Public Opinion Quarterly, Vol. 72, No. 1 2008, pp. 114–124

HOW TOO LITTLE CAN GIVE YOU A LITTLE TOO MUCH

DETERMINING THE NUMBER OF HOUSEHOLD PHONE LINES IN RDD SURVEYS

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Abstract Accurately assessing the number of household phone lines in random-digit dialed (RDD) surveys for use in weighting has become more complicated over time. This study evaluates phone line weighting by asking an in-depth battery of seven questions designed to measure the number of available land lines in the home more precisely. The results show that this weighting correction is not so simple, and that inadequately parsing the type and use of household phone numbers produces an inaccurate weight. Failing explicitly to remove irrelevant phone numbers, especially cell phones, produces a larger-than-appropriate weighting adjustment. Potentially more important on a practical level is that, when done correctly, and even when "overdone," phone line weighting had little impact across a diverse set of opinion and demographic variables.

In random-digit dialed (RDD) telephone surveys, households that can be reached on more than one phone line have a greater chance of being sampled. Survey methodologists recommend weighting by the inverse of the number of household phone lines to adjust for these differing probabilities of selection (e.g., Kalton 1983; Massey and Botman 1988; Lavrakas 1993; Czaja and Blair 1995).

Accurately assessing the number of household phone lines in RDD surveys has become more complicated over time because of their increasing use for purposes other than noncommercial verbal communication, such as faxes, modems, and home-based businesses. The issue is further complicated by the use of cell phones, which are excluded from the RDD sampling frame.

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doi:10.1093/poq/nfn004 Advanced Access publication February 1, 2008

There is a dearth of published research exploring how the number of phone lines should be measured and its consequences in weighting. We contacted a diverse group of survey organizations to find out how they operationalize this measure (see Appendix A for examples). Some instruct respondents not to count extra phone lines used for faxes, modems and businesses. Other researchers go a step further and tell respondents not to count cell phones.[1]

This study evaluates phone line weighting by asking an in-depth battery of seven questions designed to measure the number of available land lines in the home more precisely. The questions isolate the number of phone lines on which the household could have been reached by explicitly ruling out cell phones and lines that would not have been answered (e.g., those used for faxes, modems, businesses, etc.). Ultimately, and potentially of more practical significance, we also explore the implications of phone line weighting by looking at the impact of weights from these different approaches on a diverse set of attitudinal and demographic survey questions.

Methodology

The data for this study are from an ABC News/Washington Post poll conducted by telephone from December 12 to 15, 2002, among a national random sample of 1,209 adults ages 18 and over. Sampling and data collection were conducted by TNS of Horsham, PA. The response rate was 31 percent.[2]

A sample of telephone households in the continental United States was selected via RDD. Interviewers were asked to speak to the household member aged 18 or over at home who had the last birthday. To compensate for the fact that women tend to be easier to reach, in-house selection was stratified by sex, with interviewers asking to speak with the male household member 75 percent of the time and the female 25 percent of the time. If a person of the selected sex was unavailable, the interviewer was asked to speak with the person of the other sex who had the last birthday.[3]

Seven questions were included to try to get a precise measure of the number of phone numbers in the household (see Appendix B). Eighty-one percent of respondents were asked only the first question because they had only one phone line in the household. Eight percent of respondents were asked a total of three

1. The organizations we contacted were promised anonymity as a condition of providing information on their number-of-phone-lines questions.
2. Computed using AAPOR rate RR3: completed interviews/[(completed interviews + partial interviews) + (refusals + noncontacts + other) + e^* (unknown households + unknown other)]. We set e at .20 based on estimates from previously published RDD telephone surveys with similar field period lengths (Keeter et al. 2000, 127).
3. This respondent selection approach yielded a sex distribution of 52 percent women and 48 percent men.

questions and another 11 percent were asked four questions. This comes to an average of 1.3 questions per respondent.[4]

These questions were used to compute three phone weights. First is the "uncorrected" weight, computed using one question and a follow-up simply asking how many phone numbers serve the household (Q43 and 44), without instructing respondents to rule out irrelevant numbers.

