RTI International's Address-Based Sampling Atlas: Drop Points

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Abstract

The Computerized Delivery Sequence (CDS) file contains listings for nearly all addresses in the United States. Survey researchers use the CDS as a sampling frame from which to draw an address-based sample (ABS). More than 700,000 addresses on the CDS are marked as drop points, which are mail receptacles shared by multiple housing units (drop units). Drop points are a challenge to sample and present a potential source of error because of their "one-to-many" relationships. Several techniques have been developed to overcome this challenge, including deleting them from the frame or sampling all units at a given drop point. This paper serves as an introduction to these challenges, discusses the pros and cons to each "solution," and provides a list of best practices.

Introduction

The Computerized Delivery Sequence (CDS) file contains listings for nearly all addresses in the United States, both residential and business.[1] Although most residential listings are city-style addresses (e.g., 123 Main St., Apt A, Anytown, MA 01234), other types of addresses exist. Among the alternative address types are drop points, single mail receptacles that are shared by multiple housing units (i.e., drop units). The drop units have a street number but are missing a unit or apartment number. (In a small number of cases, a drop point may have a unit number. A common example may be 123 Main Street, Floor 2, where the second floor has multiple units.) Because each drop unit within a drop point has an identical street address (e.g., 123 Main St.) but is listed individually on the frame, the drop units for a given drop point appear as duplicates.

Although drop units make up a small proportion of all addresses, they are challenging to sample and are a potential source of error because of their "one-to-many" relationships. Several techniques have been developed to overcome this challenge, including deleting them from the frame or sampling all units at a given drop point. In this paper, we outline these challenges, discuss the pros and cons of each "solution," and outline a list of best practices.

Drop Points, Drop Units, and the CDS

Drop points make up 0.5 percent ($n = 737,196$) of all unique residential addresses, while drop units account for 1.5 percent ($n = 2,166,062$) of all residential addresses. In reported counts, unique addresses have a unique combination of ADDRESS1, ADDRESS2, CITY, STATE, and ZIP on the frame. Residential addresses include all housing units, even if there are duplicate addresses. A drop point building with five units would count as one unique address but five residential addresses. A typical multi-unit

building with five units would count as five unique addresses and five residential addresses. In the CDS, both unique addresses and residential addresses include addresses listed as all residential, mostly residential, and mostly business.

In rare cases, a building or street address may be mixed, containing both units that have a unit number and others that do not. This occurs when a single building has two (or more) mail receptacles, one used by a single housing unit and the other by two or more drop units. This phenomenon typically occurs when there are multiple entrances to a building: one entrance and mail receptacle may be used only by the basement unit, for example, while the other is used by all other units in the building (Amaya, LeClere, Fiorio, & English, 2014).

Drop units can be identified on the frame by a flag; however, there are a few frame inconsistencies regarding drop points of which statisticians should be aware. On the January 2017 frame, there were 38 drop points that only had one drop unit. These should be considered single units, not drop points, and should be sampled accordingly. There were also 806 duplicate addresses that were not flagged as drop units but made up only 296 unique addresses. These should be deduplicated and treated as typical city-style addresses.

Challenges of Sampling Drop Units

In general, drop units pose a challenge to researchers because of the "one-to-many" relationship between address and housing units: one unique address corresponds to many housing units. This relationship causes problems in different ways based on the mode of data collection.

Challenges with In-Person Surveys

For field surveys, the challenge is borne by the interviewer. If a drop unit is selected, the interviewer will have no indication which unit at the selected address to interview. Without additional instruction, he/she may opt to place the case on hold. If the case is not adequately managed and reactivated, the survey response rate may suffer. Alternatively, the interviewer may select a unit within the sampled drop point for which a person is at home and cooperative.

1 For simplicity's sake, we refer to the frame as the CDS. In practice, the frame used by researchers is obtained from a sample vendor and is based largely, but not exclusively, on the CDS. For more details on the distinction, please refer to Section 2.1 of "Address-Based Sampling" (American Association for Public Opinion Research Task Force on Address-Based Sampling, 2016). All data were pulled from the January 2017 CDS.

This workaround may result in interviewer selection bias because the "at home" household may be different from the other households at the address (Eckman & Koch, 2016). The interviewer's action will also make the selection probabilities unknowable.

