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Characteristics of Physical Measurement Consent in a Population-Based Survey of Older Adults

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Abstract

Background—Collecting physical measurements in population-based health surveys has increased in recent years, yet little is known about the characteristics of those who consent to these measurements.

Objective—To examine the characteristics of persons who consent to physical measurements across several domains, including one's demographic background, health status, resistance behavior toward the survey interview, and interviewer characteristics.

Research Design, Subjects, and Measures—We conducted a secondary data analysis of the 2006 Health and Retirement Study, a nationally-representative panel survey of older adults aged 50 and older. We performed multilevel logistic regressions on a sample of 7,457 respondents who were eligible for physical measurements. The primary outcome measure was consent to all physical measurements.

Results—Seventy-nine percent (unweighted) of eligible respondents consented to all physical measurements. In weighted multilevel logistic regressions controlling for respondent demographics, current health status, survey resistance indicators, and interviewer characteristics, the propensity to consent was significantly greater among Hispanic respondents matched with bilingual Hispanic interviewers, diabetics, and those who visited a doctor in the past 2 years. The propensity to consent was significantly lower among younger respondents, those who have several Nagi functional limitations and infrequently participate in "mildly vigorous" activities, and those interviewed by black interviewers. Survey resistance indicators, such as number of contact attempts and interviewer observations of resistant behavior in prior wave iterations of the HRS were also negatively associated with physical measurement consent. The propensity to consent was unrelated to prior medical diagnoses, including high blood pressure, cancer (excl. skin), lung

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disease, heart abnormalities, stroke, and arthritis, and matching of interviewer and respondent on race and gender.

Conclusions—Physical measurement consent is not strongly associated with one's health status, though the findings are somewhat mixed. We recommend that physical measurement results be adjusted for characteristics associated with the likelihood of consent, particularly functional limitations, to reduce potential bias. Otherwise, health researchers should exercise caution when generalizing physical measurement results to persons suffering from functional limitations that may affect their participation.

Keywords

physical measurements; biomeasures; consent; field interviewers

INTRODUCTION

Collecting physical measurements in population-based health surveys has increased substantially in recent years.[1,2] Understanding the interrelationships between physical, biological, and social factors on health outcomes has been a key driving force behind this trend, leading to important discoveries in such areas as physical functioning,[3,4,5,6,7] depression and stress,[8,9,10] and cognitive aging.[11,12,13,14,15] Studying these complex interactions has become a priority among western societies experiencing large demographic shifts towards older, more vulnerable, populations.[16,17,18,19]

Until recently, the main source of objective population-based physical measurement data came from large biomedical studies. For example, the National Health and Nutrition Examination Survey (NHANES) collects physical measurements on a nationally-representative sample of the U.S. population.[20] These measurements are collected by certified medical professionals inside mobile examination centers. The exceedingly high cost of hiring trained medical personnel and maintaining examination space and equipment can be a deterrent for smaller survey programs that are interested in collecting their own set of physical measurements at a lower cost.

The desire to cut costs has spawned several innovations in how physical measurements are collected in surveys. One emerging strategy is to use non-medically trained field interviewers to collect physical measurements inside respondents' homes.[21,22,23] This approach eliminates the need to hire medical professionals and acquire, or maintain separate clinic space. In addition, technological advances in measurement equipment have led to cheaper, more portable devices used by travelling interviewers.[24, 25]

Obtaining consent from survey respondents to collect physical measurements is a critical element of the survey interview, which can directly affect the representativeness of the measurements being collected. Systematic non-consent to physical measurements can lead to bias if survey respondents who consent differ from those who don't with respect to the physical characteristics being measured.[26, 27] Perhaps the biggest threat to the representativeness of physical measurement estimates is when the decision to consent is based on the respondent's health status. For example, an older person with chronic arthritis

may be cooperative to the survey request, but unwilling to consent to physical measurements that require joint movements due to their disability, or belief that their performance would be poor. Other possible reasons for non-consent may include those that are common to survey resistance in general (e.g., burden, confidentiality concerns, etc.).

