Are Refusal Conversions Different from Willing Respondents with Respect to Item Non-Response, Demographics and Selected Health Characteristics? The National Health and Nutrition Examination Survey, 1999-2002

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Introduction

It is well known that surveys in every sector including the government have experienced declines in response rates thus increasing the likelihood of non-response bias (1-5). Declines in response rates have been experienced in the National Health and Nutrition Examination Surveys (NHANES) (7-12) through which a broad spectrum of health related data are obtained on a representative sample of the United States non-institutionalized population using questionnaires and direct, standardized physical examinations.

Similar to previous NHANES surveys, NHANES 1999-2000 consisted of three phases, a screener, an interview and an examination. During the screener sample persons were identified and invited to participate in the home interview. This interview portion of the survey consisted of a number of questionnaires including questions on medical conditions, health care utilization, health insurance and self-perceived health. Sample persons who participated in the interview in turn were invited to participate in the examination carried out in mobile examination centers (MECs). The examination consisted of a number of components including blood pressure readings, blood tests and anthropometric measures such as height and weight.

In past NHANES surveys, the issue of potential bias due to non-response has been addressed by comparing sample persons who were interviewed and examined to those who were interviewed and not examined with respect to selected health characteristics (8-12). For the first time in an NHANES survey sample persons who initially refused but later agreed to participate in the NHANES 1999-2002 have been identified.

The purpose of this paper is to address the issue of potential non-response bias in the NHANES 1999-2002 by comparing these converted refusals to initially cooperating adults (willing respondents) with respect to selected survey items. We focus on adults 20 year and older.

Methods

The NHANES 1999-2002 sample is a complex, multistage, area, probability sample. The sampling procedure consists of four stages including selection of primary sampling units (PSUs), counties or groups of contiguous counties, segments within PSUs, dwelling units within segments and sample persons within dwelling units. Mexican Americans, non-Hispanic blacks, adolescents, pregnant women and (beginning in 2000) low income whites were oversampled.

During the screener, a field representative visited the household and administered a questionnaire to determine sample person eligibility. Once eligible sample persons were identified, they were invited to participle in the home interview. Interviewed individuals were invited to the MEC examination.

The classification of refusal conversion in this study was based on the disposition codes from the 1999-2002 administrative data. When the original interviewer encountered a refusal, regardless of whether it was a direct or "hard" refusal, or a soft refusal by way of avoidance or giving excuses, the interview turned in the information to the field manager. Then a joint decision was made by the interviewer and the filed manager on whether a disposition code of refusal would be assigned to the case. Once the refusal disposition from the first interviewer assigned to the case was determined, the case was classified as requiring refusal conversion. Subsequently a tailor made conversion package was mailed to the household and a second interviewer was then assigned to the case based on his/her conversion skills. The refusal conversion process could be initiated at any of the three phases of the survey, namely, screener interview or MEC appointment phase. Some sampled persons required greater efforts in refusal conversion if they refused more than one time at different phases of the survey. For example, a sample person could be converted at the screener phase and complete the household interview but subsequently refuse to make an appointment at the MEC or cancel a MEC appointment. This person would have required refusal conversion at both screener and MEC examination phases.

In this study, refusal conversions at the screener and interview levels were combined into one group, whereas refusal conversions for the MEC examination phase remained a separate group. Some of these refusal conversions were also converted-refusals at the screener or interview levels but were classified as examination converted refusals because participation in the MEC examination required much greater efforts and time

comment and thus were more difficult to convert. The last category was further divided into two subcategories: converted-refusals for the MEC who completed the exam and MEC cancellations or no shows for the exam. Therefore, screener/interview, MEC completed and MEC cancelled or no shows are mutually exclusive groups. Converted refusals at the screener/interview phases and converted-refusals at the MEC examination phase were compared to willing respondents.

To determine whether converted-refusals were different from willing respondents, we looked at demographic characteristics, item non-response and selected health characteristics which we hypothesized to be related to survey participation by refusal conversion status.

For item non-response, we looked at 10 variables, 5 based on data from the interview and 5 based on data from the MEC examination for which the extent of missing data was at least 3 percent (Table 1). For blood samples, one the 5 MEC variables, a trichotomous variable was constructed equal to 1 if venipuncture was not done, 2 if was partial (i.e. some but not all blood samples were obtained) and 3 if it was complete. For each of the 9 other variables an indicator variable was constructed with a value equal to 1 if data was missing for the item and 0 if it was not missing.

