

PREDICTORS OF NONRESPONSE IN A LONGITUDINAL SURVEY OF ADOLESCENTS¹

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Longitudinal design in surveys provides a unique opportunity to study the causes and effects of nonresponse, particularly when participants in a given round are recruited from a cohort of respondents from the prior rounds. The availability of survey data for respondents and nonrespondents in a given round allows one to directly estimate nonresponse bias and its components, as well as to gauge the relative effectiveness of weight adjustment strategies (Kalsbeek et al. 2001). In addition, multiple contacts with the same sample over several rounds of data collection can be utilized to investigate the role that the survey design and process play in determining the final recruitment outcome for individual followup rounds.

Recruiting the same sample on multiple occasions expands the list of potentially viable predictors of sample recruitment outcomes in longitudinal cohort studies. The more times one works with a sample, the more opportunities one has to observe those things that may influence recruitment in later rounds. Despite this, relatively few published studies on the predictors of nonresponse in longitudinal studies have been done. De Maio (1980), for example, examined the role of past survey experience, while Aneshensel et al. (1989) studied the role of characteristics of the baseline interview (e.g., length). More recently, Lengacher, et al. (1995) have studied the effect of incentives, and Campanelli and O'Muirchartaigh (1999) have reported on the role of interviewer continuity across consecutive rounds. Most of the remaining research on this topic has focused on nonresponse in cross-sectional in-person and telephone surveys.

This paper examines factors affecting several outcomes of subject recruitment in followup rounds of multi-round cohort samples. In particular, our goal is to identify those design and process features which affect any of four 0/1 recruitment outcome variables, defined later for the National Longitudinal Study of Adolescent Health (the Add Health Study), a national school-based health survey of teenagers with several rounds of in-home followup after an initial in-school administration. These variables presume that recruitment can lead to study participation, or any of the following four types of nonresponse, defined according to where in the recruitment process the end result occurs (Lessler and Kalsbeek, 1992):

- 1) *Not Solicited (NS)*: Sample members are not solicited for participation by the interviewer because: they have moved and their new address is unknown, they are out of the country, or interviewers were not able to talk to them about survey participation after having established contact with their place of residence.

- 2) *Solicited but Unable (SUA)*: Sample members are asked to participation in the study, but they decline because of their inability to do so. Possible reasons include: physically/mentally incapable, language barriers, scheduling problems, and so on.
- 3) *Solicited but Unwilling (SUW)*: Sample members are asked to participate but they refuse. Reasons for declining in this way include: confidentiality concerns, mistrust of government, just too busy, topic too personal, don't do surveys, and so on.
- 4) *Other nonrespondents (OTH)*: Sample members fail to become participants for a reason that does not fit in any of the three previous categories. Some examples are lost schedules, partial respondents, and other non-interviewable respondents.

Following a conceptual framework for round-specific recruitment outcomes in certain longitudinal interview surveys, we fit separate multivariate logistic regression models for various recruitment outcomes of the in-home Wave II (IH2) round of the Add Health Study. Questionnaire and process data from the prior in-home Wave I round (IH1) were used in our search for predictors of four round-specific recruitment outcomes.

The Add Health Study

The Add Health Study is an ongoing school-based national survey of health-related behaviors in adolescents from grades 7-12. Its study design calls for collecting data from selected teenagers, their parents, and school administrators to identify risk factors for adolescent health behavior and to quantify their prevalence. Questionnaire topics have included: health status, exposure to violence, smoking behavior, illegal substance use, and sexual behavior. Add Health's sample of students is school-based, meaning that multi-stage stratified systematic sampling was first used to select 80 high schools and 52 middle schools with probabilities proportional to size (PPS), and that the target population is limited to the school age population of those enrolled in grades 7-12. Stratification in school selection was by region of the country, urbanicity, school type, ethnicity, and school size. A baseline sample of students was then chosen in the second sampling stage from rosters of current students in participating schools. The final teen student sample at the study's outset consisted of an approximately equal-probability *core sample* and several specialized samples (e.g., of minorities, the disabled, twins, siblings, and unrelated pairs). The focus in our study has been on the recruitment experience from the core sample alone.

