significant (p-value of 0.4722). This increase in “Partial” address completion observed in Panel 4 was something that we expected and could be an indication of respondent’s inability to recall all address components the further away from March or April of 2010 the interview was conducted.

“Incomplete” addresses saw an unexpected significant percentage decrease between Panel 2 and Panel 3 (p-value of 0.0315). The difference in “Incomplete” addresses between Panel 2 and Panel 4 proved not significant (p-value of 0.2994).

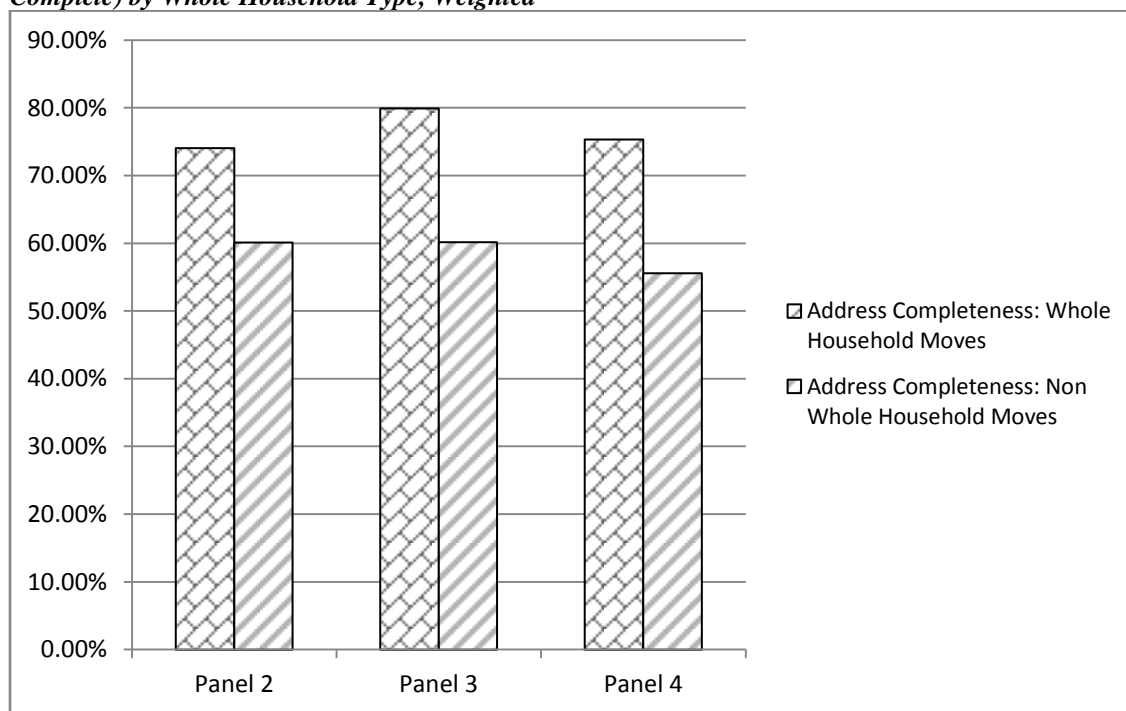


Table 14 shows many unexpected results and indicates that the measurement of address component collection might not truly provide an accurate measurement of recall ability. We do not have an explanation for the observed results.

We also examined the level of address completion for households identified as whole household movers and non-whole household movers.

Figure 4 shows the results of alternate address completeness for those households identified as a whole household mover and those for non-whole household movers. The figure displays only the alternate address completeness level for Mover Sample addresses with all components filled (i.e., “Totally Complete”). These results illustrate that those households where all members were involved in the same move and on the same date, have higher levels of knowledge regarding the alternate addresses than those of non-whole household moves.

**Figure 4: Mover Sample Alternate Address Completeness Level for 2010 March or April Moves (Totally Complete) by Whole Household Type, Weighted**

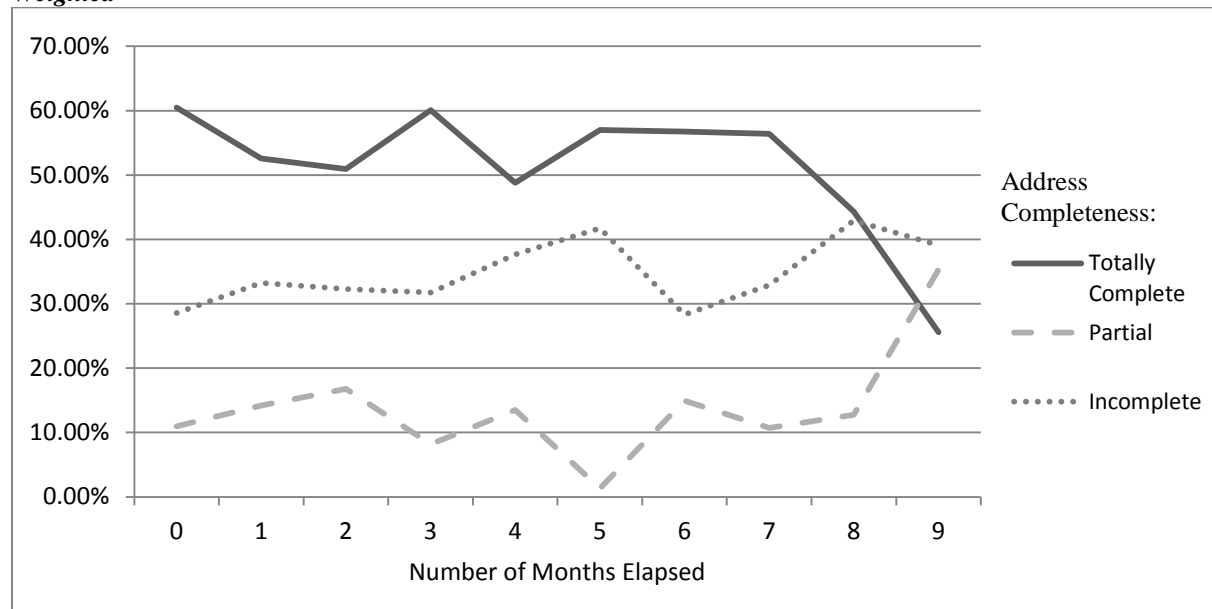


Standard Errors are reported in the Appendix A  
 Data Source: RBS Output

For a more general review of alternate address completeness levels over time, we conducted an analysis on address completeness based on the length of time (in months) between the move day and interview day. This provided a big enough universe to review both the RDD Sample and the Mover Sample.

Figure 5 shows the distribution of alternate address completeness over the number of months since the move occurred for the RDD Sample.

**Figure 5: Random Digit Dialing Sample: Alternate Address Completeness Knowledge by Lapsed Time, Weighted<sup>14</sup>**



All standard error are presented in Appendix A  
 Data Source: RBS Output

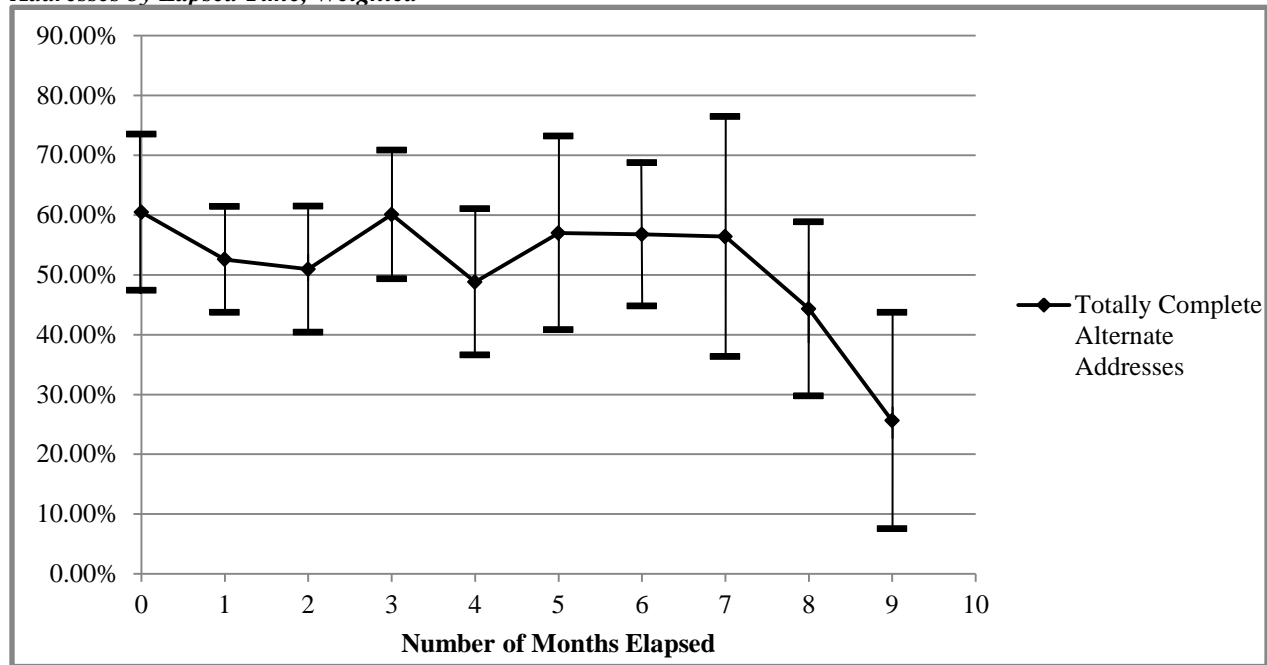
As you can see in Figure 5, most of the “Totally Complete” percentages actually remain relatively flat until seven months have elapsed. The eighth and ninth month marks show the “Totally Complete” level drop and the “Partial” level increase. This overall trend is not what we would have expected, but this could possibly indicate that recall is not a casual degradation over time when linked to reporting an address, but that there may be more of a point in time when it changes significantly.

Figure 6 below examines only the alternate address completeness level of “Totally Complete” cases over lapsed time for the RDD Sample. For ease of comparison between month differences, this figure includes the upper and lower Shewhart bounds (+/- two standard deviations). Significance tests were calculated comparing all the month difference combinations. The only significant differences observed were when comparing Month 9 to each of the other months<sup>15</sup> (with the exception of the Month 8 comparison), which showed a significant drop in the percentage of “Totally Complete” alternate addresses provided in the RDD Sample. So, essentially the address completeness level for the RDD Sample remains at comparable levels until after seven months elapsed and then the drop occurs.

<sup>14</sup> While some moves that were 10 to 13 months since interview day were recorded, they were not included because the total count was less than 30 observations.

<sup>15</sup> Table AF6 in Appendix A contains the significant difference p-value test results.

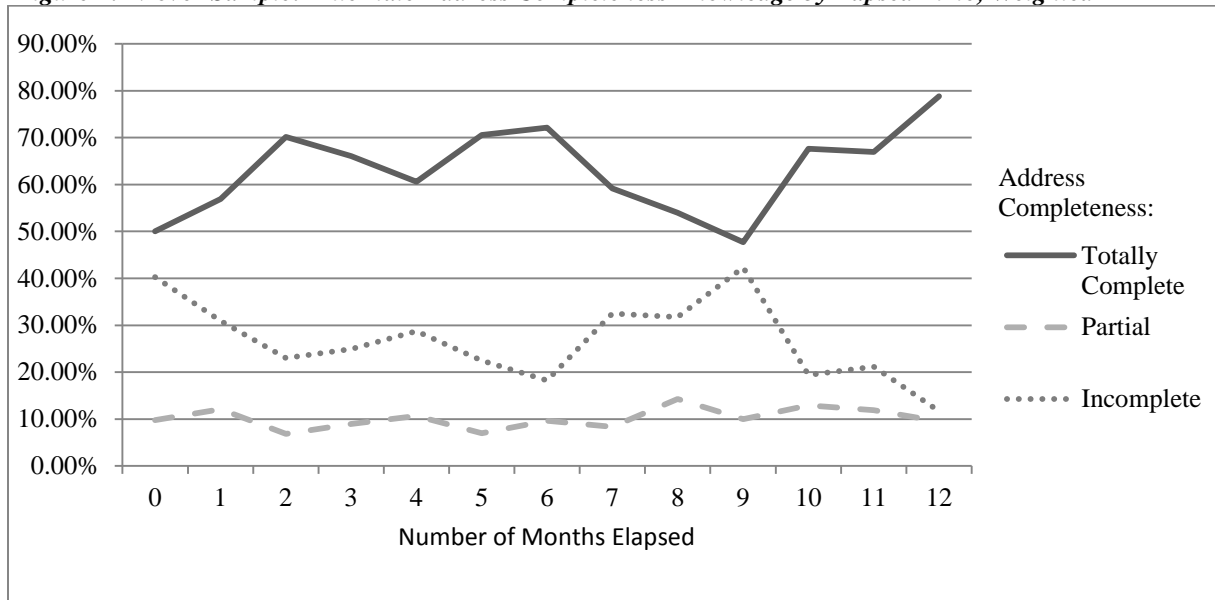
**Figure 6: Random Digit Dialing Sample: Alternate Address Completeness Knowledge for Totally Complete Addresses by Lapsed Time, Weighted**



All standard error are presented in Appendix A  
 Data Source: RBS Output

Figure 7 is the distribution of the alternate address completeness levels over the number of months elapsed since the move occurred for the Mover Sample. Because the majority of Mover Sample respondents reported a move occurring during the months of March or April of 2010, we do not see a gradual decreasing trend in the level of alternate address completeness, but rather spikes (representing interviewing periods) and valleys (representing non interviewing periods).

**Figure 7: Mover Sample: Alternate Address Completeness Knowledge by Lapsed Time, Weighted**



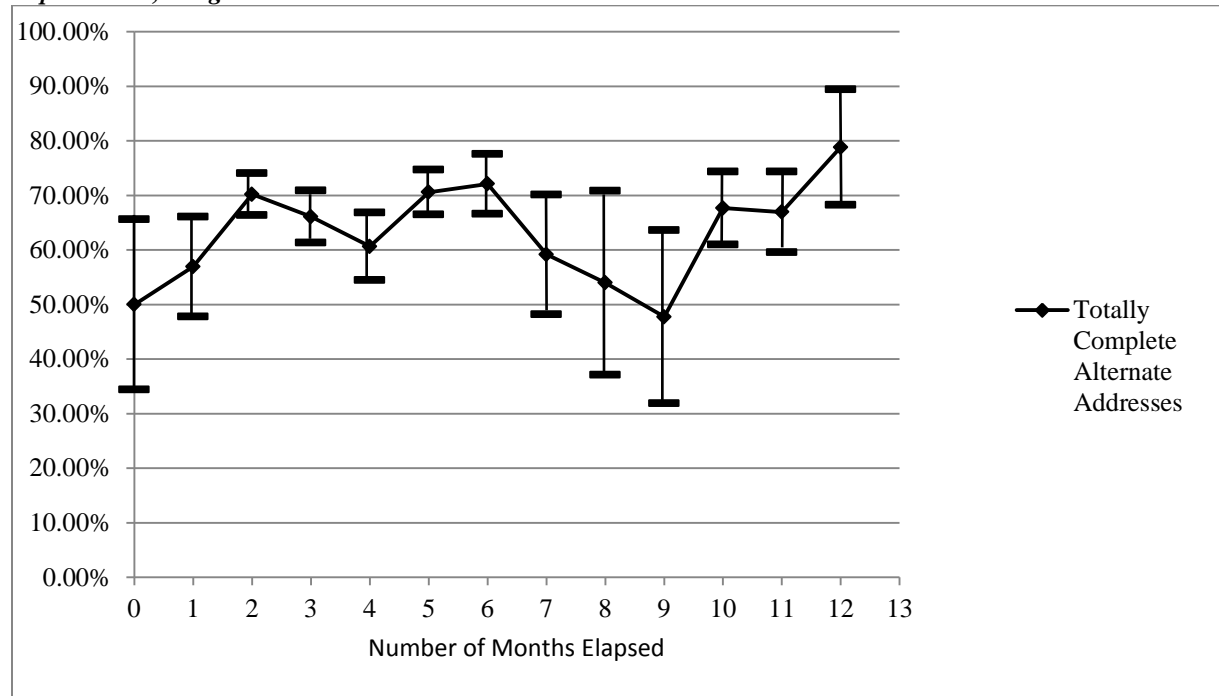
All standard error are presented in Appendix A  
 Data Source: RBS Output

With the majority of the Mover Sample reporting a move during March or April of 2010 we are able to explain the increasing and decreasing trends observed in the “Totally Complete” addresses of Figure 7 above. The first spike seen in “Totally Complete” addresses occurs after two months which represents the month difference between March or April of 2010 and Panel 2’s interview month in June 2010. The second and third spikes occur at Month 6, and Month 10, respectively. These spikes correspond to Panel 3’s interview month in September 2010 and Panel 4’s interview month in February 2011 respectively. The valleys seen in Figure 7, represent households which reported a move that did not occur during March or April of 2010 as we expected. The dramatic increase seen in Month 12 was unexpected and we are unsure why it occurred.

Figure 7 shows that the “Incomplete” level follows an inverse relationship to the “Totally Complete” level while the “Partial” addresses provided remains relatively flat across the year period.

As with the RDD Sample, we have included an examination into only those alternate addresses which reported a Complete level in the Mover Sample. Figure 8 below includes the Shewhart bounds for ease of comparison by number of months elapsed between the move and the interview. We conducted significance testing on all month difference combinations as we did with the RDD Sample.

**Figure 8: Mover Sample: Alternate Address Completeness Knowledge for Totally Complete Addresses by Lapsed Time, Weighted**



All standard error are presented in Appendix A  
 Data Source: RBS Output

In general, what we observed in our testing on Figure 8 results was that significant differences occur often between interviewing and non-interviewing month differences (e.g., Month 2 is significantly different from Month 4, and Month 6 is significantly different from Month 7 (p-values of 0.0085 and 0.0348 respectively). However, when comparing between only interviewing months (Month 2 compared to Month 6 and Month 10, and Month 6 compared to Month 10) we observed no significant differences (p-values of 0.5682, 0.5134, and 0.3060 respectively). Likewise, the results for the majority of non-interviewing months comparisons to each other were not significant.