Although some reasons for non-consent may not be directly correlated with a person's health status, the risk remains that certain population subgroups are disproportionately less likely to consent to physical measurements. For example, clinic-based studies have shown that African- Americans, a group historically subjected to inappropriate medical experimentation, participate in biological measurement collection at much lower rates than other population subgroups.[28, 29]

The existing research literature has not yet identified characteristics or mechanisms of physical measurement consent in population-based surveys. Specifically, it remains unclear whether the consent decision is associated with a person's health status and/or other factors that tend to promote resistance (or nonresponse) in survey interviews. A further gap in the literature concerns the effect of interviewer characteristics on the likelihood of obtaining physical measurement consent. In this paper, we address these issues using the 2006 Health and Retirement Study (HRS), a nationally-representative panel survey of older adults. Specifically, we examine the relationship between physical measurement consent and health status, indicators of resistance towards the survey interview, and interviewer characteristics.

METHODS

Sample and Data Source

The HRS is a federally funded longitudinal health survey of adults over the age of 50 conducted by the Institute for Social Research at the University of Michigan. The study began in 1992 with a cohort of then pre-retirement aged individuals born between 1931 and 1941. New cohorts were added in 1993 and 1998 to round out the sample over age 50, and additional cohorts are enrolled every 6 years (e.g., in 2004, 2010) to refresh the sample at the younger ages. Response rates range from 70 to 82 percent in the baseline wave (depending on birth cohort and entry year), and from 87 to 89 percent at each follow-up wave. HRS conducts about 20,000 interviews every two years. In 2006, HRS began collecting several physical measurements, including biological specimens: saliva (for which DNA was extracted and stored) and dry blood spots (analyzed for Hemoglobin A1c, total cholesterol and HDL cholesterol); and non-biological (or body) measurements: blood pressure, lung strength (peak flow), hand grip strength, balance test (semi-tandem, side-by-side, full tandem), walking test (8 ft.), height, weight, and waist circumference. A random half of the HRS sample was eligible for physical measurements in 2006, with the remaining half eligible in 2008. Only non-institutionalized respondents who had participated in a prior wave of the HRS and an in-person self-interview during the current wave (as opposed to a proxy interview) were eligible for physical measurements. Respondents were presented with three separate consent forms, the first pertaining to the collection of body measurements, the second to the collection, analysis, and storage of DNA from saliva collection, and the third to the collection, analysis, and storage of blood spot samples. Respondents had the option of consenting or not consenting to any set of physical measurements.

Interviewer Recruitment and Training

Existing field interviewers and new recruits were fully informed about the job requirements, including the role of collecting physical measurements. Interviewers were trained using instructional DVD, study manual, quizzes, in-person demonstrations, and paired-practice sessions. At the end of training, interviewers were required to pass a standardized certification exam. Additional training on physical measurement collection was provided throughout the field period.

Outcome Measure

The primary outcome measure is a dichotomous indicator of whether respondents consented to all three sets of physical measurements versus having consented to fewer measurements (or none). We focused on this parsimonious outcome for two reasons: 1) we found substantial overlap in non-consent across all physical measurements; and 2) separate analysis of the individual consent outcomes yielded similar results and did not change the conclusions of the study.

Indicators of Non-Consent Mechanisms

One hypothesized reason for not consenting to physical measurements is due to poor health, whereby respondents are physically limited in their ability to complete the measurements because of an existing health condition or functional limitation.[29] We tested this hypothesis by using several self-reported indicators of health status, including health rating, medical diagnoses (high blood pressure, diabetes, cancer [excluding skin], lung disease, heart condition, stroke, arthritis), height and weight (constructed as BMI), whether pain limits daily activities, frequency of participation in “mildly” vigorous activities, total number of reported Nagi functional limitations (log scale),[30] Medicare enrollee status, and number of doctor visits in the past 2 years.

Another hypothesized reason for non-consent is due to general resistance towards the survey interview. For example, burden, confidentiality concerns, among other factors are believed to decrease the likelihood of cooperating with a survey request.[27] We suspect that the same factors might also decrease the likelihood of physical measurement consent among survey participants. We test this hypothesis using a mix of interviewer observations from the 2004 interview and call record data from both the 2004 and 2006 interviews. These variables reflect: indicators of burden (how often respondent asked “how much longer the interview would last,” the 2004 interview mode [telephone vs. face-to-face], elapsed interview time prior to consent request), an indicator of confidentiality concerns (how often respondent expressed concerns about confidentiality), and other indicators of resistance (number of contact attempts in 2004 and 2006, rating of respondent cooperation and enjoyment during interview).