Four rounds of data gathering have been completed thus far in the Add Health study, starting with a self-administered in-school questionnaire (IS1, n=90,118) in 1994-1995 and followed by three in-person in-home interviews for IH1 (n=20,745) in 1995, IH2 (n=14,738) in 1996, and a Wave III round (IH3) that

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is being completed in 2001-2002. Recruitment and data collection in IS1, IH1, and IH2 were done by the National Opinion Research Center. RTI International is conducting IH3. The overall response rate for the core sample was 78.1% for IH1 and 88.4% for IH2 (with 12,105 and 9,148 completed interviews, respectively). In IH1 and IH2, the household first received an advanced letter to introduce the study, then interviewers contacted the selected teen's parents or guardians by personal household visit or telephone to: (i) obtain permission to interview the selected teen in the home and (ii) ask them to participate in an in-home parent interview in IH1. Once permission was given, interviewers then conducted the interview with the selected teens in person or set up an appointment for an in-home interview with them. During this interview, questions were read aloud and the respondent's answers entered into laptop computers (CAPI) for less sensitive topics and a specially designed form of audio computer assisted self-interviewing (ACASI) was used for more sensitive topics to maximize the confidentiality of the teen's responses. The parent interview followed standard face-to-face interviewing methods. A household was considered to have responded if the teen completed an interview. A more detailed description of the Add Health study design is published elsewhere (Bearman, et al., 1997; Udry 1998). The focus in our study of recruitment outcomes is IH2 only.

A Conceptual Framework for Recruitment Outcomes

The conceptual framework in our search for predictors of recruitment outcomes is an adaptation of a recently proposed framework for similar outcomes in interview surveys (Groves and Couper, 1998). Our framework (see Figure 1) is specifically intended for longitudinal studies of the student population from school-based samples as used in Add Health.

As defined in the right hand box of Figure 1, the four recruitment outcome variables we consider are: *contactability* (success in soliciting study participation among those in the entire sample); *unwillingness* (a refusal among those solicited); *inability* (not able among those solicited and not unwilling); and *participation* (responding among those solicited). Specific computational expressions are seen there for these 0/1 variables. We conduct separate searches for predictors of each variable.

Structurally, our framework presumes that outcomes of the recruitment process may be affected by several **factors** (boldface type in Figure 1) that are tied to this process. **Household teen (student) subject, school, and interviewer** factors are linked to the main "players" in the recruitment process, while the **study design and experience from prior waves**, respectively, correspond to the macro and micro scientific context. The **local social environment** and **household-interviewer interaction** reflect the macro and micro process backdrop to recruitment, respectively. Each factor, in turn, consists of a number of hypothesized *influences* (bulleted in Figure 1), some of which have justification from the research literature. It is for each of these influences that we seek *data items* to serve as potential predictors of recruitment outcomes. It should be noted that Figure 1 is intended to be a simultaneous visual portrayal of possible predictors of all four of the recruitment outcome variables we considered, with the set of factors being the same for each outcome, but the influences varying somewhat among them, as indicated. For instance, the "location protocol" in the

study design is hypothesized to influence contactability but not the other three outcome variables.

The search for outcome predictors in our framework considers the nature of recruitment in this type of longitudinal design, as well as those involved in the process itself. Viewed as a sociological event, survey recruitment may be affected by the **local social environment** surrounding the recruitment process. For example, high crime rates in the resident's neighborhood may limit access by the telephone interviewer to the household and may lead to a greater likelihood of refusal because of concern about safety. Recruitment may also be affected by the surrounding degree of urbanization. Characteristics of the **household** one is trying to recruit in an interview survey also may play a role. Several of these characteristics have been examined as predictors of survey participation (Couper and Groves, 1996; Groves and Couper, 1998). Attributes of the *teen* and other members of the **household** like its recent mobility patterns of its members, and its members' working schedules may determine at-home patterns, which in turn affect the chances that they will be solicited. Social, political, or demographic characteristics of the **household** and its members, including their education, race, and socio-economic status, are also thought to affect the household's decision to participate, as is the level of parental interest in the lives of their children. We also allow the possibility that the *teen's* recent academic performance, behavioral characteristics, and basic predisposition to participation in the study may affect the outcome of efforts to solicit or interview him/her in followup rounds.

