

THE NATIONAL HEALTH INTERVIEW SURVEY AS A SAMPLING FRAME FOR A NATIONAL MEDICAL EXPENDITURE SURVEY: A FIELD TEST DESIGN

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1. Introduction

The National Center for Health Statistics (NCHS), the National Center for Health Services Research (NCHSR), and the Health Care Finance Administration (HCFA) plan to conduct a National Medical Expenditure Survey (NMES) in 1987. The NMES will oversample several subpopulations. Among them are Blacks, Hispanics, and the elderly. Conducting an efficient sample of these groups ordinarily requires a substantial amount of screening. It is proposed to link the NMES to the National Health Interview Survey (NHIS) to accomplish the needed screening by using the NHIS sample households as a sampling frame. This paper describes the design of a field test to: 1) evaluate alternative methods of selecting a linked household sample and to analyze their effects on costs, response rates, time schedules, and potential administrative or operating problems; 2) evaluate alternative remuneration strategies to increase response to a self-administered questionnaire; and 3) evaluate alternative methods of data collection from medical providers for the purpose of verifying household respondent information. This field test is part of a multi-stage research program to select an appropriate strategy to link each of the National Center for Health Statistics (NCHS) population-based surveys to the redesigned NHIS sample implemented in 1985. It is also a developmental activity in connection with the design of the 1987 NMES.

Sirken (1983) presented the background for a series of projects planned to evaluate the NCHS population-based surveys. These projects are to evaluate the practical feasibility of alternative strategies for integrating current separate survey designs for NCHS population-based surveys using the NHIS as a sampling frame for the other surveys. The project history is summarized in section 2.

The field test of the NHIS/NMES linkage will include a two-round household panel survey of 600 households, a self-administered supplemental questionnaire for a subsample of household members 18 years of age and older, and a follow-up survey of medical providers identified by household members who have signed provider contact permission forms. Several methodological tests are included in connection with each of these field trial components. The detailed description of the field test design is presented in section 3.

The objective of this project is to conduct field trials to test and evaluate alternative strategies for: (a) linking the NMES Household Survey Component (HSC) with the NHIS; (b) completing the Health Background Component (HBC), a self-administered supplement; and (c) conducting the NMES Medical Provider Component (MPC). The results of the tests will be used to select the appropriate linkage methods, as well as appropriate survey

procedures for the NMES, so that an integrated and appropriate design can be implemented for the 1987 NMES. Specific analytic plans are discussed in section 4.

2. Historical Background

Integrated Survey Design

The National Center for Health Statistics (NCHS) conducts four population-based surveys:

- (1) The National Health Interview Survey (NHIS).
- (2) The National Medical Care Utilization and Expenditure Survey (NMCUES), now renamed the National Medical Expenditure Survey (NMES).
- (3) The National Survey of Family Growth (NSFG).
- (4) The National Health and Nutrition Examination Survey (NHANES).

These surveys provide data on the character and effects of illness and disability, the nature and cost of medical care received, the dynamics of population change, and related demographic, social, and economic variables. Currently the designs for the population-based surveys are independent and individually tailored to allow each survey to meet its specific goals. The NHIS is a continuous survey, while the other surveys are conducted periodically.

Following each decennial census of the population, the NHIS sample design is evaluated and revised. The redesign of the NHIS following the 1980 census was implemented in 1985. This redesign differs from past NHIS sample designs in a key way: the sampling frame consists of an area frame based entirely on geographical areas. The previous NHIS design employed a combined area and list frame based on decennial census information. Both designs are supplemented by a permit frame to cover new construction. Under the Bureau of the Census confidentiality provisions (13 U.S.C. 8,9), no identifiable person or household information can be released. For this reason, households and individuals selected for the pre-1985 NHIS could not be used as a frame for other NCHS surveys. The 1985 redesign of the NHIS provides an opportunity to integrate the NCHS's population-based surveys; that is, to use the NHIS sample as the sampling frame for the NMES, the NSFG, and the NHANES.

