

EFFECTS OF TELEPHONE TECHNOLOGIES AND CALL SCREENING DEVICES ON SAMPLING, WEIGHTING AND COOPERATION IN A RANDOM DIGIT DIALING (RDD) SURVEY

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The National Household Education Survey (NHES) is a household survey sponsored by the National Center for Education Statistics (NCES). The survey is a random digit dial (RDD), computer-assisted telephone interview (CATI) and has been conducted in the spring of 1991, 1993, 1995, 1996, 1999, and 2001. A special study of adults (Adult Special Study) was conducted in conjunction with the NHES:1999. One of the main goals of the Adult Special Study was to gather information on telephone technologies that could affect survey response rates or weighting procedures.

In recent years, advanced telephone technologies have become more commonplace in households and could potentially affect sampling procedures and response rates in telephone surveys like the NHES. Such technologies include cellular telephones, modems for personal computers, fax machines, answering machines, voice mail, and caller identification (caller ID). The Adult Special Study included questions designed to examine two general issues pertaining to telephone technologies:

1. To what extent are non-standard telephone technologies, such as cellular telephones and telephone numbers for modems or fax machines, reported as household telephones?
2. To what extent do telephone technologies such as answering services and caller ID effect the ability to obtain cooperation in telephone surveys?

The first issue has implications for sampling and weighting procedures. The number of household telephone numbers reported by respondents is used to determine the household's probability of being selected for the sample and for the development of sampling weights. The Adult Special Study questions ascertained whether cellular telephone numbers and additional telephone numbers for modems or fax machines were in the household, whether respondents reported cellular telephone numbers and additional telephone numbers for modems or fax machines to be "for home use," and whether household members ever answer these additional telephone numbers.

Telephone technologies that could affect responsiveness to the NHES include answering services and caller ID. Questions in the Adult Special Study

asked whether they are used to "screen" calls; that is, to see whom is calling and then decide whether or not to answer. In the NHES:1999, answering machine messages explaining the purpose of the study were left periodically. If any such messages were left in Adult Special Study households, additional questions were asked. These questions were used to determine whether the respondent heard the message itself or heard about the message from some other household member, and to determine whether the message had any influence on the decision to respond to the study. When Westat contacts a household with caller ID, depending on the communication among the local telephone companies, there are three possibilities: Westat and the telephone number are displayed, only the telephone number is displayed, or "unavailable" is displayed.

Of course, the persons answering the Adult Special Study questions had already cooperated with the study, and thus, did not represent people who used answering machines or caller ID to avoid participating. Nevertheless, these items provide a starting point for assessing the impact of telephone technologies on national telephone surveys.

Survey Methodology

The sampling method used for the NHES:1999 was a list-assisted method described by Casady and Lepkowski (1993). This method was used previously in the NHES:1995 and the NHES:1996. The list-assisted method is a single-stage, unclustered method that produces a self-weighting sample. A simple random sample of telephone numbers is selected from all telephone numbers that are in 100-banks (the set of numbers with the same first 8 digits) in which there is at least one residential telephone number listed in the White Pages directory. For the NHES:1999, the sample of telephone numbers was first stratified by minority status of the exchange. Telephone numbers in high-minority exchanges (defined as those exchanges in which at least 20% of persons are black or at least 20% of persons are Hispanic) were sampled at a rate twice that of those in low-minority exchanges. To account for the differences in probabilities of selection of telephone numbers based on minority stratum, households in the low minority stratum were given a weighting factor of two, while households in the high minority stratum were assigned a weighting factor of one.

The Adult Special Study of the NHES:1999 sampled civilian, noninstitutionalized adults who were

age 16 and older and not enrolled in elementary or secondary school. A household screener was administered to a member of the household age 18 or older to collect the information required for sampling about each household member. Data collection took place from January 3 through April 3 of 1999. For more details about the NHES:1999, see Nolin, et al. (2000).

The respondent to the Adult Special Study was the sampled adult him/herself; multiple attempts were made to complete interviews with persons not available at the time of selection. Interviews were conducted in both English and Spanish. This report is based on the 1,082 completed Adult Special Study interviews. The overall response rate for this survey was 57 percent.¹ This response rate accounts for nonresponse to both a screener used to identify and sample eligible household members and an extended interview conducted with the sampled adult.

Current Research

There has been some recent investigation into some of the issues assessed in the Adult Special Study, in particular, the effect of answering machines and caller ID on response in RDD surveys.

Tuckel and Feinberg (1991) was one of the first studies to address the use of answering machines and the resulting influence on telephone surveys. It was discovered that answering machine households are still accessible to survey researchers. This conclusion was reached by showing that the proportion of first call attempts that received answering machine dispositions fell well below the national proportion of households with answering machines. In addition, many interviews were completed in answering machine households, contact was made with the majority of households where there was an answering machine, and the contact rate overall was better than for households with no answer or busy signals.

