

AN INVESTIGATION OF RESPONSE IN A TELEPHONE SURVEY  
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One of the major concerns in any survey is the proportion of respondents who agree to participate in the survey. During the past several years the response rates achieved in telephone surveys have received considerable attention. In many cases telephone survey response rates have been compared to the response rates achieved with other modes of data collection such as face-to-face or mail surveys. At the National Center for Health Statistics (NCHS) most of our attention has been focused on analysis of the differences between response rates achieved with a telephone survey and those achieved with a face-to-face survey. The results of one such study are being presented at these meetings by Cannell, Groves, and Miller. The purpose of this paper, however, is to take a more in-depth look at the response rates achieved in a telephone survey in order to better understand the various reasons for nonresponse and to evaluate its impact on our survey results.

The results reported in this paper represent the findings from a random digit dialed telephone survey on cigarette smoking conducted by NCHS during 1979. The telephone numbers were randomly generated using the procedure described by Waksberg (1978). During the survey period approximately 6570 households were contacted and all adult members in these households who were 17 years old or older were asked to participate in a short interview (7 minutes) on cigarette smoking. The respondent rule of interviewing each adult separately about themselves is somewhat different from the respondent rule used in most telephone surveys. In most telephone surveys described in the literature a respondent rule such as a random or designated respondent in each household has been used. When every adult is eligible to be interviewed the calculation of a response rate becomes more complicated. In some households, all respondents are either interviewed or not interviewed, while in other households a subset of the members may be interviewed. In the partially completed households a person may directly refuse to be interviewed or another person may refuse to ask the respondent to come to the phone (proxy refusal). In addition, some persons in partially completed households may not be interviewed for reasons other than refusal (language barrier, too ill, hearing problem, etc.) For the cigarette survey some 10,795 persons were interviewed. In addition to examining the overall household and person response rates, this paper evaluates the effect of callbacks to the initial nonrespondents or noncontacted persons, the characteristics of the initial and followed-up respondents, the response rates for subdomains of the population, and the difference in response rates among interviewers.

#### Household and Person Response

Because of the household self-respondent rule used in the cigarette study the response rate can be approximated in a number of different ways. Nine different estimators were developed by NCHS and are described in a paper by Fitti (1979). The

different estimators reflect the unknowns associated with a telephone survey, such as the proportion of households among the "ring no answers" and the actual number of persons in households that refuse before the household composition can be determined. For this paper the following definitions were used to estimate the overall survey response rates:

Household Response Rate =

$$\frac{\text{Number of households with 1 or more interviews}}{\text{All in-scope households} + \text{ring no answers}}$$

Person Response Rate =

$$\frac{\text{Completed HH's} + \text{partially completed HH's} \times P}{\text{All in-scope households} + \text{ring no answers}}$$

P = proportion of eligible adults interviewed in the partially completed households.

The overall household response rate was 81.3 percent while the estimated person response rate was 74.1 percent. The response rates are similar to response rates achieved in other telephone surveys. If a random respondent per household had been selected, we suspect that the response rate would have been between 74 and 81 percent.

#### Effect of Callbacks on Response

One method that is often used to improve response in surveys is a series of callbacks to households or persons who were not interviewed on the initial survey attempt. The effects of callbacks on the response rates have been extensively studied for face-to-face and mail surveys and have been studied by O'Neil (1979), among others, for the telephone survey. In the study reported by O'Neil, persuasion letters were sent to respondents before a second telephone contact was attempted. In our study the telephone numbers resulting in non-interviewed households or persons were "recycled" from one to four weeks after the initial outcome. Numbers which never resulted in a contact were also recycled. These callbacks were randomly distributed among interviewers, who did not refer to the original interview attempt during the callback introduction. Figure 1 shows the distribution of outcomes on the second contact for four different types of initial outcomes: partially completed households, initial household refusals or breakoffs, potential interview households (households with persons who were not interviewed because of "not at home" or "not now, call again"), and ring no answers (numbers which were never answered on the initial dialings).