One approach to address this challenge is to sample the entire drop point, eliminating the need for the interviewer to choose a unit. Unfortunately, sampling all units at a drop point may be tedious for field interviewers in some areas. Nearly all drop points contain two (80.0 percent) or three (14.9 percent) drop units (Figure 1). Internal, qualitative analysis suggests that these addresses are frequently houses that have been converted into apartments. Approaching all units at these addresses to take part in the interview should be of little trouble to interviewers. However, the remaining 5.1 percent of drop points have four or more units, and they can pose problems for two reasons. First, some are quite large—up to 999 units. Interviewing all units would be statistically unnecessary, costly, and logistically infeasible. Second, larger drop points are much more variable in structure type. Large drop points are often gated communities, high-rises, trailer parks, or alternative housing such as halfway housing, or they may not be housing units at all (Amaya, LeClere, Fiorio, & English, 2014). Including a large drop point that is not a housing unit or is nearly impossible to access may throw off sampling or response rate assumptions and require a second sample draw.

Sampling all drop units within a drop point also introduces challenges when the count of drop units
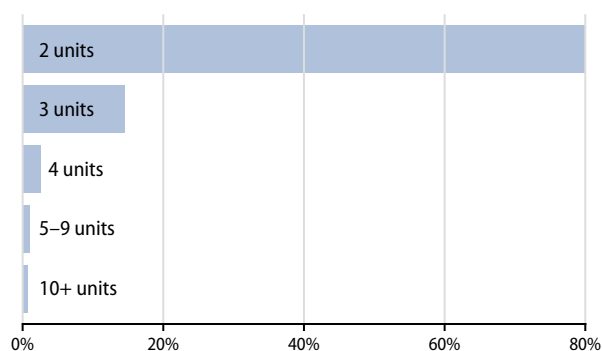
identified by the interviewer does not match the count on the frame. Although the frame count of units per point has been demonstrated to be highly accurate, it is not without error (Kalton, Kali, & Sigman, 2014). To correct the frame errors, interviewers would typically be asked to enumerate the drop units at the drop point. They may perform a traditional listing in which they are not provided with the unit count. However, some drop points are difficult to enumerate and interviewers may have a hard time correctly identifying the number of units at the drop point, introducing undercoverage (Fiorio & Fu, 2012). Alternatively, a dependent listing may be used in which the interviewer is provided with the unit count and asked to confirm or update it. This approach introduces confirmation bias—interviewers confirm the frame count even though it is incorrect (Eckman & Kreuter, 2011). This results in both undercoverage (failure to add units not counted on the frame) and overcoverage (failure to delete duplicates on the frame).

Instead of sampling all units, one may opt to draw a subsample of units within a drop point. Although Kalton and colleagues (2014) recommend this approach for buildings with four or more units, subsampling could be used regardless of drop point size. Several of the same challenges encountered when sampling the entire drop point may also arise when subsampling. Coverage will be imperfect for the reasons discussed above.

Units may be superficially numbered 1 through *X*. The central office may specify which units to sample and provide special instructions to the interviewer on how to identify the appropriate unit. Unfortunately, research on in-field sample selection suggests that interviewers have difficulty implementing these procedures either because of their complexity or the interviewer's carelessness (Eckman & O'Muircheartaigh, 2011). Interviewers may opt to bypass the correct procedure and select a unit in which someone is available for the interview. This results in selection bias and unknown selection probabilities. Additional training and monitoring protocols would be necessary to ensure correct implementation.

Figure 1. Drop points, by number of drop units they contain

Source: http://abs.rti.org/atlas/drops/viz

Challenges with Mail Surveys

Mail surveys are difficult to administer to drop units because there is no way to ensure that the survey is delivered to the selected unit. Most survey mailings are addressed the "Resident of" a given address. Without a name or unit number, the researcher has no mechanism to ensure that the mailing is received by the occupants of the sampled unit. This may result in selection bias, as the person who opens the survey may be different from the others at the drop point. Or, it is possible no one picks up the mailing since it is not addressed to her/his unit, resulting in lower response rates.

To overcome these challenges, one may once again opt to sample the entire drop point or select a subsample of units within the selected drop point. Researchers who opt to select all drop units within a drop point would identify the number of drop units based on the frame count and mail that many questionnaires to the address. As with face-to-face surveys, complications can occur if the number of units reported on the CDS is not correct. Mail response rates may suffer even if the unit count is correct. Occupants who see that all units received the same package may be more likely to perceive it as a mass mailing and throw it out without opening it. This hypothesis is entirely untested, but data do show lower response rates for drop units (Link, Battaglia, Frankel, Osborn, & Mokdad, 2008). Additionally, researchers cannot control for selection bias. An individual from a single drop unit may take all questionnaires for the building. This may be especially likely if the individual discovers an incentive in the mailing.