Tuckel and O'Neill (1995) revealed that at that time, about 52 percent of households in the U.S. had an answering machine. Ownership was found to be more prevalent among whites in higher income families with higher education levels. Call screening increased from 38 percent to 48 percent between 1989 and 1992. However, it was found that not all call screeners are unable to be contacted or refuse to participate in telephone surveys. Generally, the increase in the

¹ The response rate was computed using response rate 4 in The American Association for Public Opinion Research, 2000, *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys*, Ann Arbor, Michigan: AAPOR, with the parameter e (which denotes the proportion of cases of unknown eligibility assumed to be eligible) equal to 0.405.

prevalence of answering machines as well as in call screening should alert telephone researchers to the possible consequences regarding response.

A study by Tuckel and O'Neill (1996) further investigated the use of caller ID for screening purposes. They classify users as "connectors," who wish to remain in better contact with the public, and "cocooners," who use the device to screen unwanted calls. It was found that caller ID is used most frequently to identify numbers of annoying callers. In addition, about 75 percent of caller ID owners also own an answering machine, thereby giving telephone researchers at least a means for contacting the household. Finally, caller ID subscribers were found to have more favorable attitudes towards telephone surveys than the sample as a whole. The majority of subscribers were found to be connectors and not cocooners.

Findings

Additional Telephone Numbers and Cellular Telephone Usage. Because a household was sampled for the NHES:1999 through its telephone number(s), its probability of selection was determined by the probability of selection of the telephone number(s) in the household. In addition to the minority stratum weighting factor described above, an adjustment factor of 1/2 was assigned to households with more than one residential telephone number. The weight could be modified by a factor equal to the reciprocal of the number of residential telephone numbers in the household, but the adjustment by a factor of 1/2 is thought to be somewhat better.²

With the recent increase in cellular phone usage and the more common instance of multiple telephone numbers within a household, creating these weighting adjustments becomes a more complicated issue. Since cellular telephone numbers are generally excluded from sampling frames for RDD studies, the multiple telephone weighting adjustment should not be applied to account for telephone numbers assigned to cellular telephones. In contrast, if a household has computer or fax machine telephone numbers that are answered by household members, the weight for that household should include the multiple telephone number adjustment. The Adult Special Study attempted to capture relevant information on cellular telephone ownership and usage. Additionally, this study

² Massey and Botman (1988) note that the factor of 1/2 rather than the number of telephone numbers has less of an effect on variances while resulting in little additional bias; furthermore, the factor of 1/2 safeguards against over-adjusting for respondents who misinterpret the question to pertain to the number of telephone lines rather than the number of telephone numbers.

endeavored to determine the proportion of households with computer or fax numbers that are answered and the effects that the appropriate weighting adjustments for such households have on survey estimates.

In the NHES:1999, the multiple telephone number adjustment was based on the household respondent's response to the question "How many of these additional telephone numbers are for home use?" (This question was asked only if the respondent reported having additional telephone numbers in the household.) However, in the Adult Special Study interview, additional information about the assignment and usage of these additional telephone numbers was captured through a series of additional questions. This information could be used in computing the multiple telephone number weighting adjustment.

Estimates pertaining to additional telephone numbers in a household, including cellular phones and computer or fax machines, are given in Table 1. Overall, about 7 percent of households reported that they have more than one telephone number. Six percent of households reported having one additional number and 2 percent reported two or more additional numbers. Households that reported having additional phone numbers received the standard weighting adjustment.

Forty-four percent of households reported having a cellular telephone or a telephone number that is used for a computer or fax machine. Three percent included this cellular telephone, computer, or fax number in the count of additional telephone number, but should *not* have. These individuals received a weighting adjustment for having multiple telephone numbers when in fact they only ever answered one phone number. One percent did not include the computer or fax number in the count of additional numbers, but *should* have. These individuals did not receive a weighting adjustment for multiple telephone numbers but should have. These findings suggest that an assessment of the effect the weighting adjustments have on the estimates may provide useful information.

Overall, about 41 percent of households reported having a cellular telephone. Only 4 percent of the 41 percent of households reporting having a cellular telephone included a cellular phone in the count of additional phone numbers. Fourteen percent of households reported having a telephone number used for a computer or fax machine. Thirty-five percent of the 14 percent who have a telephone number used for a computer or fax machine answer this particular telephone number at least some of the time. Sixty-one percent of the 14 percent who have a telephone number used for a computer or fax machine included this number in the additional phone number count.

Answering Machine and Caller ID Usage. An issue of increasing concern due to its effects on the response rate in telephone surveys is the increased usage of answering machines and/or caller ID devices in order to screen phone calls. Household members may not answer if the caller ID device displays an indication of an unknown number, thereby making it more difficult to obtain completed surveys from these particular households. The Adult Special Study examined this issue by asking respondents whether they have one or both of these screening devices, whether they use them, and the frequency of their use. It is worth noting that there are limitations to this analysis since the data used are from respondents, who are likely to differ from nonrespondents in their call screening practices. However, the data collected in the Adult Special Study provide valuable insight into call screening practices.

Estimates pertaining to answering machine and caller ID usage are given in Table 2. Overall, about 81 percent of households have a call screening device (either an answering machine or a caller ID device) and nearly half of all households screen calls at least some of the time. Of households with a call screening device, 24 percent of households use it some of the time, 19 percent most of the time, and 15 percent all of the time.