About one-third of the households that were partially completed on the initial interview attempt were completed through callbacks. That is, all of the adults who were not interviewed in these households on the initial attempts were later interviewed in the follow-up attempts. The

remaining partially completed households on the initial attempts remained partially completed, although a few more individuals were interviewed in these households. The callbacks to the initial refusals and breakoffs resulted in interviews in 35 percent of the households. Interviews with all adults in a household were completed almost one-fourth of the time. These results clearly indicate that the callbacks were successful in obtaining a significant number of additional interviews. No further callbacks were attempted when persons refused for a second time.

Interviews were later obtained in 50 percent of the households where no one was ever at home or the person answering the telephone responded "not now, call again" on the initial interview attempts. These callbacks were more successful than callbacks to the initial refusals or breakoffs. In many cases it appears that the response "not now, call again" is a polite refusal. Many of these households will continue to resist interview attempts, but are more likely to later participate in the survey than are the initial direct refusals or breakoffs.

Four percent of the originally dialed telephone numbers were never answered and were assigned to the category "ring no answer" (the 7 percent figure shown in Table 1 for "ring no answer" represents a percent of household numbers). The ring no answers were dialed a total of 11 times before receiving a final disposition. The fifth call in this sequence was made to the telephone company business office to determine whether the number was a working residential number. If the number was determined to be a working number, the dialings were continued through the eleventh dialing unless a contact was made prior to the eleventh dialing. The same call rule was used for the follow-up callbacks except for the call to the telephone company business office. Of the ring no answers that were followed-up in a second interview attempt about 28 percent resulted in a household contact, 35 percent were identified as a non-household number, and 36 percent remained in the "ring no answer" category (see Figure 1). It is interesting to note that the household nonresponse rate for the recycled ring no answers is larger than the household nonresponse rate for the households contacts on the initial interview attempts (30 percent versus 22 percent). These nonresponse rates were approximated by dividing the number of households where no interviews were completed by the total number of households excluding ring no answers. One explanation is that persons who are more difficult to contact by telephone are slightly less likely to agree to participate in an interview survey.

Table 1 shows the effect of callbacks on the total response rate. It should be noted that not all of the potential callbacks were followed-up. An operational decision was made not to recycle any telephone number when more than four weeks had elapsed from the time of the original disposition of the number. Because of delays in the data processing of the original dialings the acceptable survey period did elapse for some of the numbers which were eligible to be recycled. In a few additional cases the interviewer supervisor made a decision not to recycle very adamant initial refusals. By recontacting 61 percent of the potential callbacks, the overall response rate was

increased by 7 percent. The household response rate increased from 74 percent to 81 percent while the person response rate increased from 67 percent to 74 percent.

As expected, the most difficult type of outcome to convert to an interview are the households classified as initial refusals. In these households the person answering the telephone states that no one in the household is interested in the survey even before the interview can begin. In order to take a closer look at the initial refusals they were classified according to the time of day they were initially contacted for the survey. It was hypothesized that persons refusing during the hours they were busiest with other things, such as dinner, might later be more willing to cooperate. Table 2 shows the results of the analysis. All adults were interviewed in a follow-up attempt in 30 percent of the households that initially refused after 6 P.M. while the conversion rate for initial household refusals between 12 and 4 P.M. was only approximately 15 percent. No special effort was made to schedule the second contact at a different time from the first contact. This does appear to support the hypothesis stated above. Although the pattern remains the same for households which were later partially completed, the results are somewhat harder to analyze.

It was stated earlier that the second interview attempts were initiated between 1 and 4 weeks after the first outcome (the time between contacts could be longer than 4 weeks). In an earlier telephone survey the second contacts were made from 2 to 7 days after the initial refusal. This created a number of problems. The worst was the number of potential respondents who felt they were being harassed. The interviewers were also more reluctant to make the second contact. Waiting at least one week between callbacks significantly reduced these problems. Because of this experience it was hypothesized that the longer one waits between follow-up contacts the better the conversion rate. Table 3 indicates that this is not true. The initial refusals recontacted between one and two weeks were just as likely to complete an interview on the follow-up contact as the refusals contacted more than two weeks later.

