Telephone Coverage and Measurement of Health Risk Indicators: Data From the National Health Interview Survey

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ABSTRACT

Objectives. This study compared health behavior variables for all US households and households with telephones to measure the potential impact of telephone coverage on estimates from telephone surveys.

Methods. Data were derived from the 1991 through 1994 versions of the National Health Interview Survey.

Results. Ninety-five percent of respondents lived in households with telephones. Differences in health indicators were small (<1%) in comparisons between all households and those with telephones. Results were similar when only respondents below the poverty level were included.

Conclusions. Telephone noncoverage effects appear to be small, supporting the use of telephone surveys for health risk behavior surveillance with most population groups. (*Am J Public Health*. 1998;88:1392–1395)

Telephone surveys are commonly used for conducting population-based surveillance and research on health-related knowledge, attitudes, and behaviors. The reasons for the popularity of telephones as a survey mode include the ability to rapidly collect data, substantial cost advantages relative to in-person interviews, and the opportunity to standardize interviewer–interviewee interaction.[1,2] Data from the 1990 census indicate that only 5% of households in the United States were without phones (range: 2.1% in Massachusetts to 12.6% in Mississippi).[3] Telephone coverage is lower for certain population subgroups, particularly persons of lower socioeconomic status,[4] whose health-related knowledge, attitudes, and behavior also may be different. The impact of relying on telephone surveys to measure health factors in population groups is not well documented. We used data from the household-based National Health Interview Survey (NHIS) to compare values for a variety of health indicators for persons living in all households and those living in households with telephones.

Data and Methods

Data were derived from the 1991 through 1994 versions of the NHIS, a continuous, annual, nationally representative household-based sample survey of the civilian, noninstitutionalized US population. Interviews are administered in respondents' homes by US Bureau of the Census interviewers. The NHIS is designed as a core questionnaire for all household members and supplements covering special topics of interest. In order to look at as many health-related variables as possible, we used data from 4 supplements: 1991 Health Promotion and Disease Prevention, 1992 Cancer Control, 1993 AIDS Knowledge and Attitudes, and 1994 Access to Health Care.[5–8] The respondents for these supplements were adults 18 years of age and older living in sample households (either all adults or a subsample, depending on the supplement). Sample sizes for the supplements ranged from 12 035 to 83 719. It has been shown that the response rate for the core NHIS is 95%. Rates for the supplements (e.g., 83% for the AIDS supplement) are lower because of the need to interview the adult selected for the supplement.[9]

Weighting factors, designed according to standard survey research methods to produce unbiased estimates, were used in all the estimates described here.[5–8] Software taking into account the complex design of the NHIS sample was used in estimating standard errors and confidence intervals (CIs).[10]

We also present estimates limited to persons below the poverty level to assess the potential effect of telephone coverage on survey estimates for groups with lower levels of phone ownership. Poverty level is computed for the NHIS based on family size, number of children under 18 years of age, and family income for the previous year, according to criteria determined by the federal government.[11]

Prior to 1994, telephone ownership on the NHIS was based on a question from the household section of the questionnaire (as a means of obtaining the actual telephone number for possible survey follow-up): "What is the telephone number here?" (One possible response is "none.") In 1994, a second question was added: "Is there a working telephone inside your home?" (The addition of the second question did not appear to substantially change reports of telephone ownership; in 1993, 95.7% of respondents reported having a telephone, as compared with 95.3% in 1994.)

Results

The 1994 NHIS results for households (based on the NHIS household data file) were consistent with the census data, indicating that 94.7% of households (95% CI = 94.3%, 95.2%) had telephones. The percentage of

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adult respondents (based on the Access to Health Care Supplement data file) who lived in households with phones was 95% (Table 1). The respondent data indicate that there were some systematic differences in telephone coverage among major population subgroups, but the range of coverage among groups was not large. For example, the percentage was higher in older age groups (97% for respondents aged 65 years and older). By area of residence, coverage was highest in metropolitan areas outside of central cities (97% vs 94% elsewhere). Coverage was 90% among Black and Hispanic respondents, as compared with 97% among Whites. The largest differences involved socioeconomic variables: persons below the poverty level had 83% telephone coverage. Black respondents who were below the poverty level had the lowest rate of coverage in terms of the categories shown in Table 1 (79%).

