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2020 Census Research and Testing Report: The Effect of the Mail Delivery Date on Survey Login Rates and Helpline Call Rates

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Abstract

In 2017, the U.S. Census Bureau conducted an experimental study to determine whether the day of the week a mailed survey invitation arrives at a housing unit affects the response rate to an online survey and whether staggering the mailings reduces the variation in daily calls to a telephone helpline. Prior research showed that there is increased response to Census Bureau online surveys the day the mail arrives at the home and on Mondays. We therefore hypothesized that mail arriving on Mondays might exponentially increase the overall response rate to an online survey. To study the "Monday" effect, we designed a split-panel test with a probability sample of 8,000 housing units from the U.S. For half of the sample, the mailings were sent primarily on Mondays to arrive late in the week while for the other half the mailings were sent primarily on Thursdays to arrive at the beginning of the next week. We found a significantly higher overall login rate for the panel whose mailings were intended to arrive at the beginning of the week compared with the panel whose mailings were intended to arrive late in the week, when controlling for the number of mailings received before Census Day, which was March 15, 2017. However, we could not pinpoint any particular day of the week that drove that increase and therefore the finding might have occurred due to a cumulative effect of all the mailings. We also found the staggered mailing (mailing out on Mondays and Thursdays) within this experiment reduced the variation in the number of calls per day to the helpline for some weeks compared to other similar studies without a staggered mailout.

Keywords: response rates, login rates, online questionnaire, stop-the-clock dates, staggered mailout schedule, helpline

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Table of Contents

1. Introduction 1
2. Background 1
3. Methodology 4
3.1 Research Questions 5
3.2 Sampling 5
3.3 Experimental Design 6
3.4 Mailing strategy and mailing schedule 7
3.5 Operational Details 8
3.6 Data Collection 9
3.7 OMB Clearance 10
3.8 Schedule 10
4. Research Question 1: Mail delivery day login rates 11
4.1 Research Question 1 Evaluation Measures 11
4.1.1 Mailout treatment panel analysis 11
4.1.2 IPTS data analysis 12
4.1.3 Self-reported day of delivery analysis 13
4.2 Research Question 1 Results 13
4.2.1 Mailout treatment panel results 14
4.2.2 IPTS data analysis results 16
4.3 Research Question 1 Limitations 19
5. Research Question 2: Telephone helpline call volume 19
5.1 Research Question 2 Evaluations Measures 19
5.2 Research Question 2 Results 20
5.2.1 Comparison of the call distribution of staggered mailing to nonstaggered mailings 22
5.2.2 Call volume within staggered mailing dates 24
5.3 Research Question 2 Limitations 25
6. Conclusions and Recommendations 25
6.1 Conclusions 25

6.2 Recommendations 26
7. Knowledge Management Resolutions 27
8. Acknowledgements 27
9. References 28
10. Appendix 30
10.1 Appendix A: Mail Materials 30
10.2 Appendix B: IPTS Postal Tracking Data Exploratory Analysis 35
10.3 Appendix C: Logins by Mail Material Exploratory Analysis 39
10.4 Appendix D: Self-Reported Arrival Date of Mail Material 43
10.5 Appendix E: Acronyms and Abbreviations 47

List of Tables

Table-1..... 2017 March Test NCBS Experimental Design 7
Table-2..... 2017 March NCBS Test Mail Schedule 8
Table-3..... Login Rate by Mail Panel 14
Table-4..... Logistic regression models predicting logging into the online 2017 March NCBS (using the mail panel as the independent variable) 16
Table-5..... Logins by Day of the Week the Most Recent Mail Piece Arrived 18
Table-6..... Mail Schedule for 2017 March NCBS Test, the 2016 September NCBS Test, and 2016 June NCBS Test.....20
Table-7..... Comparing the call volume between Monday mailout and a Thursday mailout 25

Table B-1.. Percent distribution of housing units by the number of days it took to deliver each mail piece (and the mean number of days to deliver each mail piece and the standard deviation).....36
Table B-2.. Regression model predicting the number of days to deliver the mail.....37
Table B-3.. Login rate over the entire survey period by the number of mail pieces delivered to the housing unit prior to Census Day, March 15 (N=8,000).....37
Table B-4.. Distribution of the number of mail pieces delivered to the housing unit prior to Census Day by mail panel (N=8,000) 38

Table C-1.. Logins with Mail Piece by Day of the Week the Mail Piece Arrived.....42

List of Figures

Figure 1: 2014 Census Test mailout dates and online login dates 2
Figure 2: 2015 Census Test mailout dates and online submission dates for self-response for Maricopa County and Savannah sites 3
Figure 3: 2015 National Content Test calls (Monday, August 24 was the first mailout. The second mailout varied depending on the panel and it was either Monday, August 31 or Thursday, August 27. Tuesday, September 8th was the third mailout; Tuesday, September 15 was the fourth mailout and Tuesday, September 22 was the fifth mailout. The federal holiday, Labor Day, was Monday, September 7, 2015) 4
Figure 4: Distribution of the 2017 March NCBS sample across region and by high and low internet access areas..... 6
Figure 5: Number of daily logins for the 2017 March NCBS Test online questionnaire by date and mail delivery panel.....13
Figure 6: Initial login day of the week by mail delivery panel.....14
Figure 7: Distribution of the calls to the telephone help line for the two mailout panels between March 6 and April 20, 2017 21
Figure 8: Total number of calls to a helpline for the 2017 March NCBS Test by day of the week and panel.....21
Figure 9: Distribution of the calls to the telephone helpline for the 2016 June NCBS betwen June 15 and July 16, 2016 (note that July 4 was a federal holiday).....22
Figure 10: Distribution of the calls to the telephone helpline for the 2016 September NCBS between August 25 and September 30, 2016 (note that September 5 was a federal holiday).....22
Figure 11: Total number of calls to a helpline for the 2016 June NCBS Test by day of the week 23
Figure 12: Total number of calls to a helpline for the 2016 September NCBS Test by day of the week.....23
Figure 13: Total number of calls to a helpline for the 2017 March NCBS Test by day of the week, summed across panels 24

Figure A 1: Panel 1 Initial letter (front).....30
Figure A 2: Panel 1 Initial letter (back).....30
Figure A 3: Panel 2 Initial letter (front).....31
Figure A 4: Panel 2 Initial letter (back).....31
Figure A 5: Panel 1 and 2 Internet Response Card for Initial mailing package. Note the barcode, User ID (blotted out), and address (blotted out).....31
Figure A 6: Panel 1 Second mailing, first reminder postcard (front).....32
Figure A 7: Panel 1 Second mailing, first reminder postcard (back). The barcode, User ID, and address would be printed on this side similar to the Internet Response Card.....32
Figure A 8: Panel 2 Second mailing, first reminder postcard (front).....32
Figure A 9: Panel 2 Second mailing, first reminder postcard (back). The barcode, User ID, and address would be printed on this side similar to the Internet Response Card.....32
Figure A 10: Panel 1 Third mailing, second reminder postcard (front) 32
Figure A 11: Panel 2 Third mailing, second reminder postcard (front) 33
Figure A 12: Panel 1 Final letter (front).....33

Figure A 13: Panel 2 Final letter (front).....34
Figure A 14: Panel 1 and 2 Internet Response Card for Final mailing package. Note the barcode, User ID (blotted out), and address (blotted out).....34

Figure C.1: Number of initial logins by mail piece and mail panel.....39
Figure C.2: Number of daily logins using the User ID in the initial letter package by date and mail panel. Mailout for the initial letter package for Panel 1 was on Monday, March 6, 2017, and was on Thursday, March 9, 2017, for Panel 2. 40
Figure C.3: Number of daily logins using the User ID in the second mailing, the first reminder postcard, by date and mail panel. Mailout for the first reminder postcard for Panel 1 was on Thursday, March 9, 2017, and was on Monday, March 13, 2017, for Panel 2. 40
Figure C.4: Number of daily logins using the User ID in the third mailing, the second reminder postcard, by date and mail panel. Mailout for the second reminder postcard for Panel 1 was on Monday, March 20, 2017, and was on Thursday, March 23, 2017, for Panel 2. 41
Figure C.5: Number of daily logins using the User ID in the final letter package by date and mail panel. Mailout for the final letter package for Panel 1 was on Monday, March 27, 2017, and was on Thursday, March 30, 2017, for Panel 2. 41

Figure D.1: Survey submission page including additional questions collecting feedback on the date the mailing was received and opinions about the data collection, with a call-out showing the possible months the respondent could choose from.....43
Figure D.2: Distribution of responses to the self-report of the date the 2017 March NCBS mail material arrived at the residence. 44
Figure D.3: Percent of self-reported dates that match the stop-the-clock date exactly or the stop-the clock date or the next day (N=2054 respondents who reported a date).....45
Figure D.4: Percent of self-reported dates that are accurate for people who answer the same day the mail arrives or a different day (N=2054 respondents who reported a date).....46

Executive Summary

The 2020 Census will offer the opportunity for households to submit their data electronically using an online questionnaire. In preparation for the 2020 Census, many tests have been conducted between 2012 and 2017 to evaluate the most effective way to motivate the public to respond online. All these tests involve the Census Bureau mailing to each household letters and postcards that include the web address of the online survey, a unique identification number for login purposes, and messaging that encourages response. We have observed spikes in logins to these online surveys on the expected "in-home" delivery date of the census-invitation mailings, which is approximately three days after the mail is sent. We see additional spikes on Mondays, with the number of logins slowly decreasing over the week until either the next Monday, or the next in-home date of a mailed invitation, when there is another smaller spike. We find the same pattern with telephone calls to the helpline. In fact, because of this call pattern, the proposed plan for the 2020 Census is to stagger the census-invitation mailings in the hopes that the telephone calls to the helpline are more uniform throughout the week to even out telephone agents' daily workload expectations.

This observed "day of the week" pattern was the stimulus for the research experiment reported in this document. The original research question was to determine whether having the mailed invitation arrive early in the week, on Mondays, would increase overall logins. To study the "Monday" effect, we designed a split-panel test with a probability sample of 8,000 housing units from the U.S. For half of the sample, the mailings were sent primarily on Mondays to arrive mid-to-late week while the other half had mailings sent primarily on Thursdays to arrive at the beginning of the next week. Up to four mailings were sent in each panel. Respondents were to report who lived at their address as of a particular day, which is called "Census Day." A Census Day of a Wednesday was selected because that is the day of the week the 2020 Census will fall on. An online survey called the 2017 National Census Bureau Survey was developed for this experiment.

The design lent itself to a telephone experiment because we had created, in essence, a staggered mailing. To study the effect a staggered mailing had on daily calls to a helpline, we assigned each panel to a unique telephone number and tracked the number of calls by day. Our second research question examined whether the staggered mailing in fact reduced the variation in the number of calls per day.

This report answers two research questions:

1. Is there a higher login rate to the 2017 March NCBS Test if the mailings are received at the beginning of the week or at the end of the week?

2. Does staggering the mailings reduce the variation in the daily number of calls to a telephone helpline?

1. Is there a higher login rate to an online census questionnaire if the mailings are received at the beginning of the week or at the end of the week?

We found a significantly higher overall login rate for the panel that sent the majority of the mailings on Thursdays (to arrive at the beginning of the next week) compared with the panel that sent the majority of the mailings on Mondays (to arrive at the end of the week), when controlling for the number of mailings received before Census Day, which was March 15, 2017.

However, we could not pinpoint with certainty which mail delivery day drove the increase in logins. We examined the login rate by the day each of the mailed invitations arrived at the housing unit according to the U.S. Postal Service. While there was a difference in the login rates by day of the week following the first mailing, the second mailing, and after the final mailing, there was no set pattern that we could determine. We also did not have enough U.S. Postal Service data to determine whether login rates differed by the day of the week after the third mailing arrived.

In examining the covariates, we found that the strongest predictor of whether the housing unit logged into the survey was how many mailings were received on or before Census Day. In this experiment, housing units were expected to receive two census-invitation mailings before Census Day and two after Census Day. However, because the mailings were staggered, the panel that was mailed out primarily on Thursdays was more likely to have only one mail piece delivered before Census Day compared to the panel that was mailed out on Mondays. This was a flaw in the experimental design.

There was also a small number of housing units, which were more likely to be located in rural areas, that received the first two mailings much later than other housing units. The likelihood of ever logging into the survey depended on how many census invitations arrived before Census Day. We found that housing units that received two census-invitation mailings before Census Day were significantly more likely to log in during the survey period than housing units that received either one census invitation or no invitation before Census Day. We suggest that it was the number of mailings that drove this finding, and not how rural the area was. In each model, we included a covariate that controlled for how rural the area was, and that covariate was not significant in any model, suggesting that how rural an area is does not affect the login rate. While there was no explicit due date in the mailed invitations, the Census Day date, March 15, 2017, was mentioned in the first census invitation letter. Perhaps residents thought it was too late to respond if they got that mail piece on or after March 15, 2017, Census Day.

2. Does staggering the mailings reduce the variation in the daily number of calls to a telephone helpline?

We compared the staggered mailout of this test with two similar but independent tests without staggered mailouts. Staggering the mailings did make calls to the helpline more uniform over weeks 2 through 4 in the data collection cycle compared with not staggering the mailings. It did not create a more even call distribution in the first week, and the benefit of staggering also ends by the fifth week of data collection given the four weeks of mailing (Raim, Nichols, & Thomas, 2018).

The data from this test also showed that Monday mailouts generated more call volume than Thursday mailouts. There were two spikes in calls for the Monday mailout. Calls increase on the in-home delivery day which was typically a Thursday and then again on Mondays; while the Thursday mailout only had one spike because the in-home delivery day was also a Monday. Perhaps some people call immediately when they receive the mail and others put off calling until the beginning of the next week, which basically means that a late week mail arrival stimulates two different groups of people to call.

Recommendations:

- **Study the cost savings of creating a more uniform call distribution in weeks 2 through 4 of a data collection compared with the cost savings with any increase in logins if mail containing a survey invitation is received early in the week.**
  The results of this experiment are in conflict. Results suggest that we could increase logins by having mail arrive early in the week, but then the daily calls to a helpline would be more variable during weeks 2 through 4 of a data collection. On the other hand, we could create more uniform calling throughout the week and optimize the number of agents and call centers needed by mailing throughout the week, but then households would receive survey invitations later in the week and login rates might be lower. This study did not cost out the two methodologies or compare potential savings.

- **Study the impact of the number of mailings received prior to Census Day on login rates.**
  While the current experimental study did not randomize the number of invitations received before, on, or after Census Day, we observed very large discrepancies in the login rate based on when the mailings arrived in relation to Census Day. Login rates were significantly higher if two mailings were received prior to Census Day. This should be studied in a randomized experiment to rule out any impact of region, urbanicity, or possible due date effect.

1. Introduction

To prepare for the decennial census, the Census Bureau conducts a series of large tests throughout each decade. Although there is differing methodology for every test, generally tens of thousands of households are sent notifications asking them to complete a test census. Response rates to the surveys are often a key outcome measure. To supplement these large tests, smaller tests of survey notifications have also occurred. Originally, these tests were conducted by email with a nonprobability panel. Since 2015, we have also conducted smaller probability-based address frame tests using postal mail and an online questionnaire. These smaller tests, allow for the refining and pretesting of innovative self-response strategies before their potential inclusion in larger census tests. This report documents the findings from the fourth (and final) of these smaller address-based tests, called the 2017 March National Census Bureau Survey (NCBS) Test.

The 2017 March NCBS Test was a split-panel test using a probability sample of 8,000 housing units. It was conducted to research whether the day of the week the census mailing invitations arrive affects login rates to an online survey and whether staggering the mailings affects the variability in the daily call volume to a census telephone helpline. The test also investigated whether instructional text in the online survey affected data quality, however, those results are reported separately in Horwitz, Nichols & Coombs (2018).

2. Background

In the 2010 Census, the main self-response mode was paper questionnaires mailed to addresses nationally. No option was provided to self-respond by internet in the 2010 Census. The 2020 Census will allow the U.S. public to submit their data electronically using an online questionnaire. The website address for the online census questionnaire will appear on the letters and postcards mailed to addresses nationally using the U.S. Postal Service (USPS). In preparation for the 2020 Census, many census tests were conducted between 2012 and 2017 to evaluate the most effective way to motivate the public to respond to the census online, whether by manipulating the content of the mailing materials or by modifying the timing or number of mail pieces (U.S. Census Bureau, 2016; Bentley & Rothhaas, 2016; Phelan, 2016; Coombs, 2016).

To evaluate these efforts of encouraging self-response, we track "login" and "submission" counts by date. If a respondent enters his or her identification number into the web survey and accesses the instrument, that is considered a login, but for a submission, the respondent would have to get to the end of the survey and select the submit button. Submission rates are generally lower than login rates because not everyone who starts the online survey selects the submit button at the end of the survey.

Throughout the tests, we have observed spikes in logins and submissions to these online surveys on the expected "in-home" delivery date of the census-invitation mailings. The "in-home" delivery date is the day the mailing most likely arrives at an address based on when it was postmarked. We estimate the "in-home" delivery day is three days after the mailing is sent. We see additional login/submission spikes on Mondays, with the number of logins/submissions slowly decreasing over the week until either the next Monday or the next in-home date of a mailed

invitation, when there is another smaller spike. Lower login and submission rates occur on weekends and on holidays.

Logins and submissions follow a similar day-of-the-week pattern as shown in the following two graphs. In the 2014 Census Test, a total of five mailings were sent to households inviting them to go online to complete the census test. Figure 1 contains the login data for the 2014 Census Test. It appears that login rates peak on the expected in-home delivery date ("Est. in home" label in Figure 1), and then exhibit a smaller peak on Mondays (denoted by the "M" label in Figure 1). Login rates dip over the weekends. The last two mailouts do not exhibit the estimated in-home delivery peak because a paper form was included in the fourth mailout; however, there appears to be a Monday spike in logins after the fourth mailout.

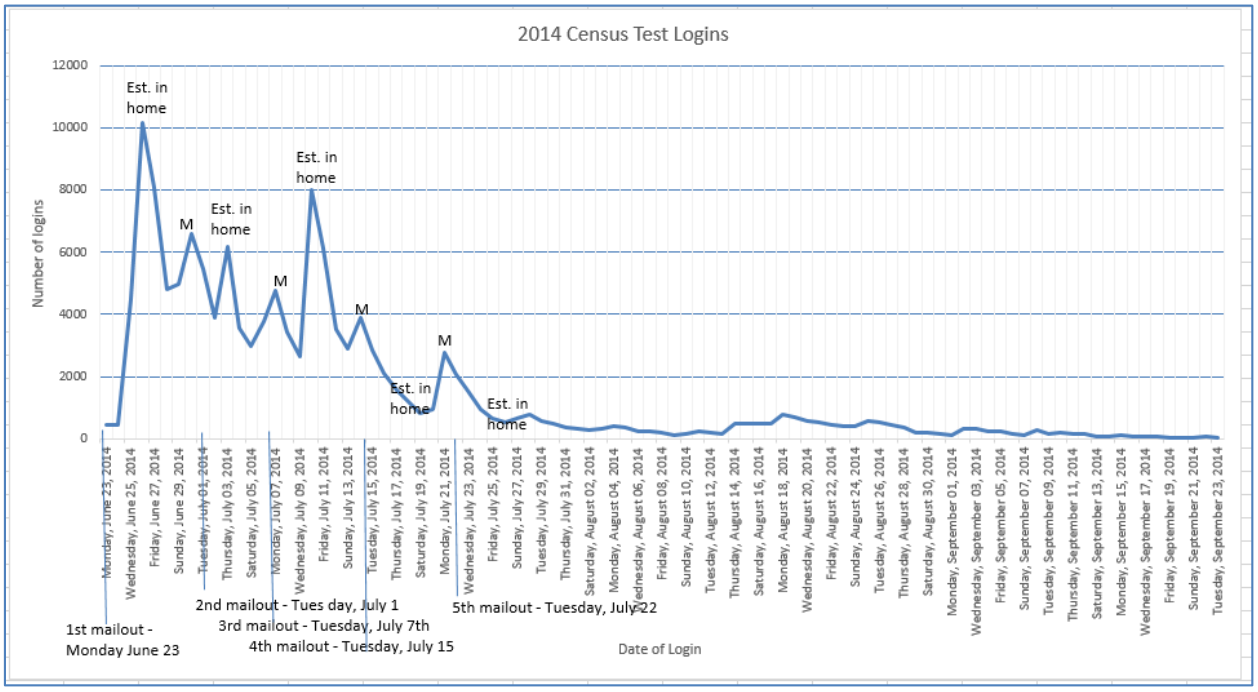

Figure 1 2014 Census Test mailout dates and online login dates
Source: U.S. Census Bureau, Application Services Division daily email tally of logins and submissions for the 2014 Census Test.

