Recall Bias on Reporting a Move and Move Date

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Abstract
The goal of the Census Coverage Measurement (CCM) for the 2010 Census was to measure the components of census coverage for omissions and erroneous enumerations. In two different CCM interviews, a roster of people living at the sample address as of Census Day (April 1, 2010) and their living situations are collected. Because these interviews were conducted five and ten months after Census Day, the interviews also collect information on people who move in and out of the sample address. One possible error in reporting the moves could be recall bias as the interviews get further and further from Census Day. This study focused on reporting moves around March or April. The control panel interviews were done around Census Day. Then we compared the percent of moves reported across three panels spread over a ten month time period to the original control panel. To target movers, we selected half of the sample from our Master Address File with the assistance of information from the National Change of Address (NCOA) file. As a secondary analysis, we also reviewed how well we could target possible mover households using the NCOA file as a tool.

Key Words: Recall Bias, Complex Living Situations, Within Household Coverage, Move Reporting, Administrative Records

Background

The purpose of the 2010 CCM program was to evaluate coverage error in the 2010 Census in order to improve future censuses. The CCM is designed to measure the census coverage of housing units and persons, excluding Alaska, group quarters, and persons residing in group quarters. The CCM provided estimates of the net coverage error and the components of census coverage, including omissions and erroneous enumerations. Since the CCM is an evaluation, its results did not affect 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 Person Interview (PI), conducted mid-August to early October 2010, and Person Followup (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 later 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 the 2010 CCM, both CCM PI and PFU operations were conducted later than in previous post-enumeration surveys for both processing needs, and to ensure

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independence from ongoing census operations such as the Coverage Followup conducted April 11, 2010 through August 14, 2010. For consideration in planning 2020 CCM timing, the census 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 Recall Bias Study (RBS) was aimed at independently measuring respondents' ability to recall alternate addresses and move dates as time between the move event and the RBS interview increased. The results of 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 to best parallel the effect of the 2010 Census environments on respondents.

Methodology

The CCM RBS collected data in four independent panels. These panels were selected to represent approximate timing of operations within CCM. These four independent panels were selected from a dual-frame design. The first frame of the RBS was a Random Digit Dial (RDD) list of telephone numbers containing 50 percent housing unit landline and 50 percent cellular phones. The numbers were pulled from national telephone banks of viable numbers excluding numbers that were in Alaska and Hawaii area codes due to the time zone differences between these areas and the census call center. Cellular phones were included because expectations are that future censuses will need to include them in any national telephone sample. This sample frame design gives us a national representation of the population. Comparing the percentage of moves reported for March or April in the first (control) panel to the percentage of March/April moves reported for the later panels should let us measure the rate of change in recalling and reporting moves during this period.

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)[2] that matched to records on an extract of the United States Postal Service (USPS) National Change of Address file. This extract of the NCOA file was dated May 1 2010, and contained records that had reported a change of address in either March or April of 2010[3]. 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 that address. Based on these results, a nationally representative sample was selected[4] (excluding Hawaii and Alaska). The sample included a mix of households that reported the move as temporary or permanent to the Post Office and a mix of households that also indicated if only an individual moved or if the entire household moved. While allowing for review of the NCOA file as a tool, this file provided greater statistical efficiency measuring recall bias of move reporting by providing a larger universe of known movers from a relatively small sample.

[2] This Master Address File was last updated in March 2010 and included updates from the 2010 Address Canvassing operation and Group Quarters Validation, but other census operations updates were not completed.

[3] Some people who moved in March or April may have completed the USPS change of address form after May 1 and are therefore not part of this analysis.

[4] Households that reported moves in the Mover Sample are not representative of the entire Continental U.S. population of movers. Analysis of the type of mover that are likely to report their move to the USPS versus those who don't has yet to be conducted.

Each of the four panels consisted of 10,000 housing units. Panel 1 consisted of 10,000 RDD housing units. The 10,000 housing units of Panels 2, 3, and 4 were split between 5,500 RDD 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.

