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Telephone Appends for Address-Based Samples—An Introduction

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The opinions expressed are those of the authors.

Abstract

Surveys with samples selected from an address frame derived from US Postal Service sources are often referred to as address-based sampling (ABS) surveys. For an ABS survey that is primarily conducted by mail, web, or face-to-face, sometimes it is helpful to have a telephone number corresponding to the sample addresses for setting appointments or conducting nonresponse follow-up prompts. The usefulness of a telephone contact mode in a mixed mode ABS design depends on both the percentage of addresses for which telephone numbers can be appended (append rate or match rate) and the accuracy of the telephone numbers associated with addresses. Before planning a telephone contact as part of a mixed mode study, the designer should know the likely effectiveness of the approach. This paper focuses primarily on append rate information, with discussion of accuracy rates. For a single ABS frame, telephone match rates vary by geography, address type, match vendor, and by landline vs. cell telephone number. Using very large samples of addresses from a total US ABS frame, we estimated state and national telephone append rates from Marketing Systems Group's sources. The append rates are summarized here and interactively at the website http://abs.rti.org/atlas/.

Introduction

Surveys with samples selected from an address frame derived from US Postal Service (USPS) sources are often referred to as address-based sampling (ABS) surveys. In ABS surveys, the address or housing unit corresponding to the address is the initial sample unit, where all or a select number of residents are interviewed. Although ABS sample units typically are contacted initially by mail or in-person, some mixed-mode ABS studies also include telephone contacts. Telephone numbers might be useful to confirm occupancy of an address, set appointments, or prompt nonrespondents. An ABS study with telephone as one of the contact modes requires that telephone numbers be available for the sample addresses.

Because telephone numbers are not found on the address frame itself, they must be appended (American Association for Public Opinion Research, 2016). The typical process involves a researcher drawing a sample from the ABS frame. The sampled addresses are sent to a vendor who submits the addresses to their telephone lookup database and attempts to append a telephone number. Telephone numbers cannot be appended to all addresses, but the proportion that can be appended (of the total attempted) is referred to as the "append rate."* The vendor returns the appended numbers and other ancillary information to the researcher. When a phone contact is desired for the survey, the caller dials the number(s) for a selected address. If the dial connects, the caller should confirm that he/she has reached an individual at the sampled address. This information is used to calculate an accuracy rate—the number of confirmed correct addresses divided by the total number of sample cases for which an attempt to confirm was made.† If the address is confirmed, the caller continues with the call to either recruit for the study or, if appropriate, to conduct the interview.

Even when implemented using the best practices outlined previously, errors and inefficiencies will creep in. The usefulness of telephone appends depends on both the append rate (match rate) and the quality of the appends (match quality and current number accuracy). This is true of any frame or sample with addresses requiring telephone appends. ABS samples differ from other types of samples in two relevant ways. First, ABS addresses have a standardized format, which should improve the match rate. Second, each frame type will have its own coverage issues, which affects both the append rate and the accuracy rate. Coverage refers to the percentage of target population units (housing units) that are included in the frame. ABS frames have excellent coverage overall, but housing units with an address that does not uniquely identify the location or the housing unit may not be covered.

To help survey researchers minimize risk and budget correctly for error and costs in ABS studies, this paper summarizes information on expected append rates based on extremely large, representative samples from an ABS frame. This paper also summarizes literature on the accuracy of appended telephone numbers and provides helpful tips for using telephone appends with an ABS sample. We have organized this paper by steps in the process, with a section dedicated to matching followed by a section on address confirmation and a summary of recommendations.

Telephone Matching

As mentioned previously, not all addresses will have a telephone number appended. Moreover, the append rate varies on several factors including the databases and quality standards used, the geography, and the types of addresses (Harter & McMichael, 2012). We will demonstrate or discuss the effect of these factors in turn in the context of our demonstration research, so we first explain the matching exercise in this research.