Differences in health-related variables between all respondents and those with telephones tended to be small, 1.4 percentage points or less for all of the health-related factors included in Table 2. The largest differences were for cholesterol screening (58.6% of all respondents and 60.0% of respondents with phones had ever been tested) and current smoking (25.4% vs 24.4%). All other differences were less than 1 percentage point.

For persons below the poverty level, we found telephone coverage of 83%, indicating that there is a larger potential for noncoverage effects in this group. However, when attention was confined to these respondents, the results were similar to those for all respondents (Table 3). Differences between all households and those with telephones were 1 percentage point or less for most comparisons; the largest differences observed were for current smoking (36.5% for all respondents and 33.3% for respondents with telephones), seat belt use all or most of the time (in front seat; 56.5% vs 58.7%), having no regular health care provider (23.3% vs 22.1%), and having had a proctoscopic exam (23.0% vs 23.9%).

TABLE 1—Telephone Coverage, by Characteristics: 1994 NHIS Access to Health Care Supplement

Category	Respondents, %[a]	95% Confidence Interval	No. Observations
Age group, y			
18–24	92.3	(91.5, 93.1)	10 068
25–44	94.5	(94.1, 94.9)	35 899
45–64	96.7	(96.5, 97.0)	23 181
65+	97.3	(96.9, 97.7)	14 571
Sex			
Male	95.1	(94.7, 95.5)	38 796
Female	95.4	(95.1, 95.7)	44 923
Race/ethnic group			
White	96.8	(96.6, 97.1)	61 773
Black	89.9	(89.0, 90.8)	10 521
Hispanic	89.9	(88.7, 91.1)	8 065
Other	94.0	(91.8, 96.1)	3 360
Region			
Northeast	95.5	(94.9, 96.1)	17 064
Midwest	95.7	(95.2, 96.2)	21 027
South	94.6	(94.1, 95.1)	27 565
West	95.5	(94.7, 96.4)	18 063
Residence			
Metropolitan central city	93.8	(93.2, 94.3)	26 483
Metropolitan outside central city	96.8	(96.4, 97.1)	38 147
Nonmetropolitan area	94.0	(93.2, 94.9)	19 089
Socioeconomic status			
Income <$10 000	83.9	(82.5, 85.2)	7 423
Below poverty	83.0	(81.6, 84.4)	8 403
Less than high school education	90.1	(89.4, 90.8)	16 691
Blacks below poverty	78.7	(76.2, 81.2)	2 263
Total	95.3	(95.0, 95.5)	83 719

[a]Percentage of respondents 18 years of age or older in households with telephones.

Discussion

These findings provide support for the use of telephone survey methods in assessing health-related factors in general population groups. This analysis expands on the work of Thornberry and Massey, who looked at the relationship between telephone ownership and health-related variables estimated from the 1985–1986 NHIS.[4] The degree of bias in surveys that exclude households without telephones is a function of 2 factors: (1) the magnitude of the difference between those owning and not owning telephones in terms of the variable being measured and (2) the magnitude of the percentage of households without telephones. Since Thornberry and Massey's analysis, there have been 2 changes: telephone coverage has continued to increase (from 93% to 95% of US households), and there are now many more health-related variables from the NHIS available for examination. Our expanded results are similar to those for 1985/86 reported by Thornberry and Massey: because phone ownership is so nearly universal, differences are small between the total population and those who have telephones. The NHIS results indicate that, even for those below the poverty level (for whom there was 83% telephone coverage), limiting attention to only those with phones does not seem to affect estimates very much.

Evidence of large differences in health measurements between telephone and nontelephone households has caused some researchers to question the suitability of telephone surveys, particularly for areas that have relatively low rates of phone ownership (e.g., American Indian reservations[12] and inner-city neighborhoods with high rates of injection drug use[13]). Even in these populations, comparisons suggest that, depending on the level of accuracy required, telephone surveys could provide an acceptable tool for public health decision making.[14] Nevertheless, the most extremely impoverished communities will probably require other means of data collection.