The RBS 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 2010. The questions were similar to those asked in the CCM PI and PFU operations. 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 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.

Schedule

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	Sample and Sizes	Representing timing of:
1	May 6th – May 24th, 2010	RDD (N=10,000)	The control – As close to collection of census truth as possible
2	June 11th – July 3rd, 2010	RDD (N=5,500) and Mover (N=4,500)	The timing of 2000 Person Interview
3	September 10th – October 2nd, 2010	RDD (N=5,500) and Mover (N=4,500)	The timing of 2010 Person Interview
4	February 4th – 26th, 2011	RDD (N=5,500) and Mover (N=4,500)	The timing of 2010 Person Followup

Data Processing Methods

After the data was 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 clerical 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 the 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. The debriefing questions 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 completed interviews and matched the name and two addresses (the "To" and "From" address) to the people 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.

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[5] 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 mover status.

The RBS analysis universe consisted of those cases identified as either a complete or sufficient partial interview. 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 on 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 type 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.

Limitations

- The goal of this study was not to measure actual recall bias, but to measure potential change in respondent reporting accuracy over time. 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 or telescoping[6] of a

[5] Snow-birds is a term used for people that have two homes they share throughout the year but move between seasonally.

[6] Misperception that an event occurred more recently than it really did.

move reported. It also cannot distinguish if the reason for the underreporting of a move was due to recall bias, other factors, or a combination.

- While the QDERS instrument was not initially created for the purpose of measuring recall bias, there was not enough time in the study development cycle to develop a new instrument specific to our measurement needs. While all the data was 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 RDD cases for the final analysis 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. Some analysis could not be done using the RDD Sample. Footnotes are included in this 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 statistically significant difference.

Response Rates

Table 2: Response Rates[7] by Sample and Panel

	Panel			
	1 (May 2010)	2 (June 2010)	3 (Sept. 2010)	4 (Feb. 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

The overall response rates observed in Table 2 were better when trying to contact a telephone number connected to an actual residence in the landline RDD and the Mover Samples than a personal 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 cases (meaning no response) for the cellular phone RDD Sample. 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 where as many households cannot, unless the household has caller ID included in their home telephone service. Cellular phone numbers would 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[8]. Hence, the cellular phone sample cases were likely not even answering the telephone upon

[7] Response Rates were calculated using formula two from the 2009 American Association for Public Opinion Research Standard Definitions paper.

[8] This called 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.

seeing a number that was not an identified source while the landline telephone sample would more likely answer with, or without a caller ID system.

Recall Bias Results

Move Reporting

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 and intended to measure whether the time that had elapsed since the move had an effect on the recall of that move. Table 3 below is the distribution by panel of the weighted percentage of households contacted that reported at least one person who moved during the months of March or April for the RDD and Mover Samples. Comparing the percentages of those reporting a March or April move across panels should allow us to measure if there is a decrease in reporting moves in March and April due to potential recall error, as time between the move and the interview increases. 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 to be consistent across all panels. If there was a change in proportion across panels, we could conclude that the data (respondents' answers) had changed, and we will be able to measure the amount of change as a function of the time lag between the reference period and the actual interview date.

Table 3: Percentage of Households Reporting a March or April Move by Sample by Panel, Weighted

		RDD Sample	Mover Sample
Panel 1 (May 2010)	Mover	2.80 (0.19)	N/A
	Long-term Cycler	0.78 (0.08)	N/A
	Overall	**3.57** (0.21)	N/A
Panel 2 (June 2010)	Mover	2.93 (0.25)	28.72 (0.94)
	Long-term Cycler	0.50 (0.09)	9.63 (0.62)
	Overall	**3.43** (0.27)	**38.34** (1.01)
Panel 3 (September 2010)	Mover	2.35 (0.21)	23.76 (0.95)
	Long-term Cycler	0.69 (0.10)	8.63 (0.63)
	Overall	**3.04** (0.23)	**32.39** (1.05)
Panel 4 (February 2011)	Mover	2.84 (0.27)	18.99 (0.92)
	Long-term Cycler	1.03 (0.14)	2.61 (0.39)
	Overall	**3.87** (0.30)	**21.60** (0.97)
Data Source: RBS Output. Standard Errors are in parentheses			

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 (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, existed between Panel 3 and Panel 1 (p-value of 0.0876). The RDD 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 cycler households were not tested to determine if significant because the quantity (< 30) was not great enough to give power to the tests.