These findings support the claim that those respondents who filed a change of address form with the Postal Service and actually reported moving in March or April of 2010 during the RBS provided a higher alternate address completion level for the move that occurred in March or April of 2010 than moves occurring outside of March or April of 2010. Any decreasing trends seen in Figure 8 cannot directly be indications of recall bias but more likely a factor of the mover universe. Further research is needed to explain some of the unexpected increases in the trends.

## **REVIEW OF THE NATIONAL CHANGE OF ADDRESS FILE**

### **5.2 *Did the National Change of Address file help identify households with movers or complex living situations?***

The Census Bureau is researching possible use of administrative records to help make the census more effective while minimizing costs and resources. One of those possible administrative records sources is the NCOA file. For CCM, a thought was that it could help identify units that are more likely to not be stable living situations and may be more complicated in enumerating the household correctly. Specifically, we hoped the Mover Sample created by matching to the NCOA file would have identified households that contained people who have moved around April 1, 2010. The following questions address how well the reports in the NCOA file match what was collected in our survey.

For this section, all results are from the sample chosen with the help of the NCOA file. This universe is larger than the Mover Sample analysis universe in Section 5.1, because we deleted cases with missing data needed for weighting purposes in the Mover Sample. The analysis in this section is not weighted and is just directly reporting what occurred within the sample that matched the NCOA file. For clarity, we will refer to this as the NCOA Match Sample or Match Sample. While some of the characteristics reviewed overlap with Section 5.1, this section's research is only focused on how effective the NCOA file is as a tool to identify movers and does not deal with possible recall bias. Due to the change in analysis universes and the lack of weighting, the results in this section are not comparable to results in Section 5.1.

#### **5.2.1 *What percentage of households contacted in the National Change of Address Match Sample at least reported an alternate address?***

An alternate address is another address besides the sample address where a person in the household could have lived or stayed during 2010. The NCOA Match Sample should have contained households with at least one mover and therefore we expected most households to report at least one alternate address. Table 15 shows the percent of households that had at least one person report an alternate address by panel.

***Table 15: National Change of Address Match Sample: Percentage of Households that Reported an Alternate Address***

Alternate Address Reported by Household	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Yes	57.46	56.21	47.75	54.22
No	42.54	43.79	52.25	45.78

Data Source: RBS Output

Results did not get anywhere close to most cases reporting at least one alternate address, and this was surprising. Instead of almost all cases reporting an alternate address, the rate of address reporting was less than 58 percent for each panel. Overall, only 54.22 percent of the households contacted had at least one alternate address reported. The fourth panel had the lowest percentage of alternate addresses reported at 47.75 percent. There was no significant difference (p-value of 0.3834) between Panel 2 and 3, but a significant difference exists between Panels 2 and 4 (p-value <0.0001) and Panels 3 and 4 (p-value <0.0001), with Panel 4 reporting proportionally fewer alternate addresses than the earlier panels. Therefore, while we did not see the very high alternate address reporting rates, we did observe that households were more likely to report an alternate address in the earlier panels.

We then reviewed the data at the person level for the NCOA Match Sample. Table 16 shows the percentage of the Match Sample people who were reported as having an alternate address. Since not all people in the household may have moved, we did not expect everyone to have an alternate address, but we expected it to be a high percentage.

**Table 16: National Change of Address Match Sample: Percentage of People Reported to have Alternate Addresses**

Alternate Address Reported	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Yes	45.14	45.24	37.98	43.12
No	54.86	54.76	62.02	56.88
Data Source: RBS Output				

Overall, 43.12 percent of the people were reported as having an alternate address<sup>16</sup>. Over 45 percent of the people were reporting an alternate address in Panels 2 and 3. The percentage of people reported as having an alternate address decreased significantly in Panel 4, reaching 37.98 percent. A significant difference of people reported as having an alternate address exists between Panels 2 and 4 (p-value <0.0001) and Panels 3 and 4 (p-value <0.0001). There was no significant difference between Panels 2 and 3 (p-value of 0.9035).

These two tables show that for this study the NCOA file only helped identify households that had alternate addresses about half the time. Since the percentages drop for later panels, this is the first indication that the file may also be a more useful tool when used closer to the time of creation by the USPS. However, we need to remember that these results could be affected by the results of the telephone look-up operation and must also remember that there is potential error associated with the responses to the RBS, i.e., it could be that the RBS respondents did

<sup>16</sup> Occasionally some people mentioned a move but did not report an alternate address during the interview. At the end of the interview, these persons refused to report the address or added the move after the interview during the debriefing portion and hence, no alternate address was collected. These alternate addresses are not included in this analysis.

not report all the moves, possibly due to recall error, maybe as a result of proxy responses for the actual mover within the household, or because they just did not want it reported or wanted to end the interview. The following results may also be impacted similarly.

### 5.2.2 What percentage of households contacted in the National Change of Address Match Sample reported at least one person moving sometime in 2010?

Table 17 shows the final move status assigned to each Mover Sample household by panel. Each person included in the analysis was assigned one of the four mover types of mover, long-term cyler, unsure if mover (don't know), and nonmover. See Section 3.2 on page 11 for the definitions. A household was marked as a mover if any person was a mover in the household. The household was marked as long-term cyler if any person was a long-term cyler. If anyone had an unknown status, the household was marked as unknown status also. All other households were marked as non-movers.

**Table 17: National Change of Address Match Sample: Percentage of Household Final Move Status by Panel**

Analysis Mover Code	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Mover	34.41	32.64	31.54	32.98
Long-term cyler	15.75	16.60	8.49	13.94
Don't Know	2.23	2.09	2.91	2.38
Non-mover	47.61	48.67	57.06	50.70
Data Source: RBS Output				

From the data collected from each Mover Sample householder, between 31 and 34 percent of the households in each panel were movers. The percentage of non-movers increased between panels, with the highest percentage in the fourth panel at 57.06 percent. There is no significant difference (p-value of 0.5614) in household mover status between Panels 2 and 3, but there is a significant difference between Panels 2 and 4 (p-value <0.0001) and in Panels 3 and 4 (p-value <0.0001). This increase in non-mover status in Panel 4 may be the result of the much later interview time, in February of the next year (2011) for Panel 4. For more on attrition in move reporting, see Section 5.1.2.

For this analysis, movers and long-term cyclers are both counted as mover households. Looking at them together, the overall percent of movers and long-term cyclers collected was 46.92 percent (3,171 households) with the maximum of 50.16 percent in Panel 2. This once again shows that the NCOA file could be a good source to identify movers when used closely to USPS collection of move dates.



As we did in the recall bias analysis section of the study, we thought there may be a difference in how owners and non-owners report moves to the USPS and hence, change the results when using the NCOA file. It could affect the accuracy of finding movers. So, we reviewed mover status for owner and non-owner households. Tables 18 and 19 show the household mover status for owners and non-owners, respectively<sup>17</sup>.

**Table 18: National Change of Address Match Sample: Percentage of Final Household Mover Status by Panel for Owner Households**

Final Household Mover Status	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Mover	28.71	27.67	27.56	28.02
Long-term cyler	19.31	19.51	9.79	16.65
Don't Know	2.44	2.24	3.11	2.56
Non-mover	49.54	50.59	59.53	52.77
Data Source: RBS Output				

**Table 19: National Change of Address Match Sample: Percentage of Final Household Mover Status by Panel for Non-Owner Households**

Final Household Mover Status	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Mover	55.79	55.45	46.67	52.92
Long-term cyler	2.47	3.22	3.7	3.07
Don't Know	1.52	1.24	2.22	1.65
Non-mover	40.23	40.10	47.41	42.37
Data Source: RBS Output				

We can see the NCOA file did better as a tool identifying non-owner households that moved than owner households that moved. Overall, 55.99 percent of non-owner households were movers or long-term cyclers, while 44.67 percent were movers or long-term cyclers for owner households. This difference is even greater for just movers, 52.92 percent and 28.02 percent,

<sup>17</sup> There were 37 households that the owner or renter status could not be determined based on the responses to the telephone interview, and these were excluded from this analysis.

respectively. Further research is needed into this difference but it appears owners are less likely to report moves in a survey than non-owners (renters).

In addition to looking at the success of identifying mover households, we wanted to review non-mover households to see if the NCOA file at least pointed to a complicated household even if they were not movers. A household was considered a non-mover when all people lived and stayed at one address all of 2010. In addition, a household was classified as a non-mover if they cycled only short times (less than 30 days) to and from an alternate address. Of the non-mover households, 10.53 percent had at least one household member that was a short-term cyler with an alternate address. Looking at the living situation for these short-term cyclers, most were in a short seasonal stay situation, such as weekend visits or less than 30 days at a vacation home. These situations do not really indicate a complex living situation.

### 5.2.3 How accurate are the type of move indicators on the National Change of Address file?

#### A. The Permanent Move Flag

When an individual reported a move to the USPS, they should have indicated if the move was permanent or temporary. We refer to this as the Permanent Mover Flag with possible values of temporary and permanent. A temporary move should have been indicated if the person planned to move back to the old address within 12 months, otherwise permanent should have been selected. An initial mail forwarding of six months could be extended to a year for a temporary move. This flag is included along with the name and address on the NCOA file. Table 20 shows the cross tabulation of mover status with the permanency flag on the NCOA file.

**Table 20: National Change of Address Match Sample: Percentage of Household Mover Status by Permanency Flag**

Household Mover Status	Permanency Flag	
	Permanent	Temporary
Mover	93.54	6.46
Long- Term Cyler	49.89	50.11
Don't Know	77.64	22.36
Non-mover	87.19	12.81
Original Sample Distribution	83.86	16.14
Data Source: RBS Output		

We expected a majority of the mover households to have permanent mover flag values and a majority of long-term cyclers to have temporary flag values. Looking at the distribution of

the flag for mover households, 93.54 percent did have the permanent flag as expected. Looking at long-term cyclers, only 50.11 percent had the temporary flag selected. It is interesting that even the majority of households we could not classify and those we classified as non-movers also had the permanent mover flag.

We wanted to study the type of living situation of the long-term cyclers to possibly explain why the temporary flag was not more accurate. In addition to the final mover status, for those people who were either short-term cyclers or long-term cyclers, we coded the type of living situation such as extended seasonal stay for snowbirds or extended jail stay. Looking at these codes for long-term cyler households, most long-term cyclers people reported their moves as staying at a seasonal home for an extended period, but were expected to return to a permanent address (e.g., snowbirds) (83.17 percent). There were also people who indicated an extended stay at a college address (6.14 percent). We believe these householders may have incorrectly filled out their change of address form indicating a permanent move when it should have been temporary because they needed the mail-forwarding period of more than six months, but less than a year. We cannot provide any evidence of this based on the data collected in the telephone interview, but if another study is done it might be interesting to get feedback on how people completed the USPS NCOA form.

### **B. Family Move Flag**

When individuals reported a move to the USPS, they should have indicated if an individual (the person’s name listed on the form) was moving or if the family was moving to the same new address where family is defined as everyone with the same last name. We refer to this as the Family Move Flag. Based on information collected during the telephone interview, we determined if the whole household moved or just an individual. However in our case, we defined a whole household move as everyone moving in the household from one location to another regardless of last name. Households that contained only one person were considered to be whole household moves. We then compared the Family Move Flag and the information from the telephone interview (Type of Move). Table 21 shows the cross tabulation of the Family Move Flag with the Type of Move definition for whole household looking only at households that had a move status of move or long-term cyler.

***Table 21: National Change of Address Match Sample: Percentage of Family Move Flag by Type of Move Reported for Movers and Long-Term Cyclers***

Family Move Flag	Type of Move Reported		Overall
	Whole Household	Non-Whole Household	
Family	74.96	25.04	53.26
Individual	36.84	63.16	46.74
Data Source: RBS Output			

Of the households that reported a move and marked family on the Family Move Flag for the USPS, we classified 74.96 percent as whole household movers. That is a very high rate of agreement. For those households that reported a move but selected as individual on the Family Move Flag, we only classified 63.16 percent as non-whole household movers. Overall, 69.44 percent of the households reporting a move matched the flag on the NCOA file that we expected. For single person households we are unsure if they indicated they were family or individual movers on the NCOA form. The individual should be checked if the person filling out the form is the only one moving, however family should be checked if everyone in the household shares the same last name and is moving to the same new address.

**5.2.4 What percentage of households contacted in the National Change of Address Match Sample reported a move in March or April of 2010?**

Table 22 shows the number and percentage of households (movers and long-term cyclers) that reported a move in March or April of 2010, February or May, other date, or no date, respectively. If the household reported a 2010 March or April move along with another month, the household was designated as having a 2010 March or April move. We included February or May moves as a separate category because there were a number of households that reported a person moving from one address on February 28 or May 1. These addresses were included as part of the February or May moves.

**Table 22: National Change of Address Match Sample: Percentage of Reported Move Month by Panel for Households with a Mover or Long-term cycle status**

Month of Move	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
March or April	74.09	63.27	51.85	64.74
February or May	15.58	16.37	16.09	15.99
Other date	3.18	8.67	20.18	9.33
No Date	7.15	11.68	11.88	9.93

Data Source: RBS Output

As expected, the majority of the movers reported a move in March or April of 2010 at 64.74 percent overall across the three panels, with the highest percentage (74.09 percent) in Panel 2. In addition 15.99 percent across all panels reported a move date in February or May. We assume this is a combination of skewed reporting in the interview and actual changes in true move date after submitting the mail forward request to the USPS. It should be noted that because Panel 4 was conducted in February 2011, people could have reported a move during any month in 2010, therefore allowing more chance of other dates than no date. Again, if we use the NCOA file to target movers close to the date it was created, we should get a majority

of the mover households to be in the time frame of interest (e.g., for Panel 2, 89.67 percent of move households have a move between February and May).

Table 23 displays the distribution of the move date (month) by the final move status for the mover and long-term cyler households. Unknown and non-movers are not included because these households did not report any dates. (Please note that the percentages are calculated for each panel by move status and month of move. For example, the summation of the percentages for movers by each month of move would total 100 percent for each panel.)

**Table 23: National Change of Address Match Sample: Percentage of Key Move Date by Household Move Status**

Month of Move	Household Move Status	Panel			Overall
		2 (June 2010)	3 (September 2010)	4 (February 2011)	
March or April	Mover	76.01	63.95	56.73	66.62
	Cycler	69.87	61.94	33.73	60.30
	Both	74.09	63.27	51.85	64.74
Feb or May	Mover	14.25	14.95	14.10	14.45
	Cycler	18.48	19.16	23.49	19.64
	Both	15.58	16.37	16.09	15.99
Other	Mover	3.71	10.01	17.50	9.65
	Cycler	2.03	6.04	30.12	8.60
	Both	3.18	8.67	20.18	9.33
No Date	Mover	6.03	11.08	11.67	9.29
	Cycler	9.62	12.86	12.65	11.46
	Both	7.15	11.68	11.88	9.93
Data Source: RBS Output					

It can be seen that in each panel that the majority of the movers and long-term cyclers reported a 2010 March or April move date in Panels 2 and 3. However, in Panel 4, 33.73 percent of the long-term cyclers reported a 2010 March or April move date, but 53.61 percent reported a move date in another month. These percentages may be skewed due to the small number of long-term cyler households (166 cyler households) contacted compared to the other types of households contacted in Panel 4. This may be caused by some nonresponse

bias for households that would be long-term-cyclers who could be at their other address this time of the year. We also cannot explain the sudden jump in moves that are for reports of other dates. When reviewing the data, we find that these cases are reporting two moves just none of them are in the months between February and May. Further research would be needed on both theories. Once again, as long as it is used close to creation, the NCOA file can be good at targeting move dates if a move is reported.

**5.2.5 How many cases (telephone numbers) ended up contacting either the corresponding name or address on the National Change of Address file?**

The next set of questions review the ability to reach the exact person or address listed on the NCOA file. While our intent was to review the success contacting the person or address on the NCOA file, results are confounded with the success of the telephone number look-up operation. For nonmatches, we could not determine if it was due to an issue in the telephone look-up or in the data reported in the NCOA file. For the success of contacting NCOA cases, see Section 5.1.1 on response rates, contact rates, and final outcomes.

*5.2.5.1 Were we able to reach people reported on the National Change of Address file?*

Across all three panels in the NCOA Match Sample, we were able to interview 6,759 housing units that rostered people. Of those, 42.06 percent reported names that matched 100 percent to the full name of the person on the NCOA file. There were 12.09 percent of the households that reported a portion of the person’s name (first or last) and could be a possible match, and 25.24 percent of the households where we could not match the names because they were unknown (no names given but a description like “Mister” or “Lady of the House”). For 20.61 percent of the households, we collected names that did not match the NCOA file.

Table 24 shows the distribution of households in the NCOA Match Sample by their person match status to the NCOA file by panel. The status for the household was set if at least one person in the household received that status.

**Table 24: National Change of Address Match Sample: Distribution of Household Person Matches by Panel**

Household Person Match Status	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Match	46.41	42.88	35.53	42.06
Possible Match	11.68	12.59	12.01	12.09
Unknown	23.56	25.71	26.84	25.24
Non-match	18.34	18.82	25.61	20.61
Data Source: RBS Output				

Table 24 shows that as time elapsed, the chances of contacting a household with a person on the NCOA file decreased. However, the majority of cases for each panel were matches. The percentage of people who matched decreased between each panel and an increase of non-matches is apparent between each panel. There is a significant difference between Panels 2 and 4 (p-value <0.0001) and Panels 3 and 4 (p-value <0.0001). There was no significant difference (p-value of 0.0874) between Panels 2 and 3. Since the fourth panel was held in February 2011, only one or two months short of a year since the NCOA reported move, it may have been more difficult to contact the person since they may have different contact information. We can assume that if telephone numbers were not looked up just once at the beginning of the study and we had instead done a look-up before each panel, we would have seen an increase in the number of telephone numbers better connected to the proper address and hence connected to the proper people (more comparable to Panel 2).

