REDESIGN OF THE NATIONAL HEALTH INTERVIEW SURVEY

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Introduction

One of the first national survey activities initiated by the Public Health Service, the National Health Interview Survey (NHIS) was inauguarated in July 1957 and has been in operation continuously to the present time. Its source of data is a cross-sectional probability sample of households in the United States. Although initially conceived as a national morbidity survey to provide descriptive statistics on the incidence and prevalence of diseases and impairments, the original data set did include information on disability and utilization of medical services. Since 1957 there has been a continuing effort to evaluate survey procedures and questionnaire content. However, except for the updating of the sample frame, the sample design has remained relatively unchanged for the past twenty years. The evolution of the NHIS objectives toward a greater emphasis on supplemental health topics, measuring change, and a desire to obtain more accurate estimates of variables (e.g., health expenditures) which are better reported using short recall periods and frequent contacts of respondents have caused us to focus our attention on sample design issues. Since the sample and field collection activities for NHIS are provided by the U.S. Bureau of the Census, it is extremely important and cost effective to address these issues at this time so that the results can be incorporated along with the usual updating of the frame based on the 1980 Decennial Census.

The purpose of this paper is to identify the objectives of the National Health Interview Survey in the 1980's and outline the research areas to be explored in conjunction with the survey redesign efforts.

Background

In July 1956 legislation was enacted authorizing the U.S. Public Health Service to conduct continuing surveys of illness and disability in the United States. The NHIS, the first of a series of data collection systems organized to implement the legislation was planned during the fall and winter of 1956.

In the early years of the survey a major emphasis was placed on the definition and refinement of a basic set of health and demographic variables to be used to produce national estimates of morbidity, disability, and health services utilization. Concern focused on the quality of the data, the efficiency of the collection and processing procedures, and the usefulness of the survey results. It soon became apparent that in order to meet health data needs it would be necessary for the survey to develop supplementary health topic modules which could be included on a one-time or rotating basis.

As a result of the efforts that were made between 1957 and 1968 to improve the measurements, it was believed that a core set of items had been developed that would provide not only a more adequate basis for producing current national estimates of the nation's health status but also form the basis for charting changes in these health indicators during the next ten years. As the demand grew for a wide assortment of information on special health topics, a major function of the NHIS program evolved into providing not only information on these supplementary topics, but of relating the supplemental information to the core health variables.

The NHIS entered the 1970's with a fixed set of core items on the questionnaire reflecting both health and demographic characteristics. It was found that with the exception of acute conditions, most of the core health measures as published in Current Estimates, did not change that much in the aggregate from year to year. The major strength of the NHIS was in providing population-based health profiles of special population groups identified through supplementary modules administered in many instances to a subsample of respondents on a self-response (not a proxy) basis. It became clear that the special population groups about which supplementary information was collected were increasingly categories of the population which were of long-term policy planning and evaluation interests; increasingly categories of people for whom measures of relative risk were needed; categories of people for whom health indicators which reflect equity values as well as well-being values were needed; increasingly categories of people who represent numerically small but substantial proportions of the population. Groups such as the elderly, the long-term care population living outside institutions, the chronically disabled, the medically underserved, those without health care coverage, Medicaid enrollees, non-immunized children, social and ethnic categories, and persons with specific diseases, such as diabetes, hypertension, or heart conditions are examples of such populations.

It has also become evident that if a continuous multi-purpose national health survey was not in place, the information needs of the Department would not be met, or if met through ad hoc surveys, it would only be at several times the costs which it now requires to add a few supplementary items to the NHIS. Moreover, as our staff interacts even more closely with the staffs of the Office of the Assistant Secretary for Health it is becoming clear that the intelligent allocation of billions of dollars of public program monies in the area of health requires current population-based estimates of health statistics for those categories of people who are of special long-term interest from a policy planning and evaluation standpoint.

It has also become clear that rotating supplements are extremely important in describing temporal variations in reports of health and illness behaviors which are changing over time and which are aspects of health likely to have major impacts on longevity and on health care programs during the next decade. The most dramatic example of this in recent years has been in the area of smoking behavior, but other aspects of health habits and life styles are also changing and we are receiving an increasing number of requests to do much more in this area.

Present Sample Design

Through a contractual arrangement with the National Center for Health Statistics (NCHS) the U.S. Bureau of the Census performs the field activities related to the NHIS including the identification of the sample households.

The current sampling plan of the survey follows a multistage probability design which permits a continuous sampling of the civilian, noninstitutionalized population of the United States. The sample is designed in such a way that each week's sample of approximately 800 households is representative of the target population and that weekly samples are additive over time.