The Add Health Study initially identified and recruited each sampled teen through the **school** they were attending at the time. Socio-demographic and disciplinary policies of these **schools** may therefore impact the ability of interviewers to locate and recruit its students and their families for followup, if the schools are partners in this process by supplying information or support to the recruitment process. The extent of locator information for followup required by the **study design**, combined with the quality of the locator information that the school provides initially, and the survey organization is able to obtain later, may also impact the ability of interviewers to locate households and complete followup interviews. It is also plausible to expect that **study design** specifications for locating and recruiting respondents, along with the use of incentives and features of the operational plan for training and supervision of interviewers, could influence recruitment outcomes. Some of these **study design** features, along with the personal and professional background of the **interviewer** have been found to be associated with contactability and unwillingness recruitment outcomes (Botman and Thornberry, 1992; Couper, 1991; Groves and Couper, 1998). In addition to the quality of locator information, recruitment outcomes in a given round may also be affected by other **experience from prior rounds**, including the recruitment process in those rounds as well as interviewer observations or responses to related behavioral questions. For example, reporting an extreme health behavior (e.g., illegal drug use) in one round may signal the possibility of avoidance in subsequent rounds. Finally, the use of certain recruitment strategies (e.g., the timing of call attempts) by the interviewer at the point of interaction with the household(er) may affect the outcome of recruitment efforts.

Methods

The principal analysis tool we used in our search for recruitment predictors was fitted logistic regression modeling with dichotomous 0/1 indicator variables corresponding to the four IH2 recruitment outcomes from our conceptual framework (i.e., contactability, unwillingness, inability, and participation). These indicators were computed by reviewing the final IH2 outcome for each member of the sample that was assigned for recruitment in that round. Each household in the IH2 sample was then classified as either a respondent or a type of nonrespondent (i.e., as NS, SUA, SUW, or OTH). The results of this sample classification were then used to define the four outcome indicator variables defined in Figure 1 that would become dependent variables in our logistic model fitting.

Subsequent procedural steps of our analysis plan were the following. First, we did a careful review of all available survey and process data from IH (conducted the year before IH2) to identify those data items corresponding to our framework that might become predictors of the recruitment outcomes we considered. This review yielded 81 data items. Influences recorded in solid bullets in Figure 1 are those with one or more of these items. To reduce this relatively large set of items to a more manageable number for subsequent modeling, a two-way categorical analysis was performed to measure the bi-variate association between each dichotomized or categorized item and the response/nonresponse outcome for the full sample. The specific measure of association we used for this purpose was a (maximum) risk ratio, calculated as the largest of the nonresponse rates among all item categories, divided by the smallest of these nonresponse rates. The 16 items with a risk ratio of 1.5 or higher were retained for subsequent evaluation as possible predictors of the four 0/1 outcome variables. Next, using sample weights that were normalized to the respondent sample size, we ran four separate stepwise selection logistic models in SAS v8.2 (SAS Institute Inc., 2001), one for each recruitment outcome variable and with all the 16 semi-finalist items as candidate predictors. Item regression coefficients significant at $\alpha=0.05$ were thereby flagged as provisional predictors for each outcome. Of the sample of 10,374 IH2 sample members (i.e., IH1 respondents) that were available for this analysis step, 7,072, 6,874, 6,650, and 6,874 were used for contactability, unwillingness, inability, and response, respectively, since observations with missing values for any of the 16 semi-finalist variables or the dependent variable were dropped from this part of the analysis. Note that we ran this stepwise model fitting both with and without plausible first-order interactions included, and that except for contactability the significant predictors that emerged were the same as reported below. Finally, for each of the four recruitment outcomes, the final stepwise model was re-run using PROC RLOGIT in SAS callable SUDAAN v8.0 (Research Triangle Institute, 2001) to account for key features of the Add Health sample design in identifying the final set of predictors for each recruitment outcome. The sample sizes were adjusted back to 7,794, 8,305, 9,298, and 8,301 for the four outcomes respectively with only the missing values of the finalized dependent and independent variables excluded.