In February 2016, RTI International (RTI) selected a very large systematic sample of 12 million addresses

* The terms "match rate" and "append rate" mean different things to different people, but often the terms are used interchangeably. In Marketing Systems Group (MSG) usage, "match rate" refers to the rate at which the addresses in the sample file match records in MSG's databases, if a telephone number is available; the "append rate" is variable-specific—in this case, the rate at which telephone numbers could be linked to the sample addresses through the match process.

† A conservative accuracy rate excludes cases for which the calls could neither confirm nor deny that the telephone number corresponded to the correct address. Although it would also be legitimate to include a portion of the unknown accuracy cases in the accuracy rate, the more conservative rate is a better indicator of the usefulness of the appended telephone numbers for planning purposes.

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from its national Enhanced ABS frame;‡ Marketing Systems Group (MSG) then attempted to match the sample to databases of landline telephone numbers. To the best of our knowledge, no other researchers have examined append rates on this scale. By limiting the landline match process to MSG's three licensed databases, we were able to identify exact landline matches for about 43 percent of the sample. (An exact match means that the street name and number, city, state, and ZIP code from the sample all matched with the same abbreviations and spellings from the telephone database.) Based on MSG's experience, this match rate could have been increased by about 30 percent if external landline databases from other vendors had also been used. The landline match rates from the sample of 12 million addresses are archived at http://abs.rti.org/atlas/appends/viz-landline.

The match rates could be further improved by incorporating cell-phone databases into the match procedure. Traditional databases include only landline telephone numbers, but additional databases have become available that can also append cell numbers to addresses. This would increase the number of appends because 50.8 percent of households do not have a landline telephone, and this percentage appears to be increasing (Blumberg and Luke, 2017).

Using a systematic subsample of 120,000 addresses, stratified by the 93 state and substate areas defined by Blumberg et al. (2011) and weighted to the US population, we estimated that 31.5 percent of US addresses could be matched to a cell telephone number using MSG's supplier. Table 1 shows append rates for both landline and cell telephone numbers using the smaller weighted sample of 120,000 addresses. For landline numbers, the append rates are extremely close to those obtained with the larger sample of 12 million addresses; though not evaluated directly, we speculate that the cell append rates would have been comparably close for the two samples.

The landline append rates are higher than the cell append rates, consistent with our expectation. For example, at the national level, 42.5 percent of addresses have landline appends, whereas 31.5 percent of addresses have cell appends. Cell append services are relatively recent, but the append rates are now high enough to generate strong

‡ RTI augments its national ABS frame with public and private data. Public data include variables commonly available for geographical areas from the US Census Bureau, US Department of Agriculture, NOAA, and US Bureau of Labor Statistics. In addition, public data include monthly updates from the Acxiom InfoBase marketing database, which contains more than 500 address- and person-level characteristics such as age, race, presence/age of children, socioeconomic indicators, and other fields commonly useful to marketers. Using the Acxiom database, RTI can apply address-level demographics to the entire ABS frame for improved sample efficiency for subpopulations through disproportionate allocation to strata and data collection interventions.

Table 1. Telephone append rates for ABS addresses, by state, based on a sample of 120,000 addresses (February 2016)

State	Append percent (standard error)					
	Total phone (landline or cell)	Landline only	Cell only	Landline and cell	Total landline	Total cell
Overall	**58.1 (0.2)**	**26.7 (0.2)**	**15.7 (0.2)**	**15.8 (0.2)**	**42.5 (0.2)**	**31.5 (0.2)**
Alaska	25.3 (1.2)	16.2 (1.0)	6.5 (0.7)	2.6 (0.4)	18.8 (1.1)	9.1 (0.8)
Alabama	62.3 (1.2)	29.8 (1.1)	16.0 (0.9)	16.4 (0.9)	46.3 (1.2)	32.4 (1.1)
Arkansas	51.6 (1.4)	25.8 (1.2)	15.1 (1.0)	10.6 (0.9)	36.4 (1.3)	25.7 (1.2)
Arizona	52.0 (1.0)	18.4 (0.8)	20.3 (0.8)	13.4 (0.7)	31.8 (0.9)	33.6 (0.9)
California	56.4 (0.8)	21.6 (0.7)	19.9 (0.7)	14.9 (0.6)	36.5 (0.8)	34.8 (0.8)
Colorado	60.1 (1.0)	22.8 (0.9)	22.1 (0.8)	15.3 (0.7)	38.1 (1.0)	37.4 (1.0)
Connecticut	65.0 (1.3)	30.2 (1.3)	13.2 (0.9)	21.6 (1.1)	51.8 (1.4)	34.8 (1.3)
District of Columbia	45.0 (1.4)	20.7 (1.1)	13.5 (1.0)	10.8 (0.9)	31.5 (1.3)	24.3 (1.2)
Delaware	71.6 (1.3)	28.3 (1.3)	20.1 (1.1)	23.2 (1.2)	51.5 (1.4)	43.3 (1.4)
Florida	58.2 (1.1)	26.5 (1.0)	15.9 (0.8)	15.8 (0.8)	42.3 (1.1)	31.7 (1.0)
Georgia	58.5 (1.1)	30.2 (1.1)	13.3 (0.8)	15.0 (0.8)	45.2 (1.2)	28.3 (1.0)