The pattern was similar, but not exactly the same in the 2015 Census Test for self-response submissions. In this test, all four in-home delivery dates were estimated to be Tuesdays (see Figure 2 for the graph of the submission data). The first mailout did not generate the biggest spike in submissions, rather it was the second mailing. And there was one additional spike (the second spike in Figure 2) in submissions that did not appear to be generated by delivery of the mail or a Monday.

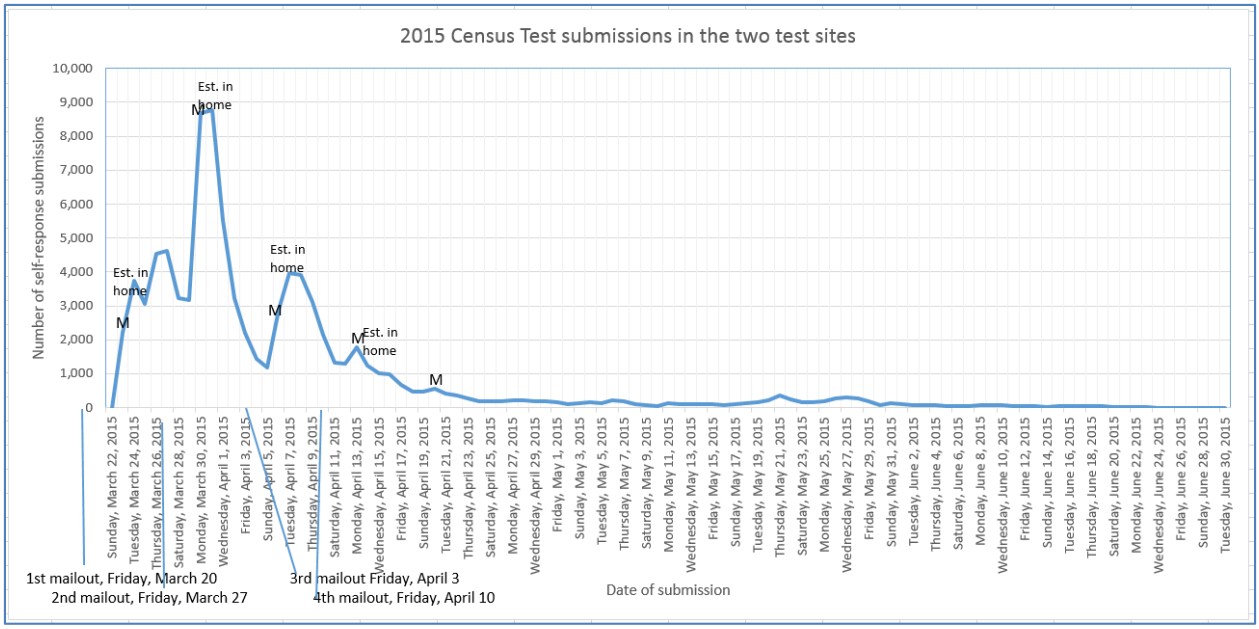

Figure 2 2015 Census Test mailout dates and online submission dates for self-response for Maricopa County and Savannah sites

Source: U.S. Census Bureau, UTS data from 2015 Census Test – included only submissions for self-responses from the Maricopa and the Savannah sites

While we found the 2015 results of the first mailing puzzling, the combined results from the 2014 and 2015 tests suggest there is a tendency for respondents to login and submit their census forms the day the invitation arrives in the home. Among the other days of the week, Mondays stand out. In addition to these larger census tests, Center for Behavioral Science Methods staff have conducted email testing with a nonprobability panel of people who have opted in to participate in Census Bureau research studies. In this testing, we observed that emailed survey notifications that go out on Mondays (the equivalent of an in-home delivery day of Monday for a mailing) appear to generate more click-throughs to the survey than email notifications that go out later in the week. While this phenomenon was never tested in a randomized email experiment, the combination of these observations generated the question of whether we could increase self-response to an online household survey using a mailed invitation simply by attempting to deliver the survey notification mailing at the beginning of the week rather than at the end of the week.

We have also observed a similar pattern of telephone calls to the helpline (that is, calls spike on the in-home delivery date and on Mondays). Calls appear to decrease during the week until either the next in-home date or the next Monday. For example, Figure 3 shows the number of phone calls received each day for the 2015 National Content Test (NCT). The results suggest that there is a spike in phone calls on Mondays (or Tuesdays, if the Monday was a holiday). In fact, because of this call pattern, the proposed plan for the 2020 Census is to stagger the census-invitation mailings so that the telephone calls to the helpline are smoothed out over the week to make for steadier workload assignments. Estimating whether a staggered mailing eliminates (or at least minimizes) the Monday spike in calls is of interest for planning purposes.

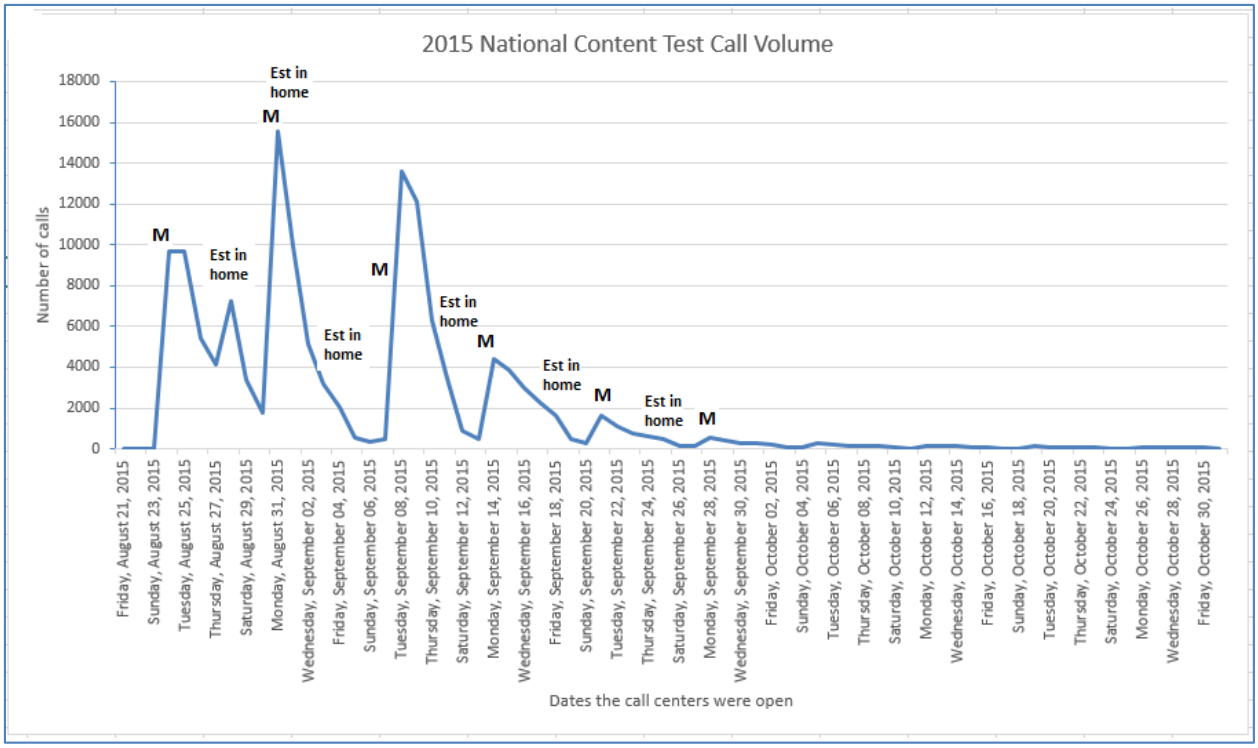

Figure 3 2015 National Content Test calls
Monday, August 24 was the first mailout. The second mailout varied depending on the panel and it was either Monday, August 31 or Thursday, August 27. Tuesday, September 8th was the third mailout; Tuesday, September 15 was the fourth mailout and Tuesday, September 22 was the fifth mailout. The federal holiday, Labor Day, was Monday, September 7, 2015)
Source: U.S. Census Bureau, 2015 NCT Call Data

While there has been much research on the optimal call schedule for telephone interviewer-administered surveys (see Weeks, Kulka, & Pierson, 1987), and there has been research on the optimal email schedule for marketing emails (Ellering, 2016) and for emailed invitations for surveys (Wronski, Liu, & Pinkus, 2017), we are unable to find any published research on optimal days for a mailed invitation to arrive to maximize response or to minimize calls to a helpline. Until more recently, there has not been a good way to track the in-home delivery date of mailed invitations using USPS data.

The current test sought to begin investigating whether in-home delivery date affects login rates to an online mandatory survey from the U.S. Census Bureau and whether those dates affect call rates to a telephone helpline. In this test, we evaluated logins instead of submissions because they are easier to define and acquire, there would be no confounding issues with break-offs, and as mentioned previously, they typically follow the same day-of-the-week pattern as submissions.

3. Methodology

This section describes the research questions to be answered in this report, the sampling strategy for the survey, the experimental panel design, the mailing strategy, the schedule, and the data collection instrument.

The online survey was called the National Census Bureau Survey, and the test of mailout dates occurred during March and April 2017.

This 2017 March NCBS Test actually had three research questions, two of which are answered in this report and the other question, which investigates the effect of instructional text on data quality in an online survey, will be answered in Horwitz, et al. (2018).

3.1 Research Questions

1. Is there a higher login rate to an online census questionnaire if the mailings are received at the beginning of the week or at the end of the week?

2. Does staggering the mailings reduce the variation in the daily number of calls to a telephone helpline?

3.2 Sampling

To study whether there is a mail delivery "day of the week" effect on login rates, we designed a split-panel test with an address-based probability sample of 8,000 housing units from the 50 U.S. states and the District of Columbia. An a priori power analysis indicated that a sample of 4,000 housing units in each panel was sufficient to detect an estimated 3 percentage point difference in login rates using alpha=0.05, beta=0.80, and assuming an overall login rate of 35 percent.

The base frame for the test sample was the extract of the Master Address File (MAF) created for the 2017 Census Test. Before the sample for this March 2017 test was drawn, we excluded addresses that had been in sample for the following studies to avoid overburdening respondents: the 2015 National Content Test, the 2016 American Community Survey (ACS), the 2016 Census Test (addresses in Los Angeles County, California; and Harris County, Texas), the first half of the 2017 ACS, the 2017 Census Test, and the three previous small-scale tests (Nichols, et al., 2017; Coombs, 2017; Eggleston & Coombs, 2018). We also excluded households that did not have usable mailing address information in the MAF extract.

Prior to sampling, the resulting frame was sorted by region, state, an indicator of how likely the unit was to have internet access (a two-level variable including high internet access and low internet access), and the percent rural based on 2010 Census data. After sorting, a systematic sample was selected with every other selected unit being assigned to one panel or the other. Half of the sample was assigned to the panel in which census mailings were sent primarily on Mondays to arrive mid-to-late week, while the other half had mailings sent primarily on Thursdays to arrive at the beginning of the week. After assigning the postal delivery panels, the sample was sorted by that panel variable and then same sorting variables mentioned earlier. The addresses were then alternatively assigned to the two instruction experimental panels. This methodology resulted in a fully crossed experimental sample.

Figure 4 shows the distribution of the 2017 March NCBS Test sample across the regions and within region by low and high internet access areas (which is referred to internally at the Census Bureau as the Optimizing Self-Response (OSR) groups). The Midwest and West regions of the U.S.

contain approximately the same number of housing units; while the Northeast region contains fewer and the South region contains about 40 percent more housing units than either the Midwest or West regions (U.S. Census Bureau, American FactFinder Population Estimates). The sample reflects that distribution.

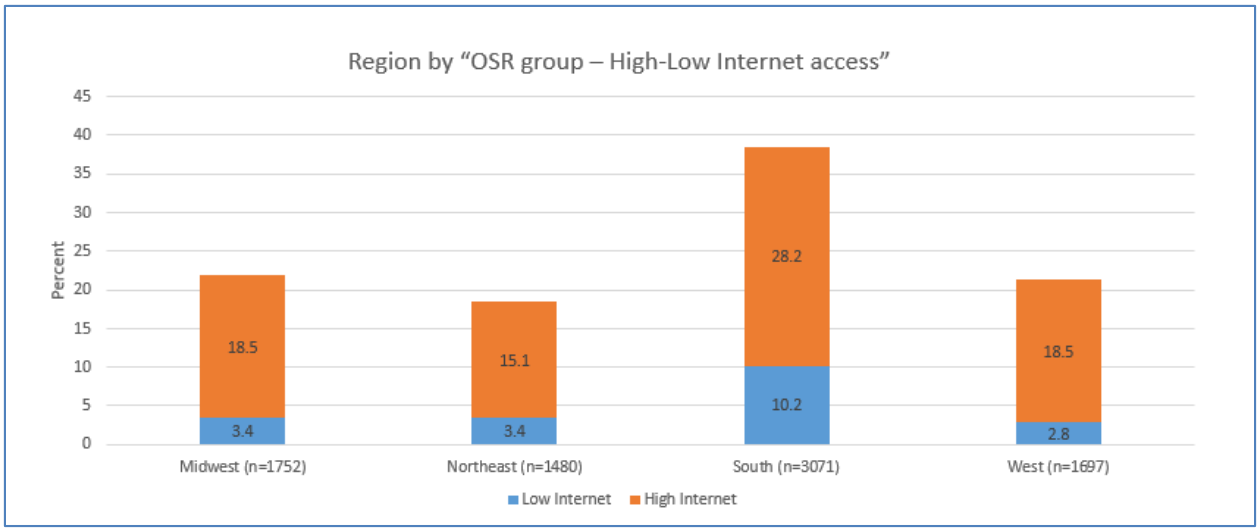

Figure 4 Distribution of the 2017 March NCBS sample across region and by high and low internet access areas
Source: U.S. Census Bureau, 2017 March NCBS Sample

3.3 Experimental Design

This experiment was designed to test the effect of two factors: the in-home mail delivery day of the week effect on login rates and the effect of instructional text on data quality in an online survey. While the latter experiment will be presented thoroughly in Horwitz, et al. (2018), we describe it briefly here because it was part of the experimental design.

Each factor had two conditions. For the in-home mail delivery day of the week factor, half of the sample (called Panel 1: Monday mailout - Late week arrival) received mailings that were sent primarily on Mondays to arrive mid-to-late week, while the other half (called Panel 2: Thursday mailout - Early week arrival) had mailings sent primarily on Thursdays to arrive at the beginning of the following week. For the instructional text factor, cases were assigned either to an online survey with instructional text on the screen or an online survey with no instructional text on the screen but available within a help link on that screen.

The survey invitations were identical across the two mail delivery conditions, except for the date they were mailed and the telephone helpline number on the mailings. Each mail delivery panel had its own helpline number. The separate telephone numbers allowed us to estimate how a staggered mailing might affect calls to a helpline, since we could then track the number of daily calls to each line separately. We have no reason to suspect that using a different telephone number for the Census Bureau helplines in each mailout panel affected the login rates for the panel.

Cases were assigned to each treatment independently, which led to a full crossing of the two factors into four groups, described in Table 1. With 8,000 cases total, this resulted in 2,000 cases per group or cell, or 4,000 per condition or panel. There was no expected interaction between the two

factors. And, if there was any increase in calls in the panel with no instructions on the web survey screen, that increase should have affected both mailout panels the same amount.

Table-1 2017 March Test NCBS Experimental Design

		Instructional Text	
		Instructions on the screen	**No instructions on the screen**
Postal mailout and in-home delivery day of the week	Panel 1: Monday mailout – Late week arrival	• Mailed survey invitations primarily on Mondays and were estimated to arrive late in the week • Telephone helpline A • Instructional text was present in the online survey	• Mailed survey invitations primarily on Mondays and were estimated to arrive late in the week • Telephone helpline A • Instructional text was not present in the online survey
	Panel 2: Thursday mailout – Early week arrival	• Mailed survey invitations primarily on Thursdays and were estimated to arrive early in the week • Telephone helpline B • Instructional text was present in the online survey	• Mailed survey invitations primarily on Thursdays and were estimated to arrive early in the week • Telephone helpline B • Instructional text was not present in the online survey

3.4 Mailing strategy and mailing schedule

Addresses received up to four mailings: an initial letter in the test and the URL for the survey, a first reminder postcard and URL, a second reminder postcard, and a final letter. See Appendix A for the mail materials. For this experiment, there was no paper questionnaire provided with the final mailing as is planned for the 2020 Census. The only way to answer the survey was online. The text in all the mailings asked residents to respond to an online census questionnaire, and the URL for the survey was located in each mailing piece. In addition, residents could use an internet search engine to find a link to the National Census Bureau Survey and a brief description of the survey located on the Census Bureau website.

The total time span – from the first to the last mailing – was four weeks. Following the proposed design of the planned 2020 Census mailings, two mailings were sent before Census Day and the remainder after Census Day, if the residents had not responded by a particular date. Respondents should report who lives in their household as of Census Day. It is not meant to be a due date, but rather the reference date. Because day of the week was critical to this analysis, we selected March 15, 2017, as Census Day because it fell on a Wednesday, which is the same day of the week as the actual Census Day for the 2020 Census. The "March 15" date was mentioned in the initial letter only because respondents can report after Census Day and including that date in subsequent mailings which might arrive after that date could be confusing to the respondent.

One panel was mailed out primarily on Mondays, while the other panel was mailed out three days later, primarily on Thursdays as shown in Table 2. The mailout date of the first reminder postcard deviated from the mailout day of the other material in the panels because previous research had

shown that having the first reminder postcard arrive three days after the first mailing is optimal for increasing online response (Phelan, 2016). Since that first reminder mailout strategy is the current plan for the 2020 Census, we decided to implement it in this experiment as well.

All sample households that had logged into the internet instrument by March 14 for Panel 1 were removed from the workload for the third and fourth mailing for that panel. All sample households that had logged into the internet instrument by March 17 for Panel 2 were removed from the workload for the third and fourth mailing for that panel. The mailing strategy schedule is presented in Table 2. We estimated a three-day in-home delivery for each mailing piece; however, we realized this would depend greatly on the location of the housing unit. All of the mailings were sent from the Census Bureau's National Processing Center in Jeffersonville, Indiana. We used the USPS to deliver the mail.

