

Address Based Sampling: What Do We Know So Far?

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Why Are We Here?

- Purpose: Understand the opportunities and challenges of using an address-based sampling (ABS) approach to survey data collections
- Goals:
 - Understand the background and basic concepts of ABS
 - Learn about the ABS sample frame
 - Explore alternative designs built on an ABS base
 - Delineate some of the current challenges and research opportunities with this methodology
 - Have fun & and learn somethin'

Special Thank You for Sharing Research & Presentations

- Mansour Fahimi, Marketing Systems Group
- Charles DiSogra, Knowledge Networks
- Vince Iannachione, RTI International

Section 1: Introduction to Address Based Sampling

Background

- While mail surveys have been around for decades, use of a residential mailing frame for sampling the general population is relatively new
 - Attempts limited by lack of a complete systematic frame
- U.S. Census began development of Master Address File for the 2000 Census using list of addresses from the U.S. Post Office
 - Soon after USPS lists became commercially available
- First published evaluation of use of mailing addresses for in-person survey was by Iannacchione, Staab, & Redden (POQ, 2003).
- First published use of the term “Address-Based Sampling” as applied to the use of mailing addresses as a sample frame for general population surveys was Link, Battaglia, Frankel, et al (POQ, 2008)

Address-Based Sampling

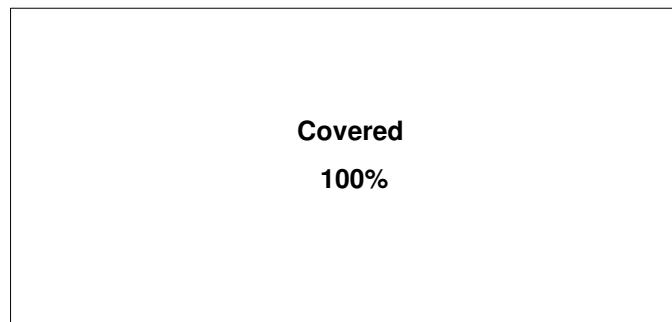
- “Address-Based Sampling” is the sampling of addresses from a database with near universal coverage of residential homes
 - Based on an address database, not traditional counting & listing approach
- ABS is now the basis or key component of many critical studies and on-going measurements:
 - National Survey of Family Growth
 - National Election Study
 - General Social Survey
 - Knowledge Networks Panels
 - Nielsen Television Audience Measurements

Why ABS?

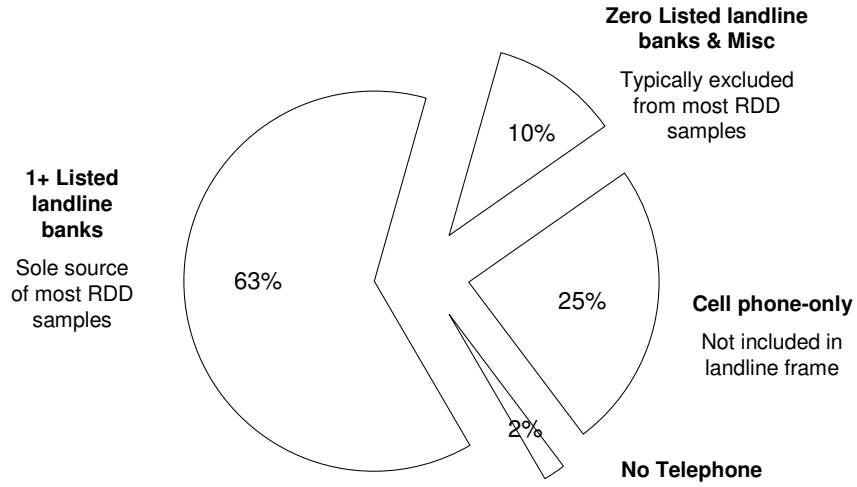
- Coverage, coverage, coverage ...
 - Degradation of landline telephone frame
 - Incompleteness (or absence) of online frame
 - Expense of traditional counting & listing (enumeration) procedures for in-person, area probability studies
- Frame offers foundation for multimode data collection designs
 - We can build any number of data collection designs (recruitment and interviewing mode combinations) using this sampling frame
- Critical to recognize: ABS is a sampling methodology, NOT a single survey design