(continued)

Table 1. Telephone append rates for ABS addresses, by state, based on a sample of 120,000 addresses (February 2016) ***(continued)***

State	Append percent (standard error)					
	Total phone (landline or cell)	Landline only	Cell only	Landline and cell	Total landline	Total cell
Hawaii	45.8 (1.4)	15.4 (1.0)	19.0 (1.1)	11.4 (0.9)	26.8 (1.2)	30.4 (1.3)
Iowa	66.9 (1.3)	27.4 (1.2)	18.9 (1.1)	20.5 (1.1)	48.0 (1.4)	39.5 (1.4)
Idaho	51.8 (1.4)	19.8 (1.1)	20.0 (1.1)	11.9 (0.9)	31.8 (1.3)	31.9 (1.3)
Illinois	62.5 (0.9)	20.1 (0.8)	21.7 (0.8)	20.7 (0.8)	40.9 (0.9)	42.4 (0.9)
Indiana	66.7 (1.0)	25.5 (1.0)	23.5 (0.9)	17.7 (0.8)	43.2 (1.1)	41.1 (1.1)
Kansas	62.1 (1.1)	25.8 (1.0)	21.3 (0.9)	15.0 (0.8)	40.8 (1.1)	36.3 (1.0)
Kentucky	55.7 (1.4)	30.8 (1.3)	11.9 (0.9)	13.1 (0.9)	43.9 (1.4)	25.0 (1.2)
Louisiana	59.9 (1.4)	29.5 (1.3)	14.2 (1.0)	16.2 (1.0)	45.7 (1.4)	30.4 (1.3)
Massachusetts	61.3 (1.2)	33.3 (1.2)	10.0 (0.7)	18.0 (1.0)	51.3 (1.2)	28.0 (1.1)
Maryland	62.7 (1.0)	31.6 (1.0)	12.2 (0.7)	18.9 (0.8)	50.5 (1.1)	31.1 (1.0)
Maine	55.0 (1.4)	39.3 (1.4)	5.3 (0.6)	10.4 (0.8)	49.7 (1.4)	15.7 (1.0)
Michigan	60.2 (1.1)	30.1 (1.1)	12.6 (0.8)	17.4 (0.9)	47.6 (1.2)	30.1 (1.1)
Minnesota	67.3 (0.9)	29.2 (0.9)	20.6 (0.8)	17.5 (0.8)	46.7 (1.0)	38.1 (1.0)
Missouri	55.7 (1.1)	29.0 (1.0)	12.1 (0.7)	14.7 (0.8)	43.6 (1.1)	26.7 (1.0)
Mississippi	50.2 (1.4)	25.1 (1.2)	11.9 (0.9)	13.2 (0.9)	38.3 (1.4)	25.1 (1.2)
Montana	51.9 (1.4)	27.0 (1.2)	13.9 (1.0)	11.0 (0.9)	38.0 (1.4)	24.9 (1.2)
North Carolina	59.8 (1.4)	27.0 (1.2)	16.6 (1.0)	16.3 (1.0)	43.3 (1.4)	32.9 (1.3)
North Dakota	51.0 (1.4)	27.3 (1.2)	12.2 (0.9)	11.6 (0.9)	38.8 (1.4)	23.7 (1.2)
Nebraska	58.4 (1.4)	34.0 (1.3)	13.2 (0.9)	11.2 (0.9)	45.2 (1.4)	24.4 (1.2)
New Hampshire	60.9 (1.4)	42.2 (1.4)	8.7 (0.8)	10.0 (0.8)	52.2 (1.4)	18.7 (1.1)
New Jersey	60.9 (1.2)	29.4 (1.2)	9.8 (0.7)	21.7 (1.1)	51.1 (1.3)	31.5 (1.2)
