

Catalogue no. 11-522-XIE

**Statistics Canada International
Symposium Series - Proceedings**

**Symposium 2005 :
Methodological Challenges for
Future Information needs**



2005



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EVALUATING HIGH EFFORT MEASURES FOR STUDYING NONRESPONSE BIAS

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ABSTRACT

One method used to examine the effect of nonresponse involves comparing survey participants who require less effort on the part of the interviewer with those who require more effort. A persistent problem for researchers involves the criteria to use in determining membership in high effort groups. Using data from the Contact History Instrument (CHI) of the 2004 National Health Interview Survey (NHIS), this paper compares more limited definitions of high effort with newer definitions to determine the utility of the more limited definitions.

KEY WORDS: High effort; nonresponse bias; contact history.

1. INTRODUCTION

As is the case in many federal surveys, the nonresponse rates in the NHIS have been rising for the past decade. The NHIS is a general health survey that produces national estimates on health insurance coverage, health access and utilization, health status, and health behaviors conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention. The annual sample consists of approximately 100,000 persons of all ages who reside in approximately 40,000 households that represent the civilian non-institutionalized household population of the United States. Trained interviewers from the U.S. Bureau of the Census conduct the in-person interviews for the NHIS using computer-assisted personal interviewing (CAPI).

Driven both by increased difficulty in contacting respondents and decreased cooperation of many respondents once contacted, the nonresponse rate in the NHIS has risen from a little over 4% in 1990 to over 13% in 2004. While many efforts have been undertaken by field staff to stem these rising rates, survey planners are also looking for ways to understand the effect on survey estimates. Nonresponse is a problem to the extent that it may bias the health estimates generated by the NHIS. Bias results from the combination of two factors: the proportion of nonrespondents and the difference between nonrespondents and respondents on variables of interest. High nonresponse rates are a problem only to the extent that the difference between the respondents and nonrespondents is substantial enough to affect any given estimate. If the difference is small, no discernible bias may exist. The main difficulty in assessing the impact of high nonresponse rates is in getting information from non-respondents: because they don't respond, the impact they have on bias is unknown.

One alternative approach to assessing nonrespondents has been to study the characteristics of those who required more effort to secure their participation in the survey. A sample can be thought of as being composed of three groups: 1) the more willing respondents; 2) the high effort respondents; and 3) the non-respondents. There are various ways to define difficult or high effort households, and those definitions are largely contingent upon the data available to the analyst. Prior to the advent of the collection of detailed contact history data, researchers studying field operations of the NHIS were limited in their ability to construct precise measures of high effort. Presumably, with the availability of more detailed visit attempt records, researchers could construct better measures of effort. Using 2004 NHIS data, this study compares the results obtained using four different measures of high effort: two based on past, more limited definitions, and two based on more detailed contact history data that we began collecting in 2004 (defined below). For each of these four measures of high effort we performed 4 analyses.

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We 1) modeled membership in high effort groups; 2) compared health estimates for high effort households with those of lower effort households; 3) assessed the impact of losing high effort responders in future administrations of the survey on national health estimates; and 4) assessed the impact on data quality as measured by item nonresponse. Four definitions of high effort households were used:

Definition A: The Field Representative (interviewer) recorded 8 or more visits to a household. This first definition is simply based on the number of visits made to a household. This is a popular approach in the literature for defining difficult or high effort households and has been used in past NHIS analyses (labeled here as “**8+ Visits**”).

Definition B: The Field Representative indicated that the household was difficult or that it would be unlikely to participate in a follow-up. In 1998 the NHIS added 2 Likert scales that asked interviewers to rate the cooperativeness and likelihood of future participation for each responding household. Using a combination of these scales, households whose cooperativeness was assessed as poor or very poor and also indicated that they would definitely refuse to participate in a future survey were designated difficult or high effort (labeled here as “**Uncooperative/Unlikely to Participate in the Future**”).

Starting in 2004, NHIS interviewers kept detailed records of each visit they made to a household using a new standardized Contact History Instrument (CHI). Using these records and the dimensions of contactability and cooperation as a guideline for defining nonresponse, we developed 2 more definitions:

Definition C: The Field Representative indicated at least one time in the contact history of the household that the household could potentially be a refusal (labeled here as “**Potential Refusals**”).

Definition D: The Field Representative indicated at least 4 consecutive unsuccessful attempts at making contact with a member of the household before making an actual contact (labeled here as “**4+ Consecutive Noncontacts**”).

Regardless of measure, the percentage of difficult or high effort households is small, ranging from 3.96% (Uncooperative/Unlikely to Participate in the Future) to 6.02% (4+ Consecutive Noncontacts) of the total sample. There was little overlap in these measures: of all the households defined as difficult or high effort for this analysis, 81.4% were high effort on only one measure; 17.1% by two measures, 1.3% by three, and 0.1% by all four.