In general, using the NCOA file we were able to target people fairly well. Assuming Panel 2 is closer to truth, the interview reached the household with the possible mover just under half the time and possibly reached them up to 80 percent of the time (possible match and unknown combined) with only 18.34 percent being true non-matches.

We also looked at whether the name given during the telephone interview matched the name provided on the NCOA file based on the final household mover status to see if they corresponded. Table 25 shows the distribution of household person match rates by household mover status.

**Table 25: National Change of Address Match Sample: Distribution of Household Mover Status by Household Person Match Codes**

Household Mover Status	Household Person Match Code			
	Match	Possible Match	Unknown	Non-Match
Mover	47.41	25.95	27.32	14.57
Cycler	20.08	9.30	12.37	6.03
Don't Know	2.32	1.71	2.81	2.37
Non-mover	30.18	63.04	57.50	77.03
Data Source: RBS Output				

Of the households that reported a name that matched the NCOA file, 67.49 percent were from mover and long-term cycler households. When the person's name provided during the telephone interview did not match the name on the NCOA file, 77.03 percent were identified as non-mover households. Knowing this, we could use the name in the NCOA file almost as a screener to have a better chance of reaching households that did move in some way.

To better show this correlation, Table 26 shows the percent of interviews overall by household move status and household person match code. If the NCOA file was truly successful, a very high percentage would be in the first two rows of the first column.

**Table 26: National Change of Address Match Sample: Overall Distribution of Households by Household Move Status and Household Person Match Code†**

Household Move Status	Household Person Match Code			
	Match	Possible Match	Unknown	Non-Match
Mover	19.94	3.14	6.89	3.00
Cycler	8.45	1.12	3.12	1.24
Don't Know	0.98	0.21	0.71	0.49
Non-mover	12.69	7.62	14.51	15.88
†All cells sum to 100 Percent Data Source: RBS Output				

Only 28.39 percent of interviews reached the household we were hoping for (cases that matched) and subsequently reported that they were some sort of mover or long-term cyler. This number is much lower than we had hoped, but if we look at it more optimistically and include possible matches and unknowns<sup>18</sup> then the percent increases to 42.66 percent. The number we are more concerned with is the 15.88 percent of cases that were a non-mover and non-match. These are the people we were not interested in. We would suspect that this may have been caused by the aging of telephone numbers, but they are evenly distributed between panels, therefore further research is needed. The other number that we should focus research on is the 12.69 percent of people who did match but for some reason did not report to us the move they reported to the USPS. While it is possible, they ended up not moving or just forwarding their mail, we doubt this high a percentage would fall in this category.

5.2.5.2 *Was at least one of the addresses (the “To” or the “From” address) on the National Change of Address file mentioned during the interview?*

People who filled out the USPS Change of Address form had to record the address they were moving to and the address from which they were moving, which is denoted by the “To” or “From,” respectively. The addresses collected during the telephone interview were matched to the “To” and “From” addresses reported on the NCOA file. Different codes were assigned independently for the “To” and “From” addresses for each household to denote the type of match made. These codes are:

<sup>18</sup> Unknowns are being included in the possible matches since as part of this study interviewers were told to not probe or “push” for name because getting the interview and reports of the moves and move dates were the focus and we would prefer the interview without names then lose the interview.



- Match – An exact match,
- Possible 1 – A good possible match (at least street, city, state match),
- Possible 2 – A possible match (They provided an address but only the city matches the address on the NCOA file),
- City Match – City was only item provided by respondent and it matches the NCOA file address,
- No address – Indicated an alternate address but only state or less was provided so no matching was possible,
- Non-match – No alternate address provided or nothing matches on the address provided.

If at least one of the addresses reported in the interview matched the “To” or “From” addresses in the NCOA file, the household level was given a code of Match, followed by Possible Match 1, then Possible Match 2, etc.

Table 27 and Table 28 show the distribution of the matching results for the “To” and “From” addresses per panel. When the household did not contain a person that moved, then the “To” address was just the sample address. The address we used to do the telephone look-up was the “To” address and in theory should have a high match rate, since a move does not need to be reported to possibly match.

**Table 27: National Change of Address Match Sample: Distribution of Match Results for "To" Addresses by Panel**

"To" Address Match Code	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Match	82.22	82.53	79.50	81.54
Possible Match 1	4.23	3.49	6.49	4.63
Possible Match 2	1.16	1.48	3.89	2.06
City Match	11.00	10.37	7.21	9.69
No Address	0.56	0.70	0.20	0.50
Non-match	0.84	1.44	2.71	1.58
Data Source: RBS Output				

There is an overall match of 81.54 percent to the “To” addresses. The non-match address percentage is less than three percent in each panel. The telephone number look-up was successful in reaching the address we wanted to contact, that is, the location people indicated in the NCOA file that they would move to.

Only movers or people with more than one address would have a “From” address to match with. We would expect a high percent of people who matched normally but since we got such a low percent of people reporting a move, this impacts the number of possible matches.

**Table 28: National Change of Address Match Sample: Distribution of Match Results for "From" Address by Panel**

"From" Address Match Code	Panel			Overall
	2 (June 2010)	3 (September 2010)	4 (February 2011)	
Match	29.39	28.54	19.79	26.32
Possible Match 1	2.95	3.05	3.63	3.18
Possible Match 2	1.52	1.00	2.25	1.55
City Match	11.32	11.29	7.52	10.21
No Address	3.67	2.96	2.40	3.06
Non-match	51.16	53.16	64.42	55.67
Data Source: RBS Output				

The overall match rate for “From” addresses was 26.32 percent. There were more “From” address matches in Panel 2 at 29.39 percent while 51.16 percent were non-matches. The percentage of non-matches increased between each panel while matches decreased. A significant difference exists among Panels 2 and 4 (p-value <0.0001), and Panels 3 and 4 (p-value <0.0001) for non-matches. There was no significant difference between Panels 2 and 3 (p-value of 0.3545). As time elapses from the NCOA creation, the chances of respondents mentioning the ‘From’ address as an alternate address decreases.

Table 29 and Table 30 display the distribution of the “To” and “From” address matches compared to the household person match code to check for potential correlation. Again, there was a higher match to the “To” addresses than the “From” addresses.

**Table 29: National Change of Address Match Sample: Distribution of “To” Address Match Codes by Household Person Match Code†**

"To" Address Match Code	Household Person Match Code			
	Match	Possible Match	Unknown	Non-Match
Match	39.27	10.12	16.05	16.10
Possible Match 1	0.77	0.36	2.59	0.92
Possible Match 2	0.06	0.13	0.62	1.24
City Match	1.85	1.36	5.15	1.33
Unknown	0.07	0.04	0.31	0.07
Non-Match	0.04	0.07	0.52	0.95
†Sum of all cells equal 100 percent. Data Source: RBS Output				

While 39.27 percent of the households were perfect matches on both name and “To” address, the percent of households interviewed that mostly matched is 53.92 percent, including possible matches (cells shaded). Having a matching name correlates greatly with getting a matching “To” address, 93.35 percent of households with a person match also had a matching “To” address reported.

Looking at where the address matches but the name does not, we theorize this as indicating the magnitude of when the NCOA file indicates a move, but the address listed is not the address where the person actually moved to. (Instead, it may be where the mail has been forwarded for that person.)

**Table 30: National Change of Address Match Sample: Distribution of “From” Address Match by Household Person Match Code†**

"From" Address Match	Household Person Match Code			
	Match	Possible Match	Unknown	Non-Match
Match	19.72	1.73	3.86	1.01
Possible Match 1	1.98	0.24	0.83	0.13
Possible Match 2	0.75	0.21	0.19	0.40
City Match	4.84	1.30	3.42	0.65
Unknown	1.09	0.33	1.17	0.47
Non-Match	13.67	8.29	15.77	17.95
† Sum of all cells equal 100 percent.				
Data Source: RBS Output				

Only 19.72 percent of the households matched both in name and the moved “From” address. Once again, looking at all possible matches, the percent of households that possibly matched increases to 30.77 percent. This is a lower percentage and is more linked to the lower reporting of moves in general than we expected, as discussed in Section 5.2.2. There were 13.67 percent of households that had a person match but did not match the “From” address. We believe these are most likely households underreporting moves in the survey.

Only 19.41 percent of households ended up matching on person name, and the “To” and “From” addresses perfectly. If we include the possible matches, that percent goes up to 24.38 percent. Both percentages are very low.

### **5.2.6 How did the person match, address match and mover status overlap in the National Change of Address Match Sample?**

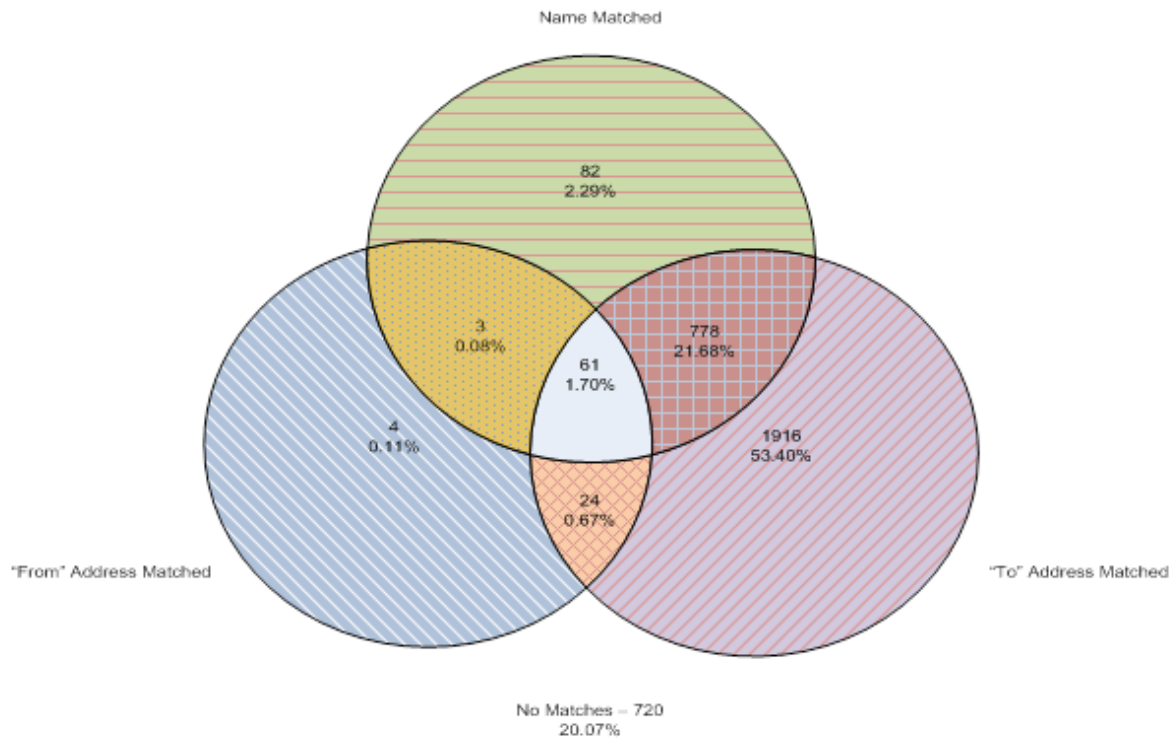
Ideally, we would like the NCOA information to provide a perfect match for person name, the “To” and “From” addresses, and the respondent to report a move in March or April of 2010. This was not the case, but the study did collect good data in some of the categories we reviewed. Overall, only 14.22 percent of the Mover Sample households had a name match, a match to both “To” and “From” addresses, and reported a move in March or April of 2010.

Since the NCOA file may have many different uses, it is good to know where it did overlap well and where it did not. Figure 9 and Figure 10 show the overlap of how the NCOA file did in collecting the expected data. Figure 9 is for when a mover was not reported and Figure 10 is for when a mover was reported. (These have been separated to present the data more

clearly.) Each category was simplified to two values – Match or No Match, where No Match includes Possible Matches and Unknowns.

**Figure 9: Non-mover Households - Perfect Match Component Overlap**

N = 3588



Data Source: RBS Output  
 Note: Figure is not drawn to scale.

Figure 9 shows that for those households that did not report a move at all in the RBS, we only got the name and both addresses to match 1.70 percent of the time, but we got the person’s name and current (“To”) address to match 21.68 percent of the time. So for those households, this indicates that we were reaching the actual households we thought we would, but they did not report the move or the “From” address. There was no match to any of the pieces at all 20.07 percent of the time for non-mover households, which means for these cases the telephone number look-up was not able to reach the people we wanted.

**Figure 10: Mover Households - Perfect Match Component Overlap**  
 N = 3171

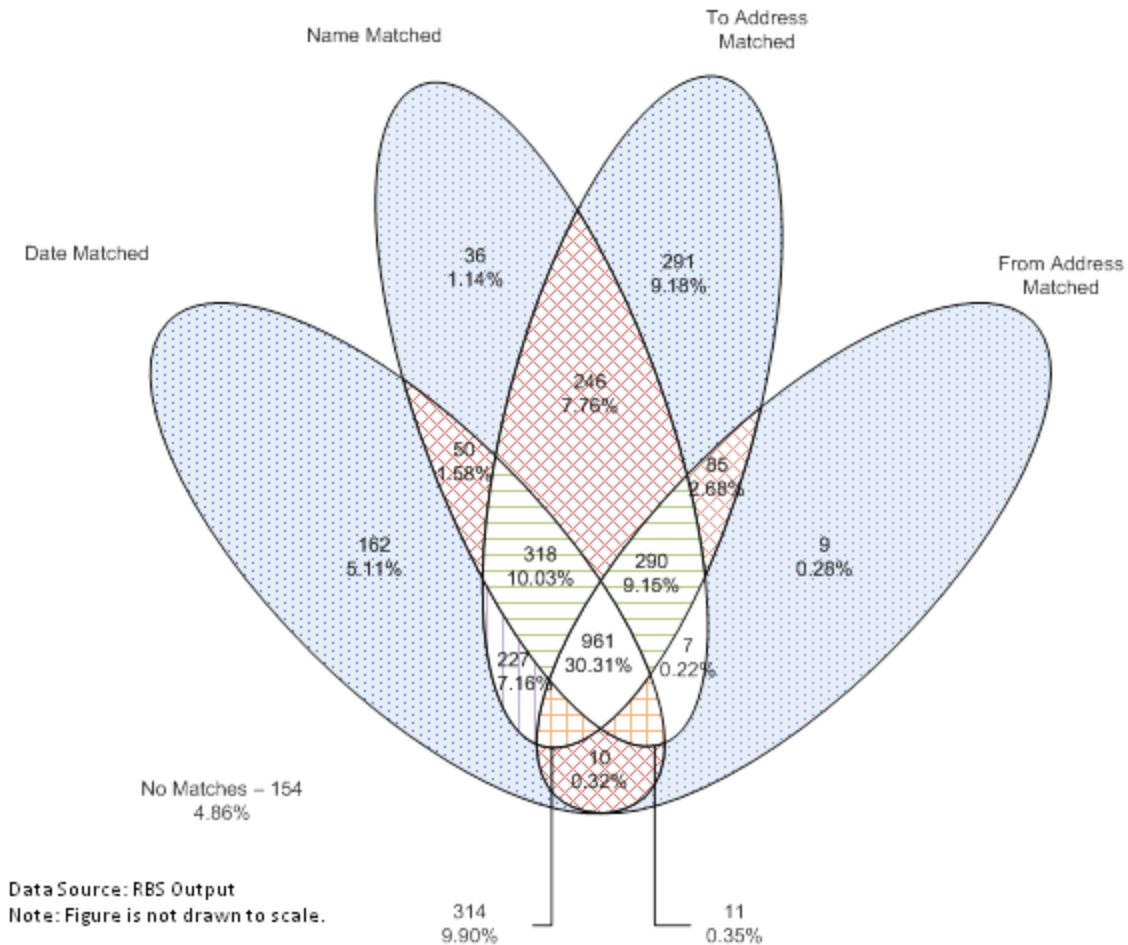


Figure 10 shows different overlaps for households classified as movers. When they do report a move, 30.31 percent of the households have all components matched (name, both addresses, and a move date in March or April of 2010). Interestingly, the next highest overlap is everything matches except the “From” address (10.03 percent). We would speculate this may be underreporting (not reporting the full address) and/or could be caused by problems with recall. The third highest overlap is when everything matches except the move date is not in March or April of 2010 (9.15 percent). This could be from misreporting the date of the move (possible recall error).

Looking at Figures 9 and 10 together, there are two overall numbers that are of importance; the number of cases that matched completely overall (the 14.22 percent mentioned at the beginning of this section) and the percent of cases where nothing matched<sup>19</sup> (12.93 percent). We would have hoped that the overall rate had been higher and the no match rate would have been lower so we could feel more confident using the NCOA file.

<sup>19</sup> The percent of cases where nothing matched ignores if the case reported a move.

The overall match rate is small but it is also only reporting perfect matches. To get a better feel for when the survey data were close, we analyzed these numbers again using more open definitions. We considered a name to be a match if it was an exact match or possible match. We considered either of the addresses a match if it was a match or any of the three possible match codes. In the mover universe, we accepted the date as a good date if it was anytime between February and May. Figures 11 and 12 display the overlaps using these updated definitions, by mover status.