The first stage of the sample consists of drawing 376 primary sampling units (PSU's) from approximately 1,900 geographically defined PSU's. A PSU consists of a county, a small group of contiguous counties, or a standard metropolitan statistical area (SMSA). The PSU's collectively cover the 50 States and the District of Columbia. The 376 PSU design is a subset of the U.S. Bureau of the Census' Current Population Survey design and the PSU's which are selected into the samples with certainty (with probability of 1) are the same for both surveys. The certainty PSU's are referred to as self-representing (SR) and are primarily SMSA's (there are 156 SR PSU's in the NHIS sample). Before selecting the sample PSU's all of the PSU's were stratified into 376 strata defined by the following variables:

(1) geographic location
(2) density of population
(3) rate of population growth from 1960 to 1970
(4) proportion of non-white population
(5) type of industry in urban areas
(6) type of farming in rural areas.

In some instances stratification resulted in a stratum being composed of a single large PSU. In these strata the PSU's were selected into the sample with certainty. In each of the 220 strata that contained more than one PSU a single PSU was drawn with probability proportional to its 1970 population. With no loss in general understanding, the remaining stages can be combined and treated in this discussion as an ultimate stage. Within PSU's, then, ultimate stage units, called segments, are defined in such a manner that each segment contains an expected four sample households (HH). Each sample household is interviewed once.

The segments are sampled from each PSU so that the overall sample is self-weighting (each person has the same probability of selection). The total NHIS sample of approximately 12,000 segments contains about 116,000 persons in about 40,000 households.

Evaluation of NHIS Procedures

In February 1977 the U.S. National Committeee on Vital and Health Statistics established an ad hoc Panel to review NHIS procedures in order to ascertain how well this activity was meeting the legislative mandate. The Panel recommended that the NCHS undertake a comprehensive evaluation, based on total survey design (TSD) principles to determine the feasibility and desirability of several alternatives to the existing NHIS sample design. Alternatives included were panel vs. cross-sectional, rotation of sample, and bounded interviews. Consistent with the ideas of TSD the Panel recommended that the Division start immediately to review its own design features (e.g., respondent rules, length of reference period, use of diaries, interview methodology) in order to take advantage of the opportunities provided by the post 1980 Census Bureau redesign effort.

In April 1979 a Working Group consisting of both NCHS and Census Bureau personnel was formed to develop a set of specifications for redesign of the National Health Interview Survey. The Working Group was charged with identifying survey objectives and outlining the research projects to be undertaken as part of the redesign effort.

The major objective of the NHIS in the 1980's, as determined by the Working Group, will be to continue to produce national descriptive health statistics with an emphasis on the collection of data on supplemental health topics. The redesign effort will focus on the following specific survey objectives:

(1) revision of the core questionnaire
(2) provide NCHS with the capability of independently conducting follow-back surveys
(3) better assessment of trends and individual change
(4) improvement of the ability to collect data on topics which have a large recall bias
(5) improve the ability to produce small area estimates
(6) expand and improve analysis capabilities
(7) utilization of existing health related variables in defining strata
(8) provide the ability to sample special subgroups of the population; and
(9) provide a continuing program to assess and monitor non-sampling error.

The major projects to be undertaken in conjunction with the redesign of NHIS are described below.

Revision of Questionnaire Content

For the past several years DHIS has been engaged in revising the complete set of items which make up the core questionnaire. A revised questionnaire was field tested in the fourth quarter of calendar year 1979. These results are currently being analyzed and a new questionnaire is scheduled to be implemented in January 1982.

Consideration of an Alternative Sampling Frame

Part of the current NHIS sample is selected from Census address files which were collected under the Title 13 confidentiality provision that prevents the release of names and addresses to the sponsoring agency. This provision which prevents any independent subsequent contact of the sample by NCHS severely limits the use of the NHIS

sample for follow-back studies. Therefore, consideration of a sample frame independent of Title 13 is a high priority item for NCHS. Any alternative solution would be judged in terms of cost, precision, and coverage.

Evaluation of a Cross-Sectional and Panel Design

The current NHIS cross-sectional design can produce aggregate estimates of net change over time, and the fact that the same PSU's are retained each year improves the ability of the sample to estimate the net change. However, except through the use of retrospective interviewing procedures, the distribution of individual changes over time cannot be obtained with the present design. Measurement of individual changes as well as more precise estimates of net change could be achieved by revisits to the sample households. A panel design with multiple visits would provide a better assessment of the dynamics of change. Multiple contacts with the sample respondents allows greater flexibility in the use of memory aids and shorter recall periods. Frequent contacts and shorter recall periods are extremely important in collecting health expenditure data.