Second is the "partially corrected" weight, computed by taking the number used in the uncorrected weight and further subtracting the number of fax, computer, business lines or other persons' private lines (Q46, 48, and 49).

Third is the "fully corrected" weight which additionally removes cell phones (Q45 and 47). This should be regarded as the most appropriate measure of phone numbers for use in weighting.

The three phone weights were computed for each respondent by taking the reciprocal of the obtained number from each of the approaches.[5]

Results

ESTIMATING NUMBER OF PHONE LINES

This study finds that the uncorrected and partially corrected approaches lead to a significant overstatement of the number of multiple phone line households. The estimate from the fully corrected approach is just under half the size of the other two. Most of the overstatement is the result of respondents counting cell phones, with the rest coming from the inclusion of irrelevant household numbers such as faxes and modems.

The uncorrected approach estimates that 19 percent of households have multiple lines. Partially correcting this number by removing fax, computer, business or other persons' private lines reduces the estimate slightly, to 17 percent. The fully corrected number, taking out cell phones, reduces it to 8 percent (figure 1).

In other words, 428 multiple phone numbers (i.e., numbers in addition to the one the respondent was talking on at the time) were identified in the uncorrected approach. But more than two-thirds of these numbers (69 percent) were inappropriate for use in weighting: 53 percent were cell phones and

4. This study isolated the number of relevant phone lines for weighting purposes using seven questions. An open issue for future research is whether a single question, explicitly listing the various types of irrelevant phone numbers, works as well as the more specific probing approach used in this study. However, even if a single question were workable, administering a single, longer question would be no less time consuming than administering seven short questions, where 81 percent of respondents get asked only the first one.

5. The analyses reported in this paper were conducted using the raw data, not weighted to Census demographics, because the purpose is to compare the pure impact of different phone line weighting approaches rather than to estimate population parameters. The results are similar using the demographically weighted data.

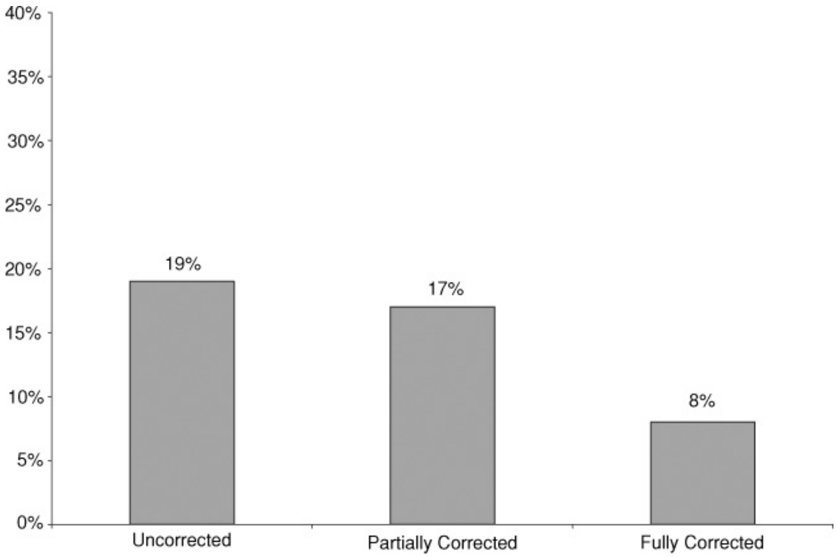

Figure 1. Estimates of Multiple Phone Line Households.

16 percent were for faxes, modems, etc. Only 31 percent of them were bona fide household numbers on which the respondent could have been reached in an RDD sample.

Cell phones are not part of the RDD sampling frame and should not be counted in the number of household phone lines, but this is not always apparent to respondents. These findings highlight the importance of explicitly telling respondents not to include cell phones when reporting the number of household phone lines. This can be easily accomplished by a minor change in question wording. Questions that don't do this (e.g., see top section of Appendix A) are likely to lead to a significant over-counting of multiple phone line households.

IMPACT OF WEIGHTING ADJUSTMENTS

The overstatement of relevant phone lines in the uncorrected and partially corrected approaches suggests that these will produce larger-than-appropriate weighting adjustments. Next we examine the actual impact of these weights on survey estimates.