Findings

Our search of all available IH1 documents yielded 81 data items corresponding to 10 influences (solid bullets in Figure 1) linked to four of the eight factors in our conceptual framework. They included degree of urbanization and measures of neighborhood safety for the **local social environment**. We also identified several **household** measures including its: size, income, number of years at the current address, and type of residential structure; its residents' ages and social inter-relationship; and the parents' education, employment status, and involvement in relevant organizations (e.g., the PTA). We found a number of items related to the **teen**, including age, race, gender, religion, depression scales, and whether or not they had received counseling in the previous year, had ever considered suicide, had recently been in trouble with school administrators, or had recently gotten bad grades in school. Finally, we were able to identify the following items based on **experience from prior rounds** (i.e., IH1): current substance use (e.g., alcohol, tobacco, and illegal drugs), whether or not they were a regular smoker, had been drunk in the past year, or had been a binge drinker, and interviewer observations of the respondent (e.g., bored, embarrassed, etc.).

The sets of significant predictors identified by stepwise model fitting differed by recruitment outcome variable, although some of the 16 items that were run through this process were significant in more than one model. Controlling for other covariates and using $p \leq 0.05$ to designate a significant predictor, the SUDAAN results for the four outcomes are presented in Tables 1-4. Note that all predictors listed in these tables had been found to be significant in the stepwise modeling:

Contactability (Table 1):

We found that teens' households were more likely to be solicited in IH2 the longer the household had lived at its current address as of IH1, and if the household's reported income in IH1 was above the poverty level based on the 1995 national standards (U.S. Bureau of the Census, 1996), or if the teen felt safe in the neighborhood, had not smoked in the past 30 days, or was performing relatively well academically at that time. Based on the size of the estimated odds ratio (OR), the items linked to neighborhood security, the household being above poverty, and current smoking status as of the prior round were the most important among the set of significant predictors, all three having a positive effect on contactability. Note that when the stepwise procedure was run with first-order interactions included, the neighborhood security and recent mobility items were no longer significant predictors of contactability and their interaction was marginally significant.

Unwillingness (Table 2):

Solicited household in IH2 were more likely to refuse to participate if the teen was white, or if in IH1 the teen had not smoked in the past 30 days, had parents who did not volunteer to do fund-raising for the PTA, or had parents whose highest educational attainment was high school or less. Race and prior smoking behavior were the two most important among these items, both demonstrating a positive effect on unwillingness.

Inability (Table 3):

Willing IH2 households were more likely to be unable to participate if in IH1 they lived in a rural area or had smoked in the past 30 days, both items being of nearly equal importance.

Participation (Table 4):

Households of solicited teens were more likely to participate in IH2 if, as of IH1, the teen was nonwhite or if the teen's parents had gone to college or had volunteered to do fund-raising for the school's PTA. Parental involvement in the PTA was most important among these three items. Recall that these two parental traits were also significant predictors of unwillingness but in the opposite direction, as one would expect.

Discussion

Our findings are partially consistent with earlier research. Among the inconsistencies, a number of items that have been found to be important predictors of survey nonresponse in interview surveys did not emerge here or were found to have differing effects. For example, Groves and Couper (1998) reported that urban residents are usually less likely to be contacted in surveys due to different reasons of spending more time out of home. Weeks et al. (1980) reported that finding someone age 14+ at home was most likely in rural areas and most difficult in the inner city. Indeed, our findings did not find level of urbanization to be predictive of contactability. Also, contrary to what we might have anticipated based on these earlier studies, teens living in rural areas were less likely to be able to participate in IH2, although recall that our assessment was limited to those who were not unwilling to participate.

Also, our findings on the effect of race only partly agree with previous studies. We found lower response rates and greater unwillingness among whites, which agrees with the findings by Weaver et al. (1975) and O'Neil (1979) for telephone surveys but not those reported by Kalton and Lepkowski et al. (1990) for in-person interviewing and by Moonesinghe et al. (1995) for a mail-then-telephone protocol.