We also looked at 10 selected survey items potentially related to survey participation (Table 2), six related to health care utilization, 2 life-style variables and 2 additional demographic variables. For the analysis we constructed 10 indicator variables corresponding to each of these 10 survey items. For example, the indicator for cholesterol screening was 1 if the sample person had his/her cholesterol checked within the past 5 years and 0 if he/she did not.

These indicator variables for converted-refusals were compared to those for willing respondents first univariately and then multivariately controlling for the possible confounding effects of gender, age, race/ethnicity and education. Design based methods are applied both for the univariate and the multivariate analysis by using the SUDAAN software procedures. For the univariate analysis the equality of percents was tested at the α overall level of 0.05 using the Student's t test through PROC DESCRIPT. The Bonferroni method was used to control for multiple comparisons. For the analysis based on data from the home interview three groups of converted refusals were compared to willing respondents and an α level of 0.0167(=0.05/3) was used. For analysis based on data based from the MEC examination two groups of converted refusals were compared to willing respondents and an α level of 0.25(=0.05/2) was used. For both the univariate and multivariate analysis, sample weights, which account for the unequal selection probabilities and adjust for non-response and non-converge were incorporated. Standard errors were estimated by Taylor Series Linearization, a design based method. The percents were age-adjusted by the direct method to the year 2000 Census population using the age-groups 20-39 years, 40-59 years and 60 years and older. For the multivariate analysis, multiple logistic regression was applied when the dependent variable was a binary random variable using PROC RLOGIST. For the variable constructed for blood sample, a trichotomous variable, generalized multiple logistic regression was applied using PROC MULTILOG.

There were 10,291 adults 20 years and older interviewed during NHANES 1999-2002. Of these, 9,471 were interviewed and examined. Sample sizes for willing respondents and converted–refusals are presented in Table 3 for the interview and examination samples. Ninety-nine percent of the willing respondents and 86 percent of the screener/interview converted refusals who participated in the home interview were also examined. Of the 913 examination converted-refusals about half are MEC completed converted-refusals. Slightly less than half are MEC cancellation/no show converted-refusals.

Results

Demographic Profile by Refusal Conversion

We first compared converted-refusal to willing respondents with respect to age, gender, race/ethnicity and education (Table 4). Whereas screener/interview and MEC cancellation/no shows resemble willing respondents with respect to age and race/ethnicity, MEC completed refusal conversions are a younger group with a larger percent of non-Hispanic blacks. Screener/interview converted refusals were similar to willing respondents with respect to education, but both MEC completed and MEC cancellation/no shows had a higher percent with less than high school education and a smaller percent with greater than high school education.

Item Non-Response

Adjusted odds ratios for the extent of missing data for items based on data from the home interview are presented in Table 5. Converted refusals at all levels are more likely than willing respondents to have missing data for poverty income ratio, family income and household income. Furthermore, MEC cancellations/no show converted refusals were more likely than willing respondents to have missing data for marital status.

Adjusted odds ratios for the extent of missing data for the five variable based on data from the MEC are presented in Table 6. Examination (MEC completed) converted-refusals are more likely to have missing data for blood pressure and body weight than willing respondents and to have failed to answer the alcohol questionnaire of the MEC CAPI or the drug questionnaire or the MEC ACASI than willing respondents. Furthermore, converted-refusals at both the screener/interview and examination levels were more

likely than willing respondents not to have any blood samples. Of particular interest is that examination converted- refusals were more than seven times more likely to have missing data for body weight than willing respondents. Odds ratios are significantly larger for examination converted refusals than the corresponding odds ratio for screener interview converted-refusals.

Health Care Utilization

Adjusted odds ratios for characteristics related to health care utilization are presented in Table 7. Aside from blood pressure screening screener/interview converted refusals were not significantly different from willing respondents. However MEC cancellation/no show converted refusals were less likely than willing respondents to have had their blood pressure checked during the past year or their cholesterol checked during the past 5 years. MEC completed and MEC cancellation no show converted–refusals were less likely to have visited a doctor during the past year than willing respondents. Finally, MEC_completed converted refusals were less likely to have health insurance than willing respondents. Although the univariate analysis demonstrated a significant difference between MEC completed converted refusals and willing respondents with respect to the percent who considered themselves to be in excellent, very good or good health, after controlling for the possible confounding effects of gender, age, race/ethnicity and education, results were no longer significant.