Ideally: Include all eligible households

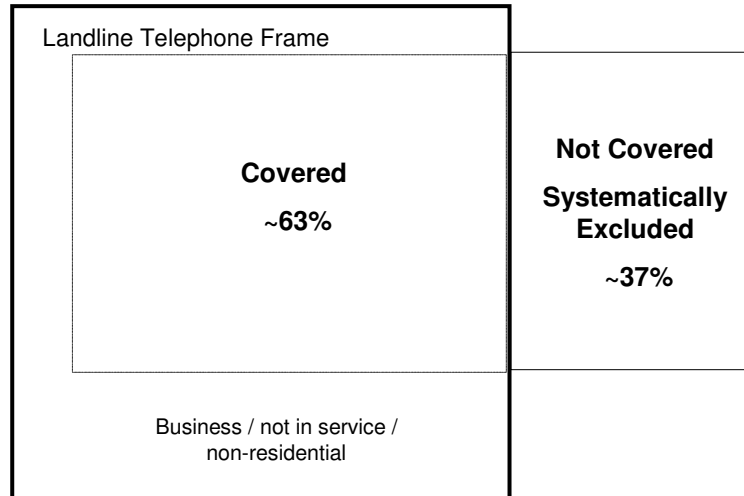
← All US Households →



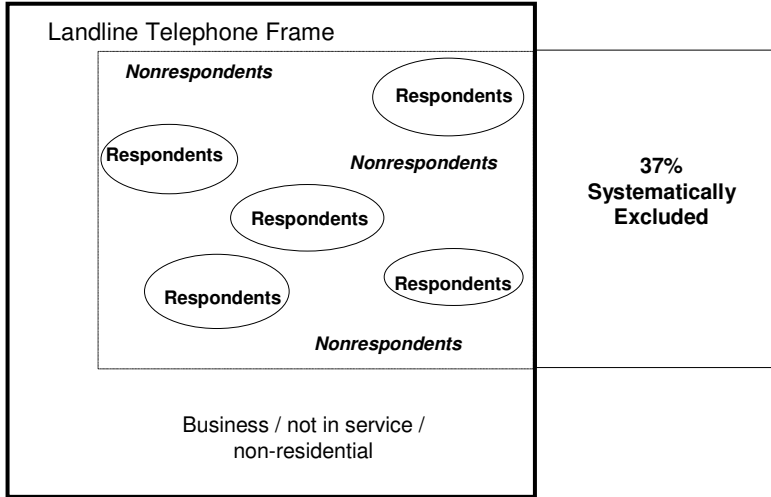
Distribution of Residential Telephone Numbers



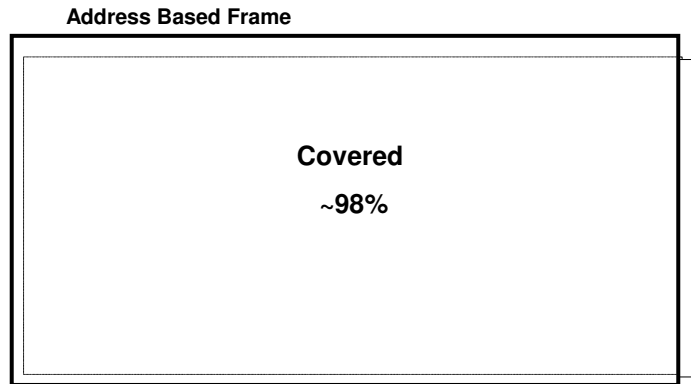
Residential Household Coverage with Standard Landline Random Digit Dialing Model



Skewed Participation with Landline RDD Model

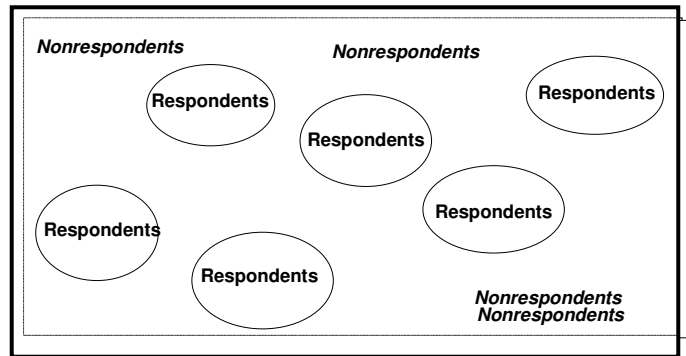


Residential Household Coverage with Address Based Sample Model



Potential for Broader Participation with Address Based Sample Model

Address Based Frame



Key Points

- Address Based Sampling is a sampling methodology not a single survey design
- ABS helps solve coverage issues, not response rate per se
 - May replace RDD in some cases, but not a one-to-one replacement for all RDD studies
- ABS facilitates numerous data collection designs

Questions?

Section 2: ABS Frame, Augmentation, & Sample Indicators

Sample Frame

- Primary source: U.S.P.S. Address Management System
 - Addresses available to qualified private companies with non-exclusive relationship with U.S.P.S.
 - U.S.P.S. products governed by US Code Title 39 Section 412 – prohibits mailers or research companies from receiving postal mailing addresses directly from the U.S.P.S.
- Two key products available:
 - Delivery Sequence File Second Generation (DSF²)
 - Computerized Delivery Sequence File (CDSF)

Delivery Sequence File Second Generation

- Can only be applied to a mailer's existing address list to clean the list of erroneous addresses
 - Similar to how Neustar database is used to identify and remove ported cellphone numbers within a list of presumed landlines
- Cannot be used to generate an address list
- Qualified companies must pass testing and pay licensing fee