An interesting observation to note in Table 3 is the slight increase (no significant difference) in the percentage of households reporting a 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 interviews 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 moves in 2010.

As for the Mover Sample, Table 3 shows a decrease in the percentage of households who reported a 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 March or April moves reported. The Mover Sample shows significant differences between Panels 2 and 3 (-5.95 percentage points), and Panels 2 and 4 (-16.74 percentage points) (p-values <0.0001). When separating the type of household move (true mover or long-term cycler) we also 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 (2.61 percent) than those of previous panels with significant differences observed between Panel 2 and Panel 3 (p-values <0.0001). This could be because so much time had lapsed between when the temporary move occurred that respondents did not think we cared about that alternate address information. Future research would be needed to try and determine what are the factors influencing these changes in the time frame from September to February of the next year.

Date Knowledge

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 also illustrate 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. Table 4 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.

Table 4: Random Digit Dialing Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted

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

Table 4 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 appear to have had greater difficulty recalling the exact date of the move at the time of the interview.

Table 5 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 5: Mover Sample: Percentage of Reported Move Date Knowledge of Households with Moves by Panel, Weighted

	Date Knowledge	No Date Knowledge
Panel 2 (June 2010)	90.49 (0.85)	9.51 (0.85)
Panel 3 (September 2010)	84.66 (1.13)	15.34 (1.13)
Panel 4 (February 2011)	86.66 (1.24)	13.34 (1.24)
Data Source: RBS Output. Standard Errors are in parentheses		

The Mover Sample shows a slight variation in the respondents' recall ability pertaining to move date knowledge across panels. When comparing percentages of move date knowledge for Panel 2 to Panel 3 in Table 5, we see 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/April of 2010 compared with the more variable move dates seen in the RDD Sample.

Alternate Address Completeness

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 lived or stayed at the time of the interview and it 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 the CCM PFU operations.

The RBS instrument collected all addresses in separate address components (i.e., House Number, Street, City, State, and Zip). Examining the level to which respondents were able to provide these address components could potentially 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 specific time frame to recall.)
- Addresses that were not outside the United States since interviewers were told address components were not necessary for foreign addresses.
- 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 level 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"[9].
- *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).
- *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. As stated before, the hypothesis was that respondents may report less complete addresses the further away from March or April the interview was conducted (i.e., Panels 3 - 4). Due to the very small number of households with a move in March and April in the RDD Sample, we did not review the RDD data at this lower level, but we were able to analyze the Mover Sample. Table 6 displays the distribution of completeness levels for alternate addresses for those Mover Sample cases who had reported a move occurring in March or April of 2010.

[9] 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.

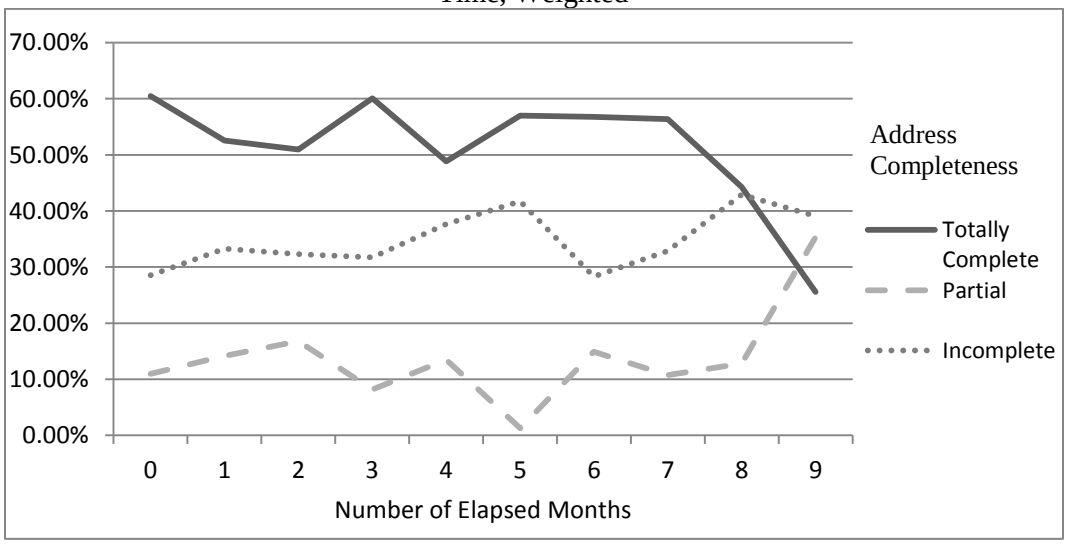
Table 6: Mover Sample: Percentage of Alternate Address Completeness Levels for March or April Movers, Weighted