Lifestyle and Demographic Variables

Table 8 shows the adjusted odds ratios of refusal conversion status with respect to current smoking and binge drinking as well as marital status and place of birth. MEC completed converted-refusals were nearly twice as likely and MEC cancellation/no shows were nearly 50 percent more likely than willing respondents to be current smokers. For binge drinking, results of the multiple logistic regression with main effects only demonstrated that refusal conversion status did not significantly affect binge drinking. However, when an interaction term of refusal conversion status with race/ethnicity was introduced into the model, a significant adjusted odds ratio for examination converted-refusals with respect to willing respondents was obtained with examination converted-refusals more than 50 percent more likely than willing respondents to be binge drinkers

Discussion

In this paper, we have compared converted-refusals to willing respondents in the NHANES 1999-2002 survey. For this comparison we chose items from across a broad spectrum of survey component s including demographic, health care utilization, lifestyle and examination components as well as sensitive questions.

We have demonstrated 1) MEC_completed converted-refusals were a younger group than willing respondents, with a larger percent of non-Hispanic blacks and participants with less than high school education, 2) the extent of item non-response was significantly greater among converted-refusals, particularly MEC_completed examination converted-refusals, than among willing respondents across a wide range of demographic, examination, and sensitive questions and 3) MEC_completed and MEC cancellation/no show converted-refusals were less likely to maintain healthy lifestyles then willing respondents.

Another study found a significant effect of converted refusals upon item non-response. In a telephone survey Masson and Lesser found that item non-response occurred in nearly 25 percent of exploratory variables for converted-refusals compared to 11 percent for willing respondents. Imputing missing data decreased the negative impact of item non-response contributed by converted-refusals (13).

It should be noted that for the NHANES 1999-2002 survey refusal conversion status was significantly associated with item non-response. Further work is necessary to see whether the findings presented in this paper involving this variable persist after imputing for missing data for these variables.

Further work is also needed to measure the impact of converted refusals upon survey estimates. This would entail constructing new sample weights treating the converted refusals as non-respondents. These weights would be constructed by applying the same procedures and measurements used to construct the original sample weights.

Extensive efforts have been made to persuade individuals who initially refused to participate in the continuous NHANES survey. The results of this study showed that conversion efforts not only improved the estimate of precision by increasing the sample size but also potentially reduced non-response bias by converting refusals who showed significant differences from willing respondents on some survey items. Further efforts are needed to persuade these converted refusals to answer survey questions and to participate in the various components of the examination.

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Table 1. Variables Used To Examine the Extent of Item Non-Response in the National Health and Nutrition Examination Survey, 1999-2002

Variable	Percent Missing[1]	Source
Interview		
Poverty Income Ratio	11.5	Demographic portion of the survey
Household Income	13.2	Demographic portion of the survey
Family Income	5.4	Demographic portion of the survey
Marital Status	5.2	Demographic portion of the survey
Cholesterol screening	3.2	Demographic portion of the survey
Examination		
Blood Pressure	4.4	4 systolic and 4 diastolic blood pressure readings
Blood samples		Obtained by venipuncture
Complete		All intended blood samples obtained
Partial	6.0	Some blood samples but others not obtained
Not done	5.0	No blood samples available
Measured body weight	3.6	Body weight measured in the MEC
Illicit drug use	14.6	1st question on drug questionnaire of the ACASI
Alcohol	7.3	1st question on alcohol questionnaire of CAPI

[1]For blood samples percent partial and percent not done.

Table 2. Variables Used To Construct Indicators of Health Care Utilization, Lifestyle Factors and Additional Demographic Characteristics: United States, 1999-2002

Variables	Definition
Health care utilization	
Had blood pressure checked within past year	0 If no 1 if yes
Had cholesterol checked within past 5 years	0 If no 1 if yes
Doctor visits	0 If number of doctor visits=0 1 If number of doctor visits>=1
Health insurance	0 if does not have health insurance 1 if has health insurance
Income	0 if <$20,000 1 if $20,000+
Self perceived health	0 if fair or poor 1 if excellent, very good or good
Lifestyle	
Current smoking	0 if does not smoke cigarettes now 1 if smokes cigarettes now
Binge drinking	0 if answers no to the question on drinking[1] 1 if answers yes to the question on drinking[1]
Demographic	
Marital status	0 if widowed, divorced, separated or never married 1 if married
Foreign born	0 if born in the United States 1 if born in Mexico or elsewhere

[1]Based on the question "Was there an extended period of time when had 5or more drinks of alcohol almost every day" from the alcohol questionnaire of the MEC CAPI.