#### Characteristics of Respondents

The major concern about high nonresponse in sample surveys is the potential for a nonresponse bias. That is, the nonrespondents in a survey may not have characteristics similar to the respondents and therefore the survey estimates may not reflect the characteristics of the target population. The higher the nonresponse rate in a survey the greater the risk of having a non-response bias. In most surveys there is no procedure for approximating the characteristics of the nonrespondents. One method that has some times been used is to examine the respondents who refused to participate in the survey on the initial contact, but were later persuaded to participate. O'Neil used such a technique to estimate the nonresponse bias in a telephone survey. It is reasoned that the respondents who initially resisted will be more like the non-respondents than the respondents who cooperated on the first contact.

Table 4 shows the percentage distributions for selected demographic characteristics for both the initial respondents and the respondents who were interviewed in a follow-up interview. The distributions show some marked differences. A much larger percent of the followed-up respondents are 65 years old or older. This indicates that older persons are not cooperating as readily as the younger age groups. The overall impact on the demographic distributions is small. This is partially due to an overall response rate of around 80 percent and partly due to the percentage of refusals who were followed-up. The possibility of a nonresponse bias exists, however, whenever the dependent survey variables are related to age.

Because of the way the smoking survey was conducted some demographic information was obtained for a subset of the nonrespondents. In the households that were partially completed the age and sex was obtained for each member of the household from the first responding adult. Thus, in these households the age and sex was obtained for persons who were not interviewed. In Table 5 the age and sex distributions for initial respondents, followed-up respondents, and a subset of the nonrespondents in the telephone survey are compared to the age and sex distribution obtained in the face-to-face National Health Interview Survey (NHIS). The comparison was restricted to NHIS respondents with telephones. Again, it is clear that persons over 65 years of age are under-represented among the initial respondents in a telephone survey. The followed-up refusals who were interviewed have a slightly greater proportion of persons 65+ than do the non-respondents in partially completed households. The distribution by sex, however, is very different for the followed-up respondents and the subset of nonrespondents. Males are much more difficult to contact than females and seem less likely to be willing to participate in a telephone interview survey than females.

Table 6 presents a comparison of the smoking characteristics for the initial respondents and respondents converted in a follow-up interview for the telephone survey. It appears that in a smoking survey persons who now smoke or who have never smoked are less enthusiastic about participating in the survey than persons who are former smokers. This is further substantiated by the interviewer observation that a number of the proxy refusals (a person who has just been interviewed refuses to ask someone else to the telephone) state that no one else in the household smokes. Although the differences are small, the survey results also seem to indicate that heavy smokers are less likely to participate in a smoking survey and persons with 1 or more quit attempts in the past 12 months are more likely to participate. Thus, it appears that a small non-response bias may exist for the smoking survey.

#### Subdomain Response Rates

By assuming that the nonrespondents in the survey have the same demographic characteristics as the initial resistors who were later interviewed it is possible to estimate the response rates for the demographic subdomains. The response rate for a subdomain, RR(S), can be approximated as follows:

$$RR(S) = \frac{RR(TR) \cdot P(TSR)}{RR(IR) \cdot P(ISR) + 1 - RR(IR) \cdot P(FSR)}$$

RR(TR) = response rate for all respondents

P(TSR) = proportion of all respondents in subdomain

RR(IR) = response rate for initial respondents

P(ISR) = proportion of initial respondents in subdomain

P(FSR) = proportion of followed-up respondents in subdomain.

The estimated subdomain response rates are shown in Table 7 under the column labeled Method A. An alternative method of estimating the subdomain response rates was suggested by Sirken and was presented by Groves, Miller, and Cannell (1981). The alternative response rate for subdomains, RR'(S), is given by

$$RR'(S) = \frac{RR(TR) \cdot P(TSR)}{P(HISS)}$$

P(HISS) = proportion of HIS respondents with telephones in subdomain.