New Mexico	46.4 (1.0)	21.4 (0.8)	15.3 (0.8)	9.7 (0.6)	31.1 (1.0)	25.0 (0.9)
Nevada	53.1 (1.1)	18.9 (0.8)	20.1 (0.9)	14.1 (0.8)	33.0 (1.0)	34.2 (1.0)
New York	57.6 (1.0)	29.0 (0.9)	12.1 (0.6)	16.5 (0.7)	45.5 (1.0)	28.6 (0.9)
Ohio	57.4 (1.1)	28.1 (1.0)	13.8 (0.8)	15.5 (0.8)	43.6 (1.1)	29.2 (1.0)
Oklahoma	51.3 (1.4)	24.4 (1.2)	13.2 (0.9)	13.7 (1.0)	38.1 (1.4)	26.9 (1.2)
Oregon	48.8 (1.4)	22.6 (1.2)	15.5 (1.0)	10.7 (0.9)	33.3 (1.3)	26.2 (1.2)
Pennsylvania	65.2 (1.0)	33.5 (1.0)	12.7 (0.7)	19.0 (0.8)	52.5 (1.1)	31.7 (1.0)
Rhode Island	64.8 (1.3)	29.4 (1.3)	11.6 (0.9)	23.8 (1.2)	53.2 (1.4)	35.4 (1.3)
South Carolina	54.6 (1.4)	29.0 (1.3)	12.6 (0.9)	12.9 (0.9)	41.9 (1.4)	25.6 (1.2)
South Dakota	65.6 (1.3)	28.1 (1.3)	19.6 (1.1)	17.8 (1.1)	46.0 (1.4)	37.4 (1.3)
Tennessee	56.4 (1.1)	29.3 (1.0)	13.0 (0.7)	14.1 (0.7)	43.4 (1.1)	27.1 (0.9)
Texas	53.4 (0.9)	21.1 (0.8)	17.3 (0.7)	14.9 (0.7)	36.0 (0.9)	32.2 (0.9)
Utah	56.1 (1.4)	19.8 (1.1)	19.5 (1.1)	16.8 (1.0)	36.7 (1.3)	36.3 (1.3)
Virginia	61.8 (1.4)	33.7 (1.3)	12.8 (0.9)	15.3 (1.0)	49.0 (1.4)	28.1 (1.3)
Vermont	58.0 (1.4)	43.7 (1.4)	6.8 (0.7)	7.4 (0.7)	51.2 (1.4)	14.3 (1.0)
Washington	51.6 (0.8)	25.6 (0.7)	15.6 (0.6)	10.4 (0.5)	36.0 (0.8)	26.0 (0.7)
Wisconsin	66.3 (1.1)	29.8 (1.1)	19.7 (0.9)	16.9 (0.9)	46.6 (1.2)	36.5 (1.1)
West Virginia	44.2 (1.4)	31.9 (1.3)	5.6 (0.6)	6.7 (0.7)	38.6 (1.4)	12.3 (0.9)
Wyoming	49.8 (1.4)	20.9 (1.1)	14.0 (1.0)	15.0 (1.0)	35.8 (1.3)	29.0 (1.3)

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interest. Combining landline and cell, the majority of addresses have phone appends to make telephone a reasonable supplemental contact mode; however, the strength of an ABS sample is the addresses, so telephone should not be the primary contact mode for an ABS sample. The logical next step is to investigate the accuracy of the appended numbers to shed additional light on the usefulness of the appends.