A third hypothesized reason for non-consent is due to interviewer demographic characteristics and/or lack of prior interviewing experience. In line with survey nonresponse theory,[27] we hypothesize that inexperienced HRS interviewers and those with less education are less likely to obtain physical measurement consent compared to more experienced and educated interviewers. In addition, we test interviewer-respondent matching effects on race,

Hispanic ethnicity, and gender with the expectation that matching increases the propensity to consent.

Finally, we adjusted for a variety of other respondent characteristics.

Statistical Analysis

Two-level random effects logistic regression models were used to quantify respondents' likelihood of consenting to physical measurements and to estimate between-level variation attributed to the interviewer. The logistic regression was performed using the NLMIXED procedure in SAS 9.1.3.[31]

HRS uses complex sample survey design features which were incorporated into our analysis. The sample consisted of 112 primary sampling units paired within 56 sampling strata. Weights were constructed that account for differential probabilities of selection, nonresponse, and sample noncoverage. The weights were applied to the NLMIXED procedure to obtain point estimates and a jackknife variance procedure (with 56 replications) was performed to compute appropriate standard errors that accounted for the stratification and clustering.[32]

A total of 9,380 randomly selected persons belonging to the target population of noninstitutionalized adults over the age of 50 were eligible for physical measurements. Non-respondents (n=1,014) and respondents who strongly preferred a telephone interview (n=507) were excluded from this analysis. Further case deletions were based on missing data for one interviewer (n=16) and missing interviewer observations (n=386) yielding a final analytic sample size of 7,457. No significant differences were found between the included and excluded cases on basic demographic variables.

RESULTS

Respondents and Physical Measurement Consent

Table 1 depicts unweighted estimates of the target population of adults aged 50+ who were eligible for the physical measurement component of the survey. Characteristics are compared among those who consented to all three sets of physical measurements and those who partially consented to some (or none) of the measurements. Overall, respondents who consented to all physical measurements were more likely to be white (82.8% vs.75.3%), have more education (12+: 80.5% vs. 76.1%), have higher health ratings (very good/ excellent: 42.2% vs. 35.1%), and belong to households with two or more eligible persons (64.5% vs. 55.8%), compared to those who did not consent to all measurements.

Physical Measurement Consent Rates

The unweighted physical measurement consent rates, in their order of presentation (and invasiveness), were 93% (n = 6,953) for body measurements, 84% (n = 6,253) for saliva collection, and 83% (n = 6,187) for blood spot collection. About 79% (n = 5,909) consented to all three sets of measurements. Crosstabs of consent (not shown) revealed substantial overlap between physical measurements. Approximately 85% (n = 5,909) of respondents who consented to body measurements went on to consent to both saliva and blood

collection. Conversely, 91% (n = 458) of respondents who refused consent to body measurements also refused consent to saliva and blood collection. In general, once a respondent refused to consent to one measurement, they were much less likely to consent to the subsequent measurement(s).

Model Building and Evaluation

Four cumulative weighted logistic regression models were built by introducing covariates related to demographic characteristics (Model 1), health status (Model 2), survey resistance (Model 3), and interviewer characteristics (Model 4), respectively. Table 2 presents fit statistics for each model. All four models yielded statistically significant chi-squared likelihood ratio tests ($P \leq 0.01$). The Pseudo-R^2 (max-rescaled)[33] statistics were generally small and ranged between 0.02 and 0.07, with the biggest increase occurring after the resistance indicators were introduced into the third model (0.04 to 0.07). Other goodness-of-fit measures, including Akaike's information criterion (AIC) and the Bayesian information criterion (BIC), provided further support that the set of resistance indicators improved model fit more than any other set of covariates. Because the model results did not substantially change with the addition of successive sets of variables, only results from the full model (Model 4) are described below.

Likelihood of Consent Based on Sample Predictors

Table 3 presents weighted odds ratios of consent to all sets of physical measurements versus consenting to some or none. After controlling for health status measures, resistance indicators, and interviewer characteristics, a few respondent demographics were associated with physical measurement consent. The odds of consenting to all physical measurements decreased with age [odds ratio (OR), 0.99 per 1-year increase; 95% confidence interval (CI), 0.99—1.00]. Hispanics were significantly more likely to consent to all physical measurements compared to non- Hispanics (OR, 1.49; CI, 1.05—2.13). Also, respondents living with other eligible persons were more likely to consent to all measurements compared to those living with no other eligible person (OR, 1.28; CI, 1.05—1.55). There was no statistically significant association between consent and respondent race, but the interaction of race and gender (not shown) yielded a statistically significant relationship suggesting that black females were more likely to consent to physical measurements relative to black males (OR, 1.46; CI, 1.03—2.07).