Table-2 2017 March NCBS Test Mail Schedule

Date	Panel 1: Monday mailout – Late week arrival	Panel 2: Thursday mailout – Early week arrival
Monday, March 6, 2017	Initial letter + Internet Response Card	
Thursday, March 9, 2017	First reminder postcard	Initial letter + Internet Response Card
Monday, March 13, 2017		First reminder postcard
Wednesday, March 15, 2017	Census Day	Census Day
Monday, March 20, 2017	Second reminder postcard	
Thursday, March 23, 2017		Second reminder postcard
Monday, March 27, 2017	Final letter + Internet Response Card	
Thursday, March 30, 2017		Final letter + Internet Response Card

3.5 Operational Details

To access the survey, the household resident needed the 12-digit authentication code (called the User ID) located above the address on the internet response card (see Figure A.5 in Appendix A) or on the reminder postcards. For this test, not only did each housing unit have its own unique User ID, but each mailing piece for each housing unit had its own unique User ID so that we could track which mailing piece was used to log into the survey. The first digit of the User ID was either 1, 2, 3 or 4, which corresponded to the mail piece (whether it was the first, second, third, or fourth mail piece). Digits 2-12 of the User ID related to the specific housing unit and did not vary across mail pieces for that particular housing unit. Any of the four User IDs for the housing unit would bring up the survey, and the respondent could save, log out, and resume the survey, even when using a User ID from a different mail piece. For the analysis in this report, we examine only the first time a respondent accessed the survey and we could determine from the User ID which mail

piece was used to access that survey as there was no way to enter the survey except with a User ID.

This experiment also acquired USPS Intelligent Mail Barcode Tracing (IMb Tracing) data for each individual mail piece. The system producing the files is called the IMb Postal Tracking System (IPTS). These data allow us to determine when the different mailing invitations arrived at the housing unit. These tracking data are primarily collected by automated mail processing scans at different post offices. Rural areas may not have as comprehensive data compared with larger, more metropolitan or technology-rich postal sites/facilities. The dataset had the User ID, date of the scan, ZIP of scan, code for undeliverable as addressed (UAA), and most importantly, a "Stop the Clock" code. Within 24 hours of a "Stop the Clock" code, the mail piece is at the address. That means for any given code, the mail piece could be delivered that day or the next day. We expected to use these data as a more precise measure of when the mail arrived at the residence because the expected three-day in-home delivery might not apply to each residence.

As mentioned earlier, a separate telephone helpline number was provided for each mailing panel, and the number was provided in all four mailings. The numbers reached an automated message that provided some basic information about the survey, including troubleshooting tips and instructions for respondents who did not have internet access. Live agent support was not provided. The recorded greeting was identical for both telephone lines and it said,

> Thank you for calling the U.S. Census Bureau. Recently, you may have received a letter or postcard from us about the National Census Bureau Survey. If you have already completed the survey online and you've received a reminder mailing, please disregard it. We have already received your response. If you are having difficulty accessing our survey's website, make sure you are entering the web address in the address bar and not your search engine such as Google, Bing, or Yahoo. Finally, this survey is only available online. If you do not have access to the internet, you are not required to respond to this survey at this time and you may disregard future mailings for this particular survey. Thank you.

The message was available from March 6 through April 20 for both mail delivery panels. On April 21, a different message was used. The wording of this message was as follows, "Thank you for calling the U.S. Census Bureau. The National Census Bureau Survey is now closed. Thank you." The number of calls to each telephone number were tracked daily, however, we do not know what phone number called each line. If a respondent called the line multiple times, these would be tracked as separate calls.

3.6 Data Collection

The NCBS was open for data collection between March 6 and April 25, 2017, which was approximately a seven-week time span for both mail delivery panels. Besides the instructional differences between the panels (see Horwitz et al., forthcoming), the NCBS survey was basically the same survey used for two previous small-scale tests (Coombs, 2017; Eggleston & Coombs, 2018). The survey was a modified version of the 2015 National Census Test (NCT) Centurion

instrument. The website address to the login page for the survey was https://respond.census.gov/ncbs. The survey collected the names of everyone living at the residence and their demographics, including relationships within the household, sex, date of birth, age, race, ethnicity, and any other address where they have been counted.

For this study, the modifications from the NCT included changing Census Day to March 15, 2017, removing the non-ID response path, showing only one version of each of the experimental questions tested in the 2015 NCT, and adding new questions after the survey submission. One of the new questions asked about when mail materials arrived at the housing unit. We added this question prior to knowing that we could obtain the IPTS data.

3.7 OMB Clearance

The data collection was covered under OMB generic clearance number 0607-0971, which expires June 30, 2019. This OMB number allows for a mandatory data collection. It was important to have a mandatory data collection for this experiment because the 2020 Census will be mandatory and that requirement significantly drives the response rate (Barth, 2015).

3.8 Schedule

Activity	Date: Panel 1	Date: Panel 2
Online survey opens and prerecorded telephone line opens	Monday, March 6, 2017	Monday, March 6, 2017
In-home delivery of First Mailing	Thursday, March 9, 2017	Monday, March 13, 2017
In-home delivery of Second Mailing	Monday, March 13, 2017	Thursday, March 16, 2017
Census Day	Wednesday, March 15, 2017	Wednesday, March 15, 2017
In-home delivery of Third Mailing	Thursday, March 23, 2017	Monday, March 27, 2017
In-home delivery of Fourth Mailing	Thursday, March 30, 2017	Monday, April 4, 2017
Prerecorded telephone line closes	Thursday, April 20, 2017	Thursday, April 20, 2017
Online survey closes	Tuesday, April 25, 2017	Tuesday, April 25, 2017

4. Research Question 1: Mail delivery day login rates

This section presents the evaluation measures, the results, and the limitations for the research question about the effect of the mail delivery day of the week on login rates. Exploratory analysis of the data is available in the Appendices and referenced in this section.

4.1 Research Question 1 Evaluation Measures

To determine whether the delivery date of the mailed invitation affected login rates, we first examined whether the housing unit (or case) had logged into the online survey. We considered a case to have logged into the survey if the User ID for that case appeared on the paradata file. The paradata file had one record per action taken in the survey for each case, and a case could appear in the file only after a valid User ID was given on the survey login page. If a housing unit had multiple logins (and six percent of the cases did), we selected the first login attempt to analyze. Thus, the results of this analysis only apply to first or initial logins.

We then conducted three different types of analysis. The first analysis used the mailout treatment panel as the independent variable to predict logins. The second analysis used the IPTS tracking data, as an anticipated more precise measure of the day the mailing materials arrived, to determine whether particular arrival days were more likely to generate a login. The third analysis compared the self-reported data to the IPTS tracking data and determined that the self-reported data was not accurate enough to use to perform the analysis.

4.1.1 Mailout treatment panel analysis

The login rate was calculated by dividing the number of housing units that logged into the survey in a given panel by the total number of housing units assigned to that panel. From the IPTS data (for details see Appendix B), we determined that there were no housing units that were UAAs, although individual pieces of mail might or might not have been delivered. To account for the three-day difference, we used the total number of initial logins for Panel 1 from March 6 through April 22 and for Panel 2 from March 9 through April 25, 2017.

$$Login\ Rate = \frac{\#\ housing\ units\ that\ logged\ into\ the\ survey\ in\ that\ panel}{\#\ housing\ units\ in\ that\ panel} * 100$$

Initially, we used chi-square tests of independence to assess whether the mailout treatments were associated with differences in login rates. We then ran a logistic model with whether the housing unit logged in as the dependent variable, and the mailout treatment as the independent variable. We controlled for some of the variables used to sort the original frame prior to sampling, including region, high or low internet access area, and the percent rural, in case those variables could account for some of the variance associated with the login rates.

After some exploratory analysis with the IPTS data, we ran a second logistic regression model with an additional control variable (the number of mail pieces received prior to Census Day). The exploratory work with the IPTS data uncovered the fact that some housing units (about 7 percent) did not receive any mailings prior to Census Day. This happened more frequently in Panel 2 (the

panel that would have arrived early in the week) than in Panel 1, most likely because Panel 2 was mailed out later than Panel 1. We do not know why other housing units received mail so late, sometimes over 30 days after the mail piece was sent. The IPTS exploratory work is found in Appendix B.

4.1.2 IPTS data analysis

In addition to analyzing login rates by panel, we also examined login rates using the IPTS mail delivery tracking data because they were a more precise measure of when the mail actually arrived at the housing unit. Because of an error, we did not receive IPTS data for the third and fourth mailing for Panel 2, however, we know that housing units received these mailings because respondents used them to log into the survey. In the analysis, we used IPTS data from mailings 1 and 2 for both panels and data from mailings 3 and 4 for Panel 1.

When we examined the tracking data, we combined the panel data together because, in theory, we had the delivery date for each mail piece. We also used data from the entire survey period from March 6 through April 25, 2017. We used chi-square tests of independence to assess whether the day that mail piece arrived was associated with differences in login rates and then used standardized residuals to identify which cells contributed to the significant results (Eggleston & Coombs, 2018; Sharpe, 2015; Delucchi, 1993; and Agresti, 2007). Agresti suggests that a cutoff of about two or three is appropriate depending on the number of cells in the analysis. Like Eggleston & Coombs (2018) we discuss any residuals that exceed an absolute value of 2.00 and accompany a significant chi-square test result.

Although our original intent was to analyze the login rate for each mail piece by day the mail piece arrived, exploratory analysis suggested that respondents continued to use prior mailings (in particular, the initial letter) to log into the survey even after they had received subsequent mail pieces. In fact, nearly half the time the initial letter was used to log into the survey, the respondent did so after receiving another mail piece. While we did run the original planned analysis and present it in Appendix C, along with the exploratory analysis, not surprisingly there was no significant relationship between the day the mail piece arrived at the residence and whether that mail piece was used to log into the survey.

We also conducted four separate sequential analyses based on the timing of each mail piece, rather than which piece was used to login. To simplify the programming needed, we limited the analysis dataset to housing units which received the mail pieces in order (for example, we excluded any housing unit that received the first reminder postcard before the initial letter).

- We examine whether the login rates differed by the day the first mailing piece arrived prior to the arrival of the second mail piece.
- Then, excluding any housing unit that had logged in previously, we examined whether the login rates between the day the second mailing arrived at the residence and the third mailing was sent differed by day of the week the second mail piece arrived.
- Then, excluding any housing unit that had logged in previously, we examine whether the login rates between the day the third mailing arrived at the residence and the fourth mailing arrived differed by day of the week the third mail piece arrived.

- Finally, excluding any housing unit that had logged in previously, we examine whether the login rates between the day the fourth mailing arrived at the residence and the end of the survey period differed by day of the week the fourth mail piece arrived.

4.1.3 Self-reported day of delivery analysis

We did not use the self-reported mail arrival date in the analysis of login data because we had more precise data from the IPTS file, however, in Appendix D we provide results of the accuracy of the self-report data as compared with the IPTS file.

4.2 Research Question 1 Results

The first research question asks if the login rate is affected by the day of the week that the mailed survey letter or postcard arrives at the residence. Past tests had observed spikes in logins on the estimated delivery day and then again on Mondays. Figure 5 shows the number of unique logins to the 2017 March NCBS Test by date and mailout panel for the entire survey period between March 6 and April 25. Like other tests, spikes in logins appear to occur on the in-home delivery date for each mailing and with smaller spikes on Mondays. Four main spikes appear for Panel 1 that correspond to the four mailing pieces. While there are three main spikes for Panel 2, the first spike is a little larger and lasts longer than Panel 1's equivalent spike. Figure 6 shows these same logins by panel by day of the week across the entire survey period. For Panel 2, where the mail was estimated to arrive early in the week, we see the greatest number of logins on Monday with logins slowly diminishing each day after that. For Panel 1, where the mail was estimated to arrive mid-to-late week, it is easier to see the in-home delivery date pattern with a spike on Thursdays, diminishing logins after that day, and then a smaller spike on Mondays.

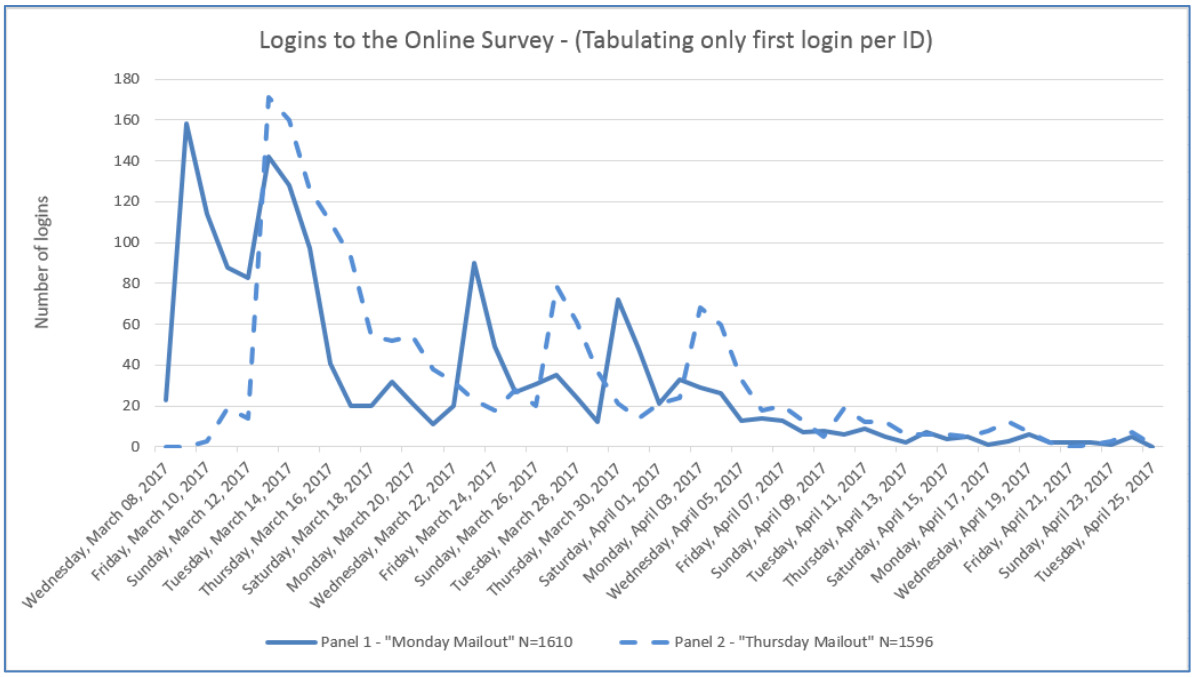

Figure 5 Number of daily logins for the 2017 March NCBS Test online questionnaire by date and mail delivery panel
Source: U.S. Census Bureau, 2017 March NCBS Test

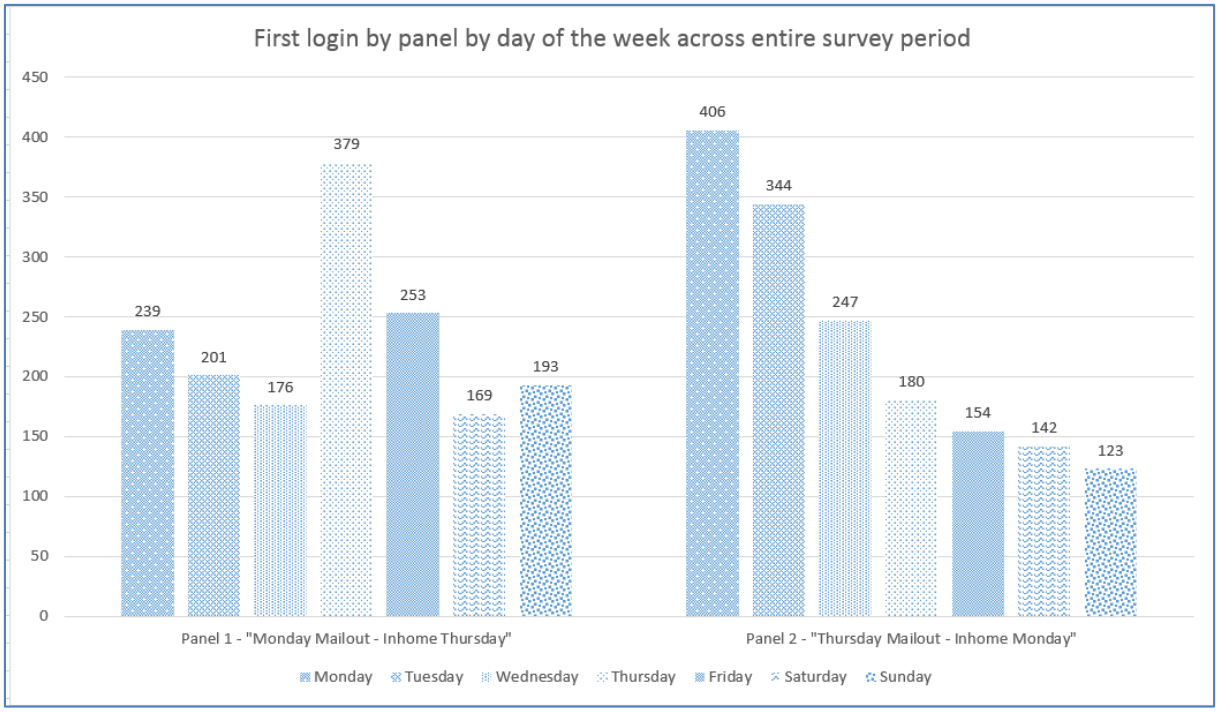

Figure 6 Initial login day of the week by mail delivery panel
Source: U.S. Census Bureau, 2017 March NCBS Test

4.2.1 Mailout treatment panel results

Adjusting the logins for the three-day difference between the panels, we calculated the total number of unique logins for Panel 1 between March 6 and April 22 and logins for Panel 2 between March 9 and April 25. Table 3 shows that the login rate was around 40 percent for both panels[1], and the rate does not differ by the mail delivery panel. A chi-square test showed no significant difference in the distribution of logged in cases across the two panels (Mail Delivery: χ^2 (df = 1) = 0.03, p = 0.86).

Table-3 Login Rate by Mail Panel

Mail panel	Sampled	Logged In	Rate
Panel 1: Monday mailout – Late week arrival	4,000	1,604	40.1%
Panel 2: Thursday mailout – Early week arrival	4,000	1,596	39.9%

Source: U.S. Census Bureau, 2017 March NCBS Test

Table 4 shows the estimates, standard errors, and significance levels for two different models predicting whether the housing unit logged into the survey. The two models are similar except in the second model, we included as a covariate the number of survey invitations that arrived at the housing unit prior to Census Day. Housing units that did not receive any mailings until after Census Day had a login rate of 9 percent compared with a 43 percent login rate for housing units

[1] The submission rate was 38 percent for this study.

that received the expected first and second mailings prior to Census Day. The housing units that received no mailings prior to Census Day were also overwhelmingly in Panel 2, which is most likely because Panel 2's mailings went out three days later than Panel 1's mailings and were more likely to arrive after Census Day. Other characteristics of the housing units that received all of the mailings after Census Day are found in Appendix B.

For these models, we again used only the login data for Panel 1 between March 6 and April 22 and login data for Panel 2 between March 9 and April 25. The mail panel is only significant in Model 2 when we have controlled for the number of mailings received before Census Day. Model 2 shows that housing units that were in Panel 2 (where we estimated they would receive most of the mailings at the beginning of the week) were more likely to log in than were housing units in Panel 1 (where we estimated they would receive most of the mailings at the end of the week). The R-square for both models is low, but adding the variable accounting for the number of mailings received prior to Census Day actually doubles it.

Several of the covariates are significant in both models. In both models, we find that addresses in the South region are significantly less likely to log in than addresses in the West region ($p<0.0001$), and a trend for addresses in the Midwest being more likely than addresses in the West to log in to the online survey (however this is not significant in Model 2). Addresses in low internet access areas are significantly less likely to log in than are addresses in high internet access areas ($p<0.0001$). We found no indication that urban or rural areas differ in their login rates given the other variables in the model.