**Figure 11: Non-mover Households - Component Match (Perfect and Possible) Overlap**  
*N=3588*

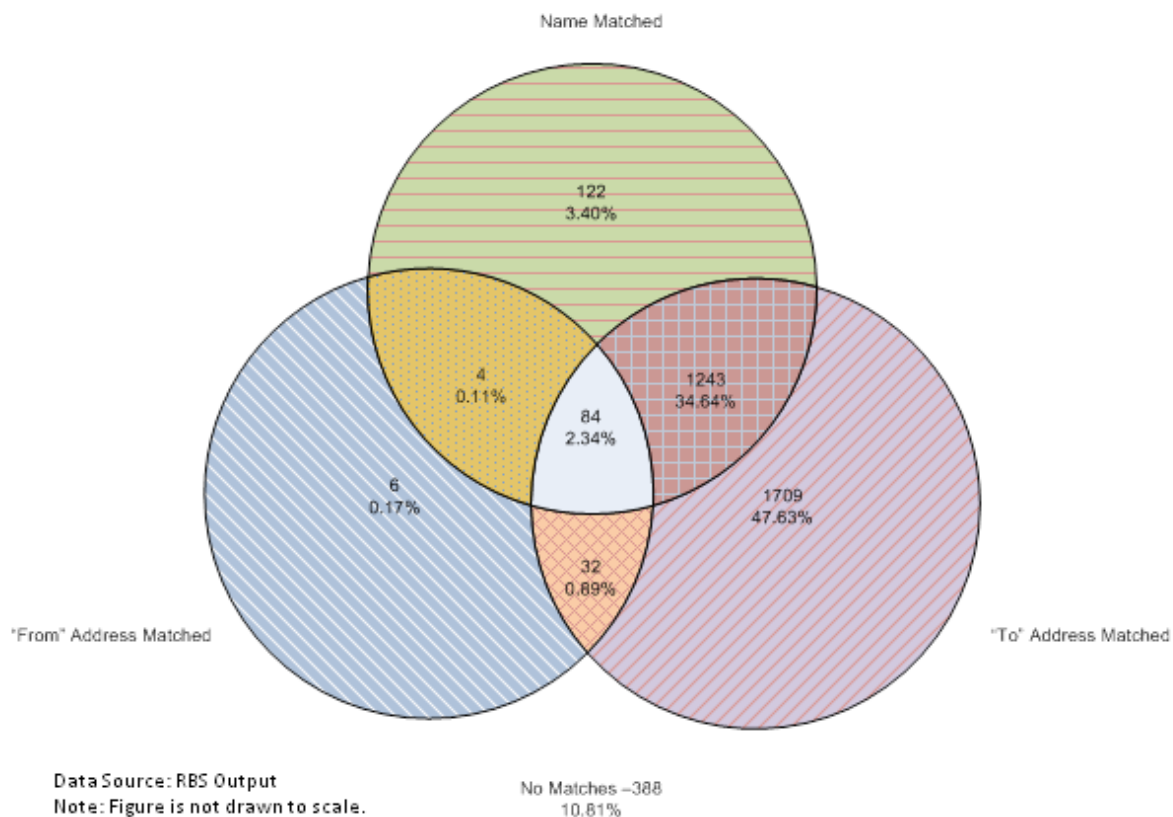


Figure 11 shows that for households classified as non-mover households the number of households that have no match at all decreased by half to 10.81 percent while the number of households that match name and current address goes up to 34.64 percent showing an even higher amount of underreporting of the move to the USPS by the respondents.

**Figure 12: Mover Household - Component Match (Perfect and Possible) Overlap  
N=3171**

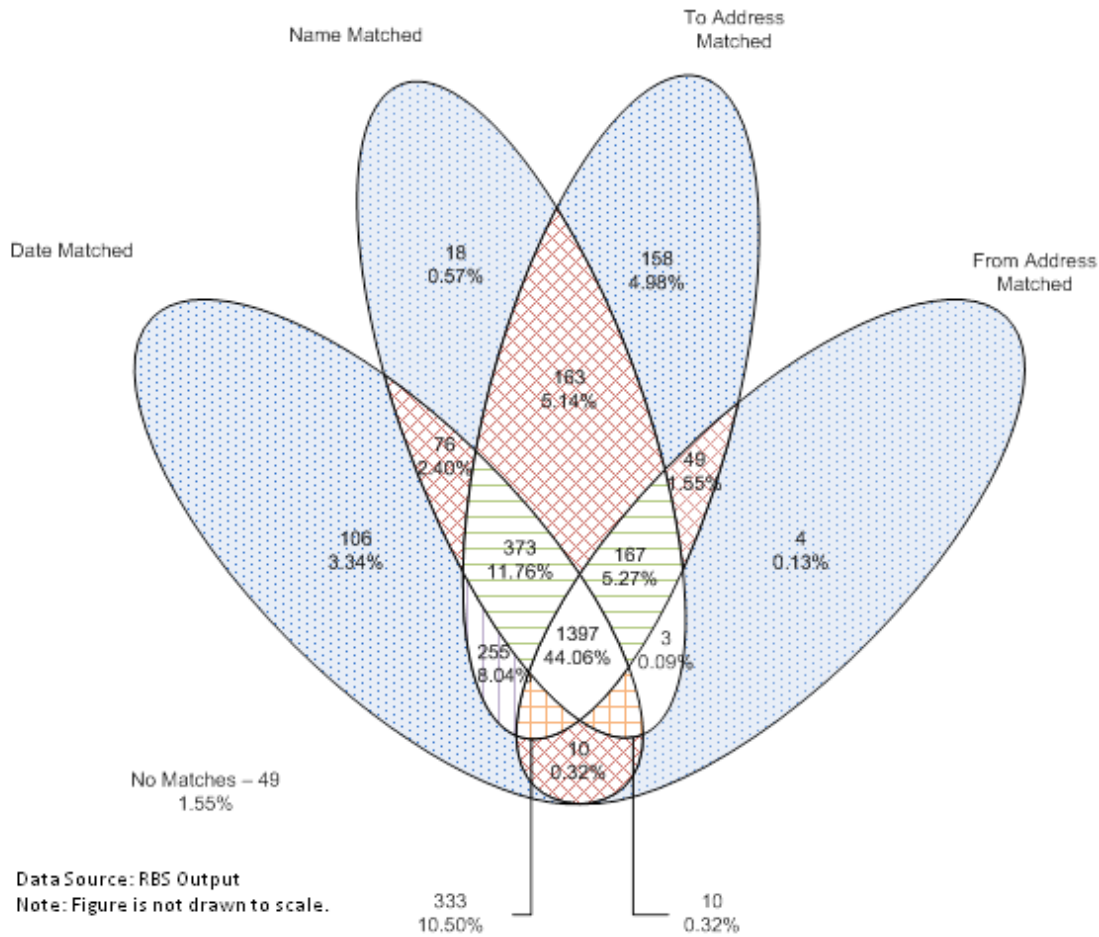


Figure 12 shows that the number of cases that match on all elements goes up to 44.06 percent when including possible matches. The next highest percent is still when all components match except the “From” address, but the percent does not change drastically (10.03 percent compared to 11.76 percent). Most interestingly, the proportion of households that match on only one component decreases in about half for all of the components compared to Figure 10 when we expand our match definitions, showing that respondents may be attempting to report matches but either vaguely or not in the same format as reported to the USPS.

Looking at Figure 11 and 12 together when using the possible matches, the two important numbers change. The percent that match all components goes up to 20.67 percent and the percent that does not have any component match decreases to 6.47 percent (ignoring if they reported a move). Just over 20 percent is still nowhere near where we would like the match rate to be and shows signs of serious recall bias or underreporting.



**COMPARISON OF LANDLINE AND CELLULAR PHONES**

**5.3 What were the differences in reporting between cellular phone and landline random digit dialing samples?**

Each panel of the Recall Bias Study is a dual frame sample survey, where one frame is the universe of all households with a landline telephone and the second frame is all households for which at least one household member has a cellular phone number. Cellular phones were included in this study because we will most likely need to include them in any telephone sample in our upcoming surveys because earlier research shows the number of cellular phone only households is increasing at an exponential rate (AAPOR, 2010). This section will be dedicated to reviewing the results from the landline and cellular phone samples to see what we learned about these universes for the RBS.

**5.3.1 What are the differences in the types of interview outcomes by sample?**

Table 31 and Table 32 show the distribution of interview outcomes for the cellular phone and landline telephone samples, respectively.

**Table 31: Random Digit Dialing Sample: Cellular Phone Sample Interview Outcome Distribution by Panel**

Outcome Category	Panel								Overall	
	1 (May 2010)		2 (June 2010)		3 (September 2010)		4 (February 2011)			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Complete	1,047	20.94	690	25.09	625	22.73	585	21.27	2,947	22.24
Sufficient	3	0.06	0	0.00	1	0.04	0	0.00	4	0.03
Refusal/Break-Offs	740	14.80	348	12.65	380	13.82	408	14.84	1,876	14.16
Other Noninterview	20	0.40	9	0.33	10	0.36	7	0.25	46	0.34
Unknown Eligibility	1,016	20.32	501	18.22	601	21.85	611	22.22	2,729	20.60
Out of Scope	2,174	43.48	1,202	43.71	1,133	41.20	1,139	41.42	5,648	42.63
<b>Total</b>	<b>5,000</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>13,250</b>	<b>100.00</b>
Data Source: CATI output										

**Table 32: Random Digit Dialing Sample: Distribution of Landline Telephone Sample Interview Outcome by Panel**

Outcome Category	Panel								Overall	
	1 (May 2010)		2 (June 2010)		3 (September 2010)		4 (February 2011)			
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Complete	1,289	25.78	777	28.25	770	28.00	753	27.38	3,589	27.09
Sufficient	1	0.02	0	0.00	0	0.00	0	0.00	1	0.01
Refusal/Break-Offs	513	10.26	260	9.45	243	8.84	234	8.51	1,250	9.43
Other Noninterview	19	0.38	5	0.18	3	0.11	10	0.36	37	0.28
Unknown Eligibility	318	6.36	257	9.35	322	11.71	225	8.18	1,122	8.47
Out of Scope	2,860	57.20	1,451	52.76	1,412	51.35	1,528	55.56	7,251	54.72
<b>Total</b>	<b>5,000</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>2,750</b>	<b>100.00</b>	<b>13,250</b>	<b>100.00</b>
Data Source: CATI Output										

Some very important differences can be seen in the distribution of outcomes by landline telephone and cellular phone samples. The landline telephone sample had a larger percentage of completed cases than those contacted via cellular phone, 27.09 percent to 22.24 percent, respectively. The cellular phone sample had a higher percentage of refusal/break-off contacts than that of the landline telephone sample, 14.16 percent to 9.43 percent, respectively. But the most striking difference observed between cellular and landline contacts was in the unknown eligibility outcome, where cellular phones had a much higher percentage (20.60 percent) than that of landlines (8.47 percent). This outcome means that we did not get an answer at the telephone number dialed, but the number was in service (i.e., no answer, possibly including telephones being turned off). Cellular phone users did not answer their telephone at all for 20.60 percent of cases. We suspect this difference could be contributed to the fact that most cellular phones can determine the source of the incoming call, while landline telephones often do not have caller ID included in their home telephone service. It could also be attributed to people not wanting to use the minutes for cellular phones on an unknown number.

### 5.3.2 Did we reach the respondent at their sampled way of contact?

Each household was contacted via the frame they were sampled from, that is landline telephone or cellular phone. At the beginning of each interview, the interviewer asked, “*Is this the number for a business, a private residence, or cellular or mobile phone?*” If it was a business, an interview was not conducted. The respondent’s answer was recorded as the mode of contact. We wanted to see if there was a difference between the sampled way of contact and the interview mode of contact. In this study, we reviewed the 6,420 completed interviews at the household level that had demographic information for each respondent. Once dropping cases without demographic information provided, these interviews consisted of 3,861 interviews completed on landline telephones and 2,559 completed on cellular phones.

Table 33 shows the overall distribution (in percentages) of how each household responded to being contacted and their sampled way of contact.

**Table 33: Random Digit Dialing Sample: Respondent’s Interview Type by Sample**

Sample	Respondent’s Interview Type	
	Landline telephone (Private Residence)	Cellular phone
Landline telephone	98.52	1.48
Cellular phone	13.55	86.45
Note: These percentages are unweighted. Data Source: RBS Output		

We reached almost all of the households that we expected to contact via landline. We also reached a majority of the cellular phone sample via cellular phones. However, there were more cases in the cellular phone sample that ended up being reported as being landline telephones (13.55 percent). This may be due to misreporting and not necessarily portage<sup>20</sup> of telephone numbers. There may have been some confusion answering the question in italics above. Respondents were not asked if the number was a landline, so a person that answered his/her cellular phone (who only has a cellular phone and used it as their main telephone) may have answered the question as “private residence,” because they really were not asked if it was a landline telephone or a cellular phone. This wording in the question has been noted and should be revised for future surveys. Another possibility may be that respondents portaged their cellular phone number to a landline telephone at a higher rate than those that portaged a number from landline to cellular.

### 5.3.3 Did the respondents have an alternate mode of contact?

In this study, the interviewers asked the respondents if they had an alternate mode of contact (that is, if they had a cellular phone when their interview was conducted via landline telephone, and vice versa for interviews conducted via cellular phone) at the end of the interview. No pre-screening was done to ensure that we were contacting cellular phone only households.

The rest of this section will refer to and display results in the following four telephone strata:

1. Landline/Cellular: Interview conducted via landline telephone (per response) and the household has a cellular phone.
2. Landline Only: Interview conducted via landline telephone (per response) and does not have a cellular phone.
3. Cellular/Landline: Interview conducted via cellular phone (per response) and the household has a landline telephone at their address.

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<sup>20</sup> Portaging a telephone number is the term used for when a person requests to keep an old telephone number and have it applied to a new address or to a new type of telephone (i.e., from landline to a cellular phone).

4. Cellular Only: Interview conducted via cellular phone (per response) and the household does not have a landline telephone.

We have presented these strata this way because literature indicates that the “only” stratum households may act differently than the dual telephone type households and even with the dual contact strata the possibility of how they were contacted may have an effect on reporting (AAPOR, 2010).

Table 34 shows the response rates of the four telephone strata by panel.

**Table 34: Random Digit Dialing Sample: Response Rates by Telephone Strata by Panel**

Telephone Strata	Panel 1 (May 2010)	Panel 2 (June 2010)	Panel 3 (September 2010)	Panel 4 (February 2011)	Overall
Landline/Cellular	49.61	50.24	52.66	55.23	51.56
Landline Only	9.57	7.77	8.17	8.18	8.58
Cellular/Landline	25.35	26.93	24.51	21.06	24.64
Cellular Only	15.47	15.06	14.66	15.53	15.22
Data Source: RBS Output					

Based on survey responses, 60.14 percent of the respondents completed the interview over their landline telephone. Cellular phone interviews accounted for 39.86 percent. While 76.20 percent of the respondents could have been reached by a different mode, 23.80 percent could only be reached by one type of mode.

#### **5.3.4 Did it take more call attempts to reach cellular phone respondents than landline telephone respondents?**

Other studies of cellular phone surveys suggest that sampling cellular phone numbers is feasible but costly and produces lower rates of participation (Link, et al.). There are some unique situations that are usually encountered when calling people on cellular phones that may be the cause of lower participation rates. People might be in their vehicle driving, shopping, working, running, or doing other things that may hinder their willingness to participate in a telephone survey at a particular time. In this study, we decided to look at the overall number of attempts made to get a household response. Table 35 shows the number of call attempts made to get a complete interview between the four telephone strata as well as the mean number of call attempts per strata.

**Table 35: Random Digit Dialing Sample: Call Attempts by Telephone Strata**

Telephone Strata	1 Call	2 Calls	3 Calls	4 Calls	5 Calls	6 - 10 Calls	11-15 Calls	16-20 Calls	20+ Calls	Mean Number of Calls
Landline/Cellular	21.57	25.89	13.63	9.52	7.82	14.98	4.44	1.48	0.66	4.00
Landline Only	31.22	23.41	14.52	8.89	4.54	13.07	2.54	1.27	0.54	3.46
Cellular/Landline	15.30	22.44	15.23	11.57	7.90	19.47	4.99	2.09	1.01	4.64
Cellular Only	17.71	23.85	15.15	11.77	6.86	16.89	5.02	2.25	0.51	4.35

Note: These percentages are unweighted.  
Data Source: RBS Output

There were some telephone call parameters set up by the call center for this survey. The maximum number of call attempts was 30 for telephone lines that had no answering machine or voicemail pick up in earlier attempts, while it was 15 for those that had either of those types of contacts. The most efficient stratum was the landline only with 31.22 percent completed within the first call attempt. Landline was in general more successful with 47 percent to 54 percent of the respondents completing within the first and second call attempts, while for the cellular phone interviews it was 37 percent to 41 percent.

We can see that starting with three call attempts the cellular phone stratum percentages are always larger than the landline strata. This may be due to the unique situations when calling cellular phone lines (i.e., the possibility of being in public or driving). Close to one-quarter of the complete cellular phone interviews required six or more attempts, with the maximum being 28 calls.

The mean number of telephone calls per strata varied between 3.46 and 4.64 per strata. We used a t-test to test whether there was a difference between the mean number of call attempts between telephone strata. The Landline Only stratum was significantly different from all the other strata (Landline/Cellular, Cellular/Landline, and Cellular only (p-value of 0.0013, <0.0001, and 0.0103)). In addition, Landline/Cellular was significantly different than Cellular/Landline (p-value <0.0001), but surprisingly not significantly different than cellular only. Also, there was no significant difference between the two cellular strata, Cellular/Landline and Cellular Only strata (p-value of 0.0809). So, the Landline Only stratum clearly takes the least number of calls to reach and conduct an interview.

### 5.3.5 Is there a length of interview time difference between each strata?

In addition to looking at the distribution of call attempts between each strata, we also looked at the length of interview time. The telephone interview was targeted to last approximately ten minutes as stated in the survey introduction. Table 36 shows the distribution on the length of the telephone interview by each of the telephone strata along with the average length of the interview for each strata.