Subsampling is even harder to implement because it necessarily leaves building occupants to determine who should participate and may result in selection bias. It may also allow respondents to "pass the buck"—individuals can take the position that since the questionnaire is not directly addressed to them (i.e., no name), it does not belong to them and is someone else's responsibility—and lead to lower response rates at these addresses (Link et al., 2008).

Similarly, most mail surveys involve remailing questionnaires to nonrespondents. Without a method to target the mail to an individual unit, a different unit may pick up the different mailings.

Challenges with Telephone Surveys

Telephone surveys that use the CDS suffer from challenges different from field and mail surveys. To conduct a telephone survey using an address-based sample, the address has to be reverse-matched to a telephone number (Harter, McMichael, Brown, Amaya, Buskirk, & Malarek 2016). Overall address-to-telephone matches and accurate matches to units in multi-unit buildings are significantly lower than single-unit addresses (Amaya, Skalland, & Wooten, 2010). Without a unit number, the match rate is likely near zero. As a result, most drop points will be finalized as unresolved (i.e., occupancy and eligibility are unknown) and as nonresponsive units since contact cannot be attempted.

When phone number matches are made, they should be screened to ensure that the housing unit reached is the one intended. Because drop units are not unique addresses, mismatches are likely to be quite high. Mismatches and nonmatches ultimately lower the response rate and increase the potential for nonresponse bias.

Appending Auxiliary Data

For all modes, it may also be possible to append data to the frame. In the January 2017 CDS frame, unit numbers could be appended to 11.1 percent of drop units using the NoStat file. This file is a US Postal Service database of supplemental data not included on the CDS that includes rural vacant addresses, new growth (e.g., unfinished new construction), and unit numbers for some drop units. In most cases, unit numbers were available for some units within a drop point, but not for all. The NoStat file could be used to append numbers to all drop units in only 0.5 percent of drop points.

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Drop points for which all unit numbers could be appended may be treated like any other multi-unit building. Kalton and his colleagues (2014) recommend that unit numbers be ignored for partially matched buildings because their presence may cause more logistical challenges. Finally, researchers have attempted to assign unit numbers to drop units using the neighboring addresses' numbering schema. If successful, field and mail efforts could be targeted to the sampled unit. Unfortunately, all of the assignment algorithms tested to date are flawed and have failed to provide accurate unit assignments (Amaya, Dekker, & LeClere, 2013).

Some vendors may be able to match some drop units to names. For field surveys, this may aid the interviewer in identifying the correct unit (e.g., perhaps the name is on the doorbell). Name may also be used to target the mailing to a given unit, or it may be used to enhance address-to-telephone matching. However, it is impossible to guarantee that the names of matched individuals live in separate drop units. For example, a drop point with four

units may be matched to four names. If all four matched names live in the same unit, then mailing four questionnaires (addressing one to each name) will result in duplicative coverage of one unit and no coverage of the other three units at the drop point. It is also impossible to ensure all units in a building are matched to a name. For field surveys, this is of little concern because the name is only a tool for interviewers and is not critical for making contact.

The Exclusion Alternative

Given all of the above challenges and the fact that drop points and units account for a small proportion of the frame, one may argue for excluding these addresses altogether. The loss in overall coverage would be small (1.5 percent), and the logistical challenge of collecting data from these units would be avoided. Unfortunately, drop points/units are not evenly dispersed throughout the country (Figure 2). Drop points are clustered in older urban areas such as New York, Chicago, Boston, and Philadelphia.