Table-4 Logistic regression models predicting logging into the online 2017 March NCBS (using the mail panel as the independent variable)

	Model 1 Estimate (Standard Error)	**Model 2 Estimate (Standard Error)**
Intercept	-0.15** (0.05)	0.69*** (0.11)
Panel 1: Monday mailout – Late week arrival	0.008 (0.05)	-0.69***(0.09)
Panel 2: Thursday mailout – Early week arrival	0	0
Region: Midwest	0.18** (0.07)	0.02 (0.07)
Northeast	-0.08 (0.07)	-0.13 (0.07)
South	-0.27*** (0.06)	-0.37*** (0.07)
West	0	0
Low internet access	-0.95*** (0.07)	-0.92***(0.07)
High internet access	0	0
Percent Rural	-0.001 (0.001)	-0.0006 (0.001)
# of mailings received prior to Census Day: None	-	-2.61*** (0.17)
1	-	-0.65*** (0.09)
2	-	0

Source: U.S. Census Bureau, 2017 March NCBS Test
Model 1: N=7999; R-Square=0.04
Model 2: N=7999; R-Square=0.08
Significant at * =.05; **=.01; ***=.001

4.2.2 IPTS data analysis results

Using the IPTS data, we examined the login rate by the day of delivery as another way to determine whether mail pieces delivered early in the week generate more logins than mail pieces delivered later in the week. Table 5 provides the percent that logged into the survey by the most recent mail piece arrival day but before the next mail piece arrived. Unlike the mailout treatment panel analysis in Section 4.2.1, there is no clear pattern to the login rates based on these data.

- There is a difference in login rates between the first and second mailing (χ^2 (df = 6) = 13.7, p =0.03). Based on the standardized residuals, Wednesday is the only day of the week with a standardized residual meeting the threshold of |2|, implying that a mail delivery day of Wednesday has a lower login rate than other mail delivery days for this time period.

- There is a marginal difference in login rates between the second and third mailing (χ^2 (df = 6) = 11.8, p =0.07). Based on the standardized residuals, Thursday is the only day of the week with a standardized residual meeting the threshold of |2|, implying that a mail delivery day of Thursday has a lower login rate than other mail delivery days for this time period.
- There is no difference in login rates between the third and fourth mailing; however, there are small cell sizes due to the fact that we did not collect tracking data for half of the sample (χ^2 (df = 6) = 3.1, p =0.80).
- There is a difference in login rates between the arrival of the fourth mailing and the end of the survey period (χ^2 (df = 6) = 14.2, p =0.03). Based on the standardized residuals, Sunday and Monday are the days of the week with a standardized residual meeting the threshold of |2|, implying that those mail delivery days have a lower login rate than other mail delivery days for this time period, which is the opposite of the hypothesis that early delivery days increase login rates.

Table-5 Logins by Day of the Week the Most Recent Mail Piece Arrived[2]

	Between 1st mailing and arrival of 2nd mailing (n=7213)		Between 2nd mailing and mailout of 3rd mailing (n=6405)		Between 3rd mailing and arrival of 4th mailing (n=2632)		Between 4th mailing arrival and end of the survey period (n=2367)	
	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual
Sunday	211 / 1779 (11.9%)	1.01	294 / 1681 (17.5%)	1.94	0 / 4 (0%)	-0.67	3 / 65 (4.6 %)	-2.27
Monday	149 / 1185 (12.6%)	1.64	156 / 990 (15.8%)	-0.22	0 / 4 (0%)	-0.67	0 / 32 (0%)	-2.33
Tuesday	25 / 276 (9.1%)	-1.15	36 / 233 (15.5%)	-0.23	24 / 198 (12.1%)	1.00	23 / 180 (12.8%)	-0.62
Wednesday	168 / 1823 (9.2%)	-3.11	214 / 1261 (17.0%)	1.05	134 / 1330 (10.1%)	0.01	176 / 1160 (15.2%)	1.16
Thursday	193 / 1572 (12.3%)	1.53	165 / 1260 (13.1%)	-3.14	100 / 1035 (9.7%)	-0.56	120 / 834 (14.4%)	0.07
Friday	36 / 318 (11.3%)	0.07	115 / 709 (16.2%)	0.17	7 / 55 (12.7%)	0.66	17 / 89 (19.1%)	1.31
Saturday	26 / 260 (10.0%)	-0.63	45 / 271 (16.6%)	0.28	0 / 6 (0%)	-0.82	0 / 7 (0%)	-1.08

Source: U.S. Census Bureau, 2017 March NCBS Test

[2] Example of how to interpret table: In the second column, the login rates are provided for the time between the 1st mailing and the 2nd mailing by the day of the week the 1st mailing was delivered. For example, we find 1,185 initial letters had a stop-the-clock day of Monday, and 12.6 percent of those letters were used to log into the survey prior the 2nd mailing (the first

4.3 Research Question 1 Limitations

We investigated the in-home delivery day-of-the-week effect on login rates to an online government survey using mail delivered by the USPS during a particular time of year (the spring) and using only two different mail strategies. Conclusions drawn in this report may not be generalizable to mail delivered by other carriers or to other types of surveys or requests for action, to other mail delivery strategies, or other times of the year.

No inferences can be drawn about response rates expected for the 2020 Census from this report due to differences in design. While the methodology for this census test was similar, it was not exactly what is planned for the actual 2020 Census. In particular, the 2017 March NCBS Test collected responses only through the internet instrument, while the 2020 Census will allow self-response through paper questionnaires and on the telephone. In addition, the 2017 March NCBS Test did not include a communication campaign, which will be a major feature of the 2020 Census. Responses for this test were collected only in English, through the internet instrument, and for people who logged in with a User ID. Current plans for the 2020 Census include support for languages other than English, providing response modes other than the internet, and allowing people to respond without providing their supplied User ID. Conclusions drawn in this report may not be generalizable to all types of respondents.

Finally, due to an oversight, we were unable to obtain the IPTS tracking data for mailings 3 and 4 for Panel 2, thus limiting analysis of the tracking data for those mailings and time frames.

5. Research Question 2: Telephone helpline call volume

This section presents the evaluation measures, the results, and the limitations for the research question about whether a staggered mailing reduces variation in the daily call volume to a Census Bureau telephone helpline. Details on statistical procedures are available in Raim, Nichols, and Mathew (2018) and referenced in this section.

5.1 Research Question 2 Evaluations Measures

For the second research question, determining whether a staggered mailout reduces variation in the number of daily calls to telephone helplines, we first conduct exploratory analysis, comparing the calls in the two panels to each other. Then, to determine if staggering produces a more uniform distribution of calls, we compare call data from the 2017 March NCBS Test with the 2016 September NCBS Test (Eggleston and Coombs, 2018) and the 2016 June NCBS Test (Coombs, 2017). All three tests used a nationally representative sample of households. Availability of the two previous studies allows us to compare the effect of a staggered mailout with a typical nonstaggered mailout, and to formally test whether variability in call volumes is decreased. The mailing schedule for the 2017 March NCBS, 2016 September NCBS Test and 2016 June NCBS Test is given in Table 6.

reminder postcard) arriving. (A Sunday "Stop the Clock" day means the letters were delivered Monday, while a Monday through Friday "Stop the Clock" day means the letters could have been delivered that day or the next [within 24 hours].)

Table-6 Mail Schedule for 2017 March NCBS Test, the 2016 September NCBS Test, and 2016 June NCBS Test

	2017 March NCBS		2016 September NCBS		2016 June NCBS	
Mailing	Date	Day of the Week	Date	Day of the Week	Date	Day of the Week
First	March 6 March 9	Monday Thursday	August 25	Thursday	June 13	Monday
Second	March 9 March 13	Monday Thursday	September 1	Thursday	June 15	Wednesday
Third	March 20 March 23	Monday Thursday	September 8	Thursday	June 24	Friday
Fourth	March 27 March 30	Monday Thursday	September 15	Thursday	July 5	Tuesday

To compare the variability of call volumes between the three studies, we first examine plots of call frequencies. We then carry out formal tests as described in Raim, Nichols, and Mathew (2018) between (1) the 2017 March NCBS Test versus the 2016 September NCBS; and (2) the 2017 March NCBS Test versus the 2016 June NCBS to test whether staggering the mailings produces a more uniform call distribution by week. We report confidence intervals to quantify the amount that the variability has been reduced. For these analyses, we exclude calls made on the first day of the 2017 March NCBS Test survey period because these were test calls made to the lines to ensure that they were operational and we do not wish to include those numbers in the evaluation. Using a certain Z statistic, we examined whether the proportion of calls was different between Panel 1 and Panel 2 using call data from Panel 1 from March 7 through April 18 and for Panel 2 from March 10 through April 20.

5.2 Research Question 2 Results

Figure 7 presents the daily call volume to the two telephone lines for each of the panels by date for the 2017 March NCBS Test. Figure 8 presents call frequencies summed by the day of the week by panel. Even with a staggered mailout there appear to be spikes on Mondays and on the in-home estimated delivery date of Thursday for Panel 1 as shown in Figure 8. Because the in-home estimated delivery day is Monday for Panel 2, there is only one spike, with the calls decreasing throughout the rest of the week. Chi-square tests showed significant differences in the distribution of calls by day of the week between the two mailout panels (χ^2 (df =6) = 112.7, $p < 0.0001$). Thus, even though there continued to be Monday spikes regardless of the mailout day, the two panels had a different distribution of calls throughout the week.

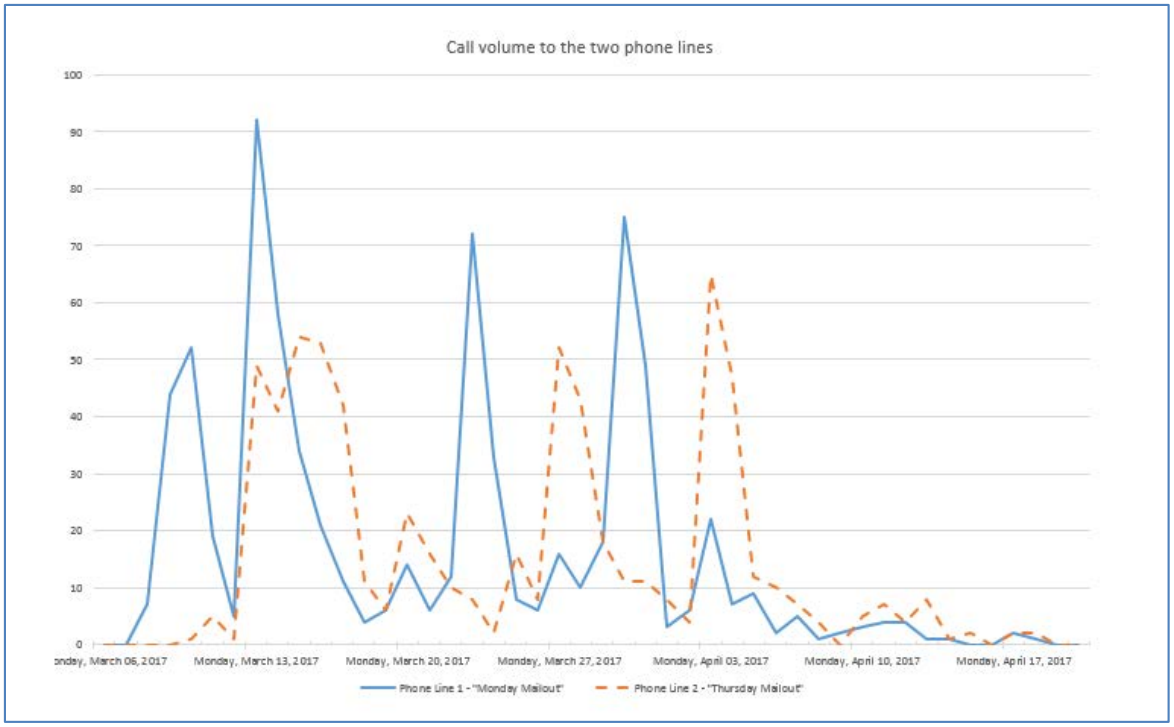

Figure 1: Distribution of the calls to the telephone help line for the two mailout panels between March 6 and April 20, 2017
Source: U.S. Census Bureau, 2017 March NCBS Test

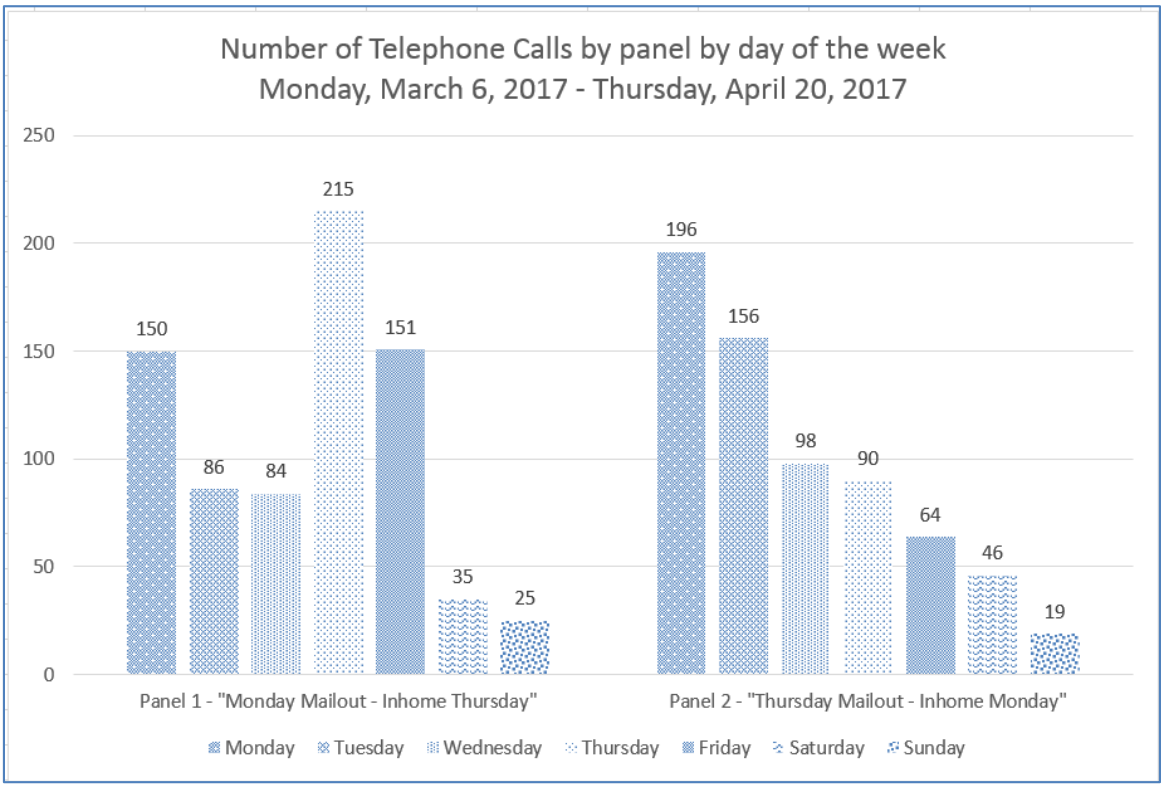

Figure 2: Total number of calls to a helpline for the 2017 March NCBS Test by day of the week and panel
Source: U.S. Census Bureau, 2017 March NCBS Test

5.2.1 Comparison of the call distribution of staggered mailing to nonstaggered mailings

Figures 9 and 10 present the daily call volume for the two comparison studies, while Figures 11 and 12 present call frequencies for those studies summed by day. Figure 13 presents the call frequency for the 2017 March NCBS Test summed by day across panels.

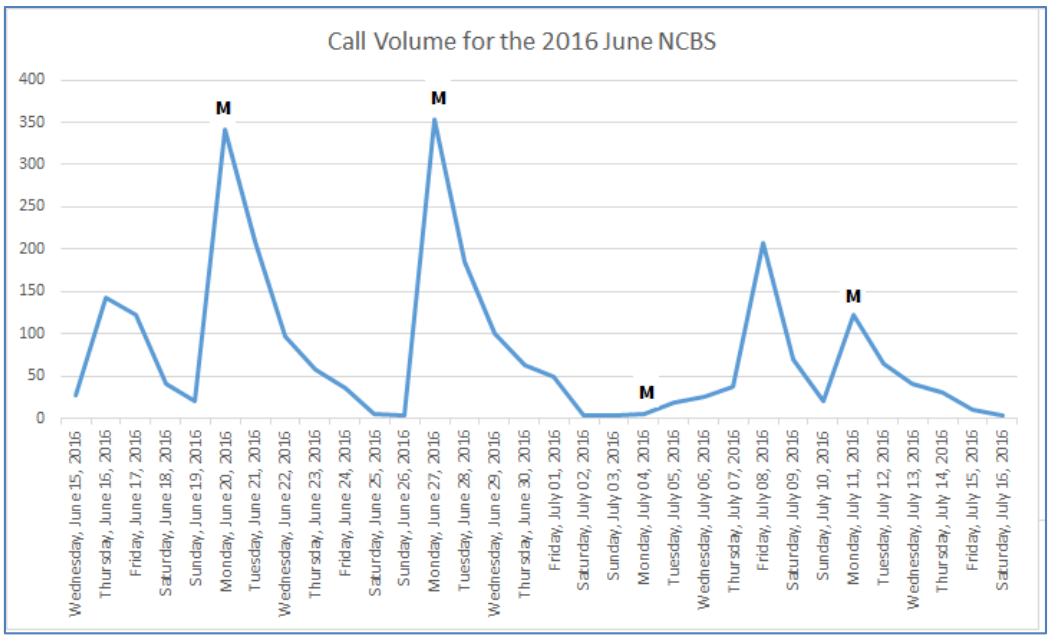

Figure 3: Distribution of the calls to the telephone helpline for the 2016 June NCBS between June 15 and July 16, 2016 (note that July 4 was a federal holiday)
Source: U.S. Census Bureau, 2016 June NCBS

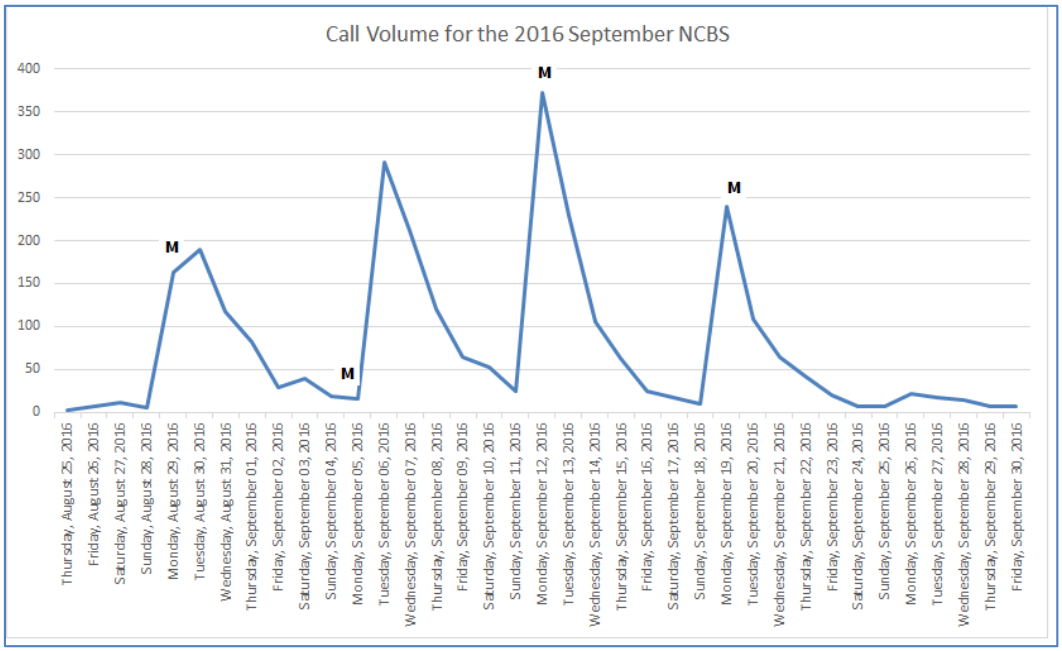

Figure 4: Distribution of the calls to the telephone helpline for the 2016 September NCBS between August 25 and September 30, 2016 (note that September 5 was a federal holiday)
Source: U.S. Census Bureau, 2016 September NCBS