At the Screener level, about 44 percent of households received an answering machine message briefly describing the NHES:1999 study and asking for participation. Eleven percent of households that received a message reported being more willing to participate as a result of the message, while only 4 percent reported being less willing to participate as a result of the message.

The second part of the table gives estimates related to the effort involved in obtaining responses from the households. The average number of call attempts to complete the NHES:1999 Screener was computed for households that screen phone calls and for households that do not screen phone calls. The average number of call attempts was higher for households that reported screening calls using a caller ID device or an answering machine. For households that screen calls at least some of the time, an average of 5.1 call attempts was needed to complete the Screener, while for households that do not screen calls, an average of 4.5 call attempts was needed. This suggests that as the use of call screening devices is becoming more prevalent, more effort is required to achieve high response rates in telephone surveys.

Recommendations

The Adult Special Study analysis of telephone usage and technologies indicate some important results

that have implications for future NHES surveys. Additionally, some of the recommendations may be applied to other RDD surveys.

The results indicate that asking additional questions to obtain information about the assignment and usage of telephone numbers in each household could prove beneficial. Two types of errors may occur in determining the number of telephone numbers in a household: either the respondent reports that there is only one phone number in the household but there is actually more than one, or the respondent says that there is more than one phone number but only one is actually used for residential purposes and answered. In the first instance, the respondent answers “no” when asked about additional phone numbers. However, the Adult Special Study has shown that respondents do not always include computers and/or fax machine numbers in the count of phone numbers. Additional questions such as, “Did you include computer and/or fax machine numbers in the count of additional phone numbers?” followed with “If we had called this number, would someone have answered it?” would capture important information about phone numbers in the household that could be used in the weighting adjustments. Similarly, households that indicate that they have more than one telephone number could be asked whether the additional telephone number is ever answered by anyone in the household. The weighting adjustment could be based upon the response to this question.

Based on the above recommendations, the NHES:2001 survey was modified to better address the telephone technology data. Several of the NHES:1999 telephone technology questions were re-worded to capture more relevant information, and some questions were added. For example, respondents were first asked if they have additional numbers for home use, not including cellular phones. Additionally, they were specifically asked if they answered any additional computer or fax lines for talking.

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Table 1. Estimates pertaining to additional telephone numbers and cellular phone usage

Characteristic	Estimate	s.e.
Number of households (thousands)	103,462	1,363
Households with multiple telephone numbers		
Households with more than one residential phone number	7%	0.7%
Households with exactly one additional number	6	0.7
Households with exactly two additional numbers	2	<0.5
Of households with multiple telephone numbers		
Exactly 0 additional residential numbers	41	5.9
Exactly 1 additional residential number	46	5.0
Exactly 2 additional residential numbers	10	2.5
Three or more additional residential numbers	3	1.2
Households with cellular telephones and/or telephone numbers used for computers or fax machines		
Households with a cellular telephone and/or a telephone number used for computer or fax machine	44	1.6
Included a cellular, computer, or fax number in the count of additional numbers but SHOULD NOT HAVE	3	0.4
Did not include a computer or fax number in the count of additional numbers but SHOULD HAVE	1	0.4
Households with cellular telephones or telephone numbers used for computers or fax machines		
Households with cellular telephone	41	1.6
Of households with cellular phone, included cellular telephone in the count of additional numbers	4	0.9
Households with a telephone number used for computer or fax machine	14	1.1
Of households that have a computer or fax number, answer that number		
Yes or Sometimes/maybe	35	3.8
No	65	3.8
Of households with computer or fax number, included that number in the count of additional numbers	61	4.5

NOTE: s.e. is standard error.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), Adult Education Interview and Adult Special Study, spring 1999.

Table 2. Estimates pertaining to answering machine and caller ID usage

Characteristic	Estimate	s.e.
Number of households (thousands)	103,462	1,363
Call screening practices		
Households with a call screening device	81	1.5
Of households with a call screening device, frequency of call screening		
Always use call screening device	15	1.3
Most of the time use call screening device	19	1.6
Sometimes use call screening device	24	1.6
Never use call screening device	42	2.1
Answering machine messages and willingness to complete survey¹		
Households that received an answering machine message	44	1.7
Of households that received an answering machine message		
Did not know about or hear the message	37	2.6
Received an answering machine message and were more willing to complete survey as a result	11	1.6
Received an answering machine message and were less willing to complete survey as a result	4	1.0
Received an answering machine message with no difference in willingness to complete survey	48	2.6
	Estimate	s.e.
Average number of call attempts.....	4.8	0.2
Average number of call attempts, households that screen calls ²	5.1	0.3
Average number of call attempts, households that do not screen calls.....	4.5	0.3

¹ In the remaining 15 percent of households in which an answering machine message was left, the Adult Special Study respondent had not heard or been told of the message.

²Households that always, most of the time, or sometimes use screening devices.

NOTE: s.e. is standard error.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Household Education Survey (NHES), Adult Education Interview and Adult Special Study, spring 1999.