Weighted marginals for all questions in the survey were produced for each of the three phone line weights derived from these approaches, and then compared to the unweighted marginals. The absolute deviation was computed for each response category in a given question; these were then averaged to obtain the mean absolute deviation for each question.

These comparisons were made for 92 survey questions. The vast majority of these were opinion questions, including presidential approval and other

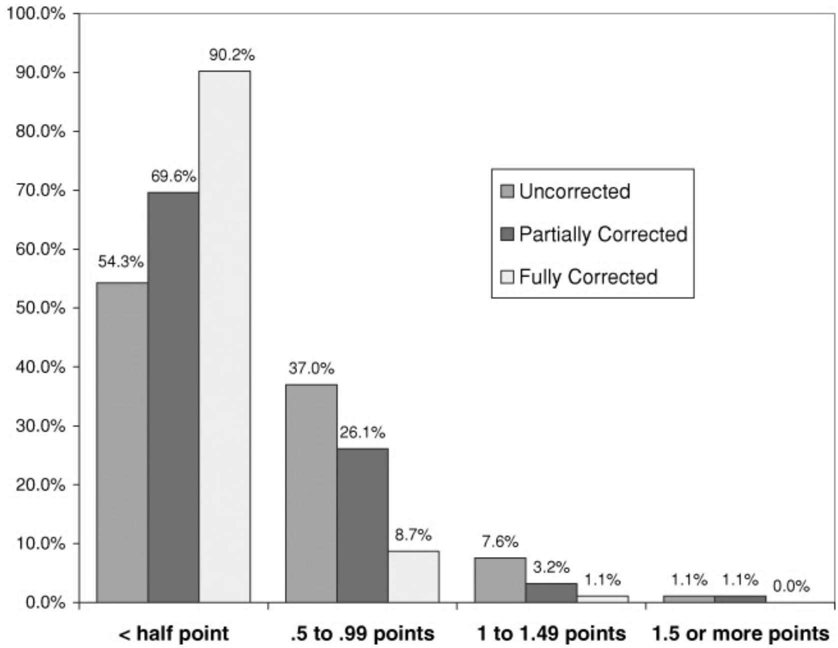

Figure 2. Change in Question Marginals after Applying Phone Line Weights.

assessments of the president and his administration, issue priorities, assessments of the political parties, and views on military action against Iraq, terrorism, the economy, and sexual abuse of children by priests. Demographics included age, race, sex, education, income, and religion.

As expected, the data show that failing explicitly to exclude irrelevant phone lines leads to a greater weight adjustment than is appropriate, with most of this effect caused by the inclusion of cell phones (figure 2). Compared with the unweighted data, the uncorrected phone line weight changed 46 percent of the individual survey question results by one-half of one percentage point or more, and the partially corrected phone line weight changed 30 percent of the question results by a half-point or more – but the fully corrected phone line weight changed just 10 percent of the question results by that much.[6] For the fully corrected weight, the average adjustment was one-quarter of a percentage point compared with .48 for the uncorrected and .41 for the partially corrected versions (figure 3).

Even more striking is the lack of any substantive impact of any of the three versions of phone line weights across this wide range of opinion and demographic questions. When the phone weighting is done properly, taking