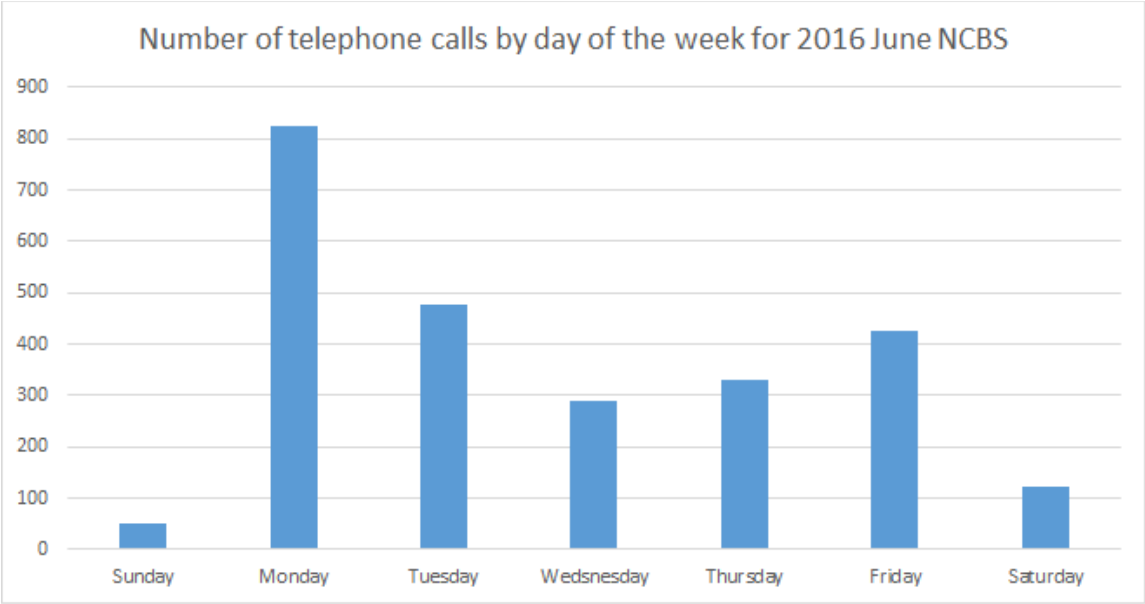

Figure 5: Total number of calls to a helpline for the 2016 June NCBS Test by day of the week
Source: U.S. Census Bureau, 2016 June NCBS

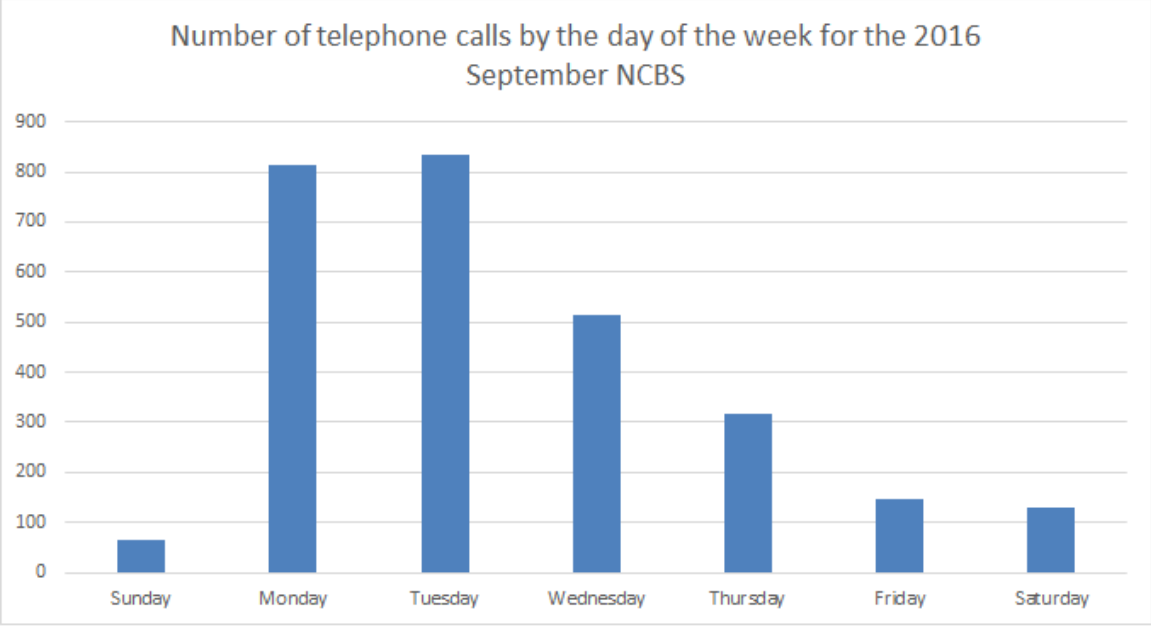

Figure 6: Total number of calls to a helpline for the 2016 September NCBS Test by day of the week
Source: U.S. Census Bureau, 2016 September NCBS

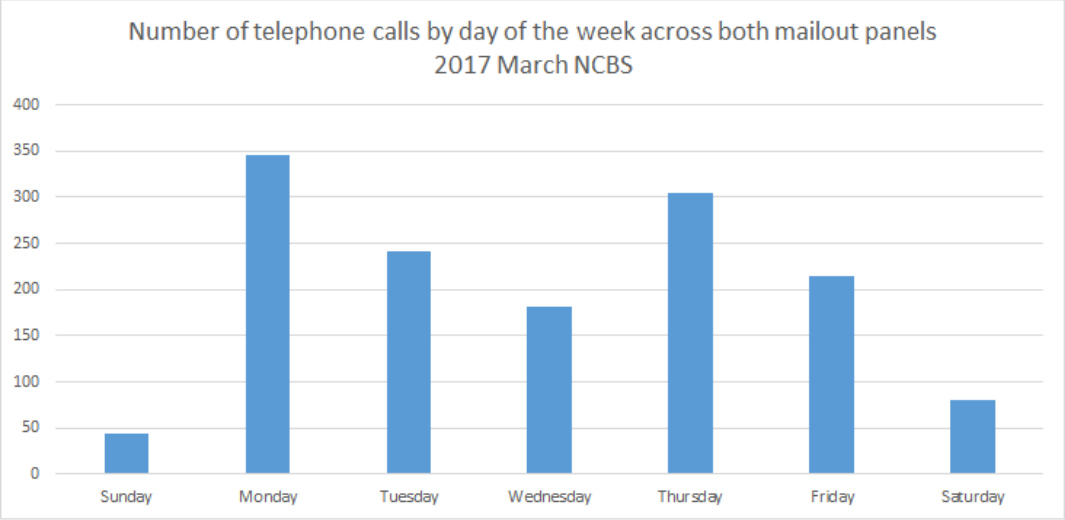

Figure 7: Total number of calls to a helpline for the 2017 March NCBS Test by day of the week, summed across panels
Source: U.S. Census Bureau, 2017 March NCBS Test

For the 2016 June NCBS Test, spikes can again be seen either on Mondays or three days after a mailing if that day fell on a weekday. For the 2016 September NCBS Test, the mailout dates were all on a Thursday, so the spikes in calls are heaviest on Monday and Tuesday at the beginning of the workweek and then decrease throughout the rest of the week and are lowest over the weekend. Focusing on the day-of-the-week bar plots, it appears that the bars in Figure 13 produce a flatter distribution than either Figure 11 or Figure 12. To formally compare call variability between two mailing strategies, Raim, Nichols, and Thomas (2018) consider a respondent's probability distribution of calling over the seven days of the week for each week of the mailout and compared the distributions from the three tests. One strategy is less variable than another if its distribution is closer to a discrete uniform distribution (where the probability of calling each weekday is 1/7) than the other. Raim, et al. found a more uniform distribution of calls for weeks 2 through 4 for the staggered mailing (that is the 2017 March NCBS) compared with the 2016 June NCBS. There was also a more uniform distribution of calls for weeks 3 and 4 for the staggered mailing compared with the 2016 September NCBS calls. In week 1, there was no difference is the uniformity because of the variability of the first week of when the mailings hit the home between the tests. Past week 4, the call uniformity is not different because fewer calls are made in all tests.

5.2.2 Call volume within staggered mailing dates

Table 7 contains the proportion of calls for each panel. There were proportionally more calls in Panel 1 compared with Panel 2, suggesting that the two spikes in calls in Panel 1 – on the in-home delivery day which is Thursday and then again on Monday – increase the total number of calls.

Table-7 Comparing the call volume between Monday mailout and a Thursday mailout

Panel	Total number of calls over survey period	Total sample size	Proportion of calls overall	*Z score and p* value
Panel 1: Monday mailout – Late week arrival	745	4,000	.186	2.83 p=0.005
Panel 2: Thursday mailout – Early week arrival	649	4,000	.162	

Source: U.S. Census Bureau, 2017 March NCBS Test

5.3 Research Question 2 Limitations

In all three studies, the telephone helpline analysis was conducted using the number of calls to a prerecorded telephone number, and we could not identify callers who called multiple times. There were also no live agents available to assist callers. For cases in which the same person called multiple times, if a live agent had been available, that agent may have resolved any issue on the first call, which could have reduced the overall number of calls.

6. Conclusions and Recommendations

The following sections present the conclusions and recommendations from this research study.

6.1 Conclusions

With the 2017 March NCBS Test, we once again observe the phenomenon of spikes in logins to a government online survey on the day the mailed survey invitation arrives at the residence with logins diminishing until either the next mailed invitation or the next Monday, when there is a smaller spike. Calls to a telephone helpline for this test follow a similar pattern.

Assuming two survey invitations arrive at residences prior to Census Day, results of this experiment suggest that delivering the survey invitation via the USPS with the Thursday mailout schedule tested in this study (so that most of the mail pieces arrive early in the week at the residence), could increase overall login rates to the survey. However, the analysis using the IPTS data suggest that it might not be just the early week delivery that drives this finding. Using the IPTS data, we did not find Monday and Tuesday delivery days generate significantly higher logins than other days. More experimentation to pinpoint the effect of the day of the week for single mailings and then multiple mailings needs to happen to conclude that it is the actual day of delivery that affects login rates, and not some sort of cumulative effect.

The early week delivery finding disappears, if some of the addresses receive all their mailings after Census Day. In this study, the number of mail pieces delivered to addresses prior to Census Day was a strong predictor of login rates. Although this experiment was not designed to randomly assign addresses to receive a different number of mail pieces prior to Census Day, there is a significant difference in login rates for those who receive two survey invitations prior to Census Day (at 43 percent) compared with those who received no invitations (at 9 percent) prior to Census Day. If the 7 percent of housing units had logged in at the same rate as the other housing units at about 42 percent instead of their actual 9 percent, we would have seen an overall login increase of 2 percent (((.42 x .07) – (.09 x .07)) x 100) for this experiment.

Even though we observed small gains in login rates with an early-in-the-week mail delivery, we did not see the same increase in calls to a telephone helpline with that mail delivery strategy. In fact, we found that the proportion of calls to the helpline was significantly lower when the majority of the mailings arrived at the beginning of the week, compared with the panel where the majority of the mailings arrived mid-to-late in the week. We do not have an explanation for this finding.

We found evidence that a staggered mailout creates a different distribution of calls throughout the week and staggering produced less variation in most of the weeks when mailed invitations arrive at the residence compared with the two tests that employed nonstaggered mailouts. Using this result for design staffing plans would be beneficial for the call centers and would allow them to efficiently assign staff to handle the call volume.

There is a cost tradeoff to consider with staggering the mailouts that this report did not address. The cost savings resulting from having more uniform daily workloads in the telephone centers with a staggered mailout should be compared with any possible savings that would result if the overall login rates slightly increased (and telephone calls decreased) if all the mail arrive early in the week.

6.2 Recommendations

Increasing online response, reducing calls to the telephone helpline requiring a live agent, and reducing the daily variability in calls to a telephone helpline so that agent staffing can be more uniform across the survey period are all ways to reduce the cost of the 2020 Census.

Results from this study suggest that a mailout schedule that mails the first, third and fourth mailings on a Thursday with an expected arrival early the following week would decrease calls to a telephone helpline and marginally increase login rates assuming there were two mailings received at the residence prior to Census Day. However, more work should be done to pinpoint what days, if any, are optimal for receiving mail about a government survey and then acting on that request. While the login rates by experimental treatment panel showed a significant difference by the mailout schedule, the mail piece tracking data did not show any meaningful pattern. The decrease in the call volume with the "Thursday" mailout was also unexpected, and if possible, the experiment should be repeated to see if the finding can be replicated.

We also recommend conducting a randomized experiment to confirm the effect of the number of mailings received at the residence and the timing of those mailings. We found that housing units

that received two mailings prior to Census Day were more likely to login into the survey compared with housing units that received only one mailing before Census Day. We also found a drastic drop-off in login rates for housing units that received all mailings after Census Day.

Until this confirmation study can be conducted, we recommend working with the USPS to ensure that two survey invitations arrive at each residence prior to Census Day, as we did not observe any negative consequence to this design.

A staggered mailout created a more uniform daily call volume of helpline telephone calls compared with a single-day mailout strategy. Reducing the massive peaks in calls, which are generated by single-day mailout strategies, could prove beneficial in the 2020 Census given the expected volume of calls. For other sample surveys, with not as large a sample, an in-home delivery of survey invitations for later in the week should possibly be avoided as it increased calls to the helpline and marginally reduced logins.

Because we did not find any previous studies examining the mail delivery's day-of-the-week affect on login rates and call rates, this study should be replicated to confirm the findings. Ideally, it should be replicated with mandatory and nonmandatory government surveys, in data collections with and without a "due date," and during different months of the year to determine if the findings hold. It might be possible to use data already available to do this type of analysis or to modify existing data collections slightly to obtain the postal tracking data.

7. Knowledge Management Resolutions

No Knowledge Management Recommendations.

8. Acknowledgements

This experiment is the product of many contributors. Thanks to the members of the small-scale mailout team including Julia Coombs, Casey Eggleston, Jennifer Childs, Jessica Graber, Jessica Holzberg, and Sarah Heimel, who provided comments on the methodology and report. Thanks to Andrew Raim and Thomas Mathew for figuring out how to test the uniformity of the calls. Thanks to the programming staff of Matthew Curtis, Sarah Dietz, and Jeffrey Buchoff, who developed the survey instrument. Thanks to Kelly Matthews for selecting the sample, Sabin Lakhe for the paradata parser, and David Pridgen for the mail materials. Thanks to the reviewers, especially Peter Miller, Jennifer Reichert, and Joanne Pascale. Finally, thanks to the staff in the National Processing Center, including Autumn Stoner, Cynthia Luttrell, Mary Self, Shirley Swift, and Jennifer Bowers, for making sure the mail was addressed correctly, sent on the correct date, and for working with USPS to retrieve the postal tracking data.

9. References

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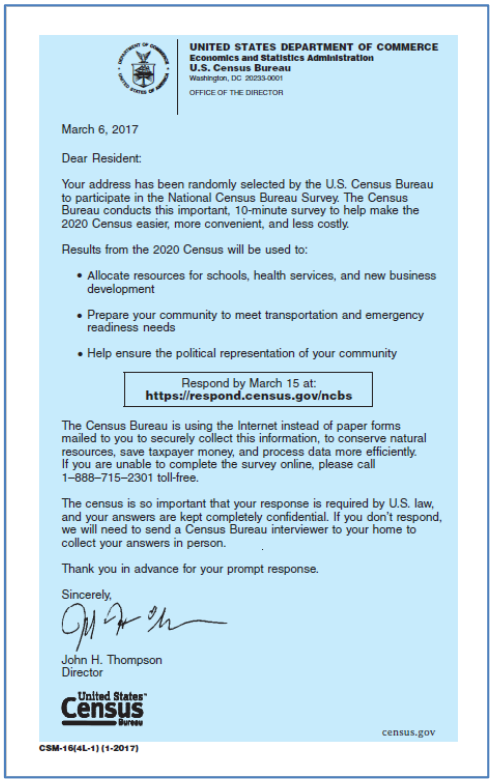
10. Appendix

10.1 Appendix A: Mail Materials



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

March 6, 2017

Dear Resident:

Your address has been randomly selected by the U.S. Census Bureau to participate in the National Census Bureau Survey. The Census Bureau conducts this important, 10-minute survey to help make the 2020 Census easier, more convenient, and less costly.

Results from the 2020 Census will be used to:

- Allocate resources for schools, health services, and new business development
- Prepare your community to meet transportation and emergency readiness needs
- Help ensure the political representation of your community

Respond by March 15 at:
https://respond.census.gov/ncbs

The Census Bureau is using the Internet instead of paper forms mailed to you to securely collect this information, to conserve natural resources, save taxpayer money, and process data more efficiently. If you are unable to complete the survey online, please call 1–888–715–2301 toll-free.

The census is so important that your response is required by U.S. law, and your answers are kept completely confidential. If you don't respond, we will need to send a Census Bureau interviewer to your home to collect your answers in person.

Thank you in advance for your prompt response.

Sincerely,

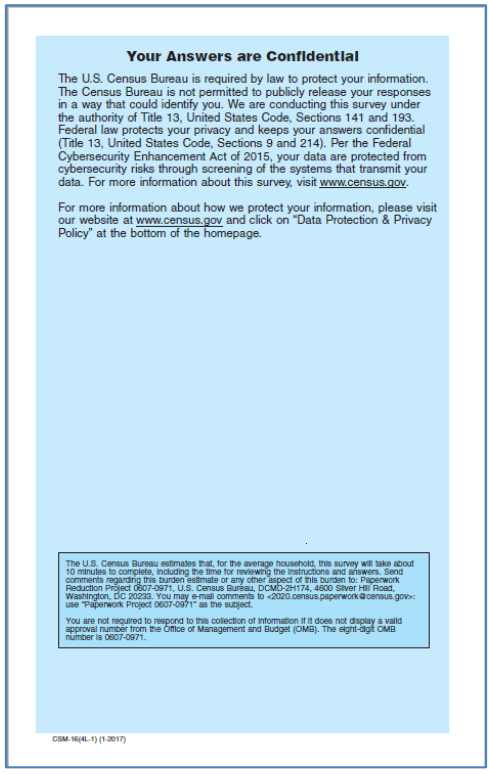
John H. Thompson
Director

United States Census Bureau

census.gov

CSM-16(4L-1) (1-2017)

Figure A 1: Panel 1 Initial letter (front)



Your Answers are Confidential

The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. We are conducting this survey under the authority of Title 13, United States Code, Sections 141 and 193. Federal law protects your privacy and keeps your answers confidential (Title 13, United States Code, Sections 9 and 214). Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. For more information about this survey, visit www.census.gov.