Effect of Health Status on Physical Measurement Consent

Few health status indicators were found to be significantly related to the likelihood of consenting to all physical measurements after controlling for potentially confounding variables. Respondents previously diagnosed with diabetes were more likely to consent compared to non- diabetics (OR, 1.27; CI, 1.09—1.48). Respondents who infrequently performed "mildly" vigorous activities were less likely to consent compared to those who performed such activities at least once per week (1–3 times/month: OR, 0.72; CI, 0.54—0.97; hardly ever/never: OR, 0.73; CI, 0.57—0.94). The odds of consenting to all physical measurements decreased with the number of reported Nagi functional limitations (OR, 0.88 per log-unit increase; CI, 0.79—1.00). Respondents who visited the doctor at least once in the past two years were more likely to consent compared to those who did not visit a doctor

(OR, 1.37; CI, 1.06—1.76). The interaction between doctor visits and self-rated health (not shown) was not statistically significant. There were no statistically significant associations between consent and self-reported health status, BMI, Medicare status, pain limitations, or ever having had high blood pressure, cancer, lung disease, heart condition, stroke, or arthritis.

Effect of Survey Resistance on Physical Measurement Consent

Several indicators of interview resistance were significantly associated with the propensity to consent to all physical measurements. Respondents who "often" asked "how long the interview would last" were less likely to consent compared to those who never asked (OR, 0.63; CI, 0.40—0.98). Similarly, those who "seldom" or "often" asked about "confidentiality" were less likely to consent compared to those who did not ask at all (seldom: OR, 0.72; CI, 0.58–0.90; often: OR, 0.53, CI, 0.26—1.08). The odds of consenting decreased with the number of contact attempts in both the 2004 wave (OR, 0.89 per log-unit increase; CI, 0.80—0.99) and the 2006 wave (OR, 0.86 per log-unit increase; CI, 0.74—0.99). Respondents who were rated "good" or "fair/poor" on their cooperativeness were less likely to consent compared to those who received an "excellent" rating (good: OR, 0.70; CI, 0.56—0.87; fair/poor: OR, 0.45; CI, 0.27—0.75). Respondents who were rated as enjoying the interview "a little bit/not at all" were significantly less likely to consent compared to those who were rated as enjoying the interview "a great deal" (OR, 0.67; CI, 0.52—0.86). Finally, there were no statistically significant associations between consent and the prior wave (2004) interview mode (face-to-face or telephone) or the elapsed interview time prior to the consent requests.

Effect of Interviewers on Physical Measurement Consent

We found no significant relationship between consent and an interviewer's gender, education, or prior HRS interviewing experience. However, respondents who were interviewed by black interviewers were less likely to consent to all physical measurements compared to respondents who were interviewed by white interviewers (OR, 0.52; CI, 0.39–0.69). Interactions between interviewers and respondents on race and gender (not shown) did not yield statistically significant results. The interaction between interviewer and respondent Hispanic ethnicity was statistically significant (OR, 3.47; CI, 1.62–7.44), indicating that Hispanic respondents were more likely to consent if interviewed by a Hispanic interviewer. Finally, the (non-experimental) interviewer variance term was statistically significant, suggesting that unmeasured interviewer characteristics influenced the decision to consent.

Consent for Individual Measurements

We examined separate consent models for each set of measurements using the same covariates (models not shown). The only contrasting finding between the individual consent models and the combined model was that black respondents were significantly less likely to consent to blood collection compared to whites (OR, 0.77; CI, 0.61—0.98). This relationship did not achieve statistical significance in the combined model. Also, the finding that diabetics were more likely to consent to physical measurements was consistent in each separate model, but more marked in the blood collection consent model.