Append rates may vary based on the quality of match requested. Several vendors offer a confidence indicator that the phone number appended is associated with the address sampled. A high-quality match may be one that exactly matches the full address, is on multiple databases, or has recently been confirmed by the vendor. A low-quality match may only match the street address (not the unit number), have an area code inconsistent with the geography, or be on only a single database. When requesting telephone appends from a vendor, it is important to specify the desired quality. Allowing for any quality match will increase the append rate but may result in more disconnected numbers and inaccurate appends (Amaya, Skalland, & Wooten, 2010). This will reduce the efficiency of data collection because callers spend more time wading through incorrect numbers. Limiting matches to those of high quality will reduce the append rate, but it may improve overall efficiency.

The append rate also varies by geography. Table 1 provides high-quality append rates for cell and exact match rates for landline databases (as available from MSG and its cell source) for the sample of 120,000 addresses. Delaware had the highest overall append rate of 72 percent, and Alaska had the lowest overall rate of 25 percent. When conducting a subnational survey, reviewing state level append rates and adjusting expectations accordingly will be important. Researchers should also visit the ABS Atlas exploratory tool (http://abs.rti.org/atlas/) to see the landline results for the larger sample and obtain landline and cell rates by address types and geographies.

The append rate is also correlated with several variables found on the ABS frame. In addition to the address itself, the frame includes a series of other variables that provide information on whether the address is a single family or multi-family unit, whether it is occupied only seasonally (i.e., vacant for 3 or more consecutive months per year), whether the USPS believes the unit is currently vacant, and more. Table 2 summarizes the append rate by available frame variables. It may be useful for researchers to review their sample distributions by these variables and adjust the anticipated append rate accordingly. See also http://abs.rti.org/atlas/appends/viz-cell.

The match process and corresponding append rate have several implications on survey costs and error. As mentioned above, using more databases and accepting poor quality matches will increase licensing and caller labor costs, respectively. If paying per match, it will also be important to correctly estimate the match rate ahead of time and set aside the appropriate funds. This may also influence another match process decision—whether to allow multiple matches.

A vendor can often link multiple telephone numbers to the same address. In some cases, individuals may have multiple telephone lines. In other cases, some phone numbers may be outdated and no longer associated with the address; this frequently occurs in units with a high occupancy turnover. In Table 2, for example, the educational units have a substantially higher append rate for cell numbers. Allowing multiple matches to the same address may improve the odds of contacting the address but also increases costs to the vendor and additional time to track multiple numbers for a single address.

Matching may also introduce bias into the survey. If the researcher does not include cell phone databases in the matching process, households without a landline will have no chance of contact by this mode. Cell-only households are more likely to be low income, renters, Hispanic, age 34 or less, and live with unrelated adults (Blumberg & Luke, 2017). To the extent the outcomes of interest are correlated with landline coverage and the need to use telephone contacts, the results may be biased. More generally, Olson and Buskirk (2015) showed that addresses for which telephone numbers can be appended are more likely to have landline numbers appended and tend to have household and block group characteristics like households with landline phones (i.e., they are not an

Table 2. Telephone append rates, by address attribute, based on a sample of 120,000 addresses (February 2016)