Computerized Delivery Sequence File

- Licensed vendors can provide addresses from this product
- For vendors who can demonstrate they have 90+% of current delivery addresses in a sub-ZIP group
- U.S.P.S. updated available weekly or monthly
 - Remove bad addresses
 - Insert missing addresses
- Most survey researchers using ABS are working with vendors licensed to use the CDSF
 - Rest of presentation assumed drawing sample with assistance of CDSF

CDSF Frame Elements (Raw File)

- | | |
|-------------------------------|------------------------|
| ▣ House Number | ▣ Tract |
| ▣ Apt Number | ▣ Block |
| ▣ Street Name | ▣ County |
| ▣ Street Suffix: Ave and Blvd | ▣ Walk Sequence Number |
| ▣ Directional: NE and W | ▣ Route Type |
| ▣ Zip | ▣ Delivery Type Code |
| ▣ Zip+4 | ▣ Vacant Code |
| ▣ City Name | ▣ Seasonal Code |
| ▣ City Code | ▣ Drop Count |
| ▣ State Code | ▣ PO Box |
| ▣ State Name | |

CDSF Terminology

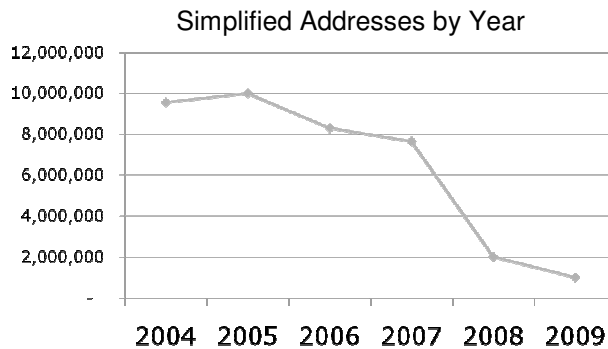
- **City-Style Address:** contain street name and number, city, state, zipcode, & unit number
- **Drop Points:** City-style addresses without the unit number
 - Mail dropped off at a single point for multiple households
 - Number of units associated with a drop point are on the CDSF
- **Post-Office Box:** residential post-office boxes
 - Proprietary methods required to identify PO Box/City-style duplicates and unique PO boxes
- **P.O. Box Throwbacks:** City-style address that receives mail at a P.O. Box rather than residential address
 - Only first class mail forwarded to PO Box
 - Cannot link PO Box and City-style address

CDSF Terminology (con't)

- Rural Route: Addresses that have not gone through the USPS Locatable Address Conversion System, which provides updated city-style address for RR boxes that have undergone emergency 911 conversion
 - Ex.) RR 22 Box 6 to 37 Mockingbird Lane
- Simplified Addresses: Do not include a street name and number
 - Address typically only has “Occupant”, city, state and ZIP Code
 - Carrier knows where to drop off the mail
- Incidence of both RR and Simplified Addresses has dropped significantly over the past 10 years

Concerns About Rural Coverage

Coverage An Initial Concern with the DSF:



Source: Fahimi 2010

Additional Information Available

- Vacant units: identified units that have been vacant 90 days or more
- Seasonal units: Receives mail only during a specific season and the months the seasonal addresses are occupied are identified
- Educational units: Identified as an educational facility such as colleges, universities, dormitories, sorority or fraternity houses, and apartment buildings occupied by students
- Business units: Identified as a delivery point to a business

Distribution of Addresses by Type

| Delivery Type | Count | Percent |
|--|-------------|---------|
| City Style | 114,135,810 | 84.0% |
| PO Box | 14,936,080 | 11.0% |
| Seasonal | 890,488 | 0.7% |
| Educational | 110,914 | <0.1% |
| Vacant | 4,071,036 | 3.0% |
| Throwback | 291,302 | 0.2% |
| Drop Points | 786,896 | 0.6% |
| Augmented City Style/Rural Route (MSG) | 192,443 | 0.1% |
| Augmented PO Boxes (MSG) | 395,307 | 0.3% |
| Total | 135,810,276 | |

Issues to Consider When Using the “Raw” CDSF File

- The “raw” DSF is for delivery not suitable for complex surveys:
 - Does not include effective stratification variables
 - Certain delivery points are more likely to be excluded (Simplified)
 - Certain delivery points do not correspond to physical dwellings (need for onsite enumeration)
 - Certain dwellings have multiple chances of selection (frame multiplicity)

Appending Data to the “Raw” CDSF Database

- A key benefit of having address as the base sample unit is the extensive amount of information that can be appended to the sample file:
 - Stratification of frame
 - Tailoring treatments: specialized materials, targeted incentives, etc.
 - Backend analyses
 - Additional analysis variables
 - Nonresponse analyses