The NHIS is a continuous survey involving personal interviews of approximately 40 minutes in length. Under the 1985 design, these interviews are conducted in 201 Primary Sampling Units (PSU's) with weekly national samples of about 950 households. The Bureau of the Census is the data collection agent. After the Census interviewers complete their weekly interview assignments, they transmit the questionnaires to the Census Bureau

Regional Offices where they are field edited. Approximately two weeks later the Regional Offices transmit the weekly batches of questionnaires to the NCHS Data Processing Center in North Carolina where they are re-edited and keyed. Tapes containing the keyed data are released to the Division of Health Interview Statistics (DHIS), Computer Systems and Programming Staff, for final editing and formatting.

The NMES is a periodic panel household survey involving personal and telephone interviews with respondents in sample households. The most recent cycle of the NMCUES, for example, collected information about approximately 17,100 key persons constituting approximately 7,200 reporting units. The data collection consisted of five interviews, an 84 minute average initial interview, followed by four follow-up interviews, with an average length of 74 minutes each. Historically, the NMES has been conducted for DHHS by a private contractor, independently of the NHIS, using the contractor's own sample design.

The proposed linked survey design for 1987 assumes that the NHIS would continue to be conducted by the Census Bureau, and that the data collection for the NMES would continue to be conducted by a private contractor. The NHIS would serve as the sampling frame for the NMES. The linked design would be implemented in three stages:

- First - NHIS interviews would continue to be conducted on a weekly basis by the Census Bureau.
- Second - NMES subsamples would be selected from the weekly NHIS samples and then transmitted to the NMES contractor.
- Third - NMES panel interviews would be conducted by the NMES contractor.

Some of the conceptual and statistical issues involved in linking the designs of the NSFG and the NMCUES (or NMES) to the NHIS have been examined (see Waksberg and Northrup, and Cox, et al). A field test to select an appropriate linkage strategy for the NSFG will be completed in 1985. These investigations have indicated that an integrated design would have advantages over the independent NHIS and NSFG designs in cost, response, respondent burden, data quality, and timeliness, particularly if separate estimates were required for relatively small population domains.

However, the integrated survey design depends on a number of operational factors. The compatibility of the survey designs and the feasibility of linking the specific surveys need to be evaluated.

NHIS/NMES Linkage

Preliminary theoretical work has shown that a linked design promises to be more cost effective than an area sample (Cox, et al, 1983). Although

an area probability sample would be adequate for developing estimates about the total United States resident population, its less efficient design would preclude separate analyses of groups of major policy interest including Blacks, Hispanics, the poor, and the elderly. This would adversely affect the ability to conduct studies of the Medicare and Medicaid populations, and elderly users and nonusers of the Veterans Administration facilities, as well as other groups that are of major concern to Federal, state, and local government. These problems could be avoided by conducting an area probability survey with a greatly enlarged sample or requiring a large amount of screening, but this alternative is also considered unacceptable. The exact extent of the increased costs is not known and indeed one of the benefits of the field trials is that they will enable the production of a useable cost model. It is expected, however, that the difference in cost between a linked design and an unlinked design large enough to produce comparable estimates for small populations is substantial (Cox, et al). The Household Survey Component of this field test was particularly designed to evaluate linkage strategies.

The data to be collected in the 1987 NMES, using a self-administered supplement, require self-response for each household member 18 years of age or older. It could be collected in an additional round or supplement to an existing round of personal or telephone interviewing for the NMES, but numerous callbacks to each household would be necessary. If high response rates can be achieved on a self-administered supplement, a major savings in field costs could be realized. The Health Background Component of this field test is designed to evaluate alternative remuneration strategies for enhancing response rates.

The Medical Provider Component of the NMES will be used to collect information from medical providers to supplement expenditure data reported by the household. The 1977 NMCUES relied on a supplementary MPS to verify the data collected from household respondents. The verification process required that a subset of cases be hand-matched and that computer algorithms be developed to apply the matching criteria. These algorithms were then applied to the entire data set. Such a method, used in the 1977 NMCUES, was found to be expensive, time-consuming, and not always reliable. The NMES linkage field test will be used to develop an MPS that directly involves the medical provider in the reconciliation process. This will expedite analysis and simultaneously improve the accuracy and completeness of reporting. The 1987 MPS will emphasize the verification of expenditure data from respondents unlikely to know the exact cost of care received. This will include Medicaid users and users of home health care. This study will determine whether a redesigned medical provider survey can substantially reduce item nonresponse and thereby improve the analytic capability of the 1987 NMES and other future health expenditure surveys. If this redesigned MPS is successful, it could shorten the time necessary to produce useable estimates by at least six months.