Address attribute	Append percent (standard error)					
	Total phone (landline or cell)	Landline only	Cell only	Landline and cell	Total landline	Total cell
Overall	58.1 (0.2)	26.7 (0.2)	15.7 (0.2)	15.8 (0.2)	42.5 (0.2)	31.5 (0.2)
City-style	58.7 (0.2)	26.9 (0.2)	15.8 (0.2)	16.0 (0.2)	42.9 (0.2)	31.8 (0.2)
Not city-style	18.2 (1.3)	8.0 (0.8)	8.6 (0.9)	1.7 (0.4)	9.6 (0.9)	10.3 (1.0)
PO Box	18.1 (1.3)	7.8 (0.8)	8.8 (1.0)	1.5 (0.4)	9.3 (0.9)	10.3 (1.1)
OWGM	14.0 (2.4)	7.5 (2.1)	4.9 (1.2)	1.6 (0.6)	9.1 (2.1)	6.5 (1.3)
MFDU	35.7 (0.4)	15.1 (0.3)	14.7 (0.3)	5.9 (0.2)	21.0 (0.3)	20.6 (0.3)
High rise	34.9 (0.4)	15.0 (0.3)	15.4 (0.3)	4.5 (0.2)	19.5 (0.4)	19.9 (0.3)
Not high rise	40.4 (1.1)	15.5 (0.8)	10.3 (0.7)	14.6 (0.8)	30.1 (1.0)	24.9 (0.9)
Non-MFDU	66.0 (0.2)	30.7 (0.2)	16.0 (0.2)	19.2 (0.2)	50.0 (0.2)	35.3 (0.2)
Vacant	16.4 (0.9)	5.9 (0.5)	8.4 (0.7)	2.0 (0.4)	8.0 (0.7)	10.5 (0.8)
Seasonal	52.0 (3.5)	32.7 (3.4)	9.0 (2.0)	10.2 (2.1)	42.9 (3.5)	19.2 (2.8)
Education	40.3 (4.5)	0.8 (0.5)	35.7 (4.4)	3.8 (1.4)	4.6 (1.5)	39.5 (4.5)
Drop point	72.1 (1.4)	22.5 (1.3)	18.1 (1.2)	31.5 (1.5)	54.0 (1.6)	49.6 (1.6)
2 units	73.5 (1.9)	29.6 (2.0)	13.6 (1.4)	30.3 (2.0)	59.9 (2.1)	43.9 (2.1)
3-4 units	74.8 (3.0)	24.4 (3.3)	15.6 (2.8)	34.8 (3.6)	59.2 (3.6)	50.4 (3.7)
5+ units	67.5 (3.1)	6.6 (1.6)	29.0 (2.8)	31.9 (3.1)	38.5 (3.2)	60.9 (3.2)
Non–drop point	57.9 (0.2)	26.7 (0.2)	15.6 (0.2)	15.5 (0.2)	42.3 (0.2)	31.1 (0.2)

Notes: A city-style address has street name and number in addition to city, state, and ZIP code; "OWGM" indicates a post office box that is a unit's only way to get mail; "MFDU" is a multi-family dwelling unit; Drop point is a mail receptacle with a single address that serves multiple housing units.

unbiased representation of all housing units). This is why we do not recommend telephone as the primary contact mode for an ABS survey.

Address Confirmation

During data collection, telephone numbers associated with an ABS sample should not be treated like a random-digit dial (RDD) telephone sample. There are important distinctions based on the fact that the sample unit is the address, not the telephone number.

First, the outcome of a call may be classified differently. In an RDD survey, a disconnected number would be considered out of scope and finalized as nonsample. In an ABS survey, the telephone number is only a contact method. A nonworking number means that you have failed to reach the sampled address via this mode. No information has been gained, and another number or mode will be required to contact the sampled address. Approximately 19 percent of high-quality landline telephone matches and 35 percent of cell telephone matches are expected to resolve as nonworking, although this rate will vary (Amaya, Skalland, & Wooten, 2010; McMichael & Roe, 2012). As Amaya et al. (2010) experienced, the percentage of numbers that are not working is likely to increase if poorer quality matches are included.

Second, once an individual has answered the phone, the caller should confirm whether the telephone number corresponds to the sampled address. Among working numbers, research indicates that the observed accuracy rate has been 92–96 percent for landlines but only 29 percent for cell telephone appends (Amaya, Skalland, & Wooten, 2010; McMichael & Roe, 2012). Especially if the caller proceeds to conduct an interview by phone, not confirming the address means that interviews may be collected from addresses that were not selected into the sample, and some sampled addresses may be finalized inappropriately. In more extreme cases, a sample unit reached by an outdated number may have multiple chances of selection. If the addresses are not confirmed, the researcher would be unaware of some

data collection errors and unable to correct for them in the analysis weights.