Over 50 percent of the interviews lasted between six to ten minutes via landline, compared to 45 percent of the cellular phone interviews. Cellular phone interviews generally had a longer average duration (over 11 minutes) (p-values < 0.0001 for all time duration categories) when

compared to the landline telephone average durations at over nine minutes. Because of the unique situations regarding cellular phones, interviews may take longer due to the environment. There might be more interruptions, pauses, or connection problems depending on where the respondent is answering his/her cellular phone or being mobile while responding to questions rather than being at home on the landline. There may also be some additional time needed to explain why they are being reached on their cellular phone.

**Table 36: Random Digit Dialing Sample: Interview Times per Telephone Strata**

Telephone Strata	1- 5 Minutes	6 - 10 Minutes	11 - 15 Minutes	16 - 20 Minutes	21+ Minutes	Average Total Minutes
Landline/Cellular	14.09	53.89	19.56	7.29	5.17	9.87
Landline Only	19.82	56.91	14.00	5.27	4.00	9.04
Cellular/Landline	7.59	48.54	28.29	9.18	6.39	11.15
Cellular Only	10.03	46.47	23.13	11.77	8.60	11.82

Data Source: RBS Output

### 5.3.6 Did we reach cellular phone respondents at different times of day than landline respondents?

Many telephone related studies show that the best times to reach a respondent is early in the week (Monday or Tuesday) or on the weekend in the afternoon going into the evening time. One study was the American Community Survey (ACS) when analyzing the 2010 ACS first call attempts from January to December 2010. We wanted to see if there was a difference between landline and cellular phone respondents in the RBS in regards to what days the interviews took place and what times during the day the interviews took place.

Figure 13 show the percentage of completed telephone interviews by the day of week and time of day<sup>21</sup> (call center times), for each of the telephone strata. This figure does not have the overnight (12 AM – 5 AM) percentages displayed since the call center did not make calls for our study in that time frame. We provide the actual counts in Appendix A. The most successful time for all strata was Saturday in the afternoon (12 PM – 4:59 PM) with 8 to 9 percent of cases completed during that time for all of the four strata. The least productive days for all strata were Sunday and Thursday. The lower rates for Sundays were due to the interviewers schedule; they only worked a half day due to budget<sup>22</sup> constraints. Thursdays just were not as productive. In general, the morning and night times were the least productive each day.

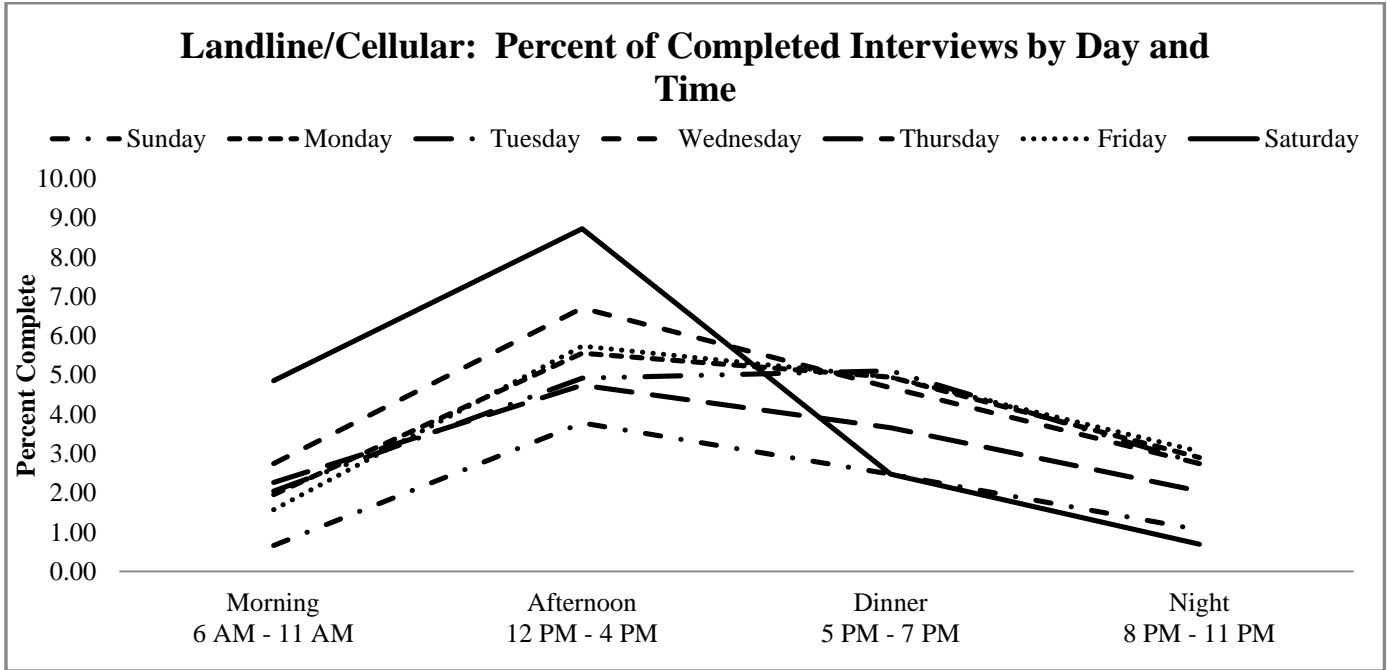
Overall the most successful day for each of the strata was Wednesday, except for the Cellular Only stratum which was Saturday. Cellular only had less variation between the days with each day (except Sunday) ranging between 14 percent and 16 percent (two percentage point difference) compared with the landline strata which varied between four and seven percentage

<sup>21</sup> The time intervals are as follows: 6:00 a.m. through 11:59 a.m., 12:00 p.m. through 4:59 p.m., 5:00 p.m. through 7:59 p.m., 8:00 p.m. through 10:59 p.m..

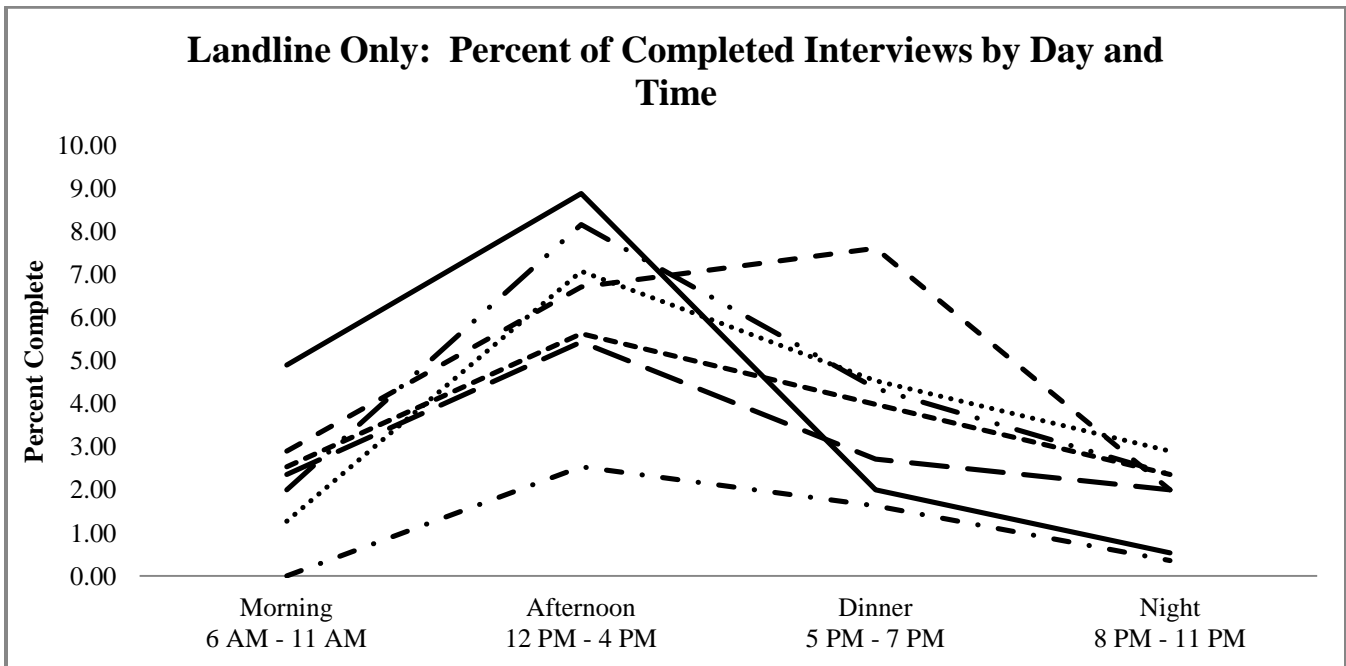
<sup>22</sup> Due to the public perception of being called on Sunday, the census only calls during the afternoon.

point differences between days. So it may be that cellular phones are less likely to have a best day or time to reach them.

**Figure 13: Random Digit Dialing Sample: Percent of Completed Interviews by Day and Time per each Telephone Strata**

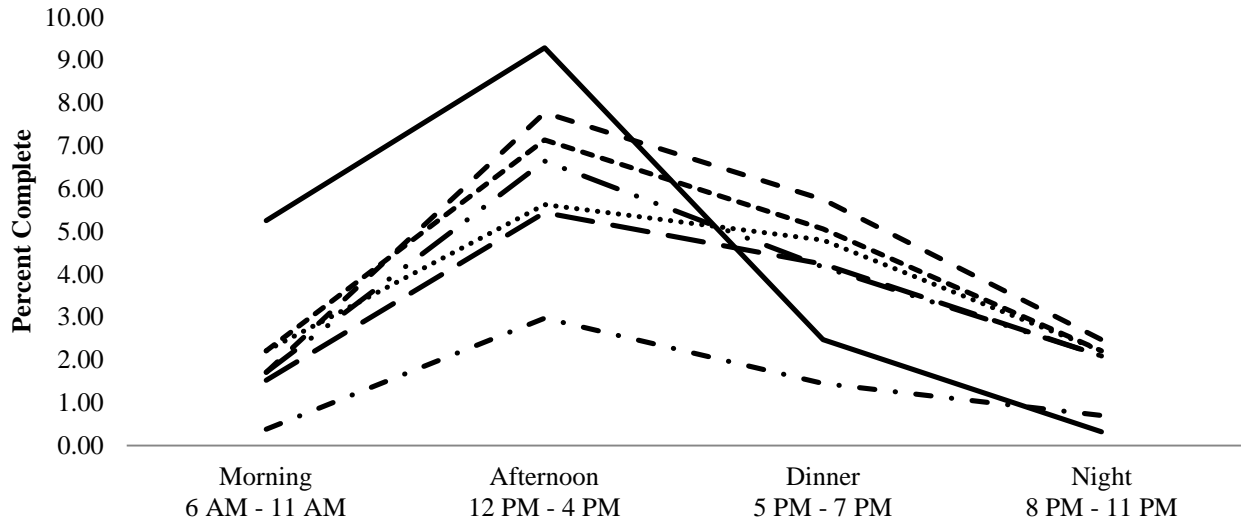


Data Source: RBS Output  
 Note: Times are for Eastern Daylight Time



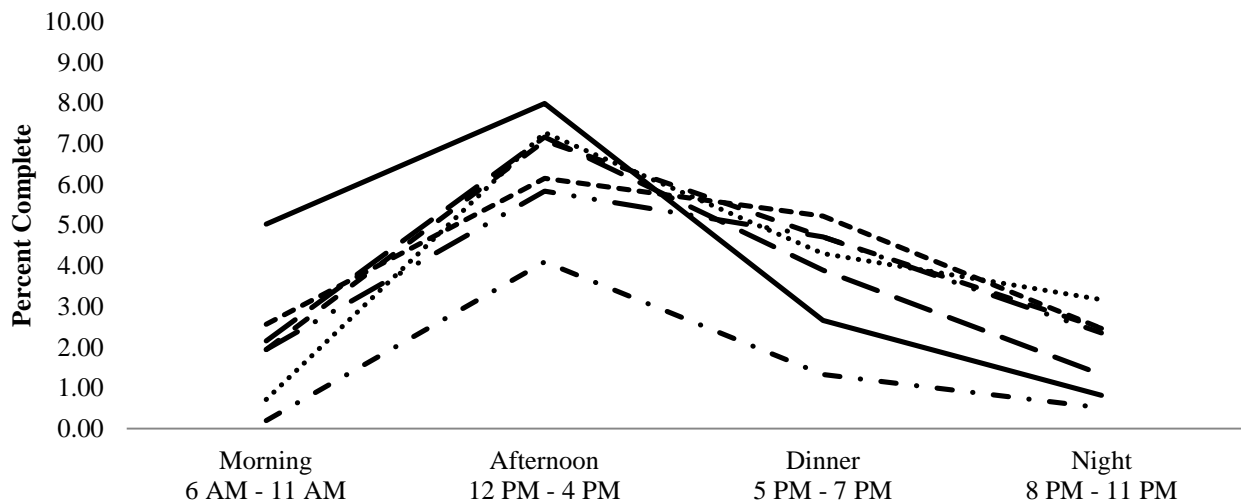
Data Source: RBS Output  
 Note: Times are for Eastern Daylight Time

### Cellular/Landline: Percent of Completed Interviews by Day and Time



Data Source: RBS Output  
 Note: Times are for Eastern Daylight Time

### Cellular Only: Percent of Completed Interviews by Day and Time



Data Source: RBS Output  
 Note: Times are for Eastern Daylight Time



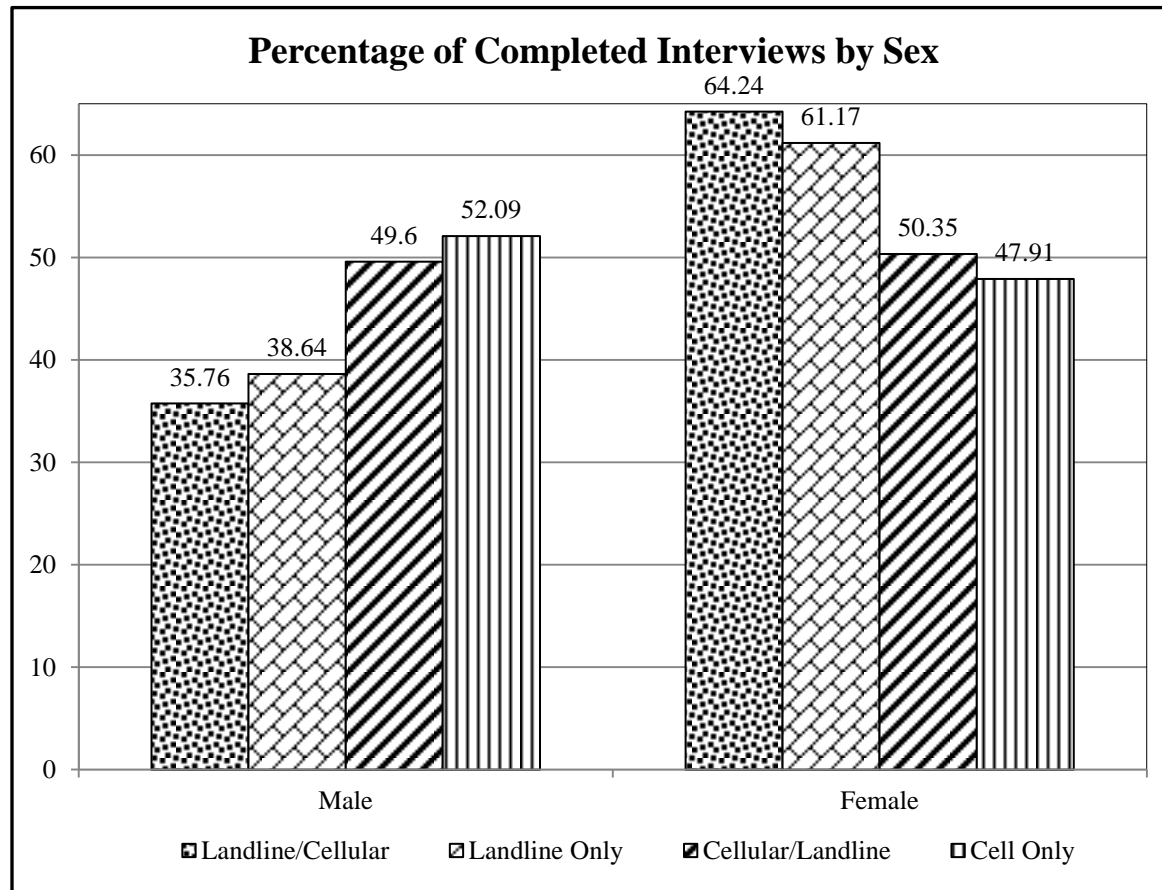
### **5.3.7 Do the people who completed the interviews on cellular phone have different demographic characteristics than those who completed the interviews via landline?**

As in other telephone surveys, the results include a look at the demographics of the respondent. We wanted to explore the differences, if any, detected between respondent ages, sex, race, and tenure (ownership). Please note that the results reported per each telephone strata for this section are weighted “to adjust for (1) the smaller size of the cellular phone sample and (2) for dual-telephone households to adjust for the chance of being included in either the cellular phone or landline samples, which means, in theory at least, that they could be overrepresented when the two samples are simply combined” (Guterbock, 2009).

#### **Sex**

Figure 14 shows the percentage of the completed telephone interviews by the sex of the respondent for each of the telephone strata (not including people that replied with a “Don’t Know” or refused to report sex). Overall, women completed 58.07 percent of the interviews and completed over 50 percent of the interviews in all strata except for Cellular only, where men completed over 52 percent of the interviews. Landline/Cellular had the lowest percentage of men responding with 35.76 percent.

**Figure 14: Random Digit Dialing Sample: Sex Distribution of Recall Bias Study Respondents by Telephone Strata**



Data Source: RBS Output

Note: “Don’t Know” and “Refusals” are not shown. For the counts, refer to Appendix A.

