

## THE LAST-BIRTHDAY SELECTION METHOD & WITHIN-UNIT COVERAGE PROBLEMS

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As Groves (1989) has noted, the real population for most household surveys is persons, not household units. Thus surveyors must be concerned with the accuracy of the within-unit coverage of various respondent selection techniques; i.e., how often does the method lead to the "correct" person being interviewed?

The Kish method (1949) was originally proposed for in-person interviews but has also been used in many telephone surveys. With a slight exception that occurs in very large households, the Kish method provides a within-unit probability sample by affording each adult a nonzero and known chance of selection. Since the Kish method requires a full listing of all adults in the household by age and gender at the start of the interview, it is time-consuming and invasive. Many survey researchers in the 1960s and 1970s attributed increases in telephone survey refusal rates to the demands of the Kish selection procedure and sought a "friendlier" within-unit selection method.

Troldahl and Carter (1964) proposed a method that used a two-question selection sequence: 1) How many people 18 years or older live in your household, counting yourself?; and 2) How many of them are men? The interviewer then selects the respondent based on one of four matrices. Because this selection method chooses the "oldest" or "youngest" male or female, the Troldahl-Carter method and its variants (e.g., Bryant, 1975; Czaja, Blair & Sebestik, 1982; Hagen & Collier, 1982) have a selection bias in units where there are three or more adults of the same gender. In these cases "middle-aged" persons have zero probability of being selected. Because of this bias and a common undersampling of males, these alternatives to the Kish method did not fully satisfy the survey research community.

In the past decade a new and "easy" approach that in theory could result in a random selection of respondents within households has been studied (Oldendick, Bishop, Sorenson & Tuchfarber, 1988; O'Rourke & Blair, 1983; Salmon & Nichols, 1983). This method either asks for the eligible person (e.g., adult > 17 years of age) within the sampling unit (e.g., household) who had the most recent (i.e., last) birthday or asks for the eligible who will have the next birthday. Given the nonintrusive nature of this approach and the heterogeneous within-unit sample that is produced, the birthday selection technique has been widely embraced by academic, public sector, and private sector surveyors. However, although these techniques could yield a true within-unit

probability sample, there is concern that this does occur in practice (see Groves and Lyberg, 1988, p. 208).

Because the birthday selection techniques are neither intrusive nor time consuming and are easy for interviewers to use, their appeal is great. After the introductory spiel, the interviewer asks for a respondent along the following lines, "For this survey, I'd like to speak with the person in your household, 18 years of age or older, who had the last birthday."

Due to the novel wording of this approach, problems arise because of household informants who do not immediately understand what the interviewer is getting at (thus, the importance of the interviewer being able to accurately explain the meaning of the last-birthday or next-birthday request). In an attempt to counter any misunderstanding, Oldendick et al. (1988) used a more detailed selection spiel:

"In order to determine who to interview, could you tell me, of the people who currently live in your household who are 18 or older -- including yourself -- who had the most recent birthday? I don't mean who is the youngest adult, but rather, who had the most recent birthday?" (p. 309)

(Of note, this wording sacrifices somewhat the ease of administering simpler wording and may be difficult for some members of the general public to follow.)

Because the birthday methods do not require any form of enumeration of all eligibles within the sampling unit, they cannot control for possible respondent mis-selection (thus, possible bias) by household informants who purposely or inadvertently answer inaccurately.

Using an RDD telephone survey in the state of Kentucky, Salmon and Nichols (1983) tested the next-birthday method and compared it with: 1) no systematic selection procedure (i.e., interviewing any willing respondent); 2) alternating selection of male/female respondents; and 3) the Troldahl-Carter (T-C) method. Salmon and Nichols found that completion rates were highest for the no-selection and next-birthday selection procedures, whereas the next-birthday and T-C methods were the most time-consuming. As far as representativeness of the sample, the T-C method oversampled older people and the no-selection procedure oversampled women. The next-birthday and male/female alternation methods did not differ significantly from the pooled sample on any demographic characteristics. When summing all the differences between the subsamples and the overall sample, the next-birthday group matched the overall sample the best. In all, Salmon and Nichols concluded that there was no

"statistically significant justification for not using the next-birthday method" (p. 276). However, Salmon and Nichols (1983) did suggest asking for the person with the last birthday (i.e., most recent) instead of next birthday because interviewers reported that some respondents had difficulty understanding the next-birthday query.