This alternative estimator is presented in Table 7 under the column labeled Method B. Both estimators give consistent results for the age and race subdomains. The estimated response rate for persons 65 years of age or older is approximately 62 percent. This is approximately 16 percentage points below the estimated response rates for persons of age 17 to 44. For the sex and education subdomains the two estimators gave very different estimates of the subdomain response rates. It appears that the respondents converted in follow-up interviews are not like the remaining non-respondents, especially with respect to their sex. Females are more likely to be interviewed on the initial attempt and on subsequent follow-up call-backs. Thus, it was concluded that Method B gives the more consistent estimates of the subdomain response rates. Because of the inconsistencies associated with Method A, it appears that the non-respondents in our telephone survey are not similar in demographic characteristics to the initial resistors who were later interviewed.

Table 7 shows both the estimated subdomain response rates and the proportion of the subdomain (coverage) living in a household with a telephone. The telephone coverage of the U.S. population was given by Thornberry and Massey (1978). The telephone coverage rates in Table 7 have been updated for 1979 using the NHIS results. Using Method B to approximate the survey response rate, the product of the response rate and the coverage rate for a subdomain yields an estimate of the total percent of a subdomain that was surveyed. Some of the results are discouraging. For the subdomain of persons with less than a high school education only 55 percent were surveyed. For persons 65+ only 60 percent were surveyed. Almost all of the elderly have telephones, but as a group they were very uncooperative when asked to

REFERENCES

participate in the survey. The total estimated proportion of the population surveyed is 69 percent. A more detailed analysis of the proportion of the population surveyed was presented by Massey, Barker, and Moss (1979).

Table 8 presents a similar analysis of the estimated coverage and response rates for geographic subdomains. Very few differences were found by Census region or division.

The response rates in a telephone survey before and after follow-up interviews by region are presented in Table 9. The person response rate varies from 71 percent in both Northeastern Divisions to 80 percent in the East South Central Division.

Interviewer Response Rates

A number of studies have shown that response rates can vary significantly among interviewers. For this study we investigated the response rates among the eleven interviewers who contacted 500 or more eligible respondents. The initial response rates were compared along with the response rates obtained in follow-up interviews. Table 10 presents the results from the telephone survey. The initial response rates varied from 65 to 80 percent, while the response rates for follow-up interviews varied from 20 percent to 71 percent. The correlation among the two sets of response rates was .62. This clearly indicates that the interviewers with the best initial response rates also performed best for the follow-up interviews. In order to maximize the final response rate it appears that the best interviewers should be assigned most of the follow-up interviews.

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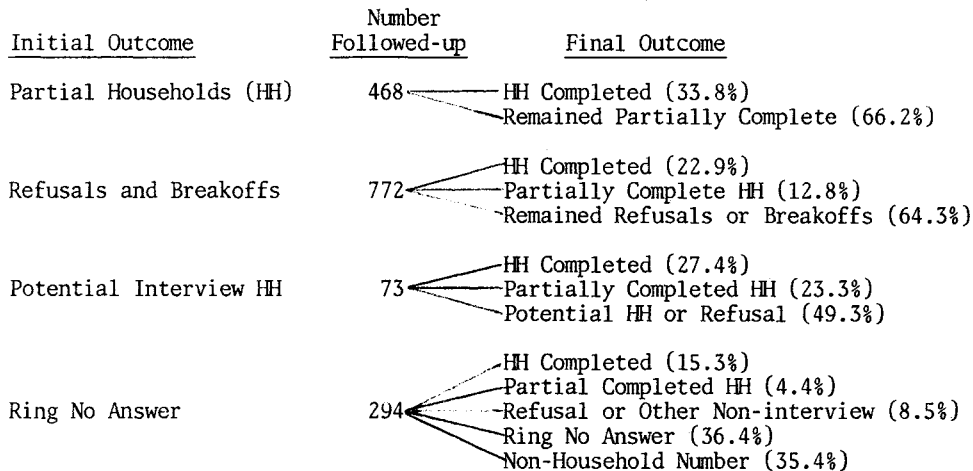