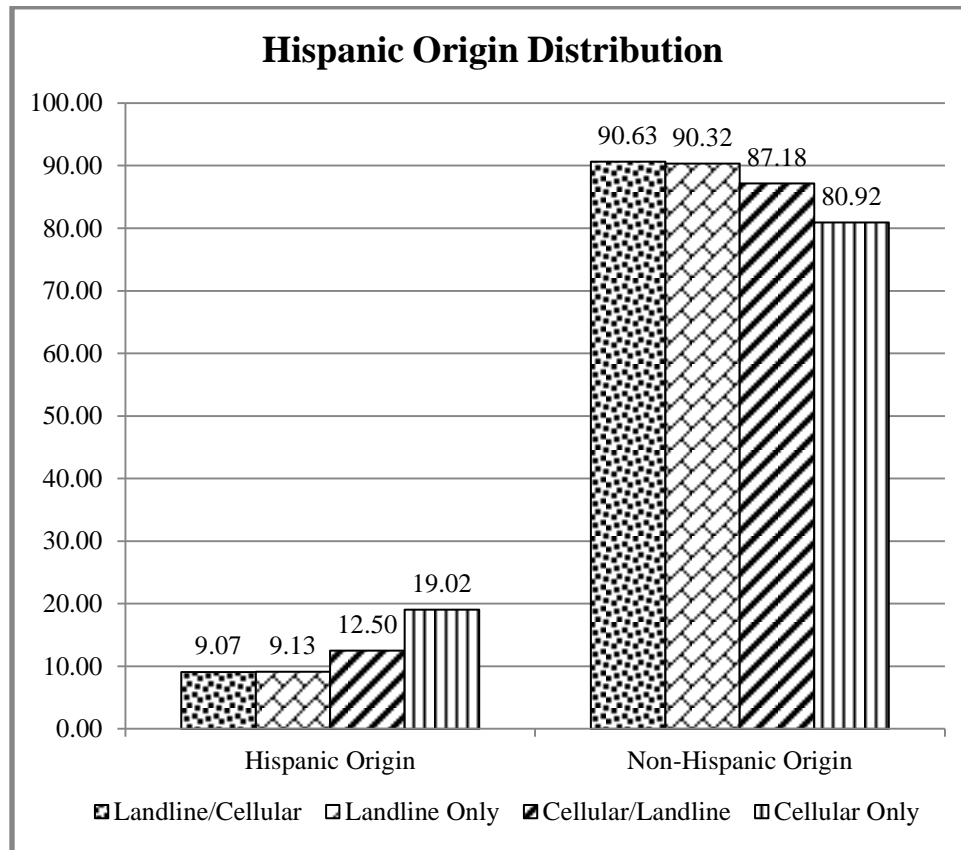
When we compared the telephone strata for males, we found there was a significant difference (p-value <0.0001) between all telephone strata except the Landline/Cellular and Landline only strata (p-value of 0.2034) and the Cellular/Landline and Cellular only strata (p-value of 0.2608).

### Hispanic Origin

As in other census operations, respondents were asked if they were of Hispanic/Latino origin. The question asked was, “Are you Spanish, Hispanic, or Latino?” Figure 15 shows the Hispanic distribution of the respondents that completed the telephone interviews, respectively.

Overall, 11.43 percent of the respondents reported they were Hispanic. Among Hispanics, the majority of the completed interviews were conducted via cellular phone at 52.26 percent. As other study findings show, a higher percentage of cellular phone only households are from the Hispanic population (Link, 2007).

**Figure 15: Random Digit Dialing Sample: Hispanic Origin Distribution of Respondents**



Data Source: RBS Output

Note: Don't Know and Refusals are not shown. For the counts, refer to Appendix A.

When we compared the telephone strata for Hispanic respondents, we found there was a significant difference ( $p$ -value  $< 0.0001$ ) between all telephone strata except the Landline/Cellular and Landline only strata ( $p$ -value of 0.9643).

## Race

As in other census operations, respondents were asked to provide their race. The question asked was, “Is your race White, Black or African American, American Indian or Alaska native, Asian, Native Hawaiian or Other Pacific Islander? You may choose more than one race.” Table 37 shows the distribution by strata of the race for the respondents of complete interviews. For consistency, “Don’t Know” and “Refused” are not reported. Research has shown that non-White respondents are more likely to be a part of a cellular only household (AAPOR, 2010).

**Table 37: Random Digit Dialing Sample: Race Distribution of Respondents by Telephone Strata**

Telephone Strata	Race						
	White	Black	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Multiple	Non-White*
Landline/Cellular	81.00 (0.74)	10.11 (0.57)	0.68 (0.15)	3.32 (0.34)	0.77 (0.16)	1.31 (0.21)	16.19 (0.69)
Landline Only	77.07 (1.80)	12.94 (1.43)	0.73 (0.36)	2.17 (0.62)	1.27 (0.48)	1.26 (0.48)	18.37 (1.65)
Cellular/Landline	76.16 (1.13)	11.77 (0.86)	0.79 (0.24)	5.16 (0.59)	1.33 (0.30)	1.81 (0.36)	20.86 (1.08)
Cellular Only	77.47 (1.50)	8.34 (0.98)	0.89 (0.33)	3.45 (0.65)	1.64 (0.45)	2.62 (0.57)	16.94 (1.33)

Data Source: RBS Output  
 Standard Errors are in parentheses. \*The non-White percentages is the summation of all the races except for White.  
 Note: “Don’t Know” and “Refusals” are not shown. For the counts, refer to Appendix A.

Of all respondents in the RBS, 78.93 percent identified themselves as White. The highest percentage of non-White respondents was recorded in the Cellular/Landline strata (20.86 percent) and a higher percentage of non-Whites completed the interview via cellular phone (37.80 percent) than landline telephones (33.13 percent). It is interesting to note that there is a spike in the Landline only strata for Black respondents at 12.94 percent compared to the 11.77 percent and 8.34 percent in the two cellular phone strata. As the percentages in Table 37 show, respondents that selected more than one race, the multiple category, completed the interviews in the Cellular Only strata at a higher percentage than the other three strata. It seems that for the RBS it is reconfirmed that cellular phone only households are more likely to be minority respondents.

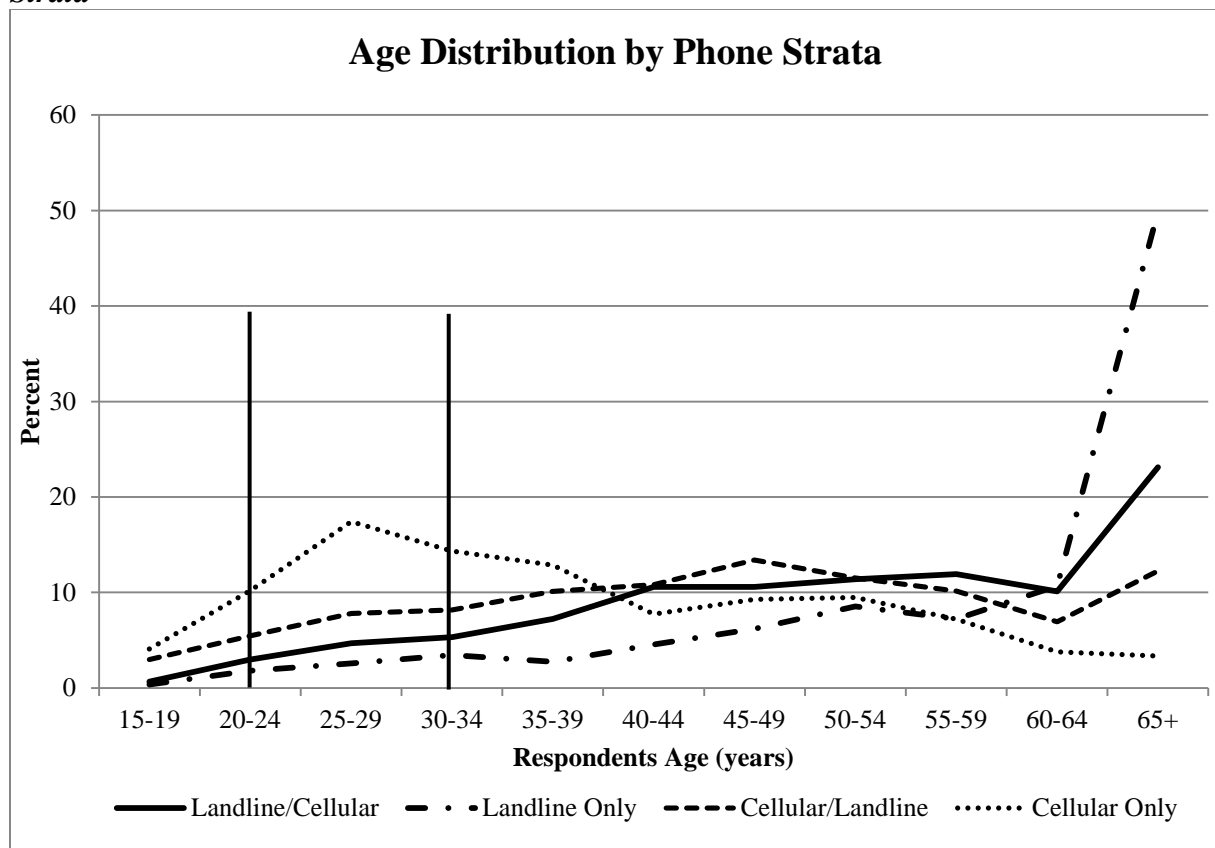
When we compared the telephone strata for non-White respondents, we found there was a significant difference between non-Whites in the Landline/Cellular and Cellular/Landline strata (p-value of 0.0003) and the Cellular/Landline and Cellular Only strata

(p-value of 0.0221). We found no significant difference (p-values > 0.1000) between the other telephone strata for non-Whites.

**Age**

Figure 16 shows the age distribution among respondents. Results from the National Health Interview Survey show that adults aged 18 to 24 and 30 to 34 are mostly cellular phone users (Brick and Keeter). Another study that compared cellular phone results to a landline survey results reported that cellular phone only households were more likely to be in the 18 to 34 years of age range, Hispanic, single or never married, a student, and out of work, when compared to those from households with both landline and cellular phone access (Link et al. 2011).

**Figure 16: Random Digit Dialing Sample: Respondents Age Distribution by Telephone Strata**



Data Source: RBS Output

Note: Don't Know and Refusals are not shown. For the counts, refer to Appendix A.

Cellular phone only households had 41.95 percent of their interviews completed by respondents that were between the ages of 20 and 34, with the peak at 17.41 percent between 25 and 29 years of age. This seems to agree with what other cellular phone studies have shown. On the other hand, landline only households had 60.51 percent of their interviews completed by people aged 60 or older and 49.84 percent completed by those over the age of

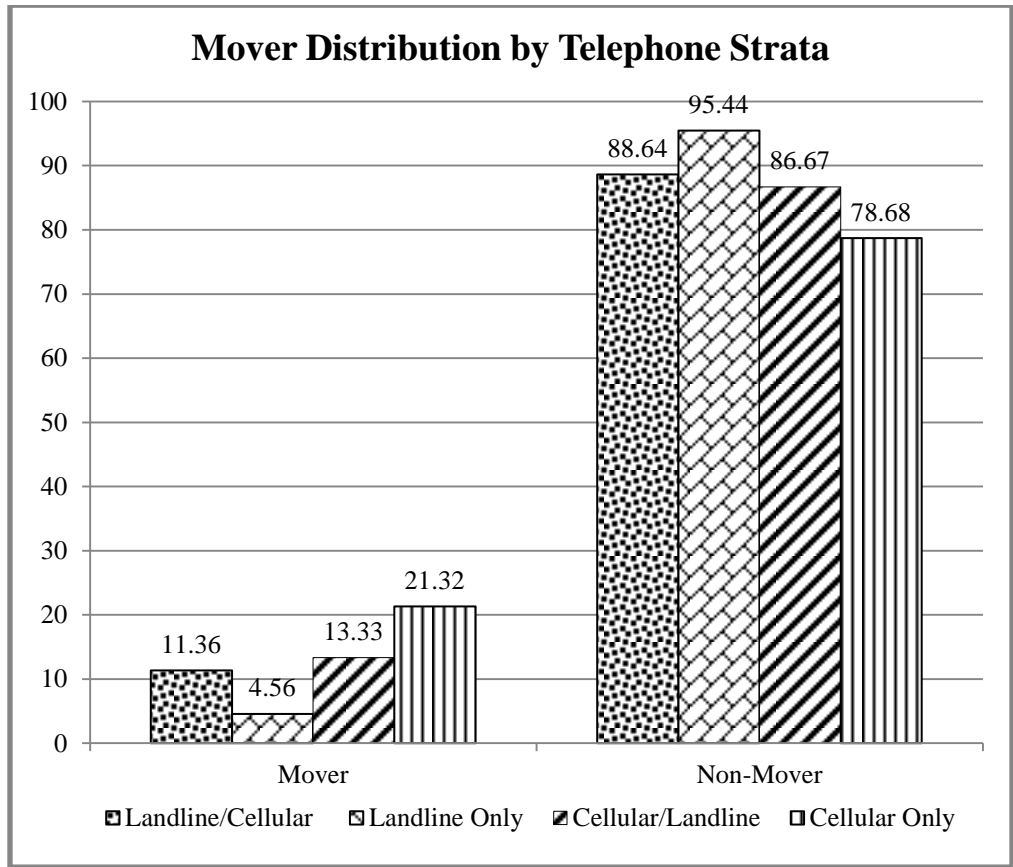
64. The two strata with both types of telephones acted very similar, having a more even distribution in general.

With the incorporation of cellular phone numbers along with landline telephone numbers in future surveys, we will most likely be able to contact the younger population (18 to 34 years of age), helping adjust for regular nonresponse bias in that age range.

**Movers**

We hypothesized that movers are more likely to be part of cellular phone only households, which is who we targeted in this survey (movers). Figure 17 shows the percentage of completed interviews by households that reported a mover by each of the strata.

*Figure 17: Random Digit Dialing Sample: Mover Distribution by Telephone Strata*



Data Source: RBS Output

Of the cellular phone only households, 21.32 percent were mover households, followed by 13.33 percent of households contacted from the Cellular/Landline stratum. For landline only households, 95.44 percent of the interviews were non-movers. Movers are more likely to be a part of cellular phone only household when compared to those that have both types of communication. When we compared the telephone strata for movers, we found there was a significant difference (p-value <0.1000) between all telephone strata. With this in mind, RDD

surveys should not be limited to landline telephone numbers if they want to capture a more diverse population, including some types of mover households.

## **6 Related Evaluations, Experiments, and/or Assessments**

This section does not apply.

## **7 Key Lessons Learned, Conclusions, and Recommendations**

### **7.1 Conclusions**

#### **7.1.1 Recall Bias**

For the RBS analysis, the results are mixed by sample. Results of the RDD Sample, representing the national population, do not show a consistent pattern of decreasing values for reporting a move as time elapses from Census Day. Using Panel 1 (the control panel), the expected percent of households reporting a move in March or April of 2010 across panels should be 3.57 percent, split between 2.80 percent movers and 0.78 percent long-term cyclers. Overall, the RDD Sample shows no significant difference from Panel 2 to Panel 1, and Panel 4 to Panel 1 in the weighted percentage of those households reporting a move during March or April of 2010 (p-values of 0.6811 and 0.4090, respectively). The only significant difference noted when comparing the weighted percentages of households reporting a move during March or April of 2010 existed between Panel 3 and Panel 1 (p-value of 0.0876). The RDD Sample true mover households saw no significant differences between Panels 2, 3, and 4 compared to Panel 1 (p-values of 0.6826, 0.1103, and 0.9029, respectively). The long-term cyler households were not tested to determine significance because the analysis universe was not large enough to give sufficient power to the tests.

The lack of decrease in the percentage of households reporting a move for Panel 4 could be caused by the survey instrument not correctly listing the year under consideration (2010) when prefacing the initial question about having another place to live or stay, but instead simply referred to “this year”, while the Panel 4 interview was conducted in February 2011. This incorrect reference however was not continued later in the other questions about alternate residences. Interviewers were also trained before the panel began to change this preface to “In 2010,” but it is speculated that interviewers maybe did not correct this misunderstanding with all respondents and may have erroneously collected move date information pertaining to March or April of 2011, possibly reporting future moves as a move in 2010. So, if we were reviewing the RDD Sample results alone, we would have concluded that there was a possibility of recall bias starting in September, but we cannot say for sure.

Overall, the Mover Sample shows a decrease in the percentage of households who reported a 2010 March or April move compared to the control panel and this is an indication of respondents possibly having a decrease in recall ability for reporting moves during March or April of 2010 as the interviews get farther from the move date. The Mover Sample shows significant differences between Panels 2 and 3, and Panels 2 and 4 (p-values <0.0001). Therefore, we see evidence of potential recall bias error as time elapses since Census Day.

When separating the type of household move (true mover or long-term cyler) we observe significant differences between Panels 2 and 3, and Panels 2 and 4 of the identified true mover households (p-values of 0.0002 and <0.0001, respectively). For the long-term cyler households, significant differences were only observed between Panel 2 and Panel 4 (p-value <0.0001). The decrease in long-term cyclers is only slight between Panels 2 and 3 of the Mover Sample and proved not significant (p-value of 0.2583).

The RDD Sample shows that non-whole household movers and non-owner households have a decrease in reporting 2010 March and April moves. For non-whole household moves both Panel 2 and Panel 3 percentages are significantly different from Panel 1 (p-values of 0.0449 and <0.0001 respectively), while Panel 1 and Panel 2 were not different for whole household (p-value of 0.1147). This means respondents are underreporting those moves sooner for non-whole household movers than for whole household movers. For non-owner household moves, Panel 1 and Panel 3 percentages are significantly lower than owner households which have no significant differences (and the percentages are slightly higher than Panel 1). So these are factors we can research more and use to help us better develop adjustments to the timing of PI and PFU. On the other hand, in the Mover Sample we found significant differences in all categories, which contradicts the findings from the RDD Sample and raises doubts about whether tenure and type of move are contributing factors.