CDSF Frame Augmentation

- ▣ There are large government and commercial databases with geographic or household data items to provide:
 - ▣ Census geographic as well as marketing & media domains
 - ▣ Demographic data for households
 - ▣ Name for address and telephone number for name/address
- ▣ Sample vendors, such as MSG, rely on ancillary data sources for:
 - ▣ Data appendage
 - ▣ Simplified address resolution
 - ▣ Assessing the need for onsite listing (enumeration)
 - ▣ Reducing the frame multiplicity

Appending Data to DSF to Enhance the Frame

- ▣ Geographic Data:
 - ▣ Each delivery point is geo-coded to a Census Block
 - ▣ Custom domains are constructed based on radius
- ▣ Demographic data for households can be retrieved:
 - ▣ Direct data items
 - ▣ Modeled data items at various levels of aggregation
- ▣ Appending names and telephone numbers:
 - ▣ Percent name append on average is over 90pct
 - ▣ Percent phone append on average is about 65pct
 - ▣ Match rates vary with geography and PO Boxes

Using the CDSF for Geographic Sampling



Address Based Sampling Short Course
 Source: Fahimi (2010) Chapel Hill, Odum Institute, Oct 2010

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Respondent Demographics by Address Type

- Compared key demographics by type of address at which respondent receives mail
 - Source: *Nielsen Radio Audience Measurement – Spring 2009*
- Total respondents: City style address (93.8%), PO Box (5.0%), Other type of address (1.2%)
- Statistically significant differences:
 - Less likely to have a City Style address: Native Americans (10.2%), Blacks (9.9%), renters (9.5%), lower income (8.8%), students (8.3%), single adults (8.2%), younger adults (8.2%), and less educated (8.1%),
- No significant differences for: sex or Hispanic ethnicity



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Respondent Demographics by Telephone Match

- Compared key demographics by presence (“matched”) or absence (“unmatched”) of telephone match to address
 - Source: *Nielsen Radio Audience Measurement – Spring 2009*
- Total respondents: matched with residential landline telephone (69.3%), unmatched (30.7%)
- Statistically significant differences - % with no initial telephone match:
 - Renters (56.5%), Asians (47.2%), Younger adults (46.9%), Students (45.9%), Hispanics (44.6%), single adults (44.3%), Native Americans (44.0%), lower income (42.8%), and Blacks (39.0%).
- No significant differences for: sex



Quality Can Vary Based on Licensed Vendor

- Access to various USPS products
- Database update frequency
- Extent of Ability to append additional data
- Experience drawing survey samples (versus mail “flooding” of a geography)



Key Points

- USPS data products can only be accessed through a licensed vendor
 - Best to work with vendors experienced in survey sampling
- ABS has terminology and characteristics different from other frames
 - Become knowledgeable about these contours and how they apply to your particular sampling / data collection needs
- ABS frame is optimized through the appending of additional data to addresses or small geographies (Census blocks)
 - Helps facilitate finer sampling stratification; specialized data collection treatments; & backend analyses

Questions?

Section 3: Examples of ABS Uses & Designs



ABS Provides a Flexible Base for Multiple Survey Designs

- Critical to remember: ABS is a SAMPLING methodology, NOT a single survey design
- Key Decisions:
 - Recruitment mode & approach
 - Interviewing mode & approach

Important to Differentiate Recruitment from Interviewing Mode

- Modes of Contact
 - Mail – 100%
 - In-person – 90+%
 - Telephone – 60%
- Modes of Surveying:
 - Face-to-face (PAPI or CAPI)
 - Mail survey
 - Telephone survey (PAPI or CAPI)
 - Web survey
 - Cell phone
 - Audio-CASI
 - Telephone-ACASI / IVR
 - Disk-by-mail
 - Diaries
 - Etc.

Conceptual Framework for Design Choices

| Sample Frame | Mode of Contacting/Recruiting | | | |
|--------------|-------------------------------|--------|--------|-------|
| | Single | | Multi- | |
| | Mode of Interviewing | | | |
| | Single | Multi- | Single | Multi |
| Single | 1 | 2 | 3 | 4 |
| Multi- | 5 | 6 | 7 | 8 |