DISCUSSION

The frequency of population-based surveys that collect physical measurements has increased rapidly in recent years and is expected to increase even further as the demand for these data grow. Little is known about whether respondents are embracing this trend, or resisting it in a way that threatens the representativeness of the physical measurement estimates. We investigated this issue by identifying respondent characteristics associated with physical measurement consent in the 2006 Health and Retirement Study, a large nationally-representative panel survey of older adults.

Consent rates were highest for the non-biological (body) measurements followed by saliva and blood collection. This pattern supports other studies that have found consent rates to be inversely related to the level of intrusion of the measurement.[2,21] However, these results are not definitive as the order of physical measurements was not randomized. In multivariate analyses, we found several parallels between the respondent profile of non-consenters and the profile of survey nonrespondents,[27] including black males and hard-to-reach respondents requiring many contact attempts who were less likely to consent to physical measurements relative to their counterparts.

A key question is whether the physical measurement consent decision is associated with the types of health characteristics that physical measurements are designed to measure. We did not find strong evidence to support this association. However, the finding that Nagi functional limitations and lack of vigorous activity decrease the likelihood of consent is somewhat concerning, particularly for surveys that collect anthropometric and physical performance measurements. We suspect that functional impairments act as sources of burden for respondents who may be unable to tolerate additional physical strains sustained during physical measurement collection. Extra steps should be taken to ease the burden of physical measurement participation among this population, or, at least, the presence of functional impairments should be accounted for in post-survey weighting adjustments.

Interestingly, the only medical diagnosis associated with consent was diabetes, which was associated with *increased* consent propensity. The tendency to consent to physical measurements among this population may be due to a greater familiarity with blood testing and other physical measurements and interest in knowing the results. Similarly, the tendency for respondents who recently visited a doctor to consent to physical measurements might also reflect a greater familiarity with such measurements and interest in knowing the results.

Indicators of general survey resistance were the most powerful predictors of physical measurement consent. Our findings, in line with survey participation theory,[27] support the hypothesis that respondents who feel burdened by the survey request or express concerns about confidentiality are less likely to consent to physical measurements. Although speculative, different approaches may be devised to address both issues in surveys that endeavor to collect physical measurements. The added burden of collecting physical measurements within a traditional survey interview might be lessened by administering reduced versions of the questionnaire and/or subsets of the physical measurements. Randomizing questionnaire content and/or sets of physical measurements to specific

respondents, as is done in multiple matrix sampling,[34] may reduce respondent burden without compromising the validity of population- based inferences. Addressing respondent concerns about confidentiality is a topic that has received much attention in the survey participation literature.[35] Offering stronger reassurances of confidentiality and outlining specific steps taken to prevent a possible disclosure have been used, with some success, to decrease survey nonresponse.[36] Randomized experiments are needed to determine the appropriate amount of reassurance needed to maximize physical measurement consent. In line with prior survey confidentiality research,[37] we suspect that the strongest reassurances will be most effective for physical measurements perceived to be most sensitive by the respondent, and less effective for less sensitive measurements.

Interviewer characteristics appeared to play a role in the physical measurement consent decision. Respondents interviewed by black interviewers were less likely to consent to physical measurements than those interviewed by white interviewers. Matching interviewers and respondents on race and other characteristics (with the exception of Hispanic ethnicity) did not affect the likelihood of consent. (The positive effect of matching on Hispanic ethnicity is likely due to respondents who required a Spanish-language interview from a bilingual interviewer.) One possible explanation of the race effect is that black interviewers may have had higher concentrations of low SES respondents. If low respondent SES is associated with lower consent, then this effect may be getting picked up by interviewer race. To explore this further, we tested several post-hoc interactions between interviewer race and proxy indicators of SES (respondent education, income, and assets) as well as geographical variables (Census region and division), but none of these interactions achieved statistical significance. Another possible confounder may be urbanicity, but we lacked enough geographical information to test this hypothesis.

The significant between-interviewer variance component suggests that additional unmeasured interviewer variables influenced physical measurement consent. However, without randomization, we cannot conclusively say how much unexplained variation in consent is attributed to the interviewer. Nonetheless, we suspect that measures of interviewer expectations regarding the sensitivity of the measurements being collected and their ability to obtain consent and perform the measurements on respondents might have explained additional variation. In general, we recommend better recruitment and screening of prospective interviewers and better training on securing physical measurement consent from the respondent.