3. Field Test Description

Respondent Universe

The respondent universe for the Household Survey Component (HSC) consists of National Health Interview Survey (NHIS) households living in NHIS dwelling units in the first six months of 1985 in ten selected NHIS primary sampling units (PSU's). The sample for the HSC will be obtained from housing units households interviewed as part of the NHIS conducted by NCHS in 1985. Persons will be considered ineligible for this component of the survey during any period in 1985 that they are members of the armed forces, in prison, in an institution, or residing outside the United States.

Unlike the area frames used for the 1977 NMCES and the 1980 NMCUES, the NHIS-based frame will contain names and addresses in addition to individual and household characteristics that will be used in sample selection. Using the NHIS to define the sample will make it possible to oversample specific subpopulations. Table 1 summarizes information on the number of households in the sampling frame, respondent universe, and sample. A subsample of adults in these households will be asked to complete the self-administered supplement.

Table 1. Field Trial Respondent Universe and Sample Size

		Respondent Universe		
		Annual Household		Sample
Race/ Ethnicity*	Age*	Income	Size [§]	Size
Black	<65	<125% PL†	470	60
		>125% PL	780	60
	65+	all	110	80
Hispanic	all	<125% PL	360	60
		>125% PL	1,120	60
Other	<65	<125% PL	650	60
		>125% PL	6,400	60
	65+	<125% PL	300	60
		>125% PL	560	60
NHIS Nonrespondents				40
Total			10,750 [§]	600

* Household contains at least one member in the category. The order of category preference used to classify was Hispanic, Black, Other for Race/Ethnicity, and 65+, <65 for Age.

† The cutoff point between poor and nonpoor for this study will be 125% of the Poverty Level (PL) as set by the U.S. Bureau of the Census.

§ The 1985 NHIS was fielded with a three quarter size sample of 37,500 households. The ten PSU's selected for this field test account for 85 percent of the NHIS sample and four months of NHIS sample will be available for use as a frame for this field test.

The respondent universe for the Medical Provider Component (MPC) consists of medical providers with whom the HSC universe members had contact within the reference period for this study.

Sample Design and Selection

The sampling frame for the field trials consists of the NHIS weekly samples of dwelling units in ten PSU's selected from the 1985 NHIS sampling frame. The sampling period extends from February 15, 1985 through June 15, 1985. From these dwelling units, approximately 600 households will be sampled for this study. Several alternative design strategies will be tested in the field trials which dictate some features of the sample design. Two types of sampling units for the NMES will be tested: the NHIS dwelling unit and the NHIS household. At the same time, two initial contact methods (telephone and in-person) and two modes of interview for round two (telephone and in-person) will be tested. When the sampling unit for this study is defined as the NHIS housing unit, the interviewer will screen the sampled address to determine if the NHIS sampled household is still in residence. Regardless of whether the NHIS household still resides at the sampled unit, the interviewer will conduct the NMES interview for all members of the housing unit. When the sampling unit is defined as the NHIS household, the interviewer will begin by screening the household to verify the household composition obtained in the NHIS interview. If all or part of an NHIS household has moved, these people will be tracked. Movers within the PSU of origin will be interviewed face-to-face; all other movers will be tracked by telephone, but not actually interviewed. The various alternative strategies will be applied to the sample in a completely crossed factorial design.

In the 1980 NMCUES "key persons" were designated and a special effort was made to keep track of every key person and to collect data from them for the duration of the survey. The 1980 NMCUES definition of "key person" was (1) an occupant of a national household sample housing unit or group quarter at the time of the first interview; (2) a person related to and living with a State Medicaid household case member at the time of the first interview; (3) an unmarried student 17-22 years of age living away from home and related to a person in one of the first two groups; (4) a related person who had lived with a person in the first two groups between January 1, 1980, and the round one interview, but was deceased or had been institutionalized; (5) a baby born to a key person during 1980; or (6) a person who was living outside the United States, was in the armed forces, or was in an institution at the time of the round one interview but who had joined a related key person. This definition of "key persons" is sometimes difficult and inappropriate to apply to the respondents in this field study. Changes, if any, that may need to be made to the definition to accommodate linkage to the NHIS will be based on the experience of this field test.