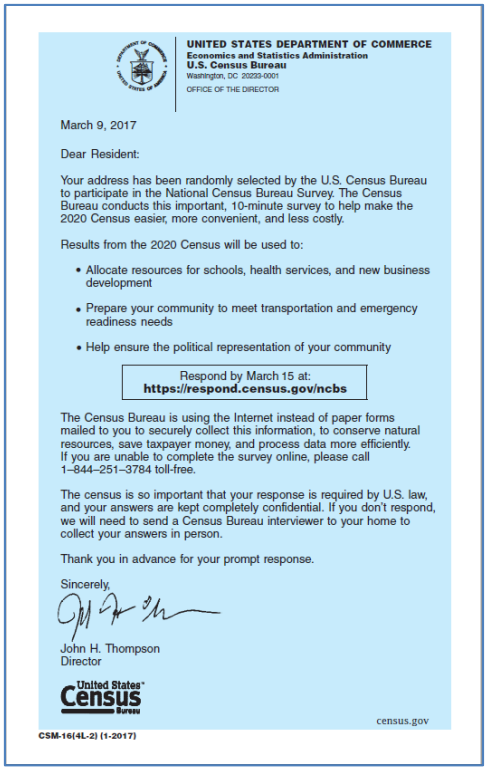
For more information about how we protect your information, please visit our website at www.census.gov and click on "Data Protection & Privacy Policy" at the bottom of the homepage.

The U.S. Census Bureau estimates that, for the average household, this survey will take about 10 minutes to complete, including the time for reviewing the instructions and answers. Send comments regarding this burden estimate or any other aspect of this burden to: Paperwork Reduction Project 0607-0971, U.S. Census Bureau, DCMD-2H174, 4600 Silver Hill Road, Washington, DC 20233. You may e-mail comments to <2020.census.paperwork@census.gov>; use "Paperwork Project 0607-0971" as the subject.

You are not required to respond to this collection of information if it does not display a valid approval number from the Office of Management and Budget (OMB). The eight-digit OMB number is 0607-0971.

CSM-16(4L-1) (1-2017)

Figure A 2: Panel 1 Initial letter (back)



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

March 9, 2017

Dear Resident:

Your address has been randomly selected by the U.S. Census Bureau to participate in the National Census Bureau Survey. The Census Bureau conducts this important, 10-minute survey to help make the 2020 Census easier, more convenient, and less costly.

Results from the 2020 Census will be used to:

- Allocate resources for schools, health services, and new business development
- Prepare your community to meet transportation and emergency readiness needs
- Help ensure the political representation of your community

Respond by March 15 at:
https://respond.census.gov/ncbs

The Census Bureau is using the Internet instead of paper forms mailed to you to securely collect this information, to conserve natural resources, save taxpayer money, and process data more efficiently. If you are unable to complete the survey online, please call 1–844–251–3784 toll-free.

The census is so important that your response is required by U.S. law, and your answers are kept completely confidential. If you don't respond, we will need to send a Census Bureau interviewer to your home to collect your answers in person.

Thank you in advance for your prompt response.

Sincerely,

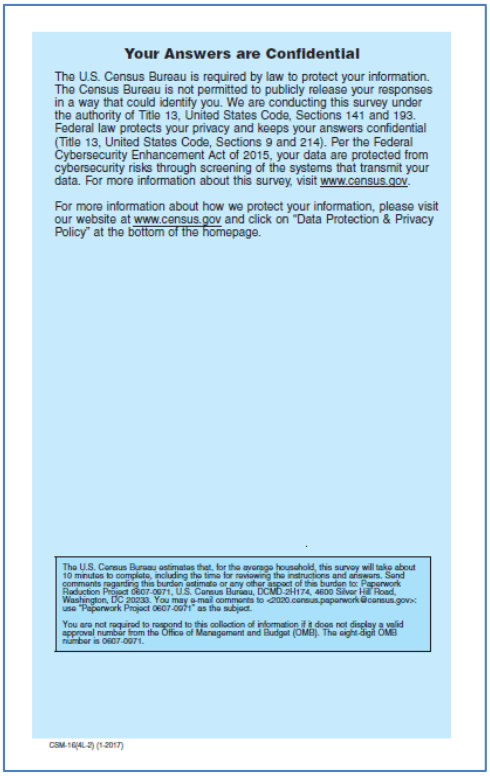
John H. Thompson
Director

United States Census Bureau

census.gov

CSM-16(4L-2) (1-2017)

Figure A 3: Panel 2 Initial letter (front)



Your Answers are Confidential

The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. We are conducting this survey under the authority of Title 13, United States Code, Sections 141 and 193. Federal law protects your privacy and keeps your answers confidential (Title 13, United States Code, Sections 9 and 214). Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. For more information about this survey, visit www.census.gov.

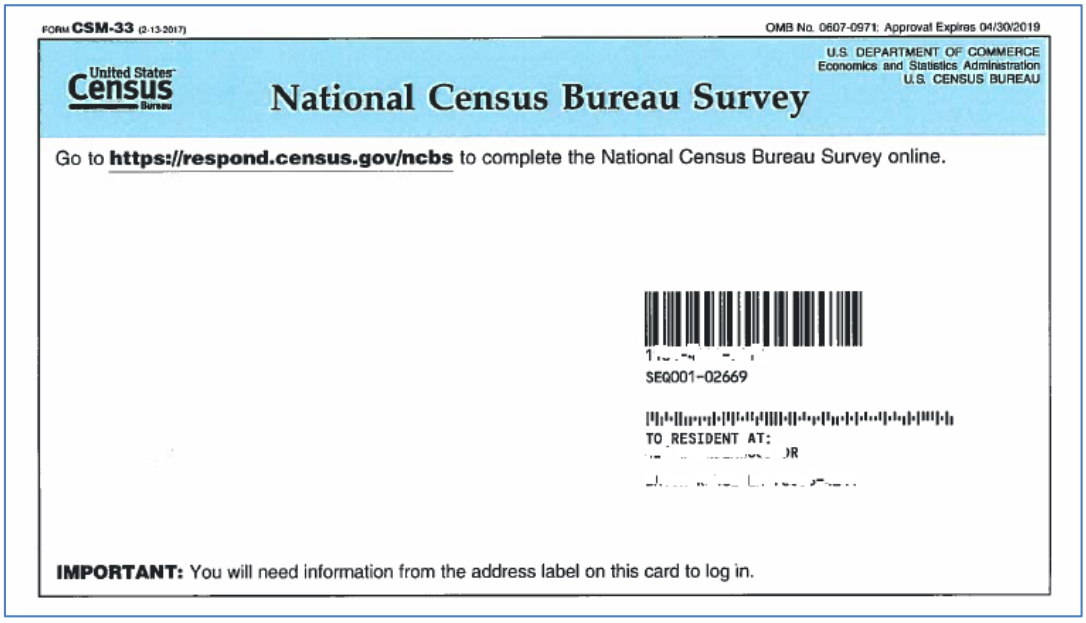
For more information about how we protect your information, please visit our website at www.census.gov and click on "Data Protection & Privacy Policy" at the bottom of the homepage.

The U.S. Census Bureau estimates that, for the average household, this survey will take about 10 minutes to complete, including the time for reviewing the instructions and answers. Send comments regarding this burden estimate or any other aspect of this burden to: Paperwork Reduction Project 0607-0971, U.S. Census Bureau, DCMD-2H174, 4600 Silver Hill Road, Washington, DC 20233. You may e-mail comments to <2020.census.paperwork@census.gov>; use "Paperwork Project 0607-0971" as the subject.

You are not required to respond to this collection of information if it does not display a valid approval number from the Office of Management and Budget (OMB). The eight-digit OMB number is 0607-0971.

CSM-16(4L-2) (1-2017)

Figure A 4: Panel 2 Initial letter (back)



FORM **CSM-33** (2-13-2017)

OMB No. 0607-0971: Approval Expires 04/30/2019

United States Census Bureau

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

National Census Bureau Survey

Go to **https://respond.census.gov/ncbs** to complete the National Census Bureau Survey online.

SEQ001-02669

TO RESIDENT AT:

IMPORTANT: You will need information from the address label on this card to log in.

Figure A 5: Panel 1 and 2 Internet Response Card for Initial mailing package. Note the barcode, User ID (blotted out), and address (blotted out)

March 9, 2017

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

Dear Resident:

Earlier, you should have received instructions for completing the **National Census Bureau Survey** online. Local communities depend on information from the census to fund programs that promote the well-being of families and children as well as equal employment opportunities for you and your neighbors. If you have not already responded, please complete this short 10-minute survey now.

Respond now at **https://respond.census.gov/ncbs**

Your response is critically important to your local community and your country and is required by law. Responding promptly will prevent you from receiving phone calls or personal visits from U.S. Census Bureau interviewers.

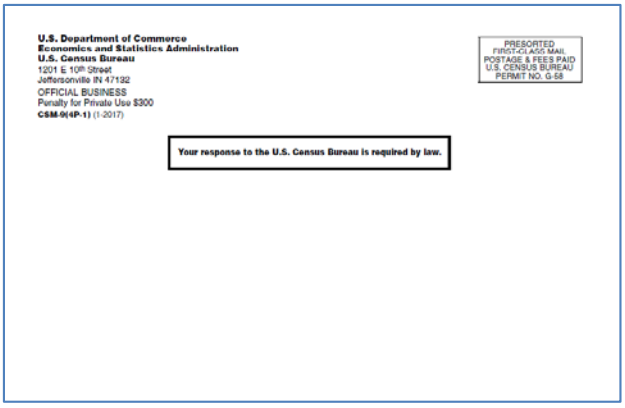
The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. If you are unable to complete the survey online, please call 1–888–715–2301 toll-free.

Sincerely,

John H. Thompson
Director

CSM-9(4P-1) (1-2017)

Figure A 6: Panel 1 Second mailing, first reminder postcard (front)



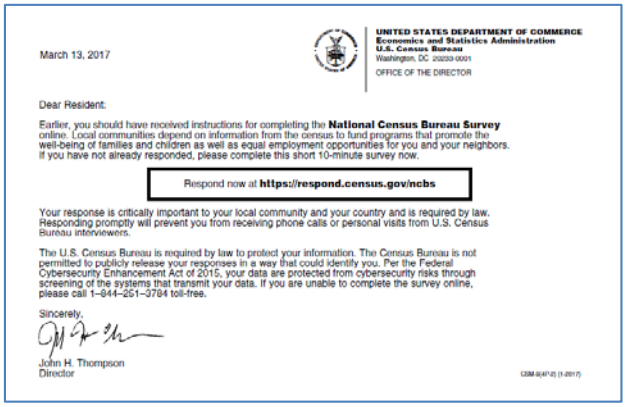
U.S. Department of Commerce
Economics and Statistics Administration
U.S. Census Bureau
1201 E 10th Street
Jeffersonville IN 47132

OFFICIAL BUSINESS
Penalty for Private Use $300
CSM-9(4P-1) (1-2017)

PRESORTED
FIRST-CLASS MAIL
POSTAGE & FEES PAID
U.S. CENSUS BUREAU
PERMIT NO. G-58

Your response to the U.S. Census Bureau is required by law.

Figure A 7: Panel 1 Second mailing, first reminder postcard (back). The barcode, User ID, and address would be printed on this side similar to the Internet Response Card



March 13, 2017

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

Dear Resident:

Earlier, you should have received instructions for completing the **National Census Bureau Survey** online. Local communities depend on information from the census to fund programs that promote the well-being of families and children as well as equal employment opportunities for you and your neighbors. If you have not already responded, please complete this short 10-minute survey now.

Respond now at **https://respond.census.gov/ncbs**

Your response is critically important to your local community and your country and is required by law. Responding promptly will prevent you from receiving phone calls or personal visits from U.S. Census Bureau interviewers.

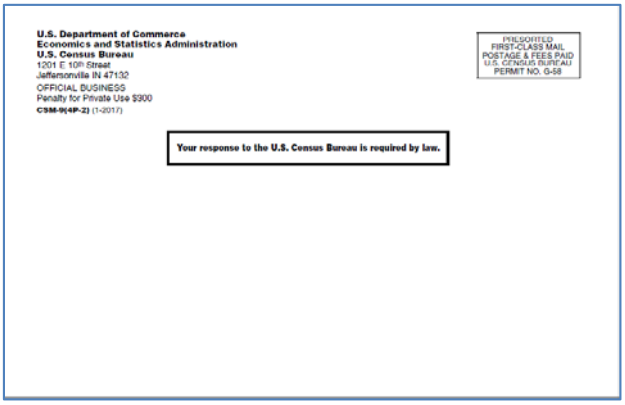
The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. If you are unable to complete the survey online, please call 1–844–251–3794 toll-free.

Sincerely,

John H. Thompson
Director

CSM-9(4P-2) (1-2017)

Figure A 8: Panel 2 Second mailing, first reminder postcard (front)



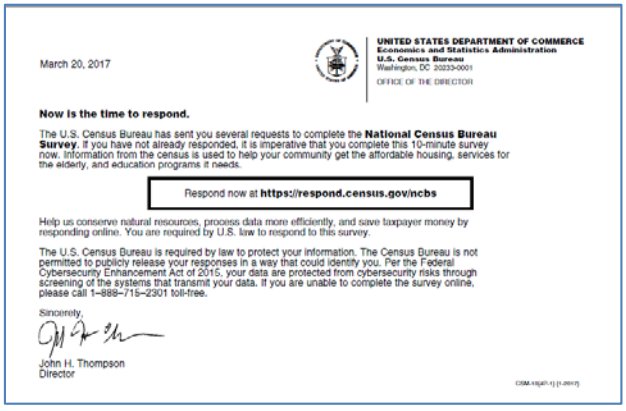
U.S. Department of Commerce
Economics and Statistics Administration
U.S. Census Bureau
1201 E 10th Street
Jeffersonville IN 47132

OFFICIAL BUSINESS
Penalty for Private Use $300
CSM-9(4P-2) (1-2017)

PRESORTED
FIRST-CLASS MAIL
POSTAGE & FEES PAID
U.S. CENSUS BUREAU
PERMIT NO. G-58

Your response to the U.S. Census Bureau is required by law.

Figure A 9: Panel 2 Second mailing, first reminder postcard (back). The barcode, User ID, and address would be printed on this side similar to the Internet Response Card



March 20, 2017

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

Now is the time to respond.

The U.S. Census Bureau has sent you several requests to complete the **National Census Bureau Survey**. If you have not already responded, it is imperative that you complete this 10-minute survey now. Information from the census is used to help your community get the affordable housing, services for the elderly, and education programs it needs.

Respond now at **https://respond.census.gov/ncbs**

Help us conserve natural resources, process data more efficiently, and save taxpayer money by responding online. You are required by U.S. law to respond to this survey.

The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. If you are unable to complete the survey online, please call 1–888–715–2301 toll-free.

Sincerely,

John H. Thompson
Director

CSM-10(4P-1) (1-2017)

Figure A 10: Panel 1 Third mailing, second reminder postcard (front)

March 23, 2017

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

Now is the time to respond.

The U.S. Census Bureau has sent you several requests to complete the **National Census Bureau Survey**. If you have not already responded, it is imperative that you complete this 10-minute survey now. Information from the census is used to help your community get the affordable housing, services for the elderly, and education programs it needs.

Respond now at **https://respond.census.gov/ncbs**

Help us conserve natural resources, process data more efficiently, and save taxpayer money by responding online. You are required by U.S. law to respond to this survey.

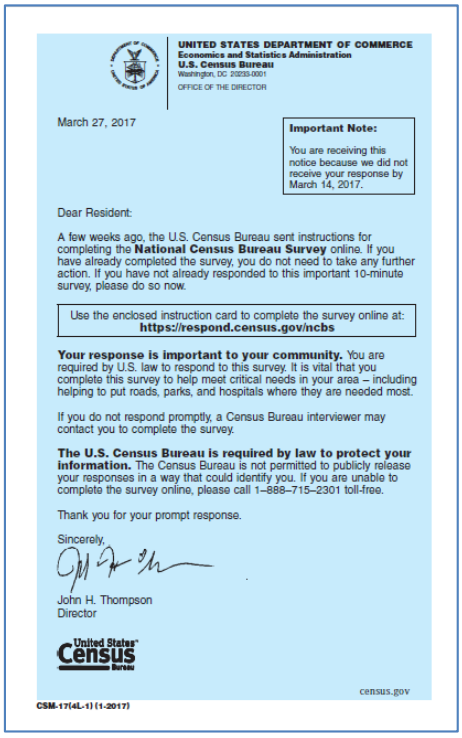
The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. Per the Federal Cybersecurity Enhancement Act of 2015, your data are protected from cybersecurity risks through screening of the systems that transmit your data. If you are unable to complete the survey online, please call 1–844–251–3784 toll-free.

Sincerely,

John H. Thompson
Director

CSM-19(EP-2) (1-2017)

Figure A 11: Panel 2 Third mailing, second reminder postcard (front)



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

March 27, 2017

Important Note:
You are receiving this notice because we did not receive your response by March 14, 2017.

Dear Resident:

A few weeks ago, the U.S. Census Bureau sent instructions for completing the **National Census Bureau Survey** online. If you have already completed the survey, you do not need to take any further action. If you have not already responded to this important 10-minute survey, please do so now.

Use the enclosed instruction card to complete the survey online at:
https://respond.census.gov/ncbs

Your response is important to your community. You are required by U.S. law to respond to this survey. It is vital that you complete this survey to help meet critical needs in your area – including helping to put roads, parks, and hospitals where they are needed most.

If you do not respond promptly, a Census Bureau interviewer may contact you to complete the survey.

The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. If you are unable to complete the survey online, please call 1–888–715–2301 toll-free.

Thank you for your prompt response.

Sincerely,

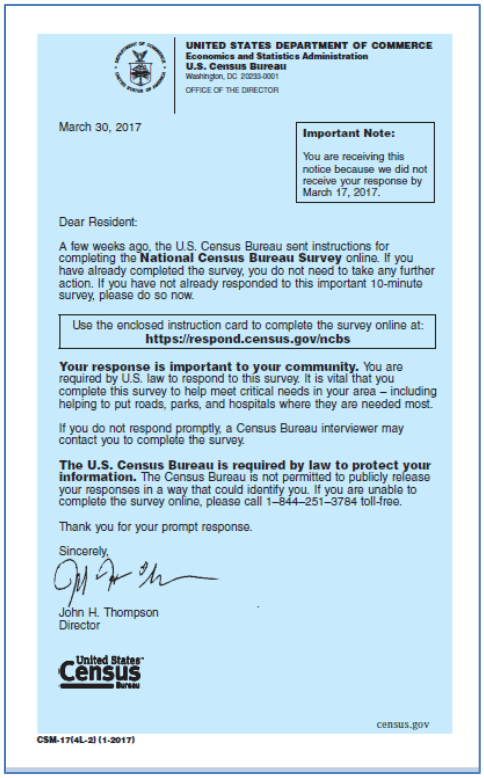
John H. Thompson
Director

United States Census Bureau

census.gov

CSM-17(4L-1) (1-2017)

Figure A 12: Panel 1 Final letter (front)



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

March 30, 2017

Important Note:
You are receiving this notice because we did not receive your response by March 17, 2017.

Dear Resident:

A few weeks ago, the U.S. Census Bureau sent instructions for completing the **National Census Bureau Survey** online. If you have already completed the survey, you do not need to take any further action. If you have not already responded to this important 10-minute survey, please do so now.

Use the enclosed instruction card to complete the survey online at:
https://respond.census.gov/ncbs

Your response is important to your community. You are required by U.S. law to respond to this survey. It is vital that you complete this survey to help meet critical needs in your area – including helping to put roads, parks, and hospitals where they are needed most.

If you do not respond promptly, a Census Bureau interviewer may contact you to complete the survey.

The U.S. Census Bureau is required by law to protect your information. The Census Bureau is not permitted to publicly release your responses in a way that could identify you. If you are unable to complete the survey online, please call 1–844–251–3784 toll-free.

Thank you for your prompt response.