The HRS only recruits non-medically-trained interviewers for physical measurement collection; thus, we were unable to directly compare differences between medically-trained and non-medically-trained interviewers on the likelihood of consent. Advantages and limitations of using non-medically trained interviewers should be noted. One advantage includes the growing consensus among survey organizations that it is easier to train regular field interviewers to collect physical measurements than it is to recruit and train those with a medical background to conduct interviews.[2,21] The main reason being that regular field interviewers tend to have the persuasive skills needed to secure cooperation at the respondent's doorstep, which is something that medically-oriented interviewers may lack. On the other hand, non-medically trained interviewers require greater scrutiny and quality

oversight of their performance. Extensive training is needed to educate interviewers on how to properly collect, store, and ship physical measurements that require special handling. Increased costs due to purchasing medical malpractice insurance are often incurred.

This research points to three practical implications for the collection of physical measurements in health interview surveys. First, it may be possible to identify likely non-consenters prior to data collection and apply adaptive tailoring strategies to mitigate respondent concerns and increase consent propensities. Panel surveys might have the most to gain from this approach as rich prior-wave data may be readily available for use in a prediction context. While the analytic models may not explain a sizeable amount of variation, even a somewhat limited prediction model is likely to achieve benefits that would otherwise not be seen. Second, prediction models could be used to impute missing physical measurement values or to develop physical measurement weighting adjustments; although, again, the quality of the imputed (or weighted) values is dependent on the quality of the model fit. Such models would benefit from the additional collection of variables that describe the specific reasons why a respondent did not consent to physical measurements. These data could potentially be used to adjust for bias and/or implement targeted strategies to increase consent propensity among specific population subgroups. And lastly, acknowledging the important role of interviewers in the physical measurement consent process could lead to better training regimens and identification and correction of interviewer problems.

A major strength of the present study is the use of rigorously collected population-based data. In addition, our study benefits from the appropriate modeling of the multilevel structure of respondent and interviewer factors affecting the propensity to consent. However, our study also had a number of limitations. The observational nature of this study, although informative in terms of hypothesis generation, precludes us from making definitive statements about factors affecting consent. Even though our models were extensively built to control for possible confounders, it is possible that extraneous factors were not accounted for. Another potential limitation is due to the fact that we studied a sample of panel respondents, who may be viewed as being more cooperative than the general population of older adults. Although we could not assess the characteristics of baseline nonrespondents, the finding that prior wave resistance indicators explained the most consent variation relative to other factors should alleviate some concerns about an overly agreeable panel. Another potential limitation is due to testing multiple comparisons simultaneously in our analytic model, which may have led us to overstate the model results. Despite these limitations, we believe that our results are generally indicative of largescale population-based household interview surveys that endeavor to collect physical measurements.

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TABLE 1

Characteristics of Sample Respondents (N = 7,457; unweighted)

	All Respondents (n = 7,457)	Full Consent (n = 5,909)	Partial (or no) consent (n = 1,548)
Age (%)			
52–69	56.0 (4179)	56.0 (3310)	56.1 (869)
70+	44.0 (3278)	44.0 (2599)	43.9 (679)
Gender (%)			
Male	42.3 (3152)	42.3 (2502)	42.0 (650)
Female	57.7 (4305)	57.7 (3407)	58.0 (898)
Race (%)*			
White	81.2 (6055)	82.8 (4890)	75.3 (1165)
Black	14.1 (1048)	12.6 (747)	19.4 (301)
Other	4.8 (354)	4.6 (272)	5.3 (82)
Education (%)*			
0–11 years	20.4 (1521)	19.5 (1151)	23.9 (370)
12 years	54.2 (4038)	54.9 (3244)	51.3 (794)
13+ years	25.5 (1898)	25.6 (1514)	24.8 (384)
Number of eligible persons in HH (%)*			
One	37.3 (2783)	35.5 (2098)	44.3 (685)
Two or more	62.7 (4674)	64.5 (3811)	55.8 (863)
Perceived health (%)*			
Excellent	10.9 (811)	11.3 (668)	9.3 (143)
Very good	29.9 (2226)	30.9 (1826)	25.8 (400)
Good	31.0 (2315)	31.2 (1844)	30.4 (471)
Fair/poor	28.2 (2105)	26.6 (1571)	34.5 (534)

*Comparisons statistically significant ($P < 0.001$).