An additional sample of dwelling units that were nonrespondents in NHIS will be included in the study to determine the probability of continued nonresponse. The households in these dwelling units will be treated in the same way as the households designated for the household sample.

Table 2 shows the combinations of design options and sample sizes for testing them. Households will be selected to achieve the subdomain yields shown in Table 1 and then randomized to the treatment groups in Table 2.

Table 2. HSC Design Options and Sample Sizes

Design Options	Sample Sizes
Household Sample Total	300
Telephone Initial Contact Subtotal	150
Round 2 Telephone	75
Round 2 In-person	75
In-person Initial Contact Subtotal	150
Round 2 Telephone	75
Round 2 In-person	75
Housing Unit Sample Total	300
Telephone Initial Contact Subtotal	150
Round 2 Telephone	75
Round 2 In-person	75
In-person Initial Contact Subtotal	150
Round 2 Telephone	75
Round 2 In-person	75
Grand Total	600

In addition, 180 households will be randomly selected for the self-administered supplement; half of these will be from the round two telephone sample and half from the sample that will only be interviewed in person. This sample is necessary in order to allow estimation of the projected response rate on the main NMES within seven percentage points at the 95 percent confidence level. An experiment will be conducted to examine the relative merits of both prepaid and promised monetary incentives. One third of these households will receive a check for \$5 per respondent at the time the questionnaire is mailed. Another third of the respondents will be informed that a \$5 check will be sent to each respondent when the supplement is returned. The final third of the respondent households will be given the \$5, but will not be told of the remuneration in advance.

At the completion of round two, all HSC respondents who reported medical provider visits within the study reference period will be asked to sign permission forms addressed to the providers they name. Families interviewed by telephone in round two will be mailed permission forms and asked to return them with appropriate signatures. Forms will be left with the household respondent for

household members who are not at home at the time of the in-person interview. The permission forms for children under age 14 will require the signature of a parent or guardian and, for minors 14 to 17 years of age, both the minor and a parent or guardian must sign.

On the basis of the NMCES experience in conjunction with the anticipated response rates, permission forms for a total of 600 unique medical providers are expected to be collected. These 600 providers will be randomly assigned to three data collection treatments: telephone data collection from the contractor's central office, mail data collection, and in-person data collection. Within each of the experimental treatments the sample will be randomly divided into two groups. One half will be told the dates of visits reported by the household, asked to confirm or deny each, and then asked to search their records for any additional visits during the time period which were not reported by the household. The other half of each sample will not be given the reported dates, but will be asked to search their records for all visits by that particular patient during the appropriate time period. The interviewer (or office clerk, in the case of the mail treatment) will then refer to the patient's report of dates and will attempt to reconcile any visits reported by the patient which were not found by the provider.

Table 3 shows the combinations of MPC design options and sample sizes for testing them.

Table 3. MPC Design Options and Sample Sizes

Dates Provided	Assigned Mode of Data Collection		
	Telephone (Central Office)	Mail (Central Office)	Personal Visit (Field Interview)
Yes	100	100	100
No	100	100	100

Because the results will be used to infer performance standards in an actual NMES, wherever appropriate, questionnaires for these trials are very similar in both content and length to forms in the 1980 NMCUES. The round one and two HSC household core questionnaire is actually a shortened version of the corresponding NMCUES instrument.

4. Tabulation and Analysis Plans

Specific plans for analyses resulting from this project will be developed jointly by the contractor and project officers. However, preliminary analysis plans are well formulated at this stage. Alternative design features and strategies will be evaluated on the basis of nonresponse effects, level of effort and/or costs, quality of data, timeliness, and operational feasibility.

Household Survey Component

The following linkage strategies and related design features will be tested:

- (a) Sample unit, comparing a sample of housing units with a sample of NHIS households.
- (b) Mode of initial contact, comparing contact by telephone with face-to-face initial contact (both methods will follow an advance letter to all sample units).
- (c) Length of time between NHIS and the first field test interview.
- (d) Mode of interview for round two, comparing telephone versus face-to-face interviews for all respondents with telephones.

The results of these field trials will be used to evaluate alternative strategies for linking the NMES to the NHIS.