Table 3. Number of Adults Ages 20 Years and Older Interviewed and Examined During the National Health and Nutrition Examination Survey, 1999-2002, Who Were Willing Respondents and Converted Refusals

	Willing Respondents	Refusal Conversion Status			
		Screener/ Interview	Examination		
				EXAM	
			Total	EXAM Completed[1]	_CANS no shows[2]
Survey phase Interview	7011	2367	913	485	428
Exam	6950	2036	485	485	0
Percent[3]	99.1	86	53.1		

[1]Converted at the examination level, appointment scheduled and completed the MEC exam.
[2]Converted at the examination level, appointment scheduled but canceled or did not show up at the MEC
[3]Percent of interviewed who were examined

Table 4. Percent of Adults Ages 20 Years and Older with Selected Demographic Characteristics by Refusal Conversion Status: United States, 1999-2002

Demographic characteristic	Willing respondents	Refusal Conversion Status		
		Screener/ interview	Examination	
			MEC_completed[1]	MEC_CANS/ no show[2]
Age	Percent(SE)[3]	Percent(SE)[3]	Percent(SE)[3]	Percent(SE)[3]
% 20-39 years	39.6(1.0)	39.9(1.9)	56.8(2.8)[3]	44.7(3.2)
% 40-59 years	38.3(0.9)	38.8(1.1)	26.3(2.4)[5]	32.1(3.5)
% 60 years and older	23.1(0.8)	21.3(1.1)	16.9(2.2)	23.2(2.6)
Gender				
% men[4]	48.3(0.5)	46.0(0.9)	46.5(0.3)	48.3(0.5)
Race/ethnicity[4]				
Mexican American	6.6(0.8)	8.0(1.1)	8.7(1.0)	6.2(1.0)
Non-Hispanic white	71.8(1.9)	70.5(2.0)	56.9(4.4)[5]	69.0(3.1)
Non-Hispanic black	10.6(1.2)	9.8(1.2)	19.7(2.8)[5]	10.5(1.4)
Education[4]				
%<high school	21.0(1.0)	23.0(1.2)	34.0(3.2)[5]	31.0(2.4)[5]
% high school	25.5(0.9)	25.8(1.4)	25.3(3.3)	22.9(2.8)
%>high school	53.4(1.6)	51.0(1.7)	40.7(4.0)[5]	46.1(2.6)[5]

[1]Converted at the examination level, appointment scheduled and completed the MEC exam.
[2]Converted at the examination level, appointment scheduled but canceled or did not show up at MEC
[3]Percent(Standard error of the percent)
[4]Age adjusted by the direct method to the year 2000 Census population using the age groups 20-39 years, 40-59 years and 60 years and older.
[5]Significantly different from willing respondents, at $p<0.05$ by the Bonferroni adjustment

Table 5. Extent of Item Non-Response for Selected Questions from the NHANES 1999-2002 Home Interview of Adults Ages 20 Years and Older

Refusal Conversion Status									
Examination									
Screener/Interview[1]				MEC completed[1,2]			MEC_CANS/no show[1,3]		
	Adjusted Odds Ratio[4]	95 Percent CI		Adjusted Odds Ratio[4]	95 Percent CI		Adjusted Odds Ratio[4]	95 Percent CI	
		Lower limit[5]	Upper limit[5]		Lower limit[5]	Upper limit[5]		Lower limit[5]	Upper limit[5]
Survey Item									
Poverty Income Ratio	**2.73**	**2.19**	**3.14**	**1.91**	**1.28**	**2.84**	**1.89**	**1.21**	**2.94**
Family Income	**4.07**	**2.86**	**5.78**	**2.27**	**1.46**	**3.55**	**3.22**	**1.84**	**5.66**
Household Income	**2.87**	**2.3**	**3.58**	**1.71**	**1.41**	**2.57**	**1.72**	**1.02**	**2.9**
Marital Status	0.91	0.66	1.27	1.31	0.75	2.3	**2.41**	**1.34**	**4.34**
Cholesterol Screening	1.42	0.98	2.05	1.37	0.77	2.42	0.8	0.4	1.61

[1]Compared to willing respondents
[2]Converted at the examination level, appointment scheduled and completed the MEC exam.
[3]Converted at the examination level, appointment scheduled but canceled or did not show up at the MEC
[4]Missing vs. non-missing; controlling for the possible confounding effects of age, gender, race/ethnicity and education
[5]95 percent confidence interval