8 Basic design choices based on combination of frame, contact mode, & interview mode

ABS Design Example #1: Nielsen Television Diary

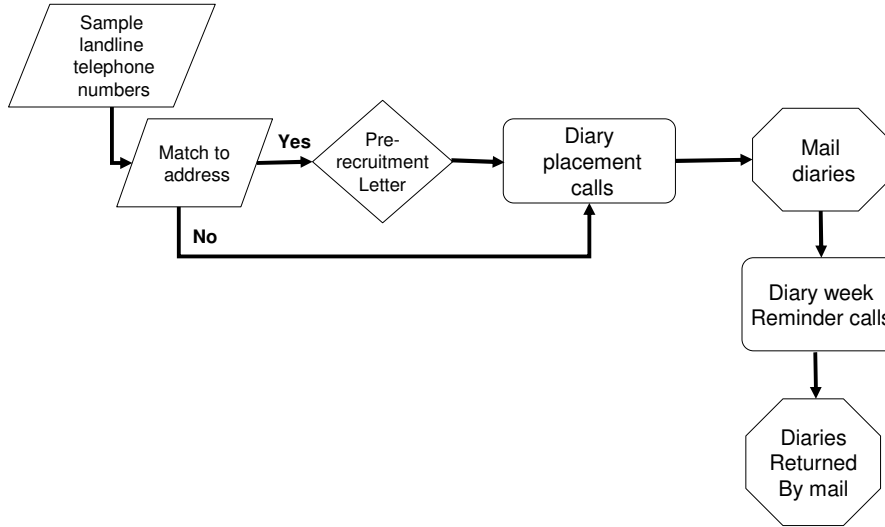
Nielsen TV Ratings Diary

- Nielsen TV ratings represent the “currency” of exchange between television stations and advertisers
 - Stations “sell audiences” to advertisers
 - **\$137 billion** spent on TV advertising in 2008
 - Minor changes in ratings can represent hundreds of millions of dollars
- Since 1950, Nielsen has used a week-long diary to collect tuning (what is watched) and viewing (who is watching) data
 - Four major “sweeps” per year: Feb, May, July, & Nov
- Recruitment to diary based on random digit dialed telephone recruitment since 1983.

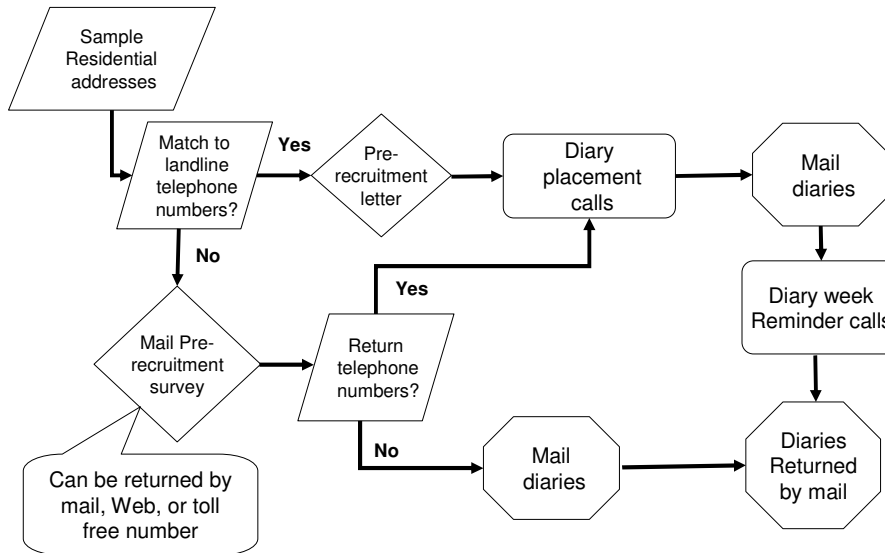
Diary Measurement Faced Same Problems as Other RDD Surveys

- Rapidly declining response rates
- Systematic under-coverage of cell phone only-households
- Lack of participation among 18-34
 - Even with oversampling techniques, unable to reach complete targets among this group
- Costs sky-rocketing
- Losing confidence in data collected and rating produced

Nielsen TV Diary RDD Design



Nielsen TV diary ABS design



Sample Size & Overview of November 2008 Implementation

- Measurement conducted in 192 markets
 - Four independent weekly samples in each market
- 646,086 addresses sampled for “regular sample”
- 825,171 addresses sampled as “over sample”
 - Note: While over-sample procedures were used, results shown here reflect regular sample only
- Timeline:
 - Pre-recruitment survey -
 - 21 days per diary week
 - Telephone recruitment -
 - 23 days for **matched** sample / 16 days for **unmatched** sample
 - Diary keeping –
 - 7 days per diary week no DVR/ 8 days for DVR diaries

Stage 1: Unmatched Address Pre-Recruitment

- “Unmatched” = addresses with no landline telephone number match
- Mailed pre-recruitment questionnaire
 - Demographics to drive mailing treatments
 - Number and type of diaries
 - Amount of incentive with diaries
- Can complete via:
 - Mail
 - Web
 - Call-in to toll free number

Pre-Recruitment Questionnaire Returns

% returned as undeliverable = 8.3%

| Pre-recruitment Questionnaire | Nov 2007 RDD | Nov 2008 ABS |
|-------------------------------|--------------|--------------|
| Return Rate | NA | 26.5 |
| Returned with Phone # | | 50.4 |
| Returned via Mail | | 82.0 |
| Returned via Web | | 15.7 |
| Returned via Phone | | 2.3 |

Return rate = # returned surveys / Total Sampled

Stage 2: Telephone Recruitment

- “Matched” addresses = addresses with a landline telephone match
 - Sent advance letter
 - Recruited by telephone
- “Unmatched” addresses
 - If phone number provided, recruit by telephone
 - Landline or cell phone
 - If pre-recruitment survey returned with no telephone, mail diaries
 - If no pre-recruitment survey is returned, process stops
 - Earlier studies showed diary response rate for this group of 2%