For the HSC, multivariate ANOVA and multiple regression techniques will be employed as analytic tools. The independent variables will be the design features or linkage strategies manipulated by the experimental design, such as type of sampling unit, initial contact method, length of elapsed time between the NHIS and the HSC, and mode of interview for round two. The dependent variables will be defined in terms of response rates, costs or level of effort, and data quality. The data will be distributed by certain key demographic variables such as age, race, sex, and income. These independent variables may also be used to standardize comparisons of the design features for demographic composition.

Response rates will be calculated based on each design feature. Also, response rates will be calculated separately for respondents who move between their NHIS and HSC interviews, for NHIS nonrespondents, and for the population subgroups of interest. Cost data will be available for comparing mode of initial contact and type of sample unit. Measures of effort, such as number of in-person contacts needed to obtain a completed interview, will be used where costs are not practical to measure due to design logistics.

Data quality has several components and will be of primary interest in comparing mode of interview for round two. Data quality will be measured by the completeness of information for locating medical providers, validity of charge data associated with medical care utilization, level of detail of source of payment, level of detail for prescribed medicines, number of health events reported, and level of item nonresponse for income questions.

Three specific interactions of interest in evaluating the linkage strategies are: sample unit by length of time between NHIS and the HSC, sample unit by mode of initial contact, and demographics by design features. Standard errors of the

differences between procedures will be estimated for all items for which knowledge of the standard errors would affect inferences made from the study.

Analytic methods will not be restricted to standard textbook methods. For example, the project will provide estimates of the proportion of movers who cannot be tracked, and the problems and costs of tracking. An improved measure of the effect of these factors on NMES can be produced by using Bureau of the Census estimates of the proportion of population who move rather than relying on the experience in the small sample used for this project.

Direct inferences from this study to the main NMES study are inappropriate because the distribution of demographic characteristics of this study sample differs significantly from the distribution of the U.S. population. An algorithm will be developed for predicting the cost, level of effort, and response rates for a national NMES linked sample design.

Health Background Component

In addition, the conduct of these field trials will be used to test and evaluate alternative strategies for attaining an acceptable response rate for a self-enumerated supplement designed to collect measures of self-perceived health status, health habits, employment-related benefits, and questions concerning attitudes toward the use of medical care and the necessity for health insurance.

The analysis of the HBC (the self-administered supplement) will evaluate response rates by the degree of follow-up effort required. This will include an evaluation of the remuneration experiment and the relative effectiveness of prepaid and promised remuneration versus no offer of remuneration. Whether the self-administered supplement has any adverse effect on participation in round two of the HSC will also be examined. Finally, the quality of response under the various experimental modes will be addressed primarily by examining item nonresponse rates.

Medical Provider Component

These field trials will also be used to test and evaluate alternative methods of contacting the medical providers and alternative methods of reconciling HSC respondent information with medical provider information. For the MPC, the major dependent variables are response rates, cost per case, and quality of data. The major independent variables are mode of data collection, providing or not providing household reports, level of provider burden, and provider's type of practice. A number of other analytical variables on which data will be collected and which may or may not come to be perceived as critical to the statistical analysis, as work on the project proceeds, include type of PSU, type of patient, source of payment, feedback on provider reactions to assigned mode and to provision or non-provision of household-reported dates, and interviewer

reaction to the assigned tasks. Overall response rates will be calculated by mode of data collection, by treatment by type of provider, and by treatment by level of provider burden. A careful analysis of the match between respondent and medical provider visit information will be done by the provider's access to the visit dates reported by the household. Average costs will also be analyzed across and within the experimental conditions.

The division of a maximum of 600 sample units in either the HSC or the MPC into the analytic cells of interest will frequently result in cells with 100 or fewer observations. With fewer than 100 cases, the observed differences between two cells would require a magnitude of 15 percentage points or more to achieve statistical significance at the 95 percent level (assuming estimates in the 25-to-75 percent range). How likely is it that significant differences will be detected? First, in a number of comparisons we expect to be able to pool across treatments. Interaction effects will be tested before pooling. Second, such large differences are expected between some cells where the issue will be: At what level of treatment do the differences narrow so much that

no practically significant advantage is seen? Third, lower levels of statistical significance will be acceptable if findings are nonsignificant but internally consistent across analytic groups.

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