O'Rourke and Blair (1983) tested the Kish method and the last-birthday procedure using an RDD survey in Illinois. Refusal rates were higher for the Kish procedure (16.9% versus 12.5%), and it was determined that this difference in refusals occurred at the respondent selection portion of the introduction. Demographic characteristics of the two subsamples were virtually identical with the exception of age: the Kish sample contained more older people. O'Rourke and Blair also built in a verification of the last-birthday method to see if respondents were using it correctly. Toward the end of the interview, respondents were asked to provide the month of birth of all adults living in the household. Because the exact date of birth was not asked, the respondent was afforded the "benefit of the doubt" in two ways in categorizing the selection outcome as accurate or inaccurate: 1) if two births were in the same month, the procedure was counted as "correct"; and 2) if a respondent was born in the month of the interview, it was also counted as "correct." In all, O'Rourke and Blair found that nine percent of the respondents did not have the last birthday (furthermore their methodology allowed them to determine that half of the incorrect respondents had selected themselves and half had been selected by someone else in their household). When compared demographically, there were no significant differences between the "correct" and "incorrect" groups.

O'Rourke and Blair also compared the distribution of birthdays by month for the Kish subsample and the last birthday subsample with the hypothesis that the birthdays in the Kish subsample would be distributed evenly by month whereas the last birthday subsample would be skewed toward the months immediately prior to interviewing. Their expectation was confirmed. In all, the researchers concluded that the last-birthday method is an "adequate, noninvasive probability procedure" (p. 432).

Oldendick, Bishop, Sorenson, and Tuchfarber (1988) also compared the Kish procedure with the last-birthday method in three Ohio RDD telephone surveys. Of note, the authors suggest that the interviewers who participated in these experiments were well familiar with Kish and were somewhat new to the last-birthday approach. They concluded that "while refusal rates with the birthday procedures [were] lower, the differences [were] not statistically significant. In addition, there [were] only minor differences in demographic characteristics . . . and in the substantive responses [of the subsamples] produced by the two methods" (p.307).

## **METHODOLOGY**

Data from two RDD surveys are used in this paper, although most of the findings are based on the second survey. A 1990 one-stage RDD survey of 1,026 adults in the Chicago metropolitan area was conducted from late April through early June of that year. A 1992 two-stage RDD survey of 1,500 adults in the United States (including Alaska and Hawaii) was conducted from mid-March through the end of April of that year. In each survey the last-birthday selection technique was used to identify one respondent per household. Methodological data were gathered as part of each survey to help test the accuracy of this respondent selection technique.

In the 1990 study respondents were asked, as part of the demographic section of the questionnaire, in what month they were born. In addition to these data being gathered in the 1992 study, respondents were also asked to identify the months in which all eligibles (adults 18 years of age or older) in their households were born.

## **RESULTS**

Table 1 shows the proportion of months in which respondents reported they were born in two separate RDD general population surveys which used the last-birthday selection method. Similar to the findings

**TABLE 1**

Reported Month of Birth for Respondents in Two RDD Surveys Using the Last-Birthday Selection Method

Month of Birth	Percentage Reporting Each Month	
	1990 Survey	1992 Survey
January	10.6	10.0
February	7.9	10.1
March	12.7	11.1
April	12.7	7.8
May	7.9	6.0
June	4.5	6.4
July	5.3	7.8
August	6.4	8.0
September	8.7	8.0
October	8.5	7.0
November	6.7	7.8
December	8.0	10.0

Note. The 1990 survey was conducted in the Chicago metropolitan area in late April and May of that year. The 1992 survey was conducted in the United States in late March and April of that year.

reported by O'Rourke and Blair (1983), the observed distribution of respondents' reported months of birth is shifted toward the months of the respective survey's field period and the months immediately preceding the field period. This, in fact, is what should happen if the selection procedure is working correctly.