Sincerely,

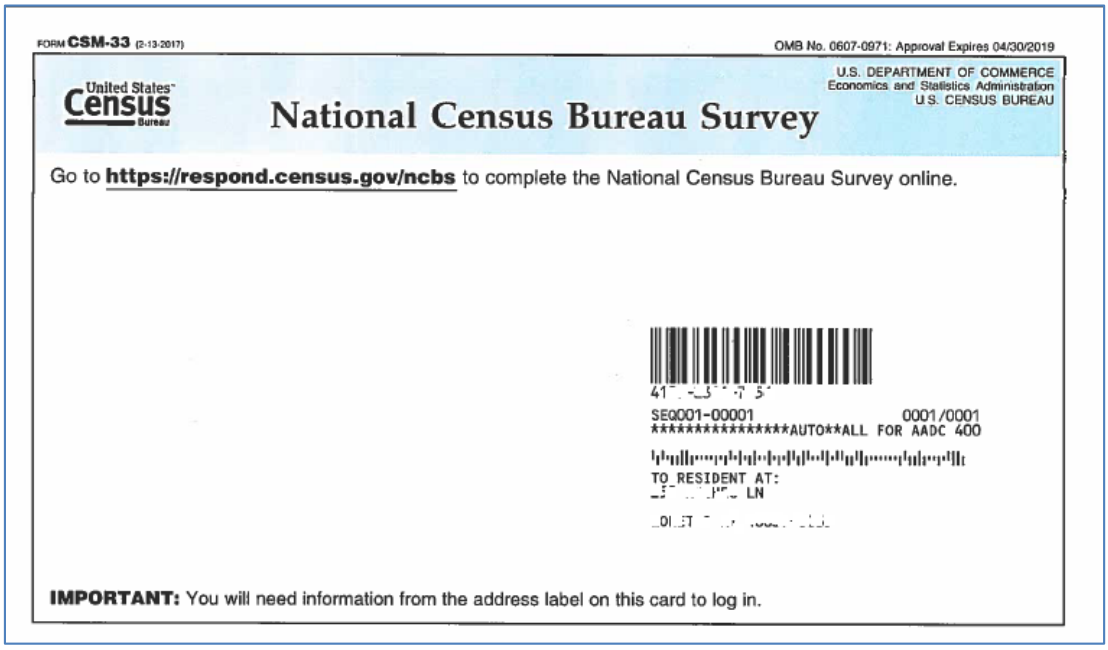
John H. Thompson
Director

United States Census Bureau

census.gov

CSM-17(4L-2) (1-2017)

Figure A 13: Panel 2 Final letter (front)



FORM **CSM-33** (2-13-2017) OMB No. 0607-0971: Approval Expires 04/30/2019

U.S. DEPARTMENT OF COMMERCE
Economics and Statistics Administration
U.S. CENSUS BUREAU

United States Census Bureau

National Census Bureau Survey

Go to **https://respond.census.gov/ncbs** to complete the National Census Bureau Survey online.

SEQ001-00001 0001/0001
**********AUTO**ALL FOR AADC 400

TO RESIDENT AT:
LN

IMPORTANT: You will need information from the address label on this card to log in.

Figure A 14: Panel 1 and 2 Internet Response Card for Final mailing package. Note the barcode, User ID (blotted out), and address (blotted out)

10.2 Appendix B: IPTS Postal Tracking Data Exploratory Analysis

The IPTS data allowed us to trace each mailing piece as it was scanned through the postal service offices prior to arriving at the residence. There were no housing units where all four mail pieces were flagged as undeliverable as addressed (UAA), and only 3 percent of housing units had one or more mail pieces coded as UAA. While most of the mail pieces were delivered and had a "Stop the Clock" (stop) date associated with them, meaning that they were delivered to the housing unit within 24 hours of that date, there were some mail pieces that did not have any corresponding USPS data. Overall, we did not get any tracking data from only 0.21 percent or 17/8,000 of the housing units.

Using the IPTS Postal Tracking data, we calculated how many days it took each piece with a stop date to arrive at the housing unit by subtracting the mailout date from the stop date. As shown in Table B.1, the majority of mailings with a stop date arrived within the expected three-day delivery time frame, however, for some housing units, the mail piece took between seven and 38 days to be delivered to the housing unit. For example, around 9 percent of housing units received the initial letter seven to 38 days after mailout. (As a reminder, we were missing Panel 2's second postcard and final letter tracking data, and the sample size is lower for Panel 1's second postcard and final letter because we did not mail those materials to housing units that had responded by March 14.)

Table B-1. Percent distribution of housing units by the number of days it took to deliver each mail piece (and the mean number of days to deliver each mail piece and the standard deviation)

Total # days to arrive	Panel 1 Initial Letter (n=3,948)	Panel 2 Initial Letter (n=3,975)	Panel 1 First Postcard (n=3,976)	Panel 2 First Postcard (n=3,942)	Panel 1 Second Postcard (n=3,241)	Panel 1 Final Letter (n=3,244)
1	6.1%	6.5%	7.2%	6.1%	7.6%	6.9%
2	44.3%	6.3%	6.6%	37.6%	50.4%	45.3%
3	38.1%	43.7%	49.6%	38.1%	38.9%	32.9%
4	1.0%	29.5%	30.2%	14.1%	2.0%	4.0%
5	0.2%	0.9%	0.9%	1.7%	0.2%	0.05%
6	1.9%	2.0%	1.4%	0.4%	0.2%	3.2%
7-38	9%	9%	4.0%	2.0%	<1.0%	7%
Total	100%	100%	100%	100%	100%	100%
Mean # days (Standard Deviation)	3.2 (2.9)	4.1 (3.1)	3.4 (1.8)	2.9 (1.6)	2.4 (0.98)	3.1 (2.6)

Source: U.S. Census Bureau, 2017 March NCBS Test

Because the mailings originated from Jeffersonville, Indiana, we also examined whether mail took longer to arrive in particular areas of the country by running a regression model predicting the number of days to deliver and controlling for region, high and low internet access areas, and the percent rural. We used each piece of mail with a stop date. All of the covariates were significant in the model using alpha=0.05, however, the model only had an R-Square of 0.02. We found that low internet access areas took longer to deliver than high internet access areas, as the area became more rural, the delivery time increased, albeit slowly, and the Midwest and South regions of the U.S. both took less time to deliver the mail than the West region with a mailout location of Jeffersonville, Indiana, as shown in Table B.2.

Table B-2. Regression model predicting the number of days to deliver the mail

	Estimate	Standard Error	*p* value
Intercept	3.4	0.03	<.0001
Region: Midwest	-0.70	0.05	<.0001
Northeast	0.09	0.05	0.06
South	-0.29	0.04	<.0001
West	0	.	.
Low internet access	0.23	0.04	<.0001
High internet access	0	.	.
Percent Rural	0.001	0.001	0.006

Source: U.S. Census Bureau, 2017 March NCBS Test
N=22,324; R-Square=0.015

The long lag time for some of the mail pieces to arrive at the residence prompted us to examine whether addresses received the mail pieces before Census Day and whether logins differed by how many mail pieces the unit received prior to Census Day. The goal was for each residence to receive two mailings prior to March 15, but we realized that the second mailing for Panel 2 could have arrived after Census Day because it was mailed March 13. Overall, around 7 percent of housing units did not receive any mailings prior to Census Day as shown in Table B.3. For those housing units, only 9 percent ever logged into the survey, while 43 percent of those housing units that received the two mailings prior to Census Day logged in. Chi-square tests showed significant differences in the distribution of logged in cases across the three situations (χ^2 (df = 2) = 23.9, p < 0.0001). Standardized residuals suggest that each category contributed to the significance.

Table B-3. Login rate over the entire survey period by the number of mail pieces delivered to the housing unit prior to Census Day, March 15 (N=8,000)

Number of Mailings received	Number	Percent of total	Login Rate	Std. Residual
Received no mailings before March 15	546	6.8	9.0	-15.4
Received one mailing before March 15	3608	45.1	41.3	2.0
Received two mailings before March 15	3846	48.1	43.3	5.7

Source: U.S. Census Bureau, 2017 March NCBS Test

Because of the mail strategy used, most addresses that received no mailing or only one mailing before Census Day were in Panel 2. Most addresses that received both mailings prior to Census Day were in Panel 1 as shown in Table B.4. This skewed distribution was our motivation for adding the variable into the logistic regression models included in the body of the report.

Table B-4. Distribution of the number of mail pieces delivered to the housing unit prior to Census Day by mail panel (N=8,000)

Number of Mailings received	Panel 1 Number	Panel 2 Number
Received no mailings before March 15	54	492
Received one mailing before March 15	367	3241
Received two mailings before March 15	3579	267
Total	4000	4000

Source: U.S. Census Bureau, 2017 March NCBS Test

Other factors besides the actual mailout dates could have also contributed to the later delivery times. Using the percent rural variable, we found that housing units that did not receive any mailings before Census Day were on average located in a more rural area (at 23 percent rural) than the units that received one mailing (which were on average 14 percent rural), or units which received two mailings (which were on average 17% rural). Low internet areas were also more likely to have no mailings before Census Day, and looking at the states where 10 percent or more of their sample did not receive any mailing before Census Day, they generally seem to fit this profile, including Alaska, Arizona, California, Idaho, Louisiana, Maine, Mississippi, New Jersey, Oregon, South Carolina, Wyoming, and Vermont.

10.3 Appendix C: Logins by Mail Material Exploratory Analysis

In this Appendix, we include figures showing what mail pieces were used to log into the survey and the date those logins took place. We use the entire survey period from March 6 through April 25 for both panels. Figure C.1 shows the number of first logins by mail piece across the entire survey period. The User ID from the initial letter package was used to login more so than any other mail piece for both panels.

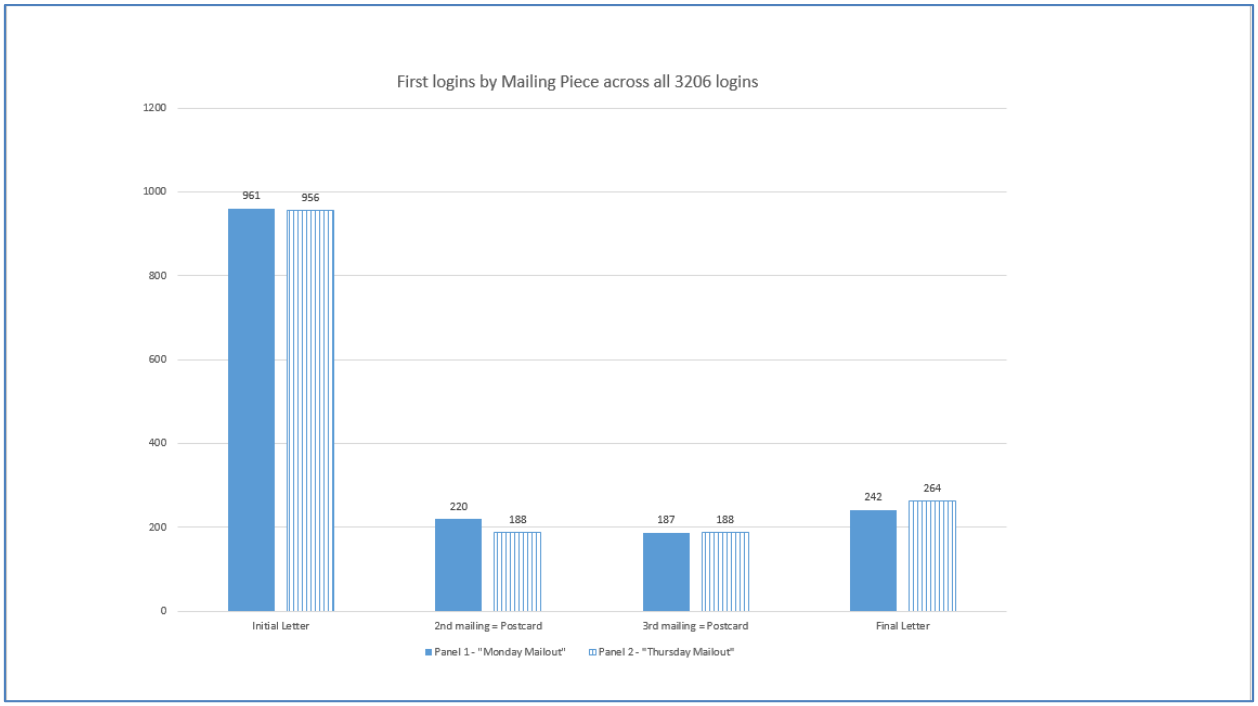


Figure C.1: Number of initial logins by mail piece and mail panel
N=3,206 Total; Panel 1=1,610; Panel 2=1,596
Source: U.S. Census Bureau, 2017 March NCBS Test

Figures C.2 through C.5 show the date the mail pieces were used to login to the survey (for the first login only). Figure C.2 shows that the initial letter package was used throughout the survey period with small spikes in use when the subsequent mail pieces were estimated to be delivered, suggesting that while the respondent was reminded about the survey from the postcards and the final letter, many respondents kept the original mail package and used that to log into the survey. In fact, only 52 percent (992/1,927) used the initial letter prior to receiving the second mailing, which means that almost half of the respondents who used the initial letter to log into the survey, used it after they had received another mail piece.

The final three mailings show spikes in logins close to when the mail pieces were delivered.

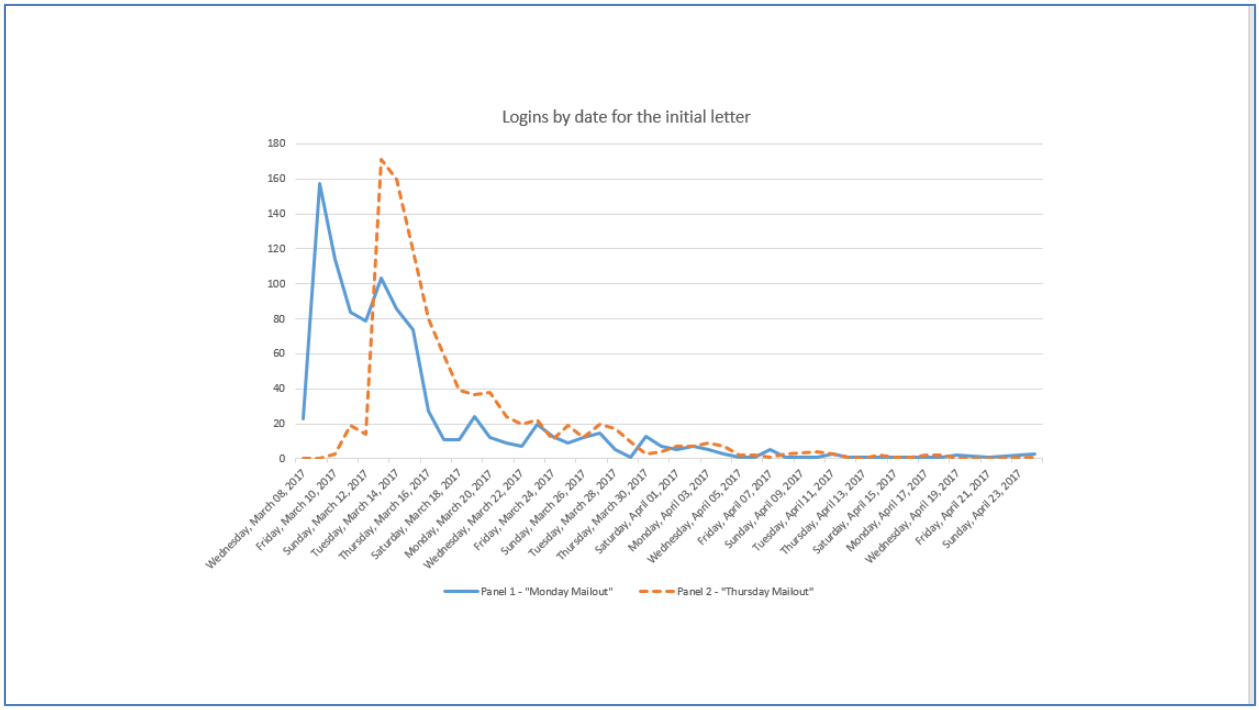


Figure C.2: Number of daily logins using the User ID in the initial letter package by date and mail panel. Mailout for the initial letter package for Panel 1 was on Monday, March 6, 2017, and was on Thursday, March 9, 2017, for Panel 2.
N: Panel 1=961; Panel 2=956
Source: U.S. Census Bureau, 2017 March NCBS Test

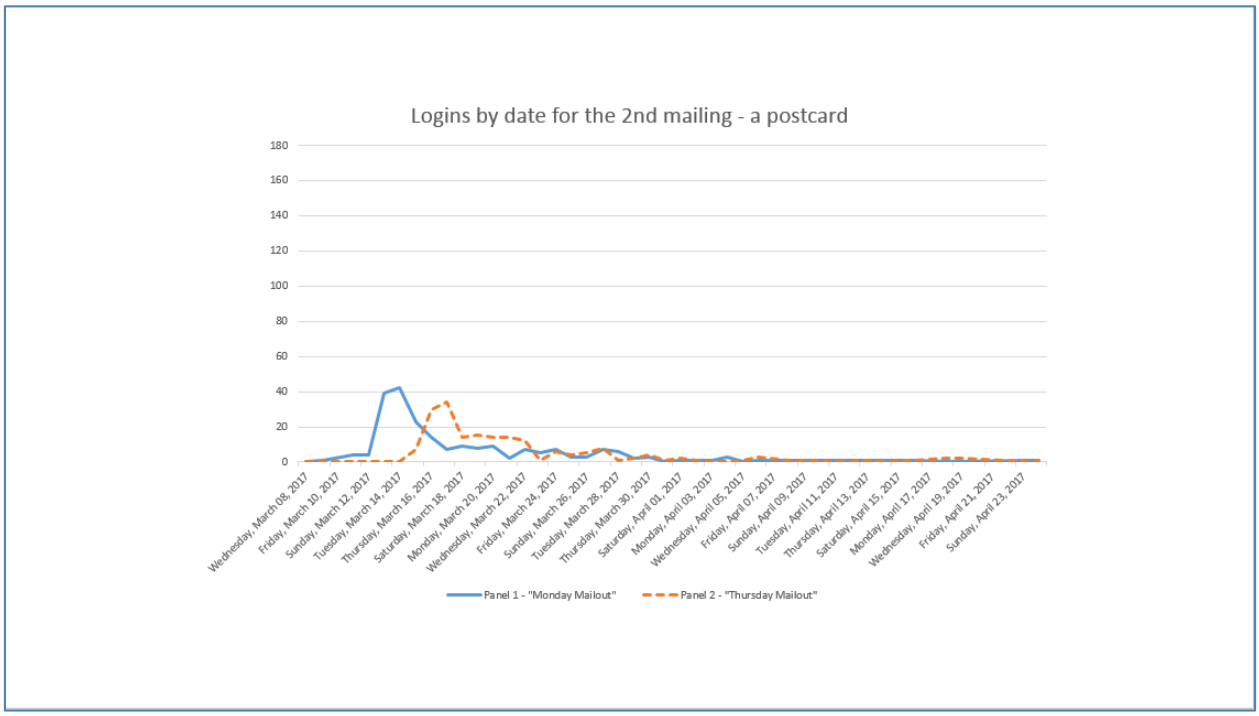


Figure C.3: Number of daily logins using the User ID in the second mailing, the first reminder postcard, by date and mail panel. Mailout for the first reminder postcard for Panel 1 was on Thursday, March 9, 2017, and was on Monday, March 13, 2017, for Panel 2.
N: Panel 1=220; Panel 2=188
Source: U.S. Census Bureau, 2017 March NCBS Test