2. FINDINGS²

2.1 Modeling High Effort Membership

Do high effort populations differ depending on the measure of high effort used? To assess this, we conducted four logistic regressions, each one using a different high effort measure as the dependent variable. Table 1 summarizes the results of these analyses. Some independent variables had consistent effects on the four high effort measures. For example, households (HH) in MSAs had higher odds of being high effort than households not in MSAs, regardless of the high effort definition. Similarly, households where someone had a functional or activity limitation had lower odds of being high effort households, regardless of measure. Nonetheless, there were some distinct, important differences. For example, using the 8+ Visits (A) or the 4+ Consecutive Noncontacts (D) measures, households containing at least one non-working adult had lower odds of being high effort than those that did not have at least one nonworking adult. In contrast, when using the Uncooperative/Unlikely to Participate in the Future (B) measure, households with at least one non-working adult had higher odds of being in the high effort group than households that did not have at least one nonworking adult; but when using the Potential Refusals (C) definition there were no differences in the odds of the household containing at least one non-working adult of being in the high effort group.

² Selected findings are reported here. Fuller results and tables can be obtained by contacting either of the authors.

Table 1: Odds Ratios Predicting Membership in High Effort Groups, NHIS, 2004 (weighted)³

	A ⁴	B ⁴	C ⁴	D ⁴
Someone in the Household Over Age 65				
Yes	0.83	0.82	0.97	0.73*
No (reference group)	1.00	1.00	1.00	1.00
Age Composition of Household				
All under 30	1.21*	0.87	0.69*	1.20*
Some between 30 and 65 (reference group)	1.00	1.00	1.00	1.00
All over 65	0.57*	0.92	1.01	0.75
Race/ethnicity of HH reference person				
Hispanic	1.10	0.98	0.85	0.87
Non-Hispanic Black	1.02	1.30*	0.86	0.94
Non-Hispanic Other (reference group)	1.00	1.00	1.00	1.00
Mostly highly educated person in HH				
< High School	0.77*	1.01	1.05	1.00
High School Graduate (reference group)	1.00	1.00	1.00	1.00
Some college/AA degree	0.89	0.72*	0.98	1.22*
Bachelor's degree or higher	1.02	0.68	0.82*	1.40*
Household Size				
1 person	1.38*	2.52*	1.13	3.07*
2 persons	1.14	1.97*	1.20*	1.78*
3 persons	0.97	1.58*	1.16	1.45*
4 persons (reference group)	1.00	1.00	1.00	1.00
At least one non-working adult in HH				
Yes	0.65*	1.27*	1.11	0.50*
No (reference group)	1.00	1.00	1.00	1.00
Someone in HH a non-citizen				
Yes	1.25*	0.92	0.88	1.05
No (reference group)	1.00	1.00	1.00	1.00
Someone in HH has a functional limitation				
Yes	0.78*	0.58*	0.76*	0.77*
No (reference group)	1.00	1.00	1.00	1.00
Housing Tenure				
Rent/Other	1.32*	1.12	0.98	1.06
Own/buying (reference group)	1.00	1.00	1.00	1.00
Metropolitan Statistical Area (MSA) status				
MSA-central city	1.76*	1.72*	1.99*	1.37*
MSA-non central city	1.37*	1.65*	1.69*	1.24*
Not in MSA (reference group)	1.00	1.00	1.00	1.00
Region of Residence				
Northeast	0.61*	1.00	1.15	1.08
Midwest	0.62*	1.15	1.43*	1.33*
South	0.59*	1.10	0.83*	1.05
West (reference group)	1.00	1.00	1.00	1.00

* p<.05

³ The data source for this and all tables is the 2004 National Health Interview Survey. Data are based on household interviews of a sample of the civilian non-institutionalized population. Age-adjusted estimates are adjusted to the year 2000 standard U.S. population.

⁴ "A" refers to the 8+ Visits measure, "B" to the Uncooperative/Unlikely to Participate in the Future measure, "C" to the Potential Refusals measure, and "D" to the 4+ Consecutive Noncontacts measure in this and all subsequent tables.

2.2 Comparing Health Estimates Between High and Lower Effort Households

Because the primary focus of the NHIS is on health measures, we were interested to see how the high effort households impact health estimates, and whether or not the results differ by high effort measure. For these analyses we focused on a set of the health indicators produced from the NHIS. For each health indicator, we compared high effort and lower effort responders on each of the four measures. For example, we divided the full weighted sample into Potential Refusals cases and the cases that were not Potential Refusals, calculated estimates for each group and conducted two-tailed t-tests to test for significance of the difference between the Potential Refusals cases and the cases that were not Potential Refusals. For example, for hypertension, 20.3% of the Potential Refusals cases had hypertension compared with 25.2% for the cases that were not Potential Refusals, a difference significant at the .05 level. We repeated the analysis 3 times: we divided the full weighted sample into cases that required 4+ Consecutive Noncontacts and those less difficult to contact; into cases that required 8+ Visits and those that did not require 8+ Visits; and finally into those labeled Uncooperative/Unlikely to Participate in the Future and those not identified as Uncooperative/Unlikely to Participate in the Future. For each analysis, we calculated estimates and conducted t-tests at the .05 level.