Asking individuals to confirm their addresses at the beginning of the call may be perceived as off-putting and invasive. To reduce negative reactions to this question, callers may mention that an advance letter was sent to the household and ask if it was received. If the individual answers "yes," the caller may infer that the correct address has been reached. If the individual answers "no," the caller may ask a follow-up question stating that the letter was sent to the following address and asking whether that is the individual's address. If it is the correct address, the call may continue. Another option is to place the question at the end of the call after the caller has built rapport with the individual; however, nonresponse prompting calls give little opportunity for building rapport, and setting appointments or conducting interviews before confirming the address is inefficient, so this option is not preferred.

Recommendations

In addition to the recommendations and tips included above, we include a few general recommendations that researchers who wish to use telephone as a contact mode in an ABS survey may wish to follow:

- Use the information in the online ABS Atlas, this paper, other publications, and paradata available on the sample to calculate an expected append rate and an accuracy rate specific to your study. This information will help inform your budget inputs, identify interviewer staffing needs, and set client expectations.
- Communicate with your sample and telephone vendors to understand the match process and to specify which match method you would like to use. You may also build quality-control programs (e.g., the same phone number should not be matched to multiple addresses) to further ensure quality matches.
- Make sure the call scripts include an address confirmation question (or series of questions, as described above).
- Adjust production reports to ensure the sample unit is the address, not the telephone number.
- Develop a protocol for handling sample units that are not reachable by telephone (e.g., nonmatches, disconnected numbers, or inaccurate numbers).

Limitations

Keep in mind that append rates and accuracy rates are in constant flux, and will likely vary by vendor and across time. For example, in February 2012, a national ABS sample achieved a 53 percent landline append rate (McMichael & Roe, 2012) compared with a 42.5 percent landline append rate in February 2016 (as Table 1 shows). The 11.5 percent difference in 4 years is not surprising given the decline of households using landline phones. In addition, these rates will likely vary by vendor, especially for cell phone appends.

Experiments are needed to determine the extent to which the use of telephone appends as a secondary contact mode will improve response rates. That knowledge can then be used to adjust initial sample sizes and allocations of sample to strata as appropriate. As a starting point, it is likely that strata with higher append rates will gain more benefit from the telephone mode than strata with lower append rates. It is worth considering whether higher cell phone append rates will improve response among harder-to-find segments of the population.

References

Amaya, A., Skalland, B., & Wooten, K. (2010). What's in a match? *Survey Practice*, *3*(6), 70–86.

American Association for Public Opinion Research (2016). *Address-based sampling.* Report prepared for AAPOR Council by the Task Force on Address-based Sampling. Retrieved from http://www.aapor.org/Education-Resources/Reports/Address-based-Sampling.aspx

Blumberg S. J., & Luke, J. V. (2017). *Wireless substitution: Early release of estimates from the National Health Interview Survey, July–December 2016*. National Center for Health Statistics. Retrieved from https://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201705.pdf

Blumberg S. J., Luke, J. V., Ganesh, N., Davern, M. E., Boudreax, M. H., & Soderberg, K. (2011). *Wireless substitution: State-level estimates from the National Health Interview Survey, January 2007–June 2010* (National Health Statistics Reports No. 39). National Center for Health Statistics. Retrieved from https://www.cdc.gov/nchs/data/nhsr/nhsr039.pdf

Harter, R., & McMichael, J. P. (2012). Scope and coverage of landline and cell phone numbers appended to address frames. In Joint Statistical Meetings Proceedings, *Survey Research Methods Section* (pp. 3651–3665). Alexandria, VA: American Statistical Association.

McMichael, J., & Roe, D. (2012). ABS and cell phones: Appending both cell phone and landline phone numbers to an address based sampling frame. Presented at the Joint Statistical Meetings, San Diego, CA. Retrieved from https://www.rti.org/pubs/jsm2012mcmichael-abscell.pdf

Olson, K., & Buskirk, T.D. (2015). Can I get your phone number? Examining the relationship between household, geographic and census-related variables and phone append propensity for ABS samples. Presented to the American Association of Public Opinion Research, Boston, MA.

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