There are other differences between household and telephone surveys that may have a greater effect on estimates than the effects of telephone coverage. For example, telephone surveys typically involve a higher level of nonresponse than household surveys such as the NHIS, and the effects of this difference are uncertain. Furthermore, there are effects related to differences in the face-to-face vs telephone mode of interview. The evidence regarding mode effects does not necessarily indicate that telephone interviews involve lower data quality than in-person interviews. Comparative studies have shown the reporting of more visits to health providers[15] and the reporting of more health-related events[16] for telephone than for face-to-face interviews. These differences alone do not prove which interview mode provides data that are closer to the truth. Because there is a tendency for such measures to be underreported (rather than overreported), these results suggest that telephone respondents may actually provide more accurate information than household respondents.

Other potential problems with telephone surveys have to do with obtaining representa-

TABLE 2—Health Indicators: Respondents in All Households and Households With Telephones, From Selected NHIS Supplements

	All Households, % (95% CI)	Households With Telephones, % (95% CI)	Difference
1991 Health Promotion and Disease Prevention Supplement			
Self-assessed health status fair or poor	12.1 (11.6, 12.5)	11.7 (11.3, 12.1)	0.4
Household tested for radon	5.0 (4.5, 5.4)	5.1 (4.7, 5.6)	–0.2
Have been told that blood pressure is high	21.2 (20.7, 21.6)	21.3 (20.8, 21.8)	–0.1
Ever had cholesterol checked	58.6 (57.7, 59.5)	60.0 (59.1, 60.8)	–1.4
Cholesterol tested in past 4 years	55.5 (54.7, 56.3)	56.9 (56.1, 57.7)	–1.4
Have been told that cholesterol is high	15.4 (14.9, 15.9)	15.9 (15.4, 16.4)	–0.4
Have been diagnosed with diabetes (nonpregnancy)	4.0 (3.8, 4.3)	4.0 (3.7, 4.2)	0.0
Wear seatbelt all/most of time in front seat	69.4 (68.5, 70.4)	70.4 (69.4, 71.3)	–0.9
Wear seatbelt all/most of time back and front seat	29.8 (28.8, 30.7)	30.4 (29.4, 31.3)	–0.6
No. observations	43 732	41 116	
1992 Cancer Control Supplement			
All adults			
Overweight based on body mass index	27.0 (26.1, 27.9)	26.8 (25.9, 27.8)	0.2
Smoked 100 or more cigarettes in life	49.4 (48.3, 50.4)	49.0 (47.9, 50.0)	0.4
Current cigarette smoker	25.4 (24.4, 26.3)	24.4 (23.5, 25.3)	1.0
Ever used smokeless tobacco	7.8 (7.1, 8.5)	7.4 (6.8, 8.1)	0.4
Current user of smokeless tobacco	1.8 (1.5, 2.1)	1.7 (1.4, 1.9)	0.2
No. observations	12 035	11 326	
Adults aged 40 and older			
Ever had a digital rectal exam	61.4 (59.7, 63.2)	62.0 (60.3, 63.7)	–0.6
Digital rectal exam in past year	21.4 (20.2, 22.5)	21.7 (20.6, 22.9)	–0.4
Ever had a proctoscopic exam	27.9 (26.6, 29.1)	28.2 (26.9, 29.5)	–0.3
No. observations	6 541	6 289	
Adult women			
Ever had a Pap smear	91.3 (90.4, 92.2)	91.2 (90.3, 92.2)	0.0
Had a Pap smear in past year	43.1 (41.7, 44.5)	43.5 (42.0, 45.0)	–0.4
No. observations	6 981	6 597	
Women aged 30 and older			
Ever had a mammogram	57.6 (55.9, 59.2)	58.3 (56.6, 60.0)	–0.7
Had mammogram in past year	24.1 (22.8, 25.5)	24.6 (23.3, 26.0)	–0.5
Ever had a breast physical exam	90.5 (89.5, 91.4)	90.8 (89.8, 91.8)	–0.3
Had breast physical exam in past year	43.3 (41.8, 44.7)	43.9 (42.4, 45.4)	–0.6
No. observations	5 516	5 274	
1993 AIDS Knowledge and Attitudes Supplement			
Ever tested for HIV, including blood donation	38.2 (37.3, 39.1)	38.0 (37.1, 38.8)	0.3
Self-reported high or medium risk of contracting HIV	5.6 (5.2, 5.9)	5.4 (5.0, 5.7)	0.2
Belief that condoms are very effective	21.2 (20.4, 22.1)	21.2 (20.4, 22.1)	0.0
No. observations	20 607	19 581	
1994 Access to Health Care Supplement			
No regular provider for health care	14.3 (13.7, 14.8)	13.7 (13.2, 14.2)	0.6
No regular provider because no insurance	2.8 (2.6, 3.0)	2.5 (2.4, 2.7)	0.2
Ever needed health care, could not get it	2.7 (2.5, 2.8)	2.5 (2.3, 2.7)	0.2
Ever delayed health care because of cost	9.1 (8.8, 9.5)	8.8 (8.5, 9.2)	0.3
No. observations	83 719	79 632	