For each of the 4 measures of high effort, Table 2 indicates for which of the indicators there were significant differences between the high effort and lower effort groups. A “+” indicates that the high effort group had a higher prevalence than the lower effort group, and a “-” indicates the high effort group had a lower prevalence. The absence of a symbol indicates that the difference between the high and lower effort groups was not significant.

Table 2: Comparisons of Measures of High and Lower Effort Groups on Selected Health Estimates, U.S. Adults, 2004 (weighted and age-adjusted).

	A	B	C	D
Psychological Distress			—	—
Diabetes				
Arthritis	—	—	—	—
Hypertension	—	—	—	—
Obesity	—	—		
Physical Activity		—		+
Smoking	—			
Alcohol Consumption		—		+

Regardless of the high effort measure used, persons from high effort households were less likely than their lower effort counterparts to report a diagnosis of hypertension or arthritis. This is in keeping with other reports that higher effort households contain healthier person—which may be because they also tend to house younger people. However, there are some important distinctions. First, the number of indicators for which there are differences between persons from the higher and lower effort households varies. For example, persons from Potential Refusals (C) households are different from persons from households not identified as Potential Refusals on three of the health indicators, whereas persons from those households with 4+ Consecutive Noncontacts (D) are different from their lower effort counterparts on five of the indicators. Second, the direction of the differences is not consistent. For example, persons from the Uncooperative/Unlikely to Participate in the Future (B) households were less likely to engage in regular leisure-time physical activity than their lower effort counterparts, whereas persons from the 4+ Consecutive Noncontacts (D) households were more likely to engage in regular leisure-time physical activity than their lower effort counterparts. These findings are a first clue that the way in which researchers define high effort groups may have unique impacts on estimates or data quality.

2.3 Impact on Health Estimates of Treating High Effort Responders as Non-Responders

To what degree would the national health estimates be affected by the loss of these high effort groups? Just noted were significant differences between persons from high and low effort households on many of the indicators. Are these differences large enough to impact the national health estimates? Because the proportion of the total responding sample that is high effort is relatively small the differences would have to be fairly large to impact the national estimates should the higher effort group fail to become respondents. To determine whether or not the loss of these cases would affect national estimates, for each indicator we treated the persons from high effort households as

nonrespondents (i.e., we excluded them), reweighted the data, and calculated new estimates. This process was repeated for each of our four measures of high effort households. Each estimate was then compared to the estimate using the full responding sample and then tested for a significant difference at the .05 level.⁵ These analyses allowed us to observe the national estimates that the NHIS would produce should these respondents become nonrespondents (see Table 3).

Table 3: The Effect of Excluding High Effort Households in Calculating Selected Health Estimates: NHIS, 2004 (weighted and age-adjusted).

	All HH's (%)	A (%)	B (%)	C (%)	D (%)
Without Insurance ¹	14.7	14.7	14.6*	14.6*	14.8*
Psychological Distress	3.0	3.1*	3.0	3.1*	3.1
Diabetes	6.9	7.0*	7.0*	7.0*	7.0*
Hypertension	25.1	25.3*	25.2*	25.3*	25.3*
Obesity	24.3	24.6*	24.5*	24.4*	24.4
Physical Activity	30.2	30.2	30.3*	30.3*	30.0*
Smoking	20.8	20.9*	20.8	20.8	20.9
Alcohol Consumption	19.2	19.2*	19.3*	19.4*	19.1

* Significantly different from All Households estimate at level .05.

