

FURTHER RESEARCH ON THE USE OF DATA ON INTERRUPTIONS IN TELEPHONE SERVICE

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Introduction

Households that are without telephone service for long periods differ from those with continuous telephone service. These differences have implications for researchers who rely on telephone survey methods to study low-income populations.

Historically, a major concern of telephone surveys has been sample frame coverage. Currently, however, well over 90 percent of households in the United States have a working telephone on any given day (Tucker, 1998). Many surveys now consider the exclusion of households without telephones to be unimportant given the cost of including them. Nonetheless, there are studies for which the omission of households without telephones causes concern. Appreciable bias will result if the excluded group comprises a large enough proportion of the study population and differs in important ways from the included group. Bias is more likely to result when study variables are correlated with factors (e.g., income) that are also associated with the likelihood of being included (having telephone service).

Three sections follow: background, analysis, and conclusion. The background for the present study includes a brief discussion of previous research and a description of the survey used in the analysis. The analysis section presents two sets of comparisons: households experiencing telephone service interruptions with those reporting no interruption; households reporting service interruptions in an inperson survey with similar ones from a telephone survey.

Background

Previous Studies. While many survey researchers and statisticians speak of telephone and nontelephone households, we know that having or not having telephone service is seldom a permanent state. Almost all households suffer an occasional interruption: when they move, or due to storms or equipment failure. Conversely, most households without service at any point in time have had service at sometime in the last year. Knowledge of the transiency of telephone coverage has led to efforts to use data on telephone service interruption to adjust for telephone survey under coverage (Brick et al., 1995). We also know that most if not all segments of the US population are represented among households with

generally uninterrupted telephone service. Thus, some telephone surveys try to compensate for the lack of coverage by post-stratifying on characteristics that are correlated with presence of a telephone in the household. These characteristics include race, ethnicity, education and income (Tucker, 1998, Giesbrecht, et al., 1996).

The paper by Brick, et al. (1995) and an earlier paper by Keeter (1992), describe efforts to estimate the coverage of telephone samples, present data on the phenomenon of transiency, and suggest possible weighting adjustments to telephone survey data based on reports of interruptions in telephone service. My research focuses on the question of how completely data obtained in a telephone survey on interruption in telephone service corrects for under coverage. In doing so I compare results from a telephone survey and an in-home survey conducted to supplement the telephone survey.

Description of the Survey from which Data are Used. The data for this paper come from a survey with two components: a telephone component including 26,277 households sampled using random-digit-dialing (RDD) methodology, and an inperson component with 453 households. All households in the inperson component reported a recent interruption in telephone service. The survey was conducted by Mathematica Policy Research for the Center for Studying Health Systems Change (CSHSC); the study is funded by the Robert Wood Johnson Foundation. Data were collected between August, 1996 and July 1997.

The bulk (90 per cent) of the RDD interviews were conducted in 60 sites, which were selected with probability proportional to size (PPS). The 60 sites comprise a national multi-stage sample. Twelve randomly selected sites (referred to below as high-intensity sites) have an allocation of sample large enough to allow precise site specific estimates (an average of 965 households), while an average of 250 households per site were interviewed in the remaining 48. The remainder of the RDD interviews were conducted as part of a stratified random sample of telephone households designed to supplement the 60 site sample and increase the precision of national estimates. More details about the design can be found in Metcalf, et al. (1996).

Since the survey is conducted as part of a study of changing patterns in health systems, one of the focuses in the household survey was on health insurance. Within households, health insurance units were formed, and

separate interviews conducted with each unit. The insurance units frequently correspond to the Census definition of a family unit, although many adults who are related to other adults in the household are treated as single person insurance units. As part of the RDD survey, data were collected about: each interviewed household's number of telephones; whether the household had experienced an interruption of two weeks or more in telephone service in the last 12 months and if so, how many months the household had been without service; and the major reason for any interruption.

The inperson interviews were conducted in the 12 high intensity sites; these sites were randomly selected from the 48 sites comprised of MSAs that in 1992 had a population of at least 200,000 persons. The inperson sample was selected using an area probability frame, with PPS selection of listing/interviewing areas (IAS) within the 12 sites. IAS were defined as groups of Census block groups and were assigned measures of size (MOS) based on the number of estimated households not having telephones at the time of the 1990 Census. We selected 96 interviewing areas, allocating them among the 12 sites in rough proportion to each site's estimated prevalence of households not reporting telephones at the time of the 1990 Census. Within each site, we excluded block groups with very low estimated prevalence of households without telephones. In sampled interviewing areas, we listed housing units and screened them for recent interruptions in telephone service. We attempted to interview households that reported an interruption of at least two weeks between the beginning of the field period and the time of screening. To test comparability with the Census question about currently having a telephone, we also asked for presence of a working telephone at the time of screening. As expected, one survey's eligibility criterion correlated highly, but not perfectly with presence of a working telephone at the time of screening: 95 per cent of those with no working telephone on the day of screening were eligible, compared to four percent of others. During the interview with the inperson sample we asked how many months of the last 12 the household had been without service. Because of software constraints (interviews used computer-assisted methods), other questions about telephone service included in the RDD survey were not asked.