However, as shown in Table 2, the 1992 national survey, which allowed for a detailed investigation of the accuracy of the last-birthday method, demonstrates that the technique does not always lead to the interviewing of the correct member within the household. The percentages in Table 2 can be interpreted in several ways:

First, it can be noted that in one quarter of the cases (19.9% + 5.5% = 25.4%), it was not possible to make a decision about whether or not the correct adult was interviewed because exact date of birth was not gathered. Either two persons were born in the same "most recent" month or a person in a multiple-adult household was born in the same month in which s/he was surveyed. Additionally, a small proportion of respondents did not provide complete information about the month(s) of birth of all adults in their household.

Apart from these respondents, another fifth (18.5%) lived in a multiple-adult household and reported information that indicated that there was another adult born in a month more recent to the survey's field period. Therefore, these persons were "selected" by mistake. Comparing these 278 "incorrect" respondents to the 512 "correct" respondents in multiple-adult household yields an accuracy-of-selection percentage of 65% (278/790). Comparing the 278 incorrect respondents to the 512 and 330 (one-adult households) "correct" respondents yields an accuracy-of-selection percentage of 75% (278/1120). Unlike the assumption made by O'Rourke and Blair (1983), we do not assume that all those in the "indeterminant" category were necessarily the correct adult in their household. However, if they were, the accuracy-of-selection percentage would increase to 80% (278/1418).

In sum, this test of the accuracy of the last-birthday method in leading to the selection of the correct adult within the household suggests that in as many as one in four cases, it appears not to work.

As shown in Table 3, it is especially interesting to observe the reported months of birth of those persons in the correct, indeterminant, and incorrect categories. First, it can be noted that the group that was correctly interviewed shows an extreme skew in months of birth toward those months immediately prior to the field period months (March and April). Second, 42% of the indeterminant group reported birthdays in the months of the field period, suggesting that a good portion of this group may have been accurately selected. Finally, the compelling conclusion to be drawn from the distribution of birthdays reported by the incorrect group is that many of them appear to have been the ones in their households with the *next* birthday, not the last

birthday. If this in fact explains many of the incorrect category, it is possible that they fairly represent a random distribution (i.e., probability sample) of next-birthday respondents.

Table 4 presents the demographic make-up of the three groups. Overall, there is little demographic difference among the three groups in terms of gender, age, race, and education. There was a nonsignificant difference of note on Hispanic origin, with those in this category constituting a larger proportion of the incorrect category. This could well signal a cultural difference in understanding the concept of a *last* birthday. In terms of household income, those in middle income categories were slightly (but significantly;  $p < .04$ ) more prevalent in the incorrect category. Why this pattern should appear is not obvious. Finally, region of the country showed a distinct and significant ( $p < .01$ ) pattern of differences, with those in the South making up a disproportionately larger share of the incorrect and indeterminant categories and those in the Midwest constituting a disproportionately larger share of the correct category. Given that the interviewing for this national survey was conducted from a facility in Illinois (a Midwestern state), these differences are noteworthy.

The 1992 national survey was part of a larger evaluation study of a national anti-crime public service advertising media campaign sponsored by the U.S. Department of Justice. As such, the substantive focus of the survey was on crime-related variables. Data from each of the groups tested in this paper were compared on several of the major substantive variables. Overall, there were few significant differences across the groups in the any of the substantive measures. None of the differences was large in absolute size.

## DISCUSSION

This paper has presented evidence which suggests that the last-birthday method leads to the correct eligible being interviewed in most (i.e., 75%-80%), but not all, cases (cf. Lavrakas, 1993). In both the 1990 and 1992 surveys, the greatest proportion of respondents reported birthdays occurring in months immediately prior to the field period, as was found in previous research. However, in the 1992 national survey it was shown that those respondents who were "correctly selected" by the last-birthday method had an extremely skewed distribution of reported birth months, whereas those who were "incorrectly selected" had an oppositely skewed distribution of reported birth-months the direction of which suggested that they may have been the ones in their household with the *next* birthday.