¹ Crude, not age-adjusted

Overall, excluding high effort households, regardless of measure, had only a minor impact. There were significant differences on many of the indicators, but on no one indicator was the difference in the estimates more than .3 percentage points, with most having a .1 or .2 percentage point difference. This was largely due to the fact that the percentage of all households defined as high effort, regardless of measure, was quite small. Nonetheless, the results did vary slightly by measure. For example, the estimate for the percentage of persons who engage in regular physical activity for all households is 30.2%. When the Uncooperative/Unlikely to Participate in the Future (B) or the Potential Refusals (C) households are treated as nonresponders, the estimates climb to 30.3%. Conversely, the estimate drops to 30.0% when the 4+ Consecutive Noncontacts (D) households are treated as nonresponders. Health insurance provides another illustration. The percentage of persons without health insurance is 14.7% for all households. The estimate drops to 14.6% when the Uncooperative/Unlikely to Participate in the Future (B) households are treated as nonresponders. The estimate increases, however, to 14.8% when the 4+ Consecutive Noncontacts (D) households are treated as nonresponders. In this example, excluding the 8+ Visits households has no significant impact. In some cases the direction of the impact was consistent, but not the magnitude. For example, the estimate for obesity among adults aged 20 years and older for all households is 24.3%. Excluding the Potential Refusals (C) households or the 4+ Consecutive Noncontacts (D) households raises the estimate to 24.4%, while excluding the Uncooperative/Unlikely to Participate in the Future (B) households raises the estimate to 24.5%. Finally, excluding the 8+ Visits households (A) raises the estimate to 24.6%.

Although the observed differences on many indicators are quite small, should the proportion of difficult or high effort households grow, the impact on the national estimates might also be expected to be greater--depending on the measure or definition employed.

2.4 Quality of Data for High Effort Responders

Finally, we were interested to see if there were differences in the quality of data provided by high effort versus lower effort households, and whether the results varied by the measure used. That is, once the effort has been expended to gather these cases into the sample, how does the quality of their data compare to those not requiring as much effort? To assess this we compared item refusal and item don't know rates for the questions behind the indicators examined here, using two-tailed t-tests to test for significant differences between the high effort and lower effort rates. For each of the four measures of high effort, Table 4 indicates on which of the questionnaire items used to generate health estimates significant differences were found between persons from the high effort and lower effort groups.

⁵ Because we compared partial-sample estimates to full-sample estimates, we used significance tests that account for the resulting covariance.

“REF” refers to refusals on items and “DK” refers to “don’t know” answers to items. A “+” indicates that the persons from the high effort group had a significantly higher prevalence than the lower effort group. The absence of a symbol indicates that there were no significant differences between the high and lower effort groups.

Table 4: Comparisons of High and Lower Effort Groups on Item Nonresponse (Refusals and Don’t Know responses) for Selected Health Estimates, U.S. Adults, 2004 (weighted).

		A	B	C	D
Anyone in family covered by health ins.	REF		+	+	
	DK	+	+		
Ever told you had diabetes	REF		+		
	DK				
Ever told you had hypertension	REF		+		
	DK				
Height	REF		+	+	
	DK		+		
Weight	REF		+	+	
	DK		+		
Ever smoked 100 cigarettes	REF		+	+	
	DK		+		
Alcohol consumption in past year	REF		+	+	
	DK		+		

For most items, the levels of nonresponse were under 1% (data not shown). There were however notable differences between item responses for persons from high effort and lower effort households, and wide variations in the results across the four high effort measures. For example, while the 4+ Consecutive Noncontacts households were difficult to contact, once contacted they appeared to be as cooperative as other households as evidenced by the fact that there were no differences in data missing on items. At the other extreme was the high effort households defined as Uncooperative/Unlikely to Participate in the Future. These high effort households produced significantly more item refusals and item don’t knows on many of the questions than their lower effort counterparts, ranging from 6% to 40% (data not shown). This was not surprising since the inability or unwillingness to provide responses to many of our questions would have informed interviewers’ assessments of cooperativeness. The Potential Refusals households also produced poorer quality data, as may be expected, but certainly not of the same magnitude.

3. CONCLUSIONS

The results do seem to differ depending on the measure used. The four measures that we explored of difficult or high effort households identified slightly different sets of households as being high effort. These different sets of high effort households had minor, but differential impacts on our health estimates, and produced differing levels of item missingness. Our evidence seems to suggest that the conclusions drawn about how difficult or high effort households affect key survey estimates may differ substantially depending on how one defines high effort.

While our findings are that the different definitions capture different subsets of the population, they do not clearly indicate that definitions using the contact history data are necessarily better. However, we think that there are advantages to using the contact history data. First, because contact history data are detailed and varied, they allowed us to explore many different measures. For this analysis we constructed nine different definitions before settling on the two we used--something that was not possible in the past with more limited data. Second, the level of detail inherent in contact history data allowed us to develop measures that we think more closely approximate the primary types of nonresponse: noncontacts and refusals. That is, we think that the operationalizations based on the contact history data more closely reflect the theoretical concepts of contactability and cooperation. To the extent that we are successful in more precisely measuring these two components, field staff could explore the relative impacts of devoting more time and resources to one problem over the other. Finally, because contact history data are collected on both responding and nonresponding households, we can look for consistent patterns in this data across both sets of households, something that cannot always be done when collecting data only on the responding sample. We did not look at nonresponding households in this study; however a next step is making comparisons between high effort groups and nonresponding groups in order to shed some light on whether high effort households can be considered proxies for nonresponding households.