Figure 1. Interview Outcomes for Households Followed-up in a Telephone Survey

Table 1. Response Rates in a Telephone Survey Before and After Follow-up Interviews

Household Outcomes	Before Follow-up	Percent Followed-up	After Follow-up
Completed Households (HH)	59	0	66
Partially Complete HH	15	45	15
Refusals or Breakoffs	15	75	12
Potential HH Interview <sup>1</sup>	1	74	1
Other Non-Interview <sup>2</sup>	3	0	3
Ring No Answer	7	62	3
Overall HH Response <sup>3</sup>	74		81
Overall Person Response <sup>4</sup>	67		74
Households in Sample <sup>5</sup>	6910	61	6773

<sup>1</sup>No eligible person ever at home or "not now, call again"

<sup>2</sup>Hearing, speech, language, or other health problem

<sup>3</sup>Households with one or more completed person interviews

<sup>4</sup>Estimated percent of eligible persons interviewed

<sup>5</sup>Includes Ring No Answers

Table 3. Conversion of Initial Refusals in a Follow-up Interview by Time Elapsed Between Contacts

Time Elapsed (Days)	Sample Size	% of HH's Completed in Follow-up Interview	% of HH's with 1 or More Follow-up Interviews
8-14	61	31	39
15-21	190	23	34
22-28	105	23	36
29+	156	24	38

Table 2. Conversion of Initial Refusals in a Follow-up Interview by Time of Day of Initial Refusal

Time of Day of Initial Interview	Number of Initial Refusals	Initial HH Refusal Rate	% of HH's Completed in Follow-up Interview	Household Conversion Rate
10 - noon	29	9	21	34
noon - 2	31	15	13	19
2 - 4	77	16	16	27
4 - 5	62	22	24	45
5 - 6	58	21	24	41
6 - 7	70	19	29	33
7 - 8	61	19	28	34
8 - 10	77	19	29	42

<sup>1</sup>Monday-Friday only; excludes dialings made before 10 am and unknown time of dialing

<sup>2</sup>The household (HH) refusal rates were approximated by Hollis (1980) from household contacts on the first dialings of telephone numbers.

<sup>3</sup>Percent of initial refusal households with 1 or more follow-up interviews

Table 4. Percentage Distribution of Selected Demographic Characteristics of Initial and Followed-up Respondents in a Telephone Survey

Age, Sex, Race, Education and Income of Respondents	All Respondents <sup>1</sup>	Initial Respondents	Followed-Up Respondents
<b>Total Sample</b>	10,795	10,496	299
<b>Age</b>			
17-24	20.3	20.3	18.7
25-44	40.2	40.5	31.8
45-64	26.7	26.7	27.8
65+	12.8	12.5	21.7
<b>Sex</b>			
Male	44.9	45.1	40.1
Female	55.1	54.9	59.9
<b>Race</b>			
Other than Black	91.7	91.8	89.0
Black	8.3	8.2	11.0
<b>Education</b>			
<12	25.1	25.1	26.8
12	38.7	38.6	41.9
13+	36.2	36.3	31.3

<sup>1</sup>Excludes Unknowns

Table 5. Comparison of Age and Sex Distribution for Initial Respondents, Followed-up Respondents, and Non-Respondents in a Telephone Survey with Respondents in a Face-to-Face Survey

Age and Sex	Face-to-Face Survey Respondents with Telephones	Telephone Survey		
		Initial Respondents	Followed-up Respondents	Non-Respondents in Partially Completed HH's
<b>Total</b>	74,381	10,496	299	1,207
<b>17-24</b>	19	20	19	17
<b>25-44</b>	38	40	32	35
<b>45-64</b>	29	27	28	31
<b>65+</b>	15	13	22	19
<b>Male</b>	46	45	40	64
<b>17-24</b>	19	22	20	17
<b>25-44</b>	39	41	37	33
<b>45-64</b>	29	26	25	34
<b>65+</b>	13	11	18	16
<b>Female</b>	54	55	60	36
<b>17-24</b>	18	19	18	16
<b>25-44</b>	38	40	28	35
<b>45-64</b>	28	27	30	26
<b>65+</b>	16	14	24	23