We used reporting moves in March or April of 2010 as our main measure of recall bias since determining a person's residence on Census Day affects our measures in CCM. However, we also looked at other measures to see if they reinforce other recall bias effects or other types of underreporting. We found that reporting the date for a move showed a possible recall bias. The RDD Sample proportions of households with date knowledge decreased between panels, showing that even when respondents report moves we may still be losing data quality as time passes due to them being unable to say when that move took place.

Another factor we reviewed for recall bias on data quality was reporting a complete address. Again, this showed possible recall bias when looking at the time between a move and the time of interview, but it does not seem to be a slow degradation of recall, but more of a point in time, around six or seven months after the move, that the ability to report (recall) a complete address drops. This appeared to be true in both the RDD and Mover Samples.

In conclusion, the RDD Sample shows there is possible recall bias collecting information between May and September to determine people's residence on Census Day. With more strength of the numbers in the Mover Sample, it also shows possible recall bias between June and September and June and February of the following year. Therefore, the overall results indicate the potential existence of recall bias when using the 2010 CCM PI and PFU timeframes to collect information on moves in the 2010 March and April timeframe, but moving the operations up in time (i.e., June) does not seem to eliminate the potential error (though this may minimize it).



### 7.1.2 Use of National Change of Address File

Using the NCOA file as an indicator of households that may have moved or have a mover did not prove to be as promising as hoped. The percentage of Match Sample households reporting a move in the interview was much lower than we expected. Overall, only 54.22 percent of the Match Sample households contacted in our survey had at least one alternate address reported. There is some influence in the results from the telephone number look-up and respondent nonresponse over panels, but percentages of interviews reporting a move is much lower than we would have expected even if we focus on the early panels to correct for aging telephone numbers and possible recall bias at around 50 percent (50.16 percent for Panel 2 compared with 46.92 percent overall for movers and long-term cyclers).

To get a better feel for when the survey data were close, we analyzed these numbers again using more open definitions. We considered a name to be a match if it was an exact match or possible match. We considered either of the addresses a match if it was a match or any of the three possible match codes. For the households that did report a move, the data matched (including possible matches) what was on the NCOA file much more often with:

- the address they moved from matching 62.22 percent of the time,
- the move being reported in March or April of 2010 64.74 percent of the time,
- the name matching 69.60 percent, and
- the current address matching 91.30 percent of the time.

These percentages are all higher for Panel 2 showing that this would be a fairly accurate indicator close to the time of reporting on the NCOA file. The problem is there is no clear marker on the file that differentiates which 50 percent are likely to report the moves and which are not. In addition, while each of those percentages in the list above is better, it is only useful if they overlap. Still, there is no clear indicator on the file that differentiates what 50 percent of cases are likely to report the moves and which are not. In the end, only 14.22 percent of the households had a name match to both the “To” and “From” addresses, and reported a move in March or April of 2010 in the RBS.

We cannot ascertain correctly if the NCOA file is an accurate enough administrative records data source to be used on its own as a tool to identify movers based on the results of this study. There are several limitations that may be confounding the results observed here. Even though the majority (64.74 percent) of the mover and long-term cyler households across the three panels reported a move in March or April of 2010, we expected the rate to be higher given that the Mover Sample reported the move to the USPS. It is possible the lower rates of moves/movers observed are due to respondent error in the RBS reporting rather than errors in the NCOA file. We need to remember that these results could be affected by the results of the telephone look-up operation, possibly because RBS respondents did not report all the moves, possibly due to recall error, maybe as a result of proxy responses for the actual mover within the household, or because they just did not want it reported or wanted to end the interview.

On the other hand, the NCOA file is very valuable as a secondary record to confirm an address or person that is more likely to have a move situation or to target mover universes as long as the limitations of the file are known.

### 7.1.3 Cellular Phone Use for Survey Interviews

Cellular phones are becoming more widely used as the main, if not the only, telephone type for a household and hence need to be included in telephone surveys. For this study, cellular phone respondents proved to be unique from landline respondents in many ways.

First, the cellular phone sample had very different outcomes from the landline sample. Landline telephone numbers had a larger percentage of completed cases than those contacted via cellular phone, 27.09 percent to 22.24 percent, respectively. Cellular phone numbers had a higher percentage of refusal/break-off contacts than that of landline telephone numbers, 14.16 percent to 9.43 percent, respectively. But the most striking difference observed between cellular and landline contacts was in the unknown eligibility outcome. This outcome means that we did not get an answer at the dialed telephone number but the number was in service (i.e., no answer, possibly including telephones being turned off). Cellular phones had a much higher percentage (20.60 percent) than that of landline telephones (8.47 percent). Cellular phone users did not answer their telephone at all 20.60 percent of the time.

Most landline households also could be reached on cellular phone (85.73 percent), but cellular phone respondents were much more evenly split on whether they were cellular phone only (38.18 percent) or cellular phone and landline households (61.82 percent).

When comparing landline and cellular respondents, landline only telephone users completed the interview in less calls. Looking at the effort needed to get complete interviews for cellular phone respondents compared with landline respondents, we found that getting complete interviews from cellular phone respondents required more effort. In this part of the research we had four strata<sup>23</sup>—Landline only, Cellular/Landline, Landline/Cellular and Cellular only. The most efficient strata was the Landline only, with 31.22 percent completed with the first call attempt. The Landline universes were in general more successful with 47.46 to 54.63 percent of the respondents completing within the first and second call attempts via landline, while of the cellular phone universe interviews the response rates were 37.74 percent to 41.56 percent for first two attempts.

When looking at the time to complete an interview, Landline only and Landline/Cellular are faster interviews than the two Cellular phone respondent universes (around 11 minutes compared to around nine minutes). Cellular phones were not particularly different than landlines in the days and times of the day that were more productive for reaching respondents.

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<sup>23</sup> The four strata are defined as:

Landline only – Respondent completed the interview on a landline telephone and reported they did not have a cellular phone  
Cellular/Landline - Respondent completed the interview on a cellular phone and reported they had a landline telephone  
Landline/Cellular - Respondent completed the interview on a landline telephone and reported they had a cellular phone  
Cellular only – Respondent completed the interview on a cellular phone and reported they did not have a landline telephone

Looking at the characteristics of respondents, the respondents we reached via cellular phone were much more likely to be a minority, Hispanic, and a young adult. They were also more likely to report a move.

## **7.2 Recommendations**

The major recommendations pertaining to recall bias observed through the results presented in this assessment are:

### **7.2.1 Recall Bias**

1. Attempt to conduct all surveys involving the collection of moves and move dates as close to the date you are measuring or collecting on. For census this would be as close to April 1, 2010 as possible. This would limit potential recall bias error and also increase response rates in both the RDD and Mover Samples.
2. Research whether conducting CCM operations closer to Census Day to limit potential recall bias outweighs the possibilities of contamination error between census and coverage survey operations.
3. Focus on collecting moves and move dates with emphasis on confirming the year of the move respondents report.
4. Conduct further research to better measure recall effects on responses and the factors that influence them. Specifically focusing on:
  - a. Research whether conducting similar interviews late in the year versus crossing into a new year, to determine if the change in year is the cause of any differences or whether these differences are attributed to the amount of time since the date of interest.
    - i. Also, interviewers should probe after the initial move collection to make sure respondents do not underreport moves that happened early in the census year.
  - b. Research respondents who are considered long-term cyclers and how to best ascertain their move patterns and their ability to recall and report them. This may allow us to identify them in CCM operations and help determine how to better handle them in processing their true residence.
  - c. Further research should be conducted into the distribution of address completeness level by lapsed time, specifically focusing on why after nine months the completeness level increases. We would like to determine if this is a sign of limited recall bias issues for reporting an address or more a sign of simply non-reporting the moves.
  - d. If more research is conducted, implement a new more focused certainty question that results in more accurate and conclusive findings.
5. Increase the sample sizes of all RDD surveys especially those that include cell phones to give more power to the test when examining subsamples.

### 7.2.2 Use of the National Change of Address file

1. If the NCOA file is used again, the telephone number look-up should be conducted throughout the operation to limit the aged telephone numbers contacted and to maintain consistent completion rates.
2. Research should be done to see what other administrative records the NCOA file could be combined with to make it a more accurate source.

### 7.2.3 Cellular Phone Use

1. Augment the sample sizes of cellular phone samples when included in “cold calling” RDD surveys to account for low response rates.
2. Adjust the survey time duration expectancies to account for extra call attempts required, explanations for contacting respondent via cellular phone, and potential natural distractions (e.g., driving).

## 8 Acknowledgements

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## 9 References

The American Association for Public Opinion Research (2009), *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Survey*. 6<sup>th</sup> edition. AAPOR.

The American Association for Public Opinion Research Cellular Phone Task Force (2010), *AAPOR Cellular Phone Task Force Report: New Considerations for Survey Researchers When Planning and Conducting RDD Telephone Surveys in the US with Respondents Reached via Cellular Phone Numbers*. AAPOR.

“B07013: Geographical Mobility in the Past year by tenure for current residence in the United States Universe: Population 1 year and over in households in the United States”. Dataset 2008-2010 American Community Survey 3-Year Estimates. American Factfinder (Census Bureau),  
[http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_10\\_3\\_YR\\_B07013&prodType=table](http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_3_YR_B07013&prodType=table)

Brick, Michael and Keeter, Scott, (2011) “Telephone Survey in the Era of Cellular Phones”. Short Course sponsored by the Joint Program in Survey Methodology. Pew Research Center, Washington DC, March 23, 2011.

Childs, J. H., and E., Nichols (2007). A New Approach to Measuring Residence Status: A Summary of Methods and Results. Paper presented at the Innovative Methodologies for Censuses in the New Millennium. September 2, 2007.

<http://www.s3ri.soton.ac.uk/isi2007/papers/Paper26.pdf>

Griffin, Richard (2011). "2010 Census Coverage Measurement Survey Recall Bias Study: Weighting and Variance Estimation," DSSD 2010 Census Coverage Measurement Memorandum Series #2010-I-11, March 3, 2011.

----- (2011). "2010 Census Coverage Measurement Survey Recall Bias Study: Weighting and Variance Estimation for Person Level Proportions," DSSD 2010 Census Coverage Measurement Memorandum Series #2010-I-12, September 22, 2011.

Guterbock, Thomas M. (2009), "Estimating Phone Service and Usage Percentages: How to Weight the Data from a Local, Dual-Frame Sample Survey of Cellular phone and Landline Telephone Users in the United States." As presented at the Annual Meeting of the American Association of Public Opinion Research, Hollywood, FL May 14, 2009.

Link, Michael W., Michael P. Battaglia, Martin R. Frankel, Larry Osborn, and Ali H. Mokdad, (2011), "Reaching the U.S. Cellular Phone Generation: Comparison of Cellular Phone Survey Results with an Ongoing Landline Telephone Survey." *Public Opinion Quarterly* 71.5 (2007): 814-839. Web. 10. Nov. 2011.

Schwarz and Sudman (Eds.) 1994. "Autobiographical memory and the validity of retrospective reports". New York: Springer-Verlag.

## Appendix A: Detailed Tables

The following tables contain the adjusted N value corresponding to the weighted proportions. Each table below is numbered to the corresponding numbered table (e.g., A#) or figure (e.g., AF#) in the report above. All weighted counts have been rounded to the nearest whole number.

**Table A6: Count of Households Reporting any Move in 2010 by Sample by Panel, Weighted**

	Panel											
	1			2			3			4		
	<i>M*</i>	<i>LC**</i>	Overall	<i>M*</i>	<i>LC**</i>	Overall	<i>M*</i>	<i>LC**</i>	Overall	<i>M*</i>	<i>LC**</i>	Overall
RDD Sample	129	43	172	128	45	173	194	96	291	211	85	296
Mover Sample	N/A	N/A	N/A	940	347	1,287	842	327	1,169	661	152	813
*M is Movers **LC is Long-term cyclers N/A is for Not Applicable												
Data Source: RBS Output												

**Table A7: Count of Households Reporting a 2010 March or April Move by Sample by Panel, Weighted**

	Panel											
	1			2			3			4		
	<i>M*</i>	<i>LC**</i>	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall	<i>M</i>	<i>LC</i>	Overall
RDD Sample	64	18	82	42	7	50	32	9	42	38	14	51
Mover Sample	N/A	N/A	N/A	720	241	962	545	198	743	371	51	423
*M is Movers **LC is Long-term cyclers N/A is for Not Applicable												
Data Source: RBS Output												

**Table A8: Random Digit Dialing Sample: Count of Whole Household Mover and Non-Whole Household Movers for March/April Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Whole Household Movers	32	26	26	22
Non-Whole Household Movers	50	24	15	29
<b>Overall</b>	<b>82</b>	<b>50</b>	<b>42</b>	<b>51</b>
Data Source: RBS Output				

**Table A9: Mover Sample: Count of Whole Household Movers and Non-Whole Householder Movers for March/April Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Whole Household Movers	N/A	661	539	275
Non-whole Household Movers	N/A	301	204	148
<b>Overall</b>	<b>N/A</b>	<b>962</b>	<b>743</b>	<b>423</b>
N/A is for Not Applicable Data Source: RBS Output				

**Table A10: Random Digit Dialing Sample: Count of 2010 March and April Movers by Tenure by Panel, Weighted**

	Panel			
	1	2	3	4
Owners	41	29	26	22
Non-owners	41	21	16	29
<b>Overall</b>	<b>82</b>	<b>50</b>	<b>42</b>	<b>51</b>
Data Source: RBS Output				

**Table A11: Mover Sample: Count of 2010 March and April Movers by Tenure by Panel, Weighted**

	Panel			
	1	2	3	4
Owners	N/A	587	455	252
Non-owners	N/A	375	288	170
<b>Overall</b>	<b>N/A</b>	<b>962</b>	<b>743</b>	<b>423</b>
N/A is for Not Applicable Data Source: RBS Output				

**Table A12: Random Digit Dialing Sample: Count of Reported Move Date Knowledge of Households with Moves by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge	157	151	238	230
No Date Knowledge	15	22	53	66
Data Source: RBS Output				

**Table A13: Mover Sample: Count of Reported Move Date Knowledge of Households with Moves by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge	N/A	1,165	989	704
No Date Knowledge	N/A	122	179	108
N/A is for Not Applicable Data Source: RBS Output				

**Table AF2A: Random Digit Dialing Sample: Counts of Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge: Whole Household Moves	58	65	113	110
Date Knowledge: Non-whole Household Moves	99	87	125	120
Data Source: RBS Output				

**Table AF2B: Random Digit Dialing Sample: Standard Errors of Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge: Whole Household Moves	1.90	2.36	2.32	2.21
Date Knowledge: Non-whole Household Moves	2.00	2.10	2.14	2.38
Data Source: RBS Output				

**Table AF3A: Mover Sample: Counts of Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge: Whole Household Moves	N/A	788	695	436
Date Knowledge: Non-whole Household Moves	N/A	377	295	269
N/A is for Not Applicable Data Source: RBS Output				



**Table AF3B: Mover Sample: Standard Errors of Move Date Knowledge for Whole Household and Non-Whole Household Movers by Panel, Weighted**

	Panel			
	1	2	3	4
Date Knowledge: Whole Household Moves	N/A	0.92	1.27	1.46
Date Knowledge: Non-whole Household Moves	N/A	1.73	2.25	2.19
N/A is for Not Applicable Data Source: RBS Output				

**Table A14: Mover Sample: Counts of Alternate Address Completeness Levels for 2010 March or April Movers<sup>32</sup>**

	Panel			
	1	2	3	4
Totally Complete	N/A	686	562	294
Partial	N/A	80	53	53
Incomplete	N/A	229	139	89
N/A is for Not Applicable Data Source: RBS Output				

**Table AF4A: Mover Sample: Count of Alternate Address Completeness Level for 2010 March or April Moves (Totally Complete) by Whole Household Type, Weighted**

	Panel			
	1	2	3	4
Address Completeness: Whole Household Moves	N/A	470	412	194
Address Completeness: Non-whole Household Moves	N/A	216	144	98
N/A is for Not Applicable Data Source: RBS Output				

<sup>32</sup> Magnitude counts do not match those in Section 5.1.2 because of the exclusions explained at beginning of Section 5.1.5.