Note. Health status was derived from the core questionnaire and may include some proxy responses; all other items were reported by respondents. CI = confidence interval.

tive samples in the face of rapidly evolving telephone technology. Studies have shown that, at least so far, the widespread use of answering machines, for example, does not appear to pose a significant threat to obtaining representative samples through random-digit dialing methods.[17,18]

As stated by Sudman, the question is not whether telephone surveys are adequate but, rather, whether the degree of accuracy provided by telephone surveys is sufficient for making public health policy decisions.[14] The comparisons presented here support the use of telephone surveys in monitoring health-related behaviors in general population groups. Efforts to improve accuracy of estimation and to assess potential biases of telephone surveys need to continue. □

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TABLE 3—Health Indicators: Respondents Below the Poverty Level in All Households and Households With Telephones, From Selected NHIS Supplements

	All Households, % (95% CI)	Households With Telephones, % (95% CI)	Difference
1991 Health Promotion and Disease Prevention Supplement			
Self-assessed health status fair or poor	24.4 (22.7, 26.1)	24.1 (22.3, 26.0)	0.3
Have been told that blood pressure is high	23.0 (21.3, 24.6)	23.6 (21.9, 25.3)	–0.6
Have been told that cholesterol is high	10.9 (10.0, 11.8)	11.7 (10.5, 12.8)	–0.8
Have been diagnosed with diabetes (nonpregnancy)	5.9 (5.0, 6.9)	6.2 (5.2, 7.2)	–0.2
Wear seatbelt all/most of time in front seat	56.5 (53.9, 59.2)	58.7 (56.1, 61.3)	–2.2
No. observations	5271	4222	
1992 Cancer Control Supplement			
All adults			
Overweight based on body mass index	31.5 (28.6, 34.4)	32.2 (29.1, 35.4)	–0.7
Current cigarette smoker	36.5 (33.2, 39.7)	33.3 (30.2, 36.5)	3.1
No. observations	1569	1288	
Adults aged 40 and older			
Digital rectal exam in past year	15.8 (12.6, 19.0)	16.3 (12.9, 19.8)	–0.5
Ever had a proctoscopic exam	23.0 (19.3, 26.8)	23.9 (19.7, 28.0)	–0.8
No. observations	681	593	
Adult women			
Had a Pap smear in past year	38.3 (34.5, 42.0)	38.9 (34.7, 43.3)	–0.7
No. observations	1095	911	
Women aged 30 and older			
Had mammogram in past year	14.7 (11.2, 18.2)	15.5 (11.7, 19.3)	–0.8
Ever had a breast physical exam	82.7 (79.5, 85.8)	82.9 (79.4, 86.4)	–0.3
No. observations	726	615	
1993 AIDS Knowledge and Attitudes Supplement			
Ever tested for HIV, including blood donation	40.4 (37.9, 42.8)	39.4 (36.7, 42.0)	1.0
Self-reported high or medium risk of contracting HIV	8.4 (7.1, 9.7)	8.3 (6.9, 9.6)	0.1
No. observations	2578	2137	
1994 Access to Health Care Supplement			
No regular provider for health care	23.3 (21.9, 24.7)	22.1 (20.7, 23.5)	1.2
Ever delayed health care because of cost	16.4 (15.2, 17.5)	16.3 (15.1, 17.4)	0.1
No. observations	8403	6957	

Note. CI = confidence interval.

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