Table 6. Comparison of Smoking Characteristics in a Telephone Survey for Initial Respondents and Respondents Converted in a Follow-up Interview

Smoking Characteristic	All Respondents	Initial Respondents	Followed-up Respondents
<u>Status</u>			
Present smoker	30.7	30.7	31.1
Former smoker	22.4	22.6	17.7
Never smoked	46.3	46.2	50.8
<u>Average Number of Cigarettes Smoked Per Day</u>			
<15	28.8	28.7	32.9
15-35	55.7	55.9	48.4
35+	15.5	15.4	18.7
<u>Quit Attempts in Past 12 Mos.</u>			
None	69.5	69.4	72.8
1 or more	30.5	30.6	27.2

Table 7. Estimated Coverage and Response Rates in a Telephone Survey for Selected Demographic Subdomains

Subdomain	Percent of Subdomain With Telephone	Estimated Survey Response Rate		Estimated Total % of Subdomain Surveyed
		Method A	Method B	
Total	93	74	74	69
<u>Age</u>				
17-24	89	76	80	71
25-44	93	79	79	74
45-64	96	73	69	66
65+	95	61	63	60
<u>Sex</u>				
Male	92	76	72	66
Female	94	72	76	71
<u>Race</u>				
Other than Black	94	75	75	71
Black	85	67	68	58
<u>Education</u>				
<12	89	72	62	55
12	95	72	75	71
13+	97	77	85	83

Method A - Obtained by projecting the characteristics of resistors in telephone survey to non-respondents.  
 Method B - Obtained by adjusting the distributions within subdomains for telephone survey to NHIS distributions.

Table 8. Estimated Coverage and Response Rates in a Telephone Survey for Geographic Subdomains

Census Regions and Divisions	Percent of Subdomain with Telephone	Survey Response Rate	Total % of Subdomain Surveyed
Northeastern	95	71	68
New England	95	71	68
Mid Atlantic	95	71	68
North Central	96	75	71
East North Central	95	74	71
West North Central	96	75	72
South	90	76	68
South Atlantic	90	76	69
East South Central	88	80	70
West South Central	90	75	67
West	94	73	69
Mountain	93	75	69
Pacific	95	73	69

Table 9. Response Rates in a Telephone Survey Before and After Follow-up Interviews, by Region

Census Regions and Divisions	Person Response Rate <sup>1</sup>		Household Response Rate <sup>2</sup>	
	Before	After	Before	After
Northeastern	64	71	72	79
New England	63	71	72	80
Mid Atlantic	65	71	73	79
North Central	67	74	74	81
East North Central	67	74	73	81
West North Central	68	75	75	82
South	70	76	77	83
South Atlantic	69	76	76	83
East South Central	74	80	82	88
West South Central	68	75	75	82
West	66	73	73	81
Mountain	69	75	77	84
Pacific	66	73	72	80

<sup>1</sup>Estimated percent of eligibles interviewed

<sup>2</sup>Households with one or more completed person interviews

Table 10. Interviewer Response Rates in a Telephone Survey for Initial Household Contacts and Followed-up Non-interviewed Households and Respondents

Interviewer	Response Rates for Initial Contacts		Response Rate for Follow-up Interviews	
	Eligible Persons	Response Rate	Eligible Persons	Response Rate
1	515	76	48	52
2	803	78	144	44
3	730	77	138	37
4	518	79	176	71
5	1254	76	273	47
6	965	75	65	37
7	817	80	208	36
8	840	65	152	20
9	1008	72	224	26
10	925	79	238	25
11	637	72	149	33
Average		75		30