6. The largest change for any question in this study was 1.7 percentage points in the uncorrected scenario.

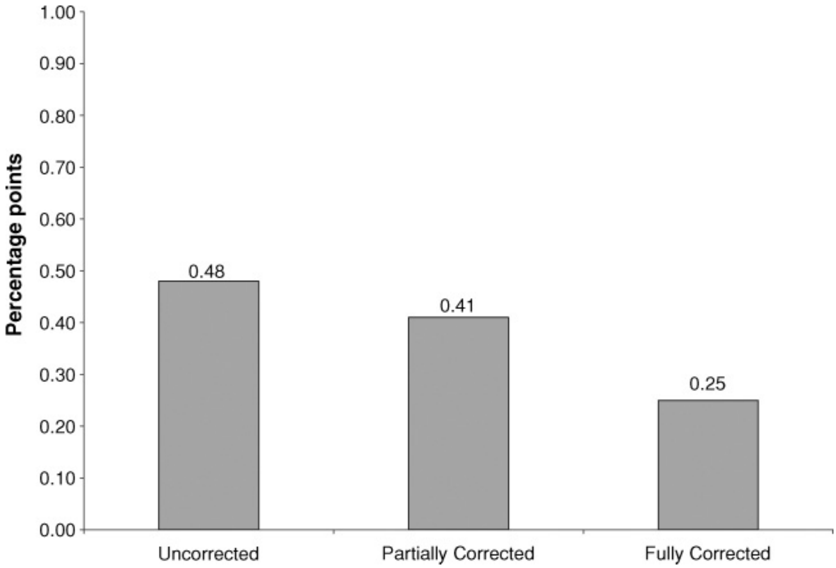

Figure 3. Mean Change in Question Marginals after Applying Phone Line Weights.

Table 1. Impact of Phone Line Weighting on Household Income

Phone line weighting	Yes[a] (%)	No (%)
Less than $30,000	26.1	25.1
$30,000 to $49,999	22.2	21.8
$50,000 to $74,999	22.0	22.0
$75,000 or more	29.7	31.1

[a]Fully corrected version.

out all irrelevant numbers, this study's marginals barely move. Indeed, even when the too large weights are used, the effect on the data is small.

To better demonstrate the practical impact of phone line weighting, consider the variable that had the largest adjustment, household income. Income provides insight into the upper bounds of phone weighting adjustments since few opinion variables are strongly correlated with phone line ownership.

Indeed, across the 92 survey questions studied, the largest impact of phone line weighting for any response category was for household incomes of $75,000 or more. But even here the practical impact was quite small: 31 percent were in the highest income group with no phone line weighting, compared with nearly 30 percent after the fully corrected weighting was applied (table 1).

Discussion

This study investigates phone line weighting in an RDD survey and finds that inadequately parsing the type and use of household phone numbers produces an inaccurate weight. Failing explicitly to remove irrelevant phone numbers, especially cell phones, produces a larger-than-appropriate weighting adjustment. Potentially more important on a practical level is that, when done correctly, and even when overdone, phone line weighting had no substantive impact across a diverse set of opinion and demographic variables.

These findings are based on the results of a single survey and therefore should not be taken as a call to abandon the practice of phone line weighting. Future research should work on identifying the types of variables for which phone line weighting does and does not make a difference. In addition, the findings in this study are from an opinion poll with a relatively short field period, typical of other such media and public polls. The field would benefit from future research looking at the impact of phone line weighting on other types of surveys.

Appendix A: Examples of Phone Line Questions

QUESTIONS THAT RULE OUT FAX, COMPUTER, AND/OR BUSINESSES, BUT NOT CELL PHONES

1. Besides the telephone number I reached you on, how many other telephone numbers, if any, does your household have that I could have reached you on? Please do not include telephone numbers or phone lines that are dedicated to a fax machine, computer, or modem.
   Source: Commercial research firm.
2. How many different telephone numbers are there in your home – not counting those used only for a fax machine or computer?
   Source: University.
3. How many different residential phone lines do you have coming into your house? (IF MORE THAN ONE:) We need to record how many different residential phone lines you have in your household – that is, the number of different phone numbers that are used by adult members of your household. Please do not count phone lines that are used primarily for business purposes or for electronic equipment – such as computers and fax machines. How many residential phone numbers are there in your household?
   Source: Polling firm.
4. Do all the telephones in your home have the same number, or do you have more than one telephone number in your home? (IF MORE THAN ONE:) Altogether, how many different telephone numbers are there in your home? How many of these are for business, fax, or computer modem use only?
   Source: University.