Figure 2. Drop points, by county

Source: http://abs.rti.org/atlas/drops/viz
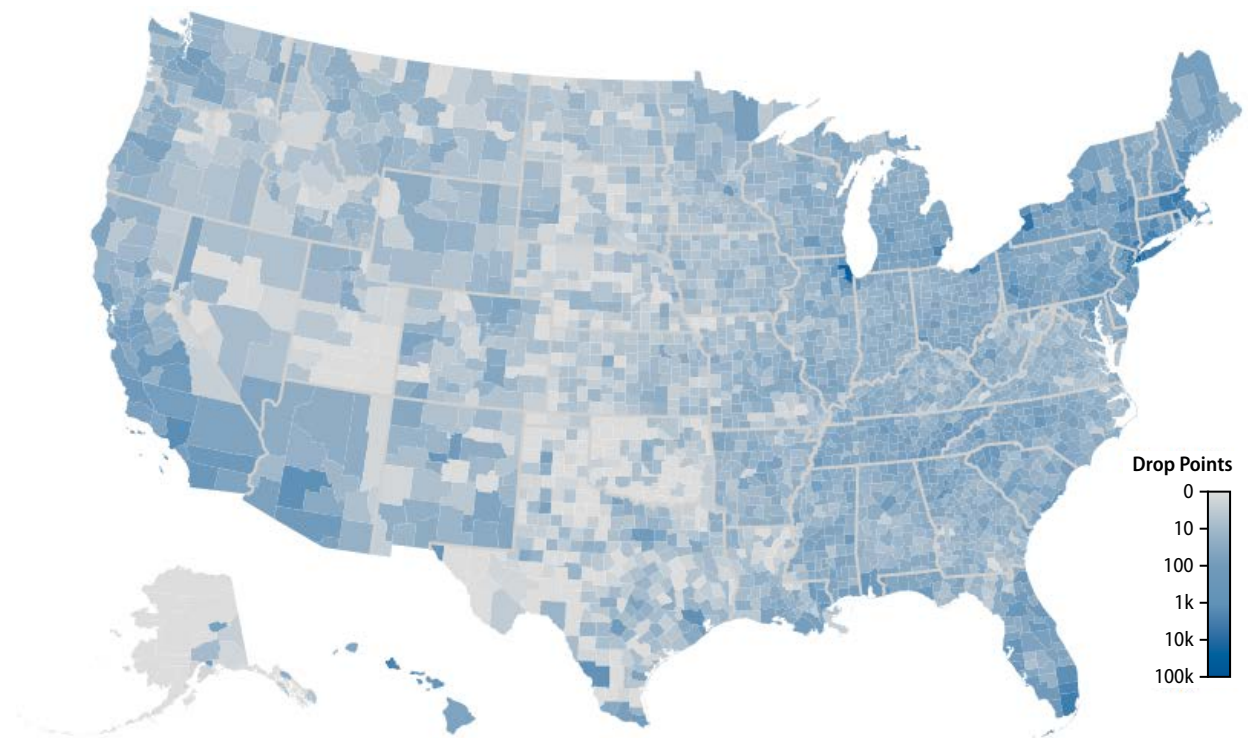
Although only 0.5 percent of all residential units are drop units in the state of Arkansas, for example, the percentage rises as high as 27.0 percent in Queens County, New York (Table 1). A local survey with few drop units in the geography may be able to exclude drop units with little consequence, but their exclusion from other geographies could result in significant undercoverage and introduce coverage bias.

Table 1. Saturation of drop units in a selection of geographies

Area	Residential addresses (N)	Drop units (N)	Drop units/ residential address (%)
Arkansas	1,514,376	7,385	0.5
New York State	8,611,306	799,880	9.3
New York City	3,560,697	638,162	17.9
Queens County	868,187	234,044	27.0

Drop units are further clustered within cities. As the proportion of drop units increases in a census community, the average age of the buildings, proportion of households with children, and the proportion of African Americans and Latinos also increases, while the median income and owner occupancy rate decrease (Clark & Moul, 2003; Dekker, Amaya, LeClere, & English, 2012). Exclusion of all drop point units would likely bias estimates correlated with these demographic variables.

Recommendations

Different protocols may be appropriate for different types of surveys. We list the most likely survey environments here and provide recommendations based on our knowledge as of January 2017.

- For surveys in which the drop units appear to comprise a relatively low proportion of the sample frame and do not appear to be clustered, they may be excluded from the frame with little risk of undercoverage or coverage bias. For all other surveys, drop units should be included on the frame, but we recognize that researchers will likely optimize the risk of coverage bias, cost of including drop units, and implications for the response rate.

- In all cases, we recommend appending unit numbers from the NoStat file (and other vendor-supplied sources, if available).

- To minimize selection bias, it may be appropriate to sample the entire drop point when the number of units is small (e.g., two to three units) but to subsample medium and large drop points.

- After a sample has been drawn, it may be worthwhile to investigate exceptionally large drop points (via Google Maps, a phone call to the main office if one can be located, or an in-person visit), because these are less likely to be housing units. Large drop points are rare and few (if any) are likely to be selected. This approach may be useful to minimize complications during data collection.

- Finally, an address-based sample using the CDS may not be ideal for all areas. Given the large proportion of drop points/units in New York State and the New York City metropolitan area (including Newark and Jersey City), we would advise using an alternative frame or enhanced listing procedure. To a lesser extent, the CDS may also be inappropriate in Philadelphia, Chicago, and Boston. This recommendation assumes a general population survey in which coverage is paramount. The budget, project goals, or other circumstances may necessitate the use of the CDS in these areas.

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