One interesting but somewhat curious finding from our research is the broad and prominent effect of reported smoking behavior from the previous round on recruitment outcome for the current round. We found that students who had been current smokers in the previous round were less likely to be solicited, more likely to be unable as long as they were not unwilling, but less likely to refuse once they are solicited. Puzzling is that accompanying these effects we might have expected smoking status to affect participation as well, but it did not.

While the longitudinal design of the Add Health Study has enabled us to evaluate the statistical effect of several substantive and process items on recruitment outcomes for IH2, only a relatively small portion of the possible outcome influences posed by our conceptual framework had data for this round of data collection. Fortunately, a wider range of data items will be available to our research team for the next round of this study (IH3) and will be used for subsequent assessment. It is our hope that the results of this and later work will enable those planning surveys like Add Health to better predict recruitment outcomes so that appropriate preventive steps can be taken in future rounds of the Add Health Study, and in other similar studies, to diminish the extent of adverse recruitment outcomes

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Figure 1. Conceptual model for recruitment outcomes in followup rounds of the Add Health Study

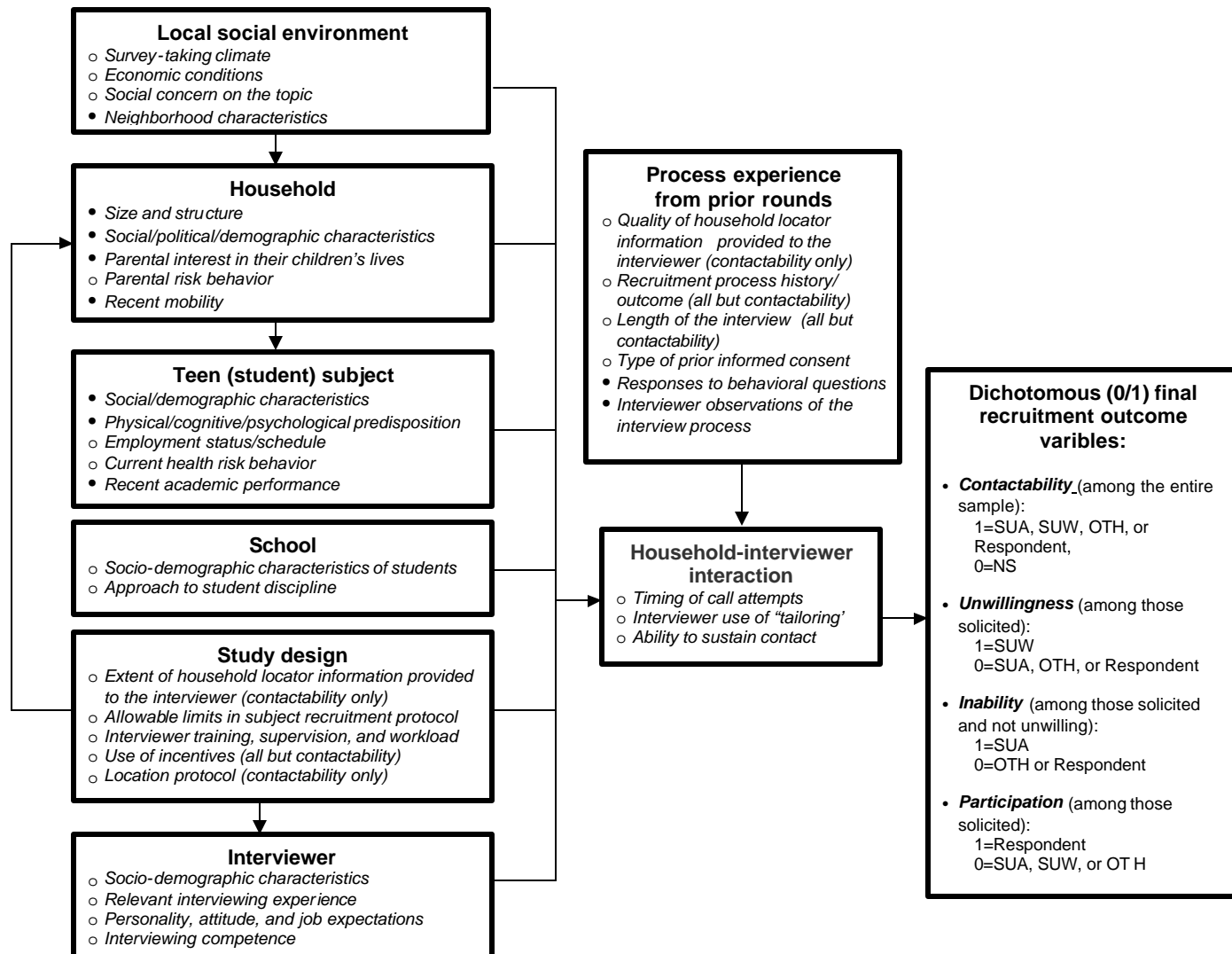


Table 1. Predicting contactability (n=7,794)

Factor/Influence		Predictor	Parameter Estimate	Standard Error	p value	OR	95% CI
		Constant	2.29	0.26	<0.0001		
Local social environment	<i>Neighborhood characteristics</i>	Feel safe in the neighborhood? (1=yes)	0.44	0.19	0.03	1.55	1.06-2.27
Household	<i>Social/political/demographic characteristics</i>	Poverty? (1=above national poverty level)	0.39	0.19	0.05	1.47	1.00-2.16
	<i>Recent mobility</i>	Years living in the current residence	0.09	0.02	0.0001	1.10	1.06-1.14
Process experience from prior rounds	<i>Responses to behavioral questions</i>	Smoking in the past 30 days? (1=no)	0.41	0.17	0.02	1.50	1.07-2.11