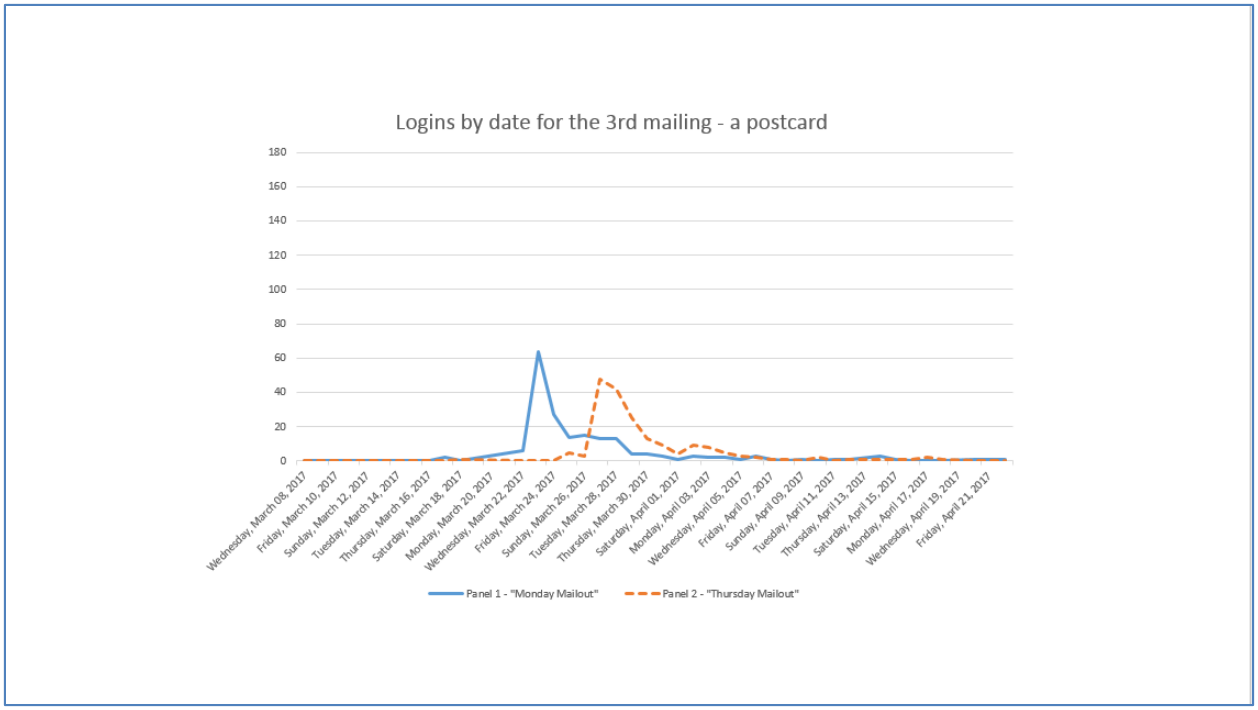


Figure C.4: Number of daily logins using the User ID in the third mailing, the second reminder postcard, by date and mail panel. Mailout for the second reminder postcard for Panel 1 was on Monday, March 20, 2017, and was on Thursday, March 23, 2017, for Panel 2.
N: Panel 1=187; Panel 2=188
Source: U.S. Census Bureau, 2017 March NCBS Test

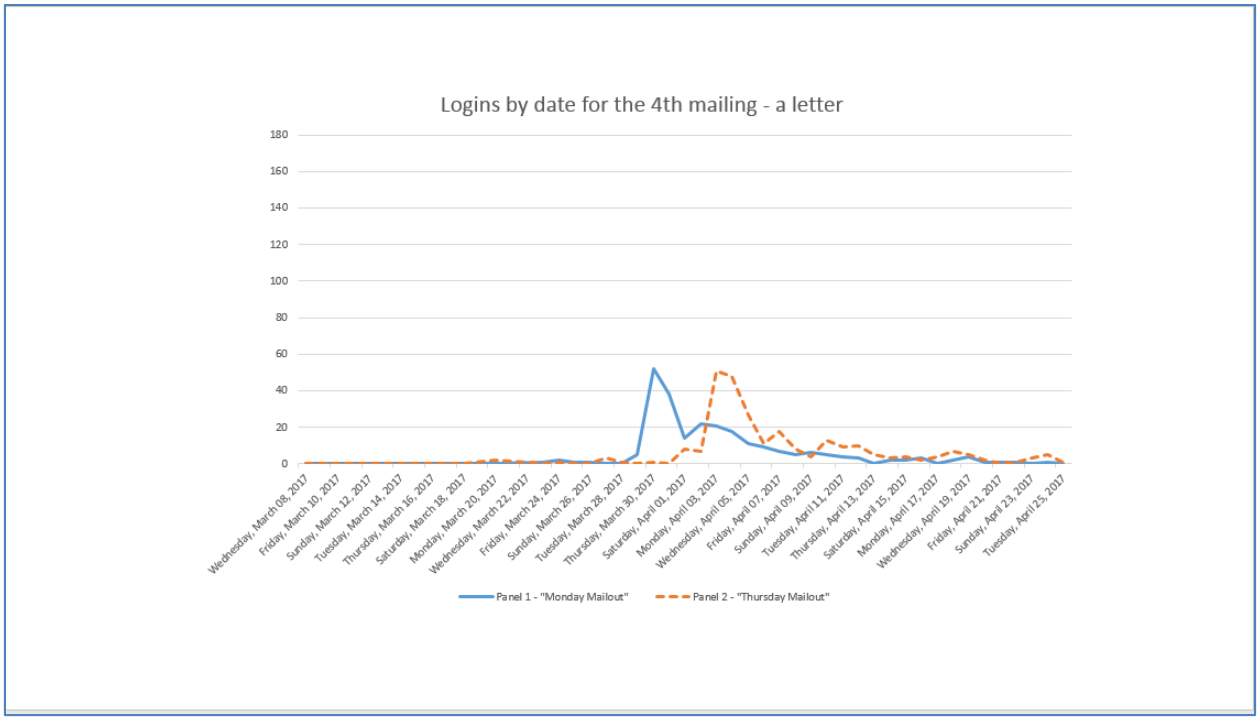


Figure C.5: Number of daily logins using the User ID in the final letter package by date and mail panel. Mailout for the final letter package for Panel 1 was on Monday, March 27, 2017, and was on Thursday, March 30, 2017, for Panel 2.
N: Panel 1=242; Panel 2=264
Source: U.S. Census Bureau, 2017 March NCBS Test.

Table C.1 includes the login rates for each mail piece by day of the week the mail piece arrived according to the IPTS data. We included only mail pieces that had a stop date and where the respondent had not logged in prior to receiving the mail piece, thus there were different sample sizes for each mail piece. We ran a chi-square test of the login rate for each mail piece by the day of the week the mail piece arrived. There was no difference in login rates by the day of the week the initial letter arrived (χ^2 (df = 6) = 5.5, p =0.48), the second postcard arrived (χ^2 (df = 6) = 5.9, p =0.43), or the final letter arrived (χ^2 (df = 6) = 9.1, p =0.17). There was a marginal difference in the login rate by the day of the week the first postcard arrived (χ^2 (df = 6) = 10.9, p =0.09), which seemed to be driven by the Saturday arrival.

Table C-1. Logins with Mail Piece by Day of the Week the Mail Piece Arrived

	Initial letter (n=7213)		First Postcard (n=6405)		Second Postcard (n=2632)		Final letter (n=2367)	
	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual	Login Count / Total Arrived that day (% of total)	Std. Residual
Sunday	480 / 1779 (27.0%)	1.06	107 / 1681 (6.4%)	0.39	0 / 4 (0%)	-0.54	2 / 65 (3.1%)	-1.83
Monday	288 / 1185 (24.3%)	-1.48	67 / 990 (6.8%)	0.85	0 / 4 (0%)	-0.54	0 / 32 (0%)	-1.87
Tuesday	70 / 276 (25.4%)	-0.25	9 / 233 (3.9%)	-1.49	19 / 198 (9.6%)	1.60	15 / 180 (8.3%)	-0.65
Wednesday	463 / 1823 (25.4%)	-0.70	81 / 1261 (6.4%)	0.42	98 / 1330 (7.4%)	1.09	120 / 1160 (10.3%)	1.01
Thursday	427 / 1572 (27.2%)	1.17	66 / 1260 (5.24%)	-1.53	60 / 1035 (5.8%)	-1.70	82 / 834 (9.8%)	0.14
Friday	88 / 318 (27.7%)	0.69	39 / 709 (5.5%)	-0.78	3 / 55 (5.5%)	-0.41	11 / 89 (12.4%)	0.86
Saturday	61 / 260 (23.5%)	-0.96	26 / 271 (9.6%)	2.40	0 / 6 (0%)	-0.66	0 / 7 (0%)	-0.87

Source: U.S. Census Bureau, 2017 March NCBS Test

10.4 Appendix D: Self-Reported Arrival Date of Mail Material

Before we knew we had access to the USPS IPTS postal tracking data, we added a question into the survey to try to obtain a more accurate measure of when the mail piece was delivered to the residence. We asked respondents to provide an answer to this question, "When did you receive the Census Bureau mailing you are using to access the survey?" We offered month and day response choices with the year prefilled with 2017. The month field had only three choices, March, April, or May. We also offered a don't know option. We collected these data from respondents on the last page of the survey, after they submitted the survey, and the picture of the survey screen is shown in Figure D.1.

Figure D.1: Survey submission page including additional questions collecting feedback on the date the mailing was received and opinions about the data collection, with a call-out showing the possible months the respondent could choose from
Source: U.S. Census Bureau, 2017 March NCBS Test Online Questionnaire Screen Shot

We found that 91 percent of respondents (2,790/3,073) who submitted their data and received this page (only about 96 percent of logins result in a submitted survey) answered this question either with a date, a don't know response, or both as shown in Figure D.2. Most of the respondents provided a date, but about a fourth of them (or 25 percent) responded that they did not know the date the mail piece arrived.

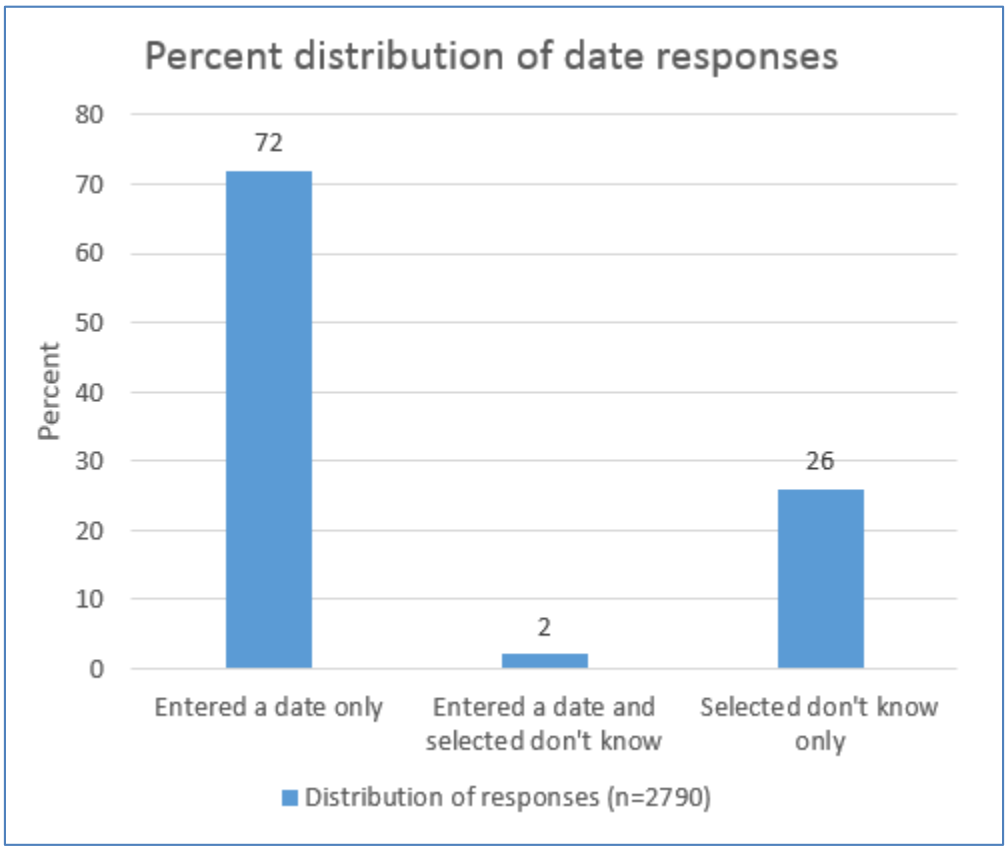


Figure D.2: Distribution of responses to the self-report of the date the 2017 March NCBS mail material arrived at the residence.
Source: U.S. Census Bureau, 2017 March NCBS Test

We matched the self-reported dates to all the USPS "Stop the clock" (stop) dates associated with the residence (there could have been up to four dates) from the IPTS postal tracking file. We found that 24 percent of the self-reported dates were an exact match to the stop date as shown in Figure D.3. Since the stop date meant that the mail would be delivered within 24 hours to the residence, we also re-matched the self-reported dates to all the stop dates and the day after the stop date. When we expanded the match to include the next day, the accuracy of the self-reported dates increased to 53 percent. This finding suggests that half the time the mail arrives the day after the stop-the-clock date.

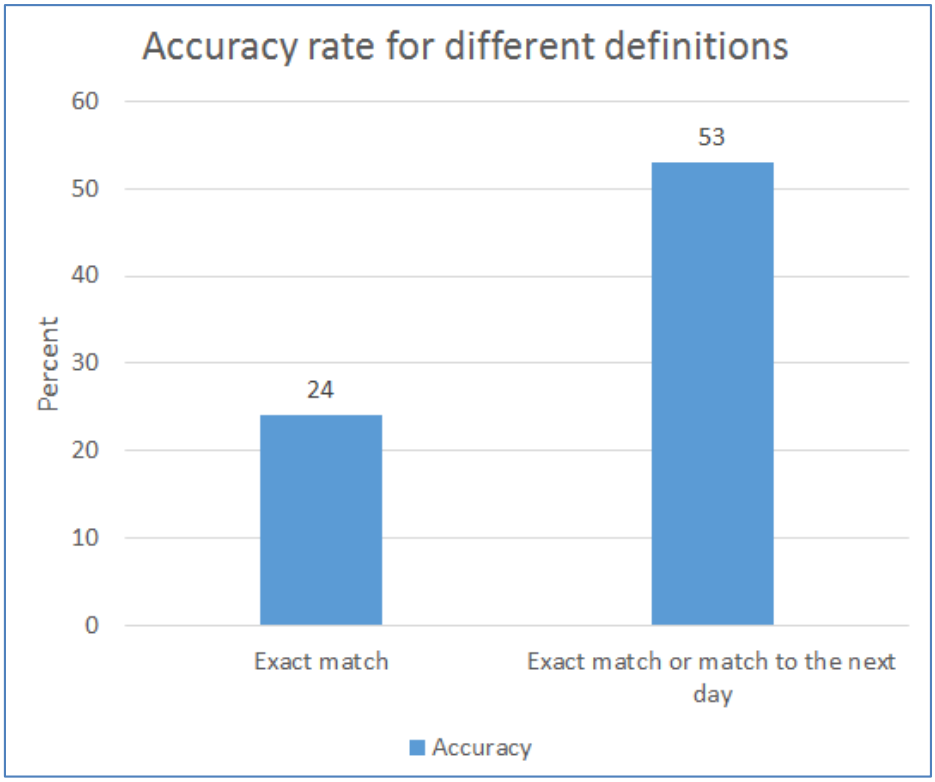


Figure D.3: Percent of self-reported dates that match the stop-the-clock date exactly or the stop-the clock date or the next day (N=2054 respondents who reported a date)
Source: U.S. Census Bureau, 2017 March NCBS Test

Defining an accurate self-report as matching the stop date or the day after the stop date, we found that respondents who answered the survey the same day as they received the mailing self-reported the date accurately about 74 percent of the time. Respondents who answered the survey a different date from receiving the mail material were accurate about the date 44 percent of the time as shown in Figure D.4.

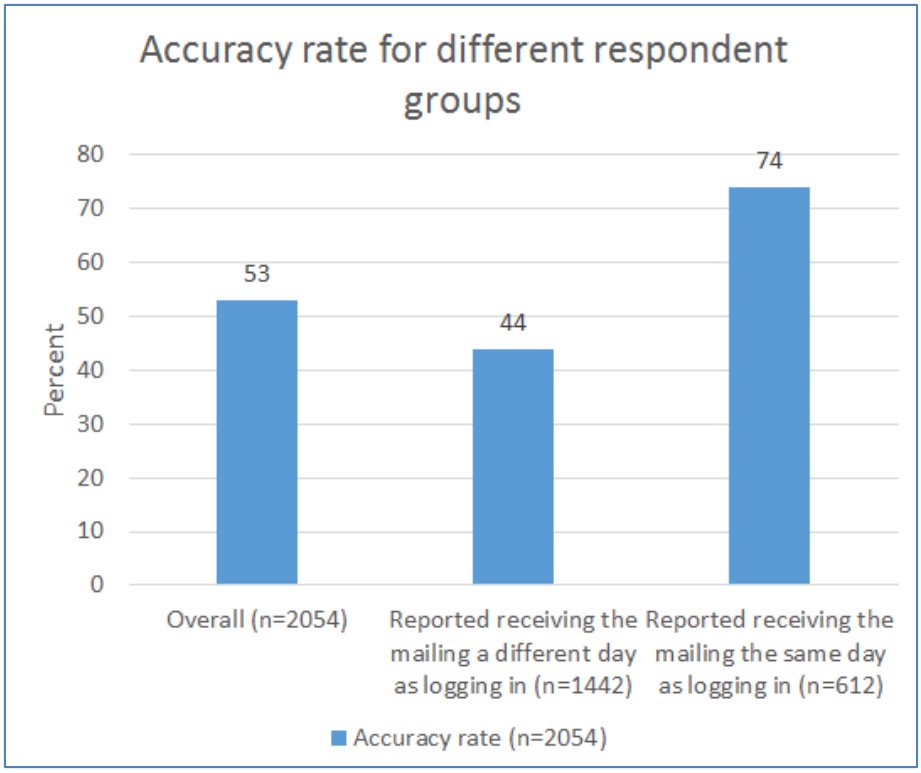


Figure D.4: Percent of self-reported dates that are accurate for people who answer the same day the mail arrives or a different day (N=2054 respondents who reported a date)
Source: U.S. Census Bureau, 2017 March NCBS Test

These accuracy estimates associated with the self-reported date the mail arrives should be considered a lower bound. There were some limitations with this analysis, as we did not have stop dates for each mailing. Stop dates were missing for mailings 3 and 4 for Panel 2 and therefore, any respondent who reported a date for one of those mailings would have been coded as "not accurate" as there was nothing to match to. Additionally, Saturday stop dates could mean the mailing was delivered "Monday," which is two days later, and this was not taken into account when coding accuracy.

Given these caveats, overall, we found that approximately a quarter of respondents did not know when their particular census mailing arrived and for respondents who entered an arrival date, the accuracy rate was 53 percent. Accuracy increased for respondents who received the mailing and proceeded to complete the survey that same day. Finally, for the primary analysis in the body of the report, we used the stop-the-clock date for when the mailing arrived. We estimate that for half the cases, the actual arrival date could be the next day.

10.5 Appendix E: Acronyms and Abbreviations

ACS: American Community Survey

IPTS: IMb Postal Tracking System

IMb: Intelligent Mail barcode

NCBS: National Census Bureau Survey

NCT: National Content Test

USPS: United States Postal Service