	Totally Complete	Partial	Incomplete
Panel 2 (June 2010)	68.97 (1.48)	8.03 (0.90)	23.00 (1.34)
Panel 3 (September 2010)	74.47 (1.65)	7.08 (0.97)	18.45 (1.64)
Panel 4 (February 2011)	67.51 (2.64)	12.09 (1.67)	20.40 (2.11)
Data Source: RBS Output. Standard Errors are in parentheses			

Table 6 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). The difference observed for the Totally Complete addresses between Panel 2 and Panel 4 were not significant (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 observed results. Table 6 shows many unexpected results and indicates that the measurement of address component collection might not truly provide an accurate measurement of recall ability.

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

Figure 1: Random Digit Dialing: Alternate Address Completeness Knowledge by Lapsed Time, Weighted



As you can see from Figure 1, most of the Totally Complete percentages actually remain mostly 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 where recall ability changes significantly.

Significant tests were calculated comparing all the month difference combinations. The only significant differences observed were when comparing Month nine to each of the other months (with the exception of the Month eight 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 the drop begins. The results of the Mover Sample were inconclusive due to the limited data at certain points in time since it was so linked to March and April moves and thus not presented.

Results of the National Change of Address File

The Census Bureau is researching possible use of administrative records[10] to help make the census more effective, while minimizing costs and resources. One of those possible administrative records could be the NCOA file. For CCM, a thought was that this file could help identify units that are more likely to not be stable living situations (i.e., contains movers) and as a result be more complicated in enumerating the household correctly. Specifically, we hoped the Mover Sample created by matching the census MAF to the NCOA file would have identified households that contained people who had moved around April 1, 2010.

The universe on this analysis is larger than the Mover Sample analysis universe in the recall results presented above, 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 the recall result, 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 recall results.

National Change of Address Person and Address Match Results

We conducted a review of our 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.

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 overall 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

[10] Refers to micro data records contained in files collected and maintained by administrative or program agencies and commercial entities. Government and commercial entities maintain these files for the purpose of administering programs and providing services.

"Mister" or "Lady of the House"). For 20.61 percent of the households, we collected names that did not match those on the NCOA file.

Overall, we observed that as time elapsed, the chances of contacting a household with a person on the NCOA file decreased. The percentage of people who matched decreased between each panel and an increase of non-matches was apparent between each panel. 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 people since by then they may have had different contact information. We believe 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.

People that 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. There is an overall match of 81.54 percent to the "To" address. 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. The overall match rate for "From" address was 26.32 percent. The highest percentage of "From" address matches were observed 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. As time elapses from the NCOA creation, the chances of respondents mentioning the 'From' address as an alternate address decreases.

National Change of Address Move Status

Our analysis questioned what percentage of households contacted in the NCOA Match Sample reported at least one person moving in 2010. Table 7 below 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: mover, long-term cycler, unsure if mover (don't know), and nonmover. A household was marked as a mover if any person was a mover in the household. The same conditioning was applied in the following hierarchy: Long-term Cyclers, Unknown, and finally Non-Mover households.