QUESTIONS THAT RULE OUT FAX, COMPUTER, AND/OR BUSINESSES, AND CELL PHONES

1. How many telephone numbers does your household have that you receive calls on? Please do not include cell phones or phone numbers that are used only for computers or fax machines.
   Source: Commercial research firm.
2. Not including cell phones, do all of the telephones in your household have the same telephone number, or does your household have more than one telephone number? (IF MORE THAN ONE:) Not including cell phones, how many DIFFERENT TELEPHONE NUMBERS come into your household? Please include any numbers used for receiving phone calls, but do not include numbers used exclusively for computers or fax machines.
   Source: University.
3. How many different telephone numbers do you have in this household? Do not count any numbers that are used only for fax machines, computers, business numbers, or extensions that use the same number. Also do not count cell phones.
   Source: University.
4. Now I dialed you at [PHONE NUMBER], how many other numbers are there in your home? (IF ONE OR MORE:) Are any of those other phone numbers portable cell phones you use when you're not at home, or beeper numbers, or lines that are primarily used for a computer, a modem, or a fax? (IF YES:) Specify if cell phone, beeper, computer, modem, and/or fax.
   Source: Media pollster.

APPENDIX B: QUESTIONS USED TO DETERMINE PHONE NUMBERS IN THE HOUSEHOLD

43. For statistical purposes, how many telephone numbers serve your household that I could normally reach you on at this time of day – just this one, or are there any others?

($n = 1{,}209$)		
80%	1 Just this one	SKIP TO Q50
19	2 More than one	ASK Q44
0	8 DK/no opinion	SKIP TO Q50
1	9 NA/refused	SKIP TO Q50

ASK IF Q43 = 2, MORE THAN ONE PHONE LINE
44. How many, NOT INCLUDING the number we're talking on now?

IF THEY SAY ZERO (NONE OTHER THAN THE LINE THEY ARE ON) SKIP TO Q50.

IF THEY SAY ONE, ASK Q45. IF THEY SAY >1, ASK Q47.

($n = 234$)	
53%	1
28	2
8	3
5	4
3	5
2	6

ASK IF Q44 = 1

45. Is that other phone number a cell phone, or not?

($n = 125$)		
53%	1 Yes	SKIP TO Q50
47	2 No	
0	8 DK/no opinion	SKIP TO Q50
0	9 NA/refused	SKIP TO Q50

ASK IF Q45 = 2

46. Is that a separate phone number that rings in your household and that I could normally reach you on at this time of day, or is it normally used for other things – like a fax, computer, business line, or someone else's private line?

($n = 58$)		
62%	1 Separate phone number	SKIP TO Q50
38	2 Normally used for other things	SKIP TO Q50
0	8 DK/no opinion	SKIP TO Q50
0	9 NA/refused	SKIP TO Q50

ASK IF Q44>1

47. Of the (# from Q44) telephones that serve your household, how many of those are cell phones, if any?

IF ANSWER TO Q47 = ANSWER TO Q44 SKIP TO Q50.

($n = 109$)	
24%	0
23	1
40	2
10	3
2	4
1	5

ASK IF (Q44 – Q47 = 1)

48. Is that other one a separate phone number that rings in your household and that I could normally reach you on at this time of day, or is it normally used for other things – like a fax, computer, business line, or someone else's private line?

($n = 39$)		
51%	1 Separate phone number	SKIP TO Q50
46	2 Normally used for other things	SKIP TO Q50
3	8 DK/no opinion	SKIP TO Q50
0	9 NA/refused	SKIP TO Q50

ASK IF (Q44 – Q47 > 1)

49. How many of those are separate phone numbers that ring in your household and that I could normally reach you on at this time of day, meaning they're not normally used for other things – like a fax, computer, business line, or someone else's personal line?

($n = 42$)	
10%	0
24	1
36	2
19	3
5	4
7	5

References

Czaja, Ronald and Johnny Blair. 1995. *Designing Surveys: A Guide to Decisions and Procedures*. Thousand Oaks, CA: Pine Forge Press.

Kalton, Graham 1983. *Introduction to Survey Sampling*. Newbury Park, CA: Sage.

Keeter, Scott, Carolyn Miller, Andrew Kohut, Robert M. Groves and Stanley Presser. 2000. "Consequences of Reducing Nonresponse in a National Telephone Survey." *Public Opinion Quarterly* 64:125–48.

Lavrakas, Paul J. (1993). *Telephone Survey Methods: Sampling, Selection and Supervision*. Newbury Park, CA: Sage.

Massey, James T. and Steven L. Botman. 1988. "Weighting Adjustments for Random Digit Dialed Surveys." In *Telephone Survey Methodology*, eds. R. M. Groves et al. New York: Wiley.