Analysis

The remainder of this paper describes those households with telephone interruptions and compares those with interruptions identified in the telephone survey component with those found in the inperson component. Dimensions on which comparisons are made include

length of interruption, income, and race/ethnicity. Tests of significance were t-tests based on standard errors adjusted for design effects. The design effects were estimated using a generalized variance function.

Comparisons of Households With and Without Interruption in Telephone Service. As indicated in Table 1, three percent of households in the RDD component reported having a telephone service interruption of two weeks or more in the previous 12 months. Over half of interruptions were reported to have lasted two months or less, and only six percent lasted more than nine months. The prevalence of interruption was higher in the small metro and nonmetropolitan sites than in other sites. The mean length of interruption was 3.1 months. Those in metropolitan sites with larger population (including high-intensity sites) were more likely to have short periods (two months or less) of interruption.

As expected, the households with interruption in telephone service reported lower levels of income than those with no reported interruption. Of those reporting an interruption, a third reported annual income of \$10,000 or less; of households with no interruption only 12 percent reported income in that range (Tables 2 and 2A). Further, those with more lengthy interruptions were more likely to report low incomes.

Tables 2 and 2A (for high-intensity sites) also present comparisons by length of interruption of race/ethnicity, numbers of health insurance units, and persons, and presence of a household member 65 years or older. The proportions Black and Hispanic were higher among households with interruptions than among those reporting no interruption. There is no clear pattern of ethnic distribution by length of reported interruption. Households with phone service interruption were also more likely to report multiple health insurance units or to have larger numbers of household members. Among those reporting interruptions those with the shortest periods of interruption were least likely to reside alone. This is consistent with the observation on presence of a person age 65 or older in the household, where only seven percent of those with an interruption of two months or less had a member in this age range compared to nine percent of all those reporting an interruption and 21 percent of those with no reported interruption.

Of those reporting an interruption, half gave cost as the main reason. Approximately one quarter mentioned a move as the reason for being without service, with 15 percent giving personal preference and 10 percent service not being available. Those with the shortest interruptions (less than two months, were more likely to cite a move or service not available (29 and 18 percent respectively) than were those with the longest periods (10-12 months)

among whom less than eight percent gave either of those reasons.

Comparison of Inperson and Telephone Components. Those in the inperson sample (all of whom had some interruption in telephone service) tended to have lower incomes and longer reported periods of service interruption than those in the RDD sample who reported telephone service interruption. Table 3 presents mean lengths of reported service interruption for the inperson sample.

The mean and median length of compared interruptions are six months, compared to a mean of 3.2 and a median of 2.0 for the portion of the RDD sample in the high-intensity site that reported some interruption. The inperson sample were much more likely to report lengthy interruptions, with 37 percent reporting interruption of 10 to 12 months, compared to eight percent of those in the RDD sample in the same sites.

Table 4 presents the characteristics of the inperson sample overall and by length of interruption, allowing comparison with the RDD sample. Compared to the RDD sample who report any telephone service interruption the households in the inperson sample are more likely to report incomes of less than \$10,000. Similarly, they are more likely than their RDD-identified counterparts to be Black or Hispanic, and to live in single person households.

Conclusion

Let me begin by offering a few caveats. The inperson sample is small, clustered in 12 sites and by design excludes up to 20 percent of the potentially survey-eligible households (those in areas with very low prevalence of households without telephones).

Nonetheless, the analysis presented above suggests: first, households with no interruption in service differ from those reporting some degree of interruption; second, that those households that report interruption in telephone service in a telephone survey differ in important ways from the population of all households experiencing significant interruption in service (or not having service at all).

In the RDD survey, households reporting interruptions in service of more than six months are relatively rare (less than 15 percent of all reporting an interruption or less than half a percent overall). This implies that in surveys with a 1,000 or fewer cases, there may be no reports of long interruptions. This is significant because households with longer interruptions seem to differ in important ways from those with brief interruptions. Such differences may be large enough to make a difference in some studies, especially if the study

is focused on low income individuals. We hope weighting can correct for the difference, but as Brick, et. al. (1995) point out, the increase in variance due to weighting may offset reduction in bias.

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TABLE 2A

RDD SURVEY INCOME, ETHNICITY, AND OTHER CHARACTERISTICS BY INTERRUPTION IN TELEPHONE SERVICE
(HIGH-INTENSITY SITES ONLY)

	No Interruption (n=11,280)	Any Interruptions (n=292)	Of Those With Any Interruption, Those With Interruptions Lasting:			
			Less than 2 Months	3-6 Months	7-9 Months	10-12 Months
Income						
Less than 10,000	11.2	31.1*	23.7	42.6	9.6	62.2
10,000 to 40,000	42.4	48.3*	45.6	50.3	66.5	37.8
Over 40,000	46.4	20.6*	29.7	7.1	23.8	0.0
Race/Ethnicity						
Non-Hispanic/White	73.8	57.9*	59.2	56.0	60.3	53.0
Non-Hispanic/Black	10.3	17.8*	15.2	23.1	15.1	20.5
Hispanic	9.4	17.0*	16.9	14.3	17.0	26.4
Other	6.5	7.3	8.7	6.6	7.6	0.0
Number of Insurance Units						
1	82.1	69.2*	61.4	82.3	66.3	82.2
2	14.9	22.9	29.1	14.5	14.9	14.7
3 or more	3.0	7.9	9.5	3.2	18.8	3.1
Presence of Person 65 or Older						
Yes	19.7	9.3*	7.6	17.2	4.1	0.0

*Differences between group reporting and those not reporting interruption significant at $\alpha \leq 0.05$.