Table 7: National Change of Address Match Sample: Percentage of Household Final Move Status by Panel

	Mover	Long-term Cycler	Unknown	Non-Mover
Panel 2 (June 2010)	34.41	15.75	2.23	47.61
Panel 3 (September 2010)	32.64	16.60	2.09	48.67
Panel 4 (February 2011)	31.54	8.49	2.91	57.06
Overall	**32.98**	**13.94**	**2.38**	**50.70**
Data Source: RBS Output.				

From the data collected from each Mover Sample Panel, between 31 and 34 percent of the households in each panel were identified as movers. The percentage of non-movers increased between panels, with the highest percentage in the fourth panel at 57.06 percent. This increase in non-movers in Panel 4 may be the result of the much later interview time, in February of the next year (2011) for Panel 4. 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).

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 (3,390 households) in Panel 2. This once again shows that the NCOA file could be a good source to identify movers when used closely to United States Postal Service collection of move dates.

National Change of Address Move Month Reported

To ensure that the Mover Sample contacted "movers" (movers and long-term cyclers) moving in March or April, we analyzed what percentages of households reported a move by which month the move occurred. Table 8 shows the percentage of movers and long-term cyclers households that reported a move in March or April, February or May, other date, or no date, respectively. If the household reported a March or April move along with another month, the household was designated as having a 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.

Table 8: National Change of Address Match Sample: Percentage of Reported Move Month by Panel for Households with a Mover or Long-term cycle status

	March or April	February or May	Other Date	No Date
Panel 2 (June 2010)	74.09	15.58	3.18	7.15
Panel 3 (September 2010)	63.27	16.37	8.67	11.68
Panel 4 (February 2011)	51.85	16.09	20.18	11.88
Overall	**64.74**	**15.99**	**9.33**	**9.93**
Data Source: RBS Output.				

As expected, the majority of the movers reported a move in March or April, 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 of 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.

National Change of Address Overlap

Ideally, we would like the NCOA information to provide a perfect match for the person name, the "To" and "From" addresses, and the respondent to report a move in March or April. 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 that matched, a match to both the "To" and "From" addresses, and reported a move in March or April.

Since the NCOA file may have many different uses, it is good to know where it did overlap well and where it did not. When respondents did report a move, 30.31 percent of the households have all components matched (name, both addresses, and a move date in March or April). 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 (9.15 percent). This could be from misreporting the date of the move in the survey (possible recall error) or an effect of that the NCOA is really reporting when they wanted their mail to be transferred to a new address.

Conclusions

Recall Bias Conclusions

For the Recall Bias 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 move reports. 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. The only significant difference noted when comparing the weighted percentages of households reporting a move during March or April existed between Panel 3 and Panel 1. So, if we were reviewing the RDD Sample results alone, we would have concluded that there was a possibility, but we cannot say for sure, of recall bias starting in September.

Overall, the Mover Sample shows a decrease in the percentage of households who reported a 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 got farther from the move date. Therefore, we see evidence of potential recall bias error as time elapsed since Census Day.

In conclusion, 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 timeframe, but moving the operations up in time (i.e., June) does not seem to eliminate the potential error (though this may minimize it).

National Change of Address Conclusions

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 (only 46.92 percent). 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 limited number of cases where we obtained telephone numbers and respondent nonresponse over panels, but the 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 phone numbers and possible recall bias the percentage reporting a move is around 50 percent (50.16 percent for Panel 2 compared with 46.92 percent overall for movers and long-term cyclers).

There is no clear indicator on the NCOA 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 households had a name match to both the "To" and "From" addresses, and reported a move in March or April in our survey.

Recommendations

From our analysis, we recommend conducting all surveys that collect move information around Census Day as close to April 1 as possible. This will reduce any potential of recall issues and provide higher response rates. We also recommend conducting further research to better measure recall effects and the factors leading to them. 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. If the NCOA file is to be used as contact frame, we recommend conducting any phone number lookup operation as close to the move date reported as possible to avoid potential telephone number aging.

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