Stage 3: Diary Returns

- “Intabulation” or “Intab” Diary = returned with valid data
 - Diaries are checked upon return and deemed:
 - Intab
 - No good
 - Ineligible
- Diaries accepted up to 3 weeks after close of survey period

Sample Representation: Head of Household Demographics

| Characteristic | Nov 07 RDD | Nov 08 ABS | Population estimate |
|------------------------|---------------|---------------|------------------------|
| AOH: | <35 | 9.2 | 21.5 |
| | 35-54 | 34.9 | 39.4 |
| | 55+ | 55.9 | 39.1 |
| Black* | 13.4 | 13.4 | 17.0 |
| Hispanic* | 14.9 | 17.4 | 18.9 |
| Cell Phone Only | 0.0 | 7.5 | N/A |

Note: Regular sample only – oversample excluded

*Treatment markets only (10+% penetration)

Coverage vs Response Tradeoff?

- Response rates are an incomplete indicator of data quality
 - Not necessarily a good indicator of nonresponse bias
 - Does not account for under-coverage in telephone frames
- Need to view data in terms of total participation considering both initial frame coverage & final response rate

| | <u>Coverage</u> | <u>Response</u> |
|---------------|-----------------|-----------------|
| Nov 2007 RDD: | 75% | 26% |
| Nov 2008 ABS | 98% | 18% |

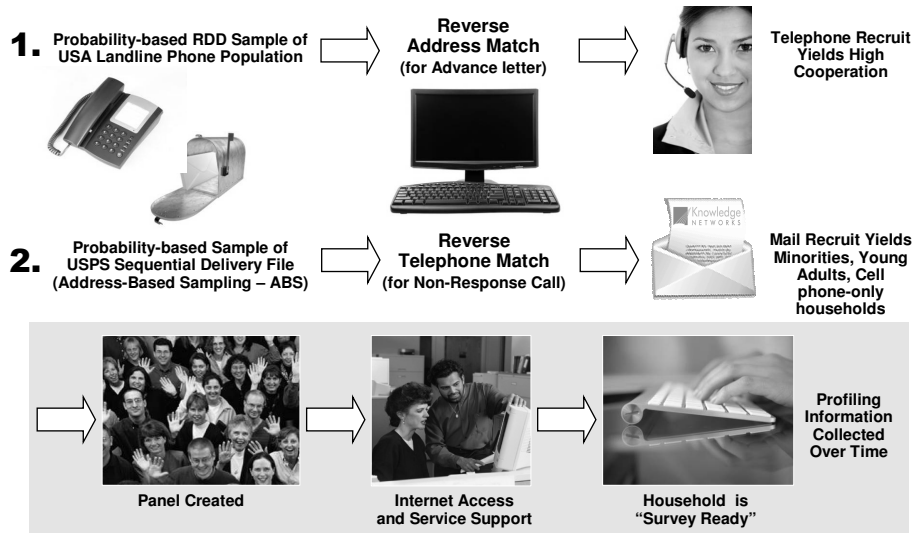
Example #2: Knowledge Networks Online Panel

Knowledge Networks Panel: Background

- Recruit and maintain a large on-going, probability-based, nationally representative online panel of adult population
- Includes:
 - Households found to have no Internet access
 - KN provides them a laptop computer with free monthly ISP
 - Cell phone only households
 - Spanish-language households
- Extensive profile data maintained on member demographics, attitudes, opinions, behaviors, etc.
- Samples from the panel are assigned to client studies using e-mail invitations and a link to the online survey questionnaire

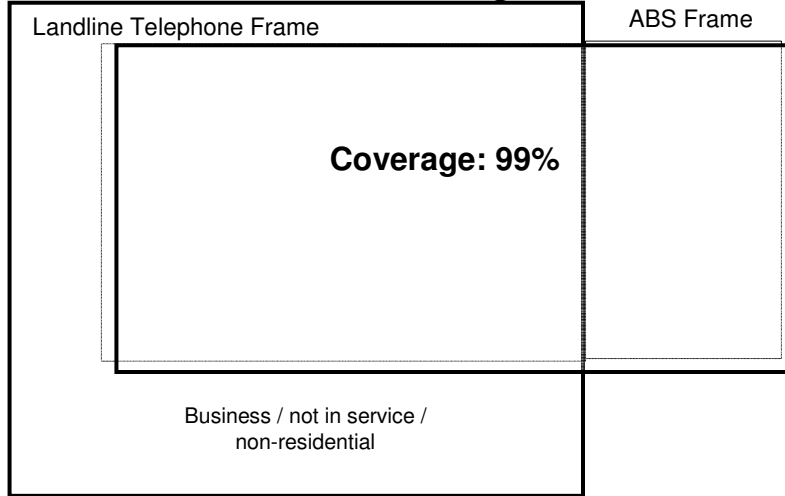
[Source: Garrett, Dennis & DiSogra, 2010]