TABLE 3

LENGTH OF REPORTED INTERRUPTION FOR FIELD (INPERSON) SAMPLE
(n = 453)

Months of Interruption	Percent
2 or less	35.7*
3-6	24.3
7-9	2.4
10-12	37.6*
Mean	6.0*
Median	6.0*

* Difference between this sample and the subgroup of RDD sample in the same sites, with some interruption in service is significant at $\alpha \leq 0.05$.

TABLE 1

PERCENT OF RDD SAMPLE REPORTING INTERRUPTION AND LENGTH OF INTERRUPTION, BY SAMPLE

	High-Intensity Sites	Other Metropolitan with 1992 Population Over 200,000	Metropolitan with 1992 Population 200,000 or Less or Nonmetropolitan	Supplementary Sample	Total RDD
Percent Reporting Interruption	2.6	2.6	4.4*	2.5	3.0
	(n=11,572)	(n=8,808)	(n=2,905)	(n=2,697)	(n=26,277)
Of Those Reporting Interruption: Months of Interruption					
2 or less	57.3	57.5	51.6	51.8	54.7
3-6	27.3	29.6	31.8	38.3	31.1
7-9	7.0	7.3	9.5	8.2	8.1
10-12	8.4	5.2	7.2	1.7	6.1
	(n=292)	(n=232)	(n=137)	(n=67)	(n=728)
Mean	3.2	3.1	3.4	3.1	3.1
Median	2.0	2.0	2.0	2.0	2.0

*Difference between types of sites significant at $\alpha \leq 0.05$.

TABLE 2

INCOME, ETHNICITY, AND OTHER CHARACTERISTICS BY INTERRUPTION IN TELEPHONE SERVICE

	No Interruption (n=25,549)	Any Interruptions (n=728)	Of Those With Any Interruption, Those With Interruptions Lasting:			
			Less than 2 Months	3-6 Months	7-9 Months	10-12 Months
Income						
Less than 10,000	12.2	33.7*	25.1	39.2	55.4 ^b	53.2 ^b
10,000 to 40,000	44.0	51.2*	53.2	53.0	37.6	41.6
Over 40,000	42.8	15.1*	21.7	7.8	7.0	5.2
Race/Ethnicity						
Non-Hispanic/White	75.6	58.4*	59.9	54.9	57.8	64.1
Non-Hispanic/Black	10.5	21.1*	19.1	24.9	20.4	20.9
Hispanic	7.7	13.6*	13.0	15.0	11.3	15.0
Other	6.2	6.9	8.0	5.2	10.5	0.0
Number of Insurance Units						
1	83.2	69.8*	60.8	81.2	80.4	78.1
2	14.3	23.2	30.4	14.1	12.6	19.0
3 or more	2.5	7.0	8.8	4.7	7.0	2.9
Presence of Person 65 or Older						
Yes	21.4	9.1*	6.8	13.3	14.9	0.0

*Differences between those reporting and not reporting interruption significant at $\alpha \leq 0.05$.

^bDifferences based on length of interruption (over 6 months versus less than 6 months) significant at $\alpha \leq 0.05$.

TABLE 4

INPERSON SAMPLE: INCOME, ETHNICITY, AND OTHER CHARACTERISTICS
BY INTERRUPTION IN TELEPHONE SERVICE

	Total	Those With Interruptions Lasting:			
		Less than 2 Months	3-6 Months	7-9 Months	10-12 Months
Income					
Less than 10,000	41.1	28.1	35.7	26.3	57.1 ^b
10,000 to 40,000	49.5	59.4	55.7	55.6	36.4
Over 40,000	9.5 ^a	12.4	8.6	18.1	6.4
Race/Ethnicity					
Non-Hispanic/White	38.0 ^a	26.8	45.0	46.5	43.5
Non-Hispanic/Black	42.7 ^a	58.6	38.2	37.3	30.8
Hispanic	12.5	8.3	32.3	12.3	16.6
Other	6.8	6.3	4.5	3.9	8.9
Number of Insurance Units					
1	69.8	71.1	64.4	68.3	72.3
2	23.6	23.7	31.2	31.7	18.0
3 or more	6.6	5.2	4.4	0.0	9.7

^aDifference compared to RDD sample (with interruptions) in same sites is significant at $\alpha \leq 0.05$.

^bDifference between this group and those with briefer interruptions is significant at $\alpha \leq 0.05$.