**Table AF4B: Mover Sample: Standard Errors of Alternate Address Completeness Level for 2010 March or April Moves (Totally Complete) by Whole Household Type, Weighted**

	Panel			
	1	2	3	4
Address Completeness: Whole Household Moves	N/A	1.83	1.93	3.14
Address Completeness: Non-whole Household Moves	N/A	2.75	3.61	4.67
N/A is for Not Applicable Data Source: RBS Output				

**Table AF5A: Random Digit Dialing Sample: Count of Alternate Address Completeness Knowledge by Lapsed Time, Weighted**

Address Completeness	Number of Months Elapsed									
	0	1	2	3	4	5	6	7	8	9
Complete Address	54	69	56	58	46	28	32	24	18	8
Partial Address	10	19	18	8	13	1	9	5	5	11
Incomplete Address	26	44	36	31	35	20	16	14	18	12
Data Source: RBS Output										

**Table AF5B: Random Digit Dialing Sample: Standard Errors of Alternate Address Completeness Knowledge by Lapsed Time, Weighted**

Address Completeness	Number of Months Elapsed									
	0	1	2	3	4	5	6	7	8	9
Complete Address	6.53	4.43	5.26	5.38	6.11	8.09	5.99	10.04	7.28	9.05
Partial Address	5.10	3.42	3.72	2.96	3.53	1.32	5.47	5.05	5.97	12.34
Incomplete Address	5.76	3.87	4.30	5.89	6.74	8.07	5.97	8.47	7.35	10.88
Data Source: RBS Output										

**Table AF6: Random Digit Dialing Sample: Significance Test Results for Alternate Address Completeness Knowledge for Totally Complete Addresses by Lapsed Time, Weighted**

Complete Alternate Address Comparison	
Elapsed Month Comparison	p-values
0 Month and 9 Month	0.001773800
1 Month and 9 Month	0.007389940
2 Month and 9 Month	0.015471221
3 Month and 9 Month	0.001048108
4 Month and 9 Month	0.033461891
5 Month and 9 Month	0.009698388
6 Month and 9 Month	0.004069088
7 Month and 9 Month	0.022722257
8 Month and 9 Month	0.107079070
Data Source: RBS Output	

**Table AF7A: Mover Sample: Count of Alternate Address Completeness Knowledge by Lapsed Time, Weighted**

Address Completeness	Number of Months Elapsed												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Complete Address	29	100	402	338	169	325	267	59	27	29	130	151	52
Partial Address	6	21	39	46	30	32	36	8	7	6	25	27	6
Incomplete Address	23	54	132	127	80	103	68	32	16	25	37	48	8
Data Source: RBS Output													

**Table AF7B: Mover Sample: Standard Errors of Alternate Address Completeness Knowledge by Lapsed Time**

Address Completeness	Number of Months Elapsed												
	0	1	2	3	4	5	6	7	8	9	10	11	12
Complete Address	7.80	4.58	1.92	2.39	3.09	2.05	2.75	5.48	8.44	7.93	3.35	3.70	5.30
Partial Address	4.01	2.54	0.99	1.34	2.11	1.27	1.84	3.84	5.33	3.65	2.66	2.50	3.81
Incomplete Address	7.08	3.97	1.97	2.03	3.42	1.83	2.06	5.36	7.66	7.50	3.13	3.61	4.24
Data Source: RBS Output													

**Table A15: National Change of Address Match Sample: Counts of Households that Reported and Alternate Addresses**

Alternate Address Reported per Household	Panel			Overall
	2	3	4	
Yes	1,441	1,290	934	3,665
No	1,067	1,005	1,022	3,094
<b>Total</b>	<b>2,508</b>	<b>2,295</b>	<b>1,956</b>	<b>6,759</b>
Data Source: RBS Output				

**Table A16: National Change of Address Match Sample: Counts of People Reported to have Alternate Addresses**

Alternate Address Reported	Panel			Overall
	2	3	4	
Yes	3,298	2,930	2,112	8,340
No	4,008	3,546	3,449	11,003
<b>Total</b>	<b>7,306</b>	<b>6,476</b>	<b>5,561</b>	<b>19,343</b>
Data Source: RBS Output				

**Table A17: National Change of Address Match Sample: Counts of Household Final Move Status by Panel**

Analysis Mover Code	Panel			Overall
	2	3	4	
Mover	863	749	617	2,229
Long-term cyclist	395	381	166	942
Don't Know	56	48	57	161
Non-mover	1,194	1,117	1,116	3,427
<b>Total</b>	<b>2,508</b>	<b>2,295</b>	<b>1,956</b>	<b>6,759</b>
Data Source: RBS Output				

**Table A18: National Change of Address Match Sample: Counts of Final Household Mover Status by Panel for Owner Households**

Final Household Mover Status	Panel			Overall
	2	3	4	
Mover	565	519	425	1,509
Long-term cyclist	380	366	151	897
Don't Know	48	42	48	138
Non-mover	975	949	918	2,842
<b>Total</b>	<b>1,968</b>	<b>1,876</b>	<b>1,542</b>	<b>5,386</b>
Data Source: RBS Output				

**TableA19: National Change of Address Match Sample: Counts of Final Household Mover Status by Panel for Non-Owner Households**

Final Household Mover Status	Panel			Overall
	2	3	4	
Mover	294	224	189	707
Long- term cycler	13	13	15	41
Don't Know	8	5	9	22
Non-mover	212	162	192	566
<b>Total</b>	<b>527</b>	<b>404</b>	<b>405</b>	<b>1,336</b>
Data Source: RBS Output				

**Table A20: National Change of Address Match Sample: Counts of Household Mover Status by Permanency Flag (plus original sample distribution).**

Mover Status	Permanent	Temporary	<b>Total</b>
Mover	2,085	144	<b>2,229</b>
Long- Term Cyclers	470	472	<b>942</b>
Don't Know	125	36	<b>161</b>
Non-mover	2,988	439	<b>3,427</b>
<b>Original Sample Distribution</b>	<b>5,668</b>	<b>1,091</b>	<b>6,759</b>
Data Source: RBS Output			

**Table A21: National Change of Address Match Sample: Count of Family Move Flag by Type of Move Reported for Movers and Long-Term Cyclers**

Family Move Flag	Type of Move Reported		Total
	Whole Household	Non-Whole Household	
Family	1,266	423	<b>1,689</b>
Individual	779	703	<b>1,482</b>
<b>Total</b>	<b>2,045</b>	<b>1,126</b>	<b>3,171</b>
Data Source: RBS Output			

**Table A22: National Change of Address Match Sample: Count of Reported Move Month by Panel for Households with a Mover or Long-term cycle status**

Month of Move	Panel			Total
	2	3	4	
March or April	932	715	406	<b>2,053</b>
February or May	196	185	126	<b>507</b>
Other date	40	98	158	<b>296</b>
No Date	90	132	93	<b>315</b>
<b>Total</b>	<b>1,258</b>	<b>1,130</b>	<b>783</b>	<b>3,171</b>
Data Source: RBS Output				

**Table A23: National Change of Address Match Sample: Distribution of Key Move Date by Final Move Status at Household Level**

Month of Move	Move Status	Panel			Overall
		2	3	4	
March or April	Mover	656	479	350	1,485
	Cycler	276	236	56	568
	Both	932	715	406	2,053
February or May	Mover	123	112	87	322
	Cycler	73	73	39	185
	Both	196	185	126	507
Other	Mover	32	75	108	215
	Cycler	8	23	50	81
	Both	40	98	158	296
No Date	Mover	52	83	72	207
	Cycler	38	49	21	108
	Both	90	132	93	315
Data Source: RBS Output					

**Table A24: National Change of Address Match Sample: Count of Household Person Match Status by Panel**

Household Person Match Status	Panel			Overall
	2	3	4	
Match	1,164	984	695	2,843
Possible Match	293	289	235	817
Unknown	591	590	525	1,706
Non-match	460	432	501	1,393
<b>Total</b>	<b>2,508</b>	<b>2,295</b>	<b>1,956</b>	<b>6,759</b>
Data Source: RBS Output				



**Tables A25: National Change of Address Match Sample: Count of Household Mover Status by Household Person Match Codes**

Household Move Status	Household Person Match Code			
	Match	Possible Match	Unknown	Non-Match
Mover	1,348	212	466	203
Cycler	571	76	211	84
Don't Know	66	14	48	33
Non-mover	858	515	981	1,073
<b>Total</b>	<b>2,843</b>	<b>817</b>	<b>1,706</b>	<b>1,393</b>
Data Source: RBS Output				

**Table A26: National Change of Address Match Sample: Count of Match Results for "To" Address by Panel**

"To" Address Match Code	Panel			
	2	3	4	Overall
Match	2,062	1,894	1,555	5,511
Possible Match 1	106	80	127	313
Possible Match 2	29	34	76	139
City Match	276	238	141	655
No Address	14	16	4	34
Non-match	21	33	53	107
<b>Total</b>	<b>2,508</b>	<b>2,295</b>	<b>1,956</b>	<b>6,759</b>
Data Source: RBS Output				

**Table A27: National Change of Address Match Sample: Count of Match Results for "From" Addresses by Panel**

"From" Address Match Code	Panel			
	2	3	4	Overall
Match	737	655	387	1,779
Possible Match 1	74	70	71	215
Possible Match 2	38	23	44	105
City Match	284	259	147	690
No Address	92	68	47	207
Non-match	1,283	1,220	1,260	3,763
<b>Total</b>	<b>2,508</b>	<b>2,295</b>	<b>1,956</b>	<b>6,759</b>
Data Source: RBS Output				

**Table A28: National Change of Address Match Sample: Distribution of cases by “To” Address Match Codes by Household Person Match Code**

"To" Address Match	Household Person Match Code				Total
	Match	Possible Match	Unknown	Non-Match	
Match	2,654	684	1,085	1,088	<b>5,511</b>
Possible Match 1	52	24	175	62	<b>313</b>
Possible Match 2	4	9	42	84	<b>139</b>
City Match	125	92	348	90	<b>655</b>
Unknown	5	3	21	5	<b>34</b>
Non-Match	3	5	35	64	<b>107</b>
<b>Total</b>	<b>2,843</b>	<b>817</b>	<b>1,706</b>	<b>1,393</b>	<b>6,759</b>
Data Source: RBS Output					

**Table A29: National Change of Address Match Sample: Distribution of Cases for “From” Address Match by Household Person Match Code**

"From" Address Match	Household Person Match Code				Total
	Match	Possible Match	Unknown	Non-Match	
Match	1,333	117	261	68	<b>1,779</b>
Possible Match 1	134	16	56	9	<b>215</b>
Possible Match 2	51	14	13	27	<b>105</b>
City Match	327	88	231	44	<b>690</b>
Unknown	74	22	79	32	<b>207</b>
Non-Match	924	560	1,066	1,213	<b>3,763</b>
<b>Total</b>	<b>2,843</b>	<b>817</b>	<b>1,706</b>	<b>1,393</b>	<b>6,759</b>
Data Source: RBS Output					

**Table A30: Random Digit Dialing Sample: Counts of Respondent's Interview Type by Sample**

Type	Respondent's Interview Type	
	Landline	Cellular Phone
Landline	3,468	52
Cellular Phone	393	2,507
Data Source: RBS Output		

**Table A31: Random Digit Dialing Sample: Counts of Telephone Strata by Panel**

	Panel 1	Panel 2	Panel 3	Panel 4	Overall
Landline/Cellular	1,135	724	722	729	3,310
Landline Only	219	112	112	108	551
Cellular/Landline	580	388	336	278	1,582
Cellular Only	354	217	201	205	977
Data Source: RBS Output					

**Table A32: Random Digit Dialing Sample: Call Attempts by Telephone Strata**

Telephone Strata	1 Call	2 Calls	3 Calls	4 Calls	5 Calls	6 -10 Calls	11-15 Calls	16-20 Calls	20+ Calls	Overall
Landline /Cellular	714	857	451	315	259	496	147	49	22	3,310
Landline Only	172	129	80	49	25	72	14	7	3	551
Cellular/ Landline	242	355	241	183	125	308	79	33	16	1,582
Cellular Only	173	233	148	115	67	165	49	22	5	977
Data Source: RBS Output										

**Table A33: Random Digit Dialing Sample: Distribution of Interview Times by Telephone Strata**

Telephone Strata	1- 5 Minutes	6 - 10 Minutes	11 - 15 Minutes	16 - 20 Minutes	21+ Minutes	Overall
Landline/Cellular	466	1,782	647	241	171	3,307
Landline Only	109	313	77	29	22	550
Cellular/Landline	120	767	447	145	101	1,580
Cellular Only	98	454	226	115	84	977
Data Source: RBS Output						

**Table AF13: Random Digit Dialing Sample: Completed Interviews by Day and Time for each Telephone Strata<sup>33</sup>**

**Landline/Cellular**

<b>Day</b>	<b>Overnight 12 AM – 5 AM</b>	<b>Morning 6 AM – 11 AM</b>	<b>Afternoon 12 PM – 4 PM</b>	<b>Evening 5 PM – 7 PM</b>	<b>Night 8 PM – 11 PM</b>
Sunday	0	22	125	82	35
Monday	1	65	184	164	96
Tuesday	1	68	163	169	91
Wednesday	1	91	222	155	91
Thursday	0	75	157	121	68
Friday	0	52	190	164	102
Saturday	0	161	289	82	23

Data Source: RBS Output

**Landline Only**

<b>Day</b>	<b>Overnight 12 AM - 5 AM</b>	<b>Morning 6 AM - 11 AM</b>	<b>Afternoon 12 PM - 4 PM</b>	<b>Evening 5 PM - 7 PM</b>	<b>Night 8 PM - 11 PM</b>
Sunday	0	0	14	9	2
Monday	0	14	31	22	13
Tuesday	0	11	45	24	13
Wednesday	1	16	37	42	11
Thursday	0	13	30	15	11
Friday	0	7	39	25	16
Saturday	0	27	49	11	3

Data Source: RBS Output

**Cellular/Landline**

<b>Day</b>	<b>Overnight 12 AM - 5 AM</b>	<b>Morning 6 AM - 11 AM</b>	<b>Afternoon 12 PM - 4 PM</b>	<b>Evening 5 PM - 7 PM</b>	<b>Night 8 PM - 11 PM</b>
Sunday	0	6	47	23	11
Monday	0	35	113	80	35
Tuesday	1	27	105	66	33
Wednesday	1	27	123	91	39
Thursday	0	24	86	67	33
Friday	0	35	89	76	35
Saturday	0	83	147	39	5

Data Source: RBS Output

<sup>33</sup> All times reported are in Eastern Daylight Time

Cellular Only

Day	Overnight 12 AM - 5 AM	Morning 6 AM - 11 AM	Afternoon 12 PM - 4 PM	Evening 5 PM - 7 PM	Night 8 PM - 11 PM
Sunday	0	2	40	13	5
Monday	0	25	60	51	24
Tuesday	0	19	57	46	23
Wednesday	0	19	69	46	24
Thursday	0	21	70	38	13
Friday	0	7	71	42	31
Saturday	0	49	78	26	8

Data Source: RBS Output

**Table AF14: Random Digit Dialing Sample: Sex Distribution of Respondents by Telephone Strata (weighted)**

Telephone Strata	Male	Female	Don't Know	Refused
Landline/Cellular	1,183.60 (0.90)	2,126.40 (0.90)	0.00 (NA)	0.00 (NA)
Landline Only	2,12.91 (2.08)	337.07 (2.08)	0.00 (NA)	1.02 (0.18)
Cellular/Landline	784.62 (1.33)	796.55 (1.33)	0.83 (0.06)	0.00 (NA)
Cellular Only	508.89 (1.77)	468.11 (1.77)	0.00 (NA)	0.00 (NA)

Data Source: RBS Output  
Standard Errors are in parenthesis.

**Table AF15: Random Digit Dialing Sample: Hispanic Origin Distribution of Respondents by Telephone Strata (weighted)**

Telephone Strata	Hispanic	Non-Hispanic	Don't Know	Refused
Landline/Cellular	300.06 (0.54)	2,999.90 (0.55)	4.34 (0.07)	5.67 (0.08)
Landline Only	50.33 (1.22)	497.64 (1.26)	3.03 (0.32)	0.00 (NA)
Cellular/Landline	197.71 (0.89)	1,379.30 (0.89)	1.66 (NA)	3.37 (0.12)
Cellular Only	185.84 (1.39)	790.57 (1.39)	0.00 (NA)	0.58 (0.09)
Data Source: RBS Output Standard Errors are in parentheses.				

**Table A34: Random Digit Dialing Sample: Race Distribution of Respondents by Telephone Strata (weighted)**

Telephone Strata	Race							
	White	Black	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Multiple	Don't Know	Refused
Landline/Cellular	2,681.10	334.65	22.49	110.04	25.50	43.37	71.94	20.88
Landline Only	424.66	71.28	4.02	11.95	7.02	6.96	20.13	4.98
Cellular/Landline	1,204.80	186.18	12.54	81.66	20.98	28.68	41.31	5.81
Cellular Only	756.92	81.44	8.72	33.70	16.05	25.57	50.13	4.47
Data Source: RBS Output								

**Table AF16: Random Digit Dialing Sample: Age Distribution of Respondents by Telephone Strata**

Telephone Strata	15-19 Years	20-24 Years	25-29 Years	30-34 Years	35-39 Years	40-44 Years	45-49 Years	50-54 Years	55-59 Years	60-64 Years	65 Years and Over	DK/REF
Landline/Cellular	21.68 (0.15)	98.66 (0.32)	154.64 (0.40)	176.89 (0.42)	240.08 (0.49)	350.52 (0.58)	349.98 (0.58)	377.09 (0.60)	394.67 (0.61)	335.46 (0.57)	765.68 (0.79)	44.64 (0.22)
Landline Only	2.04 (0.26)	9.97 (0.57)	14.18 (0.68)	19.08 (0.78)	15.09 (0.70)	25.11 (0.89)	34.11 (1.03)	47.08 (1.19)	39.97 (1.11)	58.80 (1.32)	274.60 (2.13)	10.98 (0.60)
Cellular/Landline	47.167 (0.45)	86.59 (0.61)	123.57 (0.71)	129.38 (0.73)	159.96 (0.80)	171.02 (0.83)	211.83 (0.91)	182.19 (0.85)	160.51 (0.80)	109.42 (0.68)	193.72 (0.87)	6.64 (0.17)
Cellular Only	39.76 (0.70)	99.52 (1.07)	170.06 (1.34)	140.18 (1.24)	125.61 (1.19)	75.38 (0.95)	90.63 (1.03)	92.76 (1.04)	70.27 (0.92)	36.89 (0.68)	32.64 (0.64)	3.30 (0.21)
Data Source: RBS Output Standard Errors are in parentheses												



**Table AF17: Random Digit Dialing Sample: Distribution of Mover/Non-Mover by Telephone Strata (weighted)**

Telephone Strata	Mover	Non-Mover
Landline/Cellular	375.97 (0.60)	2,934.00 (0.60)
Landline Only	25.14 (0.89)	525.86 (0.89)
Cellular/Landline	210.90 (0.90)	1,371.10 (0.90)
Cellular Only	208.28 (1.45)	768.72 (1.45)
Data Source: RBS Output Standard Errors are in parentheses.		

## Appendix B - List of Acronyms

<b>ACRONYMS</b>	<b>DEFINITION</b>
CATI	Computer Assisted Telephone Interview
CCM	Census Coverage Measurement
DSSD	Decennial Statistical Studies Division
MAF	Master Address File
NCOA	National Change of Address
NPC	National Processing Center
PFU	Person Followup
PI	Person Interview
QDERS	Questionnaire Design Experimental Research Survey
RBS	Recall Bias Study
RDD	Random Digit Dialing
USPS	United States Postal Service