Percentages may not add to 100 due to rounding.

TABLE 2

Multivariate Association of Consent to All Physical Measurements (Body Measurements, Saliva, and Blood) on Respondent Demographics, Health Status, Resistance Indicators, and Interviewer Characteristics (weighted; n=7,457).

Covariates	Model 1	Model 2	Model 3	Model 4
Respondent Demographics	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Age	1.00 (0.99–1.01)	1.00 (0.99–1.01)	0.99 (0.98–1.00)	0.99 (0.98,1.00)
Gender				
Male	Referent	Referent	Referent	Referent
Female	1.14 (0.98,1.32)	1.13 (0.98,1.31)	1.06 (0.90,1.24)	1.05 (0.90,1.23)
Education				
0–11 years	Referent	Referent	Referent	Referent
12 years	1.23 (1.00,1.50)	1.13 (0.92,1.39)	1.14 (0.91,1.43)	1.13 (0.91,1.39)
13+ years	1.29 (1.03,1.63)	1.15 (0.91,1.45)	1.12 (0.88,1.43)	1.12 (0.88,1.41)
Race				
White	Referent	Referent	Referent	Referent
Black	0.67 (0.55,0.83)	0.73 (0.59,0.89)	0.83 (0.67,1.03)	0.85 (0.69,1.04)
Other	0.77 (0.57,1.02)	0.78 (0.58,1.04)	0.82 (0.62,1.10)	0.82 (0.61,1.10)
Hispanic				
Yes	1.39 (1.01,1.91)	1.52 (1.11,2.07)	1.46 (1.05,2.02)	1.49 (1.05,2.13)
No	Referent	Referent	Referent	Referent
Frequency of religious service attendance				
At least once/week	1.30 (1.08,1.57)	1.20 (0.99,1.44)	1.19 (0.99,1.43)	1.19 (0.99,1.44)
Less than once/week	Referent	Referent	Referent	Referent
Number of eligible persons in household				
One	Referent	Referent	Referent	Referent
Two or more	1.37 (1.14,1.65)	1.34 (1.11,1.61)	1.28 (1.06,1.55)	1.28 (1.06,1.55)
Health Status Indicators				
Perceived health Excellent		Referent	Referent	Referent
Very good		0.97 (0.75,1.26)	0.96 (0.74,1.25)	0.96 (0.74,1.24)
Good		0.82 (0.61,1.10)	0.84 (0.63,1.12)	0.84 (0.63,1.13)
Fair/poor		0.77 (0.57,1.06)	0.79 (0.57,1.09)	0.80 (0.58,1.09)
High blood pressure				
Yes No		0.97 (0.83,1.13)	0.97 (0.83,1.14)	0.97 (0.83,1.14)
Diabetes		Referent	Referent	Referent
Yes				
No		1.27 (1.08,1.50)	1.27 (1.08,1.48)	1.27 (1.09,1.48)
Cancer (excl. skin)		Referent	Referent	Referent
Yes				