KnowledgePanel Dual-Frame Recruitment

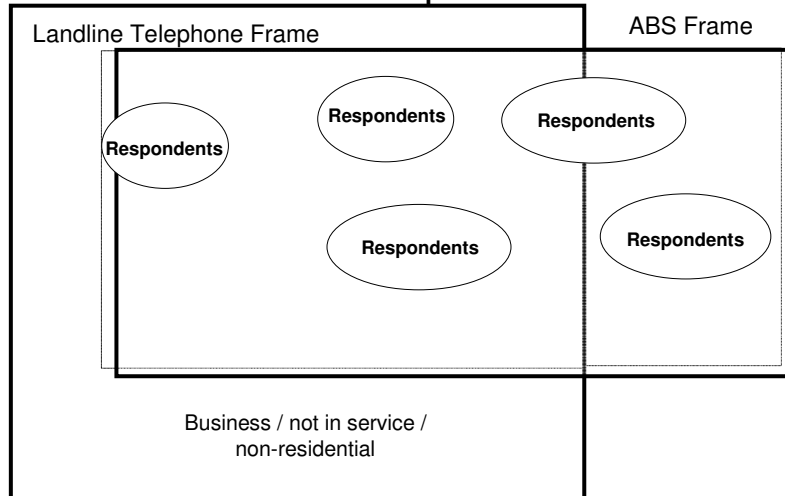


[Source: Garrett, Dennis & DiSogra, 2010]

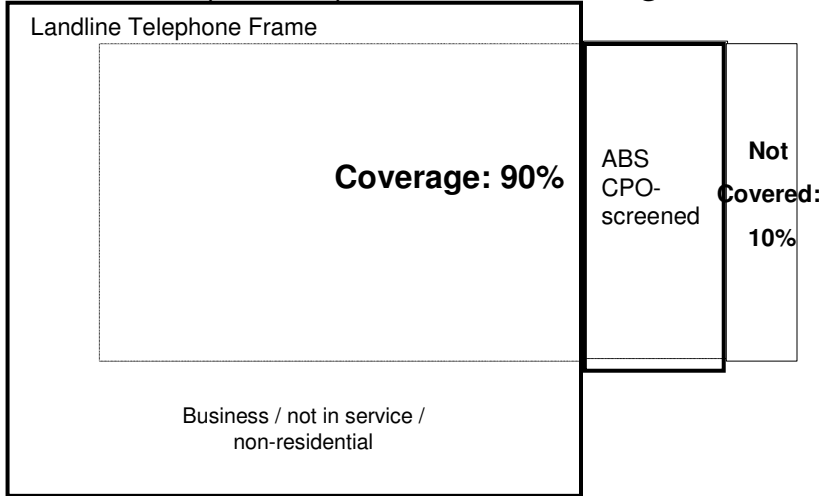
Dual Frame Landline-ABS (Full) Model: Coverage



Dual Frame Landline-ABS (Full) Model Response



Alternative: Dual Frame Landline-ABS (Partial) Model: Coverage



Example #3: Use of ABS to Enhance Area Probability Sampling

National Survey on Drug Use and Health (NSDUH)

Target population:

Civilian, non-institutionalized population 12 and older

- Households (HHs) and
- Non-institutional group quarters (GQs)

Data collected quarterly in all 50 states and DC

- 7,200 local areas known as *segments*
- 140,000 screenings and 67,500 interviews completed annually

[Source: Iannachione et al., 2010.]

Area Probability Overview

- Probability-based sampling methodology based on sampling of geographies, then homes within geographies.
- Geography of interest is parceled into discrete areas (typically predefined Census blocks are used)
 - Blocks are then randomly sampled according to a set of rules
- Field staff then visit geography and enumerate all residential dwellings
 - Using a map of the area and walking a specific, pre-determined path
 - Identify all homes
- Homes are then sampled for interviewing
- All homes then have a known probability of selection

[Source: Iannachione et al., 2010.]

Field Enumeration (FE) for the NSDUH

- Frame construction requires field staff to completely enumerate a local area or *segment*
- Coverage supplemented during screening process
- FE is not perfect – housing units can be missed (5-10%)
- FE is very expensive

[Source: Iannachione et al., 2010.]

Use of ABS with Field Enumeration

Pros:

- Less costly
- Faster
- Enables larger segments

Con:

- Undercoverage in:
 - rural areas
 - group quarters
- Can NSDUH use only an ABS frame?
 - Undercoverage would be a problem in rural states
 - Target population includes group quarters (dorms, etc.)

In other words, complete coverage is required

[Source: Iannachione et al., 2010.]