It can be noted that the 1992 study is the first to report this type of information on a national U.S. sample of adults whose households were reached via RDD. The few previous studies on this general topic have presented findings that are generally consistent with our findings, but using local/regional samples of the public.

**TABLE 2**

Categorization of 1992 Survey Respondents  
(N = 1,500)

	Frequency	Relative Frequency
Reported Single Adult Household:		
Correct Respondent Selection	330	22.0%
Reported Multiple Adult Household:		
Correct Respondent Selection	512	34.1%
Indeterminant	298	19.9%
Incorrect Respondent Selection	278	18.5%
Incomplete Birthday Data	82	5.5%
<b>TOTALS</b>	<b>1,500</b>	<b>100.0%</b>

**TABLE 3**

Reported Month of Birth for Respondents in 1992 Survey  
By Selection Accuracy Status

Month of Birth	Percentage Reporting Each Month		
	Correct	Indeterminant	Incorrect
January	16.4	9.1	3.6
February	18.2	6.4	0.7
March	15.4	18.8	0.0
April	0.4	22.8	6.1
May	0.0	4.7	16.9
June	2.0	5.0	11.9
July	3.3	4.7	14.4
August	4.3	6.0	14.0
September	7.6	5.4	10.8
October	8.2	4.4	9.4
November	9.0	7.0	7.6
December	15.2	5.7	4.7

**TABLE 4**

## Demographic Characteristics By Selection Accuracy Status

Demographic	Percentage		
	Correct	Indeterminant	Incorrect
<b>Gender:</b>			
Female	52.1	53.7	54.3
Male	47.9	46.3	45.7
<b>Age:</b>			
18-29	20.4	23.4	19.2
30-44	38.4	38.6	37.7
45-59	25.7	21.7	26.8
60 and Older	15.5	16.3	16.3
<b>Race/Ethnicity:</b>			
Black	9.8	10.8	8.4
White	86.3	85.0	87.5
Other	3.8	4.2	4.2
Hispanic Origin	4.9	5.7	8.6
<b>Education:</b>			
Not H.S. Grad	8.5	10.6	11.2
H.S. Grad, No College	33.4	30.9	32.4
Some College	27.3	30.2	29.1
College Grad	30.7	27.9	27.3
<b>Income:</b>			
Less than \$10,000	8.4	9.5	4.7
\$10,001-\$20,000	10.7	14.5	11.2
\$20,001-\$40,000	27.7	26.4	30.7
\$40,001-\$60,000	20.9	22.3	22.7
\$60,001-\$80,000	13.3	7.4	6.9
More than \$80,000	9.2	10.8	10.5
<b>Region:</b>			
Northeast	21.9	19.5	19.1
Midwest	21.9	14.4	13.7
South	36.1	42.3	45.3
West	20.1	23.8	21.9

If it is true that most of those who are "mis-selected" by the last-birthday method are themselves a random sample of those with next birthdays, it could be argued that the end result, despite the mistakes in selection, yields an overall within-unit probability sample of adults. There was evidence that this may be occurring, at least to some extent. On the other hand, other evidence suggests some systematic sources of error associated with the incorrect selections; for example, those associated with Hispanic origin, income, and region of residence.

This last point (i.e., region) is especially interesting as it suggests that more care should be taken in: 1) making certain that the household informant understands what the interviewer is saying when using the selection technique; and 2) that an interviewer verifies that the respondent is in fact the correctly selected household member. This concern for careful selection must be balanced against not making the selection sequence overly invasive, which is a reason that the birthday technique has been attractive to many surveyors.

The 1992 study also suggests that the mistakes in selection may be associated with biased measures in some substantive variables, albeit quite small in magnitude in this study. However, considerable additional methodological research will be needed before one can be confident of the likely magnitude of these errors across different variable domains and thus the effect of the birthday methods on Total Survey Error (cf. Groves, 1989).

Based upon the present findings we suggest that survey researchers should be confident that the birthday selection technique will work with enough accuracy to continue with its use. To the extent that measures can be built into a study to test the accuracy of respondent selection -- and in the future we would recommend measuring exact month and day of birth -- researchers can estimate possible bias that within-unit respondent mis-selection may be contributing to their study.

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