Covariates	Model 1	Model 2	Model 3	Model 4
Respondent Demographics	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
No		1.01 (0.83,1.23)	0.98 (0.80,1.21)	0.98 (0.79,1.21)
Lung disease		Referent	Referent	Referent
Yes				
No		1.25 (0.98,1.59)	1.22 (0.96,1.56)	1.21 (0.95,1.54)
Heart condition		Referent	Referent	Referent
Yes				
No		1.01 (0.85,1.21)	0.97 (0.79,1.20)	0.97 (0.80,1.16)
Stroke		Referent	Referent	Referent
Yes				
No		0.85 (0.65,1.11)	0.81 (0.62,1.06)	0.81 (0.62,1.06)
Arthritis		Referent	Referent	Referent
Yes				
No		1.18 (1.01,1.38)	1.15 (0.98,1.35)	1.14 (0.97,1.34)
Pain limits activities		Referent	Referent	Referent
Yes				
No		0.97 (0.80,1.17)	0.95 (0.77,1.17)	0.95 (0.77,1.17)
Performs mildly vigorous activities		Referent	Referent	Referent
At least once/week				
1–3 times a month		Referent	Referent	Referent
Hardly ever/never		0.72 (0.54,0.96)	0.73 (0.54,0.97)	0.72 (0.54,0.97)
Reported BMI		0.70 (0.55,0.89)	0.73 (0.57,0.93)	0.73 (0.57,0.94)
< 18.5				
18.5–24.9		Referent	Referent	Referent
		1.03 (0.57,1.86)	1.14 (0.62,2.09)	1.15 (0.62,2.11)
25.0–29.9		1.06 (0.58,1.93)	1.15 (0.62,2.14)	1.16 (0.62,2.17)
> 30		1.03 (0.57,1.89)	1.13 (0.61,2.10)	1.14 (0.61,2.12)
Did not report BMI		0.62 (0.31,1.25)	0.75 (0.36,1.54)	0.75 (0.36,1.55)
Number of functional limitations (log scale)		0.89 (0.80,1.00)	0.89 (0.79,1.00)	0.88 (0.79,1.00)
Medicare enrollee				
Yes		1.13 (0.92,1.38)	1.09 (0.89,1.35)	1.10 (0.89,1.35)
No		Referent	Referent	Referent
Number of doctor visits in past two years				
None		Referent	Referent	Referent
One or more		1.38 (1.08,1.77)	1.36 (1.04,1.77)	1.37 (1.06,1.76)
Resistance Indicators				
Number of contact attempts in				
2006 wave (log scale)			0.86 (0.74,0.99)	0.86 (0.74,0.99)
2004 wave (log scale)			0.89 (0.79,1.00)	0.89 (0.80,0.99)

Covariates	Model 1	Model 2	Model 3	Model 4
Respondent Demographics	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Interview mode (2004)				
Phone			1.00 (0.83,1.21)	1.01 (0.82,1.23)
Face-to-face Asked how long interview would last (2004)			Referent	Referent
Never				
Seldom			Referent	Referent
Often			0.87 (0.68,1.12)	0.87 (0.69,1.11)
Asked about confidentiality (2004)			0.63 (0.40,0.99)	0.63 (0.40,0.98)
Never				
Seldom			Referent	Referent
Often			0.72 (0.58,0.90)	0.72 (0.58,0.90)
Respondent cooperation (2004)			0.53 (0.26,1.08)	0.53 (0.26,1.08)
Excellent				
Good			Referent	Referent
			0.70 (0.56,0.88)	0.70 (0.56,0.87)
Fair/poor			0.45 (0.27,0.76)	0.45 (0.27,0.75)
Respondent enjoyment (2004)				
A great deal			Referent	Referent
Quite a bit			1.00 (0.82,1.23)	1.00 (0.82,1.23)
Some			0.87 (0.68,1.10)	0.87 (0.69,1.10)
A little/not at all			0.67 (0.52,0.87)	0.67 (0.52,0.86)
Elapsed time prior to consent request				
First quartile			Referent	Referent
Second quartile			1.05 (0.83,1.32)	1.06 (0.84,1.33)
Third quartile			1.12 (0.85,1.48)	1.14 (0.86,1.50)
Fourth quartile			1.20 (0.89,1.61)	1.21 (0.90,1.62)
Interviewer Characteristics				
New hire				
Yes				0.87 (0.59,1.29)
No				Referent
Age				0.99 (0.98,1.00)
Gender				
Male				Referent
Female				1.45 (0.98,2.14)
Race				
White/other				Referent
Black				0.52 (0.39,0.69)

Covariates	Model 1	Model 2	Model 3	Model 4
Respondent Demographics	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Hispanic				
Yes No				1.01 (0.60,1.71)
Education				Referent
12 years				
13–15 years				Referent
16+ years				1.45 (0.81,2.57)
				1.42 (0.82,2.45)
Interviewer variance	1.73 (1.49,2.02)	1.76 (1.51,2.06)	1.74 (1.02,3.00)	1.71 (1.27,2.31)

Bold indicates statistically significant ($P < 0.05$).

TABLE 3

Model Fit Statistics

	Model 1	Model 2	Model 3	Model 4
Pseudo R^2 (max. rescld)	0.02	0.03	0.07	0.07
Likelihood ratio statistic	84.0	77.4	157.1	17.7
Chi-squared p-value	<0.01	<0.01	<0.01	0.01
AIC	7224.2	7186.8	7059.7	7056.0
BIC	7258.8	7284.2	7204.2	7222.5
Degrees of freedom	55	55	55	55
Sample size	7,457	7,457	7,457	7,457