Combining the Best of FE and ABS

ABS: Used in segments where ABS coverage adequate

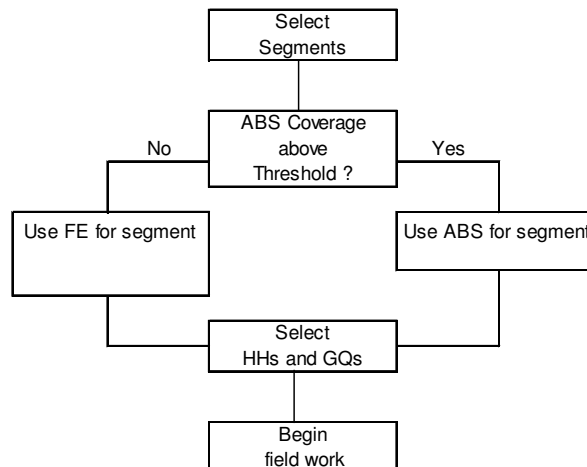
FE: Used in the remaining segments

Result:

Hybrid ABS/FE frame that is cheaper than FE
yet retains the relatively complete coverage of FE

[Source: Iannachione et al., 2010.]

Implementing the ABS/FE Hybrid Frame



[Source: Iannachione et al., 2010.]

Cost Savings Associated with Frame Construction

| | ABS Coverage Threshold | | | FE Only |
|---------------------|-------------------------------|------------|------------|----------------|
| | 20% | 50% | 80% | |
| ABS Segments | 95% | 85% | 63% | 0% |
| FE Segments | 5% | 15% | 37% | 100% |
| Cost Savings | 62% | 55% | 41% | 0% |

[Source: Iannachione et al., 2010.]

Coverage of the Hybrid Frame

| | ABS Coverage Threshold | | |
|-----------------------|-------------------------------|--------------|--------------|
| | 20% | 50% | 80% |
| Urban Segments | 98.9% | 99.0% | 99.1% |
| Rural Segments | 92.3% | 93.4% | 95.6% |
| Overall | 97.5% | 97.8% | 98.4% |

[Source: Iannachione et al., 2010.]

Key Points

- As a survey frame, ABS approaches can:
 - Use ABS as a stand-alone approach (single frame)
 - Use ABS in conjunction with other frames (dual frame)
 - Use ABS to augment how more traditional frames are constructed (ex. Enhanced area probability frame construction)
- Can build any number of data collection designs using ABS, but need to separate:
 - Modes of contacting respondents (limited choices)
 - Modes of interviewing respondents (open array of choices)

Questions?

Section 4. Lessons Learned ... To Date ...

What key elements have we learned about ABS so far?

- Allows us to reach cell phone only households
 - Offers an alternative to directly sampling cell phone exchanges
- Improves coverage but not necessarily response rate in all cases
 - Declining coverage is a critical source of potential bias in many traditional survey designs today
- Facilitates numerous survey designs & use of multiple modes of data collection
 - Need to distinguish mode of contact from mode of interviewing
- Using addresses as the base sample unit provides great opportunity to append data from other databases to enhance sampling, data collection, and analyses
- Depending on design used, can reduce costs over traditional survey approaches



ABS Best Practices

- ABS has its own strengths & weaknesses compared to other sampling approaches – need to understand these before employing the methodology
- Use a sample vendor familiar with using DSF for survey sampling
 - Vendors vary significantly in their ability to draw samples from the file
- Use Multiple Listing Services for Phone Appends
- Use Multiple Modes (if possible) to improve response
 - Need to learn more about how to optimize combinations of modes
- Make effective use of sample indicators at the sampling, data collection, and analysis stages



Areas for Further Research with ABS Designs

- Optimal sampling within an address environment
 - Types of addresses to include/exclude
 - Coverage studies, particularly in rural and non-traditional areas
- Effective use of sample indicators:
 - Rich area for exploitation to improve sample & data collection designs
 - Accuracy of some key indicators (such as telephone number) still a question
- Maximizing contact rates
 - New or more effective means of contacting individuals
 - “Unmatched” addresses (those with no identifiable telephone number) are the most problematic:
 - Currently initial contact with home is limited to mail or in-person approaches
- Maximizing response rates in a balanced manner
 - Optimizing use of mixed-modes (which combinations work best in which order)
- Use of geocoded data for backend analyses
 - Additional analysis variables
 - Geo-based non-response bias analyses

Take Away Messages

- Survey research is in a time of extreme change
 - Increasingly difficult to obtain high quality data in a timely & cost effective manner
- RDD has been the work horse for survey research
 - Eroding coverage & declining response rates
- No single alternative on the horizon
 - Complex mix of frames & modes
 - More customized approaches to fit particular niches/ no “one size fits all”
- Address based sampling offers a stable base on which to build
 - Rich, diverse frame data in augmented frame
 - Has positives & negatives
 - Can support an array of different surveys designs
- ABS is still in its infancy, but the growing number of studies adopting & testing this approach will allow the industry to rapidly optimize the use of this important sample frame.

Thanks!

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