Table 6. Extent of Item Non-Response of Adults Ages 20 years and Older for Selected Components from the NHANES 1999-2002 MEC Examination by Refusal Conversion Status

Refusal Conversion Status						
	Screener/Interview[1]			Examination(MEC_completed)[1,2]		
	Adjusted Odds Ratio[3]	95 Percent CI		Adjusted Odds Ratio[3]	95 Percent CI	
		Lower limit[4]	Upper limit[4]		Lower limit[4]	Upper limit[4]
Survey item						
Blood pressure	**1.91**	**1.34**	**2.72**	**4.90**	**3.25**	**7.38**
Blood[5]	**2.32**	**1.72**	**3.13**	**5.66**	**3.23**	**9.92**
Illicit drug use	**2.38**	**1.77**	**3.20**	**6.30**	**4.58**	**8.66**
Body weight	**2.58**	**1.49**	**3.43**	**7.59**	**5.16**	**11.16**
Alcohol use	**2.64**	**2.01**	**3.47**	**8.16**	**6.30**	**10.57**

[1]Compared to willing respondents
[2]Converted at the examination level, appointment scheduled and completed the MEC exam.
[3]Missing vs. non-missing; controlling for the possible confounding effects of age, gender, race/ethnicity and education
[4]95 percent confidence interval
[5]Not done vs. complete

Table 7. Selected Survey Characteristics of Adults Ages 20 Years and Older Based on Data from the NHANES 1999-2002 Home Interview by Refusal Conversion Status

	Examination								
	Screener/Interview[1]			MEC_Completed[1,2]			MEC_CANS/no show[1,3]		
	Adjusted Odds Ratio[4]	95 % CI		Adjusted Odds Ratio[4]	95 % CI		Adjusted Odds Ratio[4]	95 % CI	
		Lower limit	Upper limit		Lower limit	Upper limit		Lower limit	Upper limit
Individual measures									
Blood pressure checked past year[5]	**0.80**	**0.66**	**0.98**	0.94	0.67	1.32	**0.66**	**0.05**	**0.98**
Cholesterol checked past 5 years[5]	1.04	0.91	1.19	0.78	0.58	1.03	**0.65**	**0.48**	**0.89**
Doctor visits: at least one vs. none									
Health Insurance[5]	0.87	0.71	1.06	**0.75**	**0.57**	**0.98**	**0.66**	**0.05**	**0.90**
Family income:<$20,000 vs.	0.84	0.67	1.07	**0.67**	**0.46**	**0.98**	0.88	0.63	1.23
$20,000+	0.83	0.66	1.05	1.37	1.00	1.87	1.07	0.75	1.52
Self perceived health[6]	1.08	0.89	1.29	0.76	0.53	1.11	0.85	0.60	1.19

[1]With respect to willing respondents
[2]Converted at the examination level, appointment scheduled and completed the MEC exam.
[3]Converted at the examination level, appointment scheduled but canceled or did not show up at the MEC
[4]Controlling for the possible confounding effects of gender, age, race/ethnicity and education.
[5]Yes vs. No

Table 8. Selected Lifestyle and Demographic Characteristics of Adults Ages 20 Years and Older by Refusal Conversion Status: United States, NHANES, 1999-2002

Refusal Conversion Status									
	Screener/Interview[1]			Examination					
				MEC_Completed[1,2]			MEC_CANS/no show[1,3]		
	Adjusted Odds ratio[4]	95 % CI		Adjusted Odds ratio[4]	95 % CI		Adjusted Odds ratio[4]	95 % CI	
		Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
Life-Style factors									
Current smokers	0.93	0.80	1.09	**1.90**	**1.47**	**2.44**	**1.46**	**1.03**	**2.09**
Binge drinkers	1.06	0.83	1.36	**1.61**	**1.07**	**2.42**	NA	NA	NA
Demo-graphic characteristics									
Married	1.04	0.90	1.20	**0.61**	**0.44**	**0.84**	**0.60**	**0.44**	**0.82**
Foreign born	**1.48**	**1.15**	**1.92**	1.26	0.82	1.94	1.37	0.85	2.21

[1]With respect to willing respondents
[2]Converted at the examination level, appointment scheduled and completed the MEC exam.
[3]Converted at the examination level, appointment scheduled but canceled or did not show up at the MEC
[4]Controlling for the possible confounding effects of age, gender, race/ethnicity and education.