Teen (student) subject	<i>Recent academic performance</i>	Index of poor academic performance*	-0.15	0.04	0.001	0.86	0.79-0.94

* Including poor grades, trouble with teacher/school/hw/students, fight, skip school, repeat grade, and out-of-school suspension.

Table 2. Predicting unwillingness among those solicited (n=8,305) Survey Research Methods

Factor/Influence		Predictor	Parameter Estimate	Standard Error	p value	OR	95% CI
		Constant	-3.85	0.20	<0.0001		
Household	<i>Social/political/demographic characteristics</i>	Highest educational attainment of parents (1=college or higher)	-0.29	0.12	0.02	0.74	0.58-0.96
		<i>Parental interest in their children's lives</i>	A parent volunteers in school fund-raising? (1=yes)	-0.51	0.25	0.05	0.60
Process experience from prior rounds	<i>Responses to behavioral questions</i>	Smoking in the past 30 days? (1=no)	0.48	0.19	0.02	1.61	1.09-2.40
Teen (student) subject	<i>Social/demographic characteristics</i>	Race (1=white)	0.66	0.15	0.0001	1.94	1.42-2.66

Table 3. Predicting inability among those solicited but not unwilling (n=9,298)

Factor/Influence		Predictor	Parameter Estimate	Standard Error	p value	OR	95% CI
		Constant	-3.10	0.13	<0.0001		
Local social environment	<i>Neighborhood characteristics</i>	Rural? (1=yes)	0.30	0.14	0.03	1.36	1.02-1.79
Process experience from prior rounds	<i>Responses to behavioral questions</i>	Smoking in the past 30 days? (1=no)	-0.30	0.12	0.02	0.74	0.58-0.94

Table 4. Predicting response among those solicited (n=8,301)

Factor/Influence		Predictor	Parameter Estimate	Standard Error	p value	OR	95% CI
		Constant	2.35	0.19	<0.0001		
Local social environment	<i>Neighborhood characteristics</i>	Rural? (1=yes)	-0.13	0.08	0.14	0.88	0.74-1.05
Household	<i>Size and structure</i>	Household size (continuous)	0.04	0.04	0.35	1.04	0.96-1.12
	<i>Social/political/demographic characteristics</i>	Highest education of residential parents (1=college or higher)	0.27	0.10	0.012	1.30	1.06-1.60
	<i>Parental interest in kids' lives</i>	A parent volunteers in school fund-raising? (1=yes)	0.41	0.15	0.01	1.51	1.12-2.04
Teen (student) subject	<i>Social/demographic characteristics</i>	Race (1=white)	-0.25	0.10	0.02	0.78	0.63-0.96