In evaluating the feasibility of integrating a panel component into the continuous NHIS, several alternative survey designs will be studied. The alternatives will be evaluated in terms of cost, precision, and the types of statistics that could be collected. Alternative designs that will be studied are:

(1) Cross-section design

The current NHIS design will be evaluated with special attention being given to the measurement of trends.

(2) Cross-sectional design with a yearly panel

Under this design, a subsample of the households interviewed in one year would be revisited the following year. The sample size for this design will remain the same as the current design.

(3) Cross-sectional design with a quarterly panel component

Under this design members of a household would be interviewed a total of 4 times a year. Our experience with the Medical Care Utilization and Expenditures Survey indicates that revisiting households more often magnifies the field operational problems. Within the framework of this basic design several patterns of scheduling households in and out of the survey will be studied. For this design only one fourth (1/4) as many households can be interviewed for the same cost in a year. The extent to which this would impair our ability to produce the descriptive statistics that are now produced will be examined. For a number of our statistics, however, the shorter recall period will improve the validity of our statistics.

Small Area Estimation

There is a tremendous amount of interest among many groups outside of NCHS for the Center providing estimates of health characteristics for States and smaller areas. Several reports of State statistics using synthetic and composite estimates have been published in the past 10 years. Since it appears unlikely in the near future that the NHIS will have a sample large enough to produce State estimates directly, small area estimates will continue to be published using synthetic estimation techniques. A number of design changes could be made, however, that would greatly improve our ability to produce small area estimates.

The following design features will be evaluated for their effect on the precision and costs of producing local, State and national statistics:

(1) stratification by State boundaries
(2) definition and size of PSU
(3) number of sample PSU's
(4) rotation of PSU's each year within States
(5) combining data for 3 or 5 year periods
(6) allocation of equal sample size to each State.

Stratification and Allocation of Sample

The purpose of this study is to investigate the health and health-related variables that might possibly be used to stratify the non-self-representing (NSR) PSU's to achieve an optimum sample design for health statistics. Previously, the variables used for stratification in the Current Population Survey (CPS) have been used for the NHIS. It has always been reasoned that the economic variables used in the CPS are highly correlated with health variables, therefore, the NHIS design is an efficient design. In addition, until recently, no health variables have been available at the PSU level.

A number of health-related variables will be evaluated for possible use in stratification. Included among the variables will be air quality measures, water quality measures, extent of medical services (used to identify medically underserved areas), and selected mortality data.

A correlation analysis will be conducted to study the relationship of each of the health-related variables to demographic characteristics, CPS stratification variables, NHIS statistics, and each other.

The analysis will be used to select the best set of variables for stratification. Additional research will focus on the number and size of strata to use and the number of PSU's to select in each stratum.

The NHIS sample has always been allocated proportional to population size (PPS). The PPS allocation has the advantage of being nearly

optimal for estimating gross levels and for being nearly self-weighting. Its main disadvantage is that such an allocation is not optimum for making estimates for many of the important subgroups of the population including States, low income families, Blacks, Hispanics, persons in medically underserved areas, persons in high polluted areas, and the aged. This study will investigate alternative allocations for improving the estimates for the important subgroups of the population and their impact on our national statistics.

Producing reliable estimates for the subgroups of the population listed above may involve restratification, oversampling of PSU's and oversampling of populations within PSU's. Each of the optimum individual variable allocations will be evaluated in terms of cost, impact on national statistics, improvement of subgroup estimates, and impact on the estimates of other subgroups. The allocation which provides the greatest gains in precision for subgroups without adversely affecting precision at the national level relative to cost, will be the one recommended for the NHIS redesign.

Utilization of Telephone Interviews

A research study will be conducted to determine how the telephone interview can best be utilized by the NHIS on a continuing basis. A cost-risk-benefit analysis will be conducted for each of its potential uses including:

(1) pretesting supplements
(2) conducting follow-back interviews
(3) conducting reinterviews
(4) reducing the relative cost of data collection
(5) estimating interviewer variances and biases
(6) estimating response bias
(7) conducting independent studies at a lower cost than a face-to-face interview survey, and
(8) conducting local area surveys.

Because a telephone interview system is a centrally operated data collection system, it is better suited for measuring many of the components of nonsampling error than the NHIS. The ability to randomize interviewer assignments over the entire population and to better monitor and control interviewer behavior at a central location is ideal for estimating interviewer effects. Being able to supplement the NHIS in any geographic location in the U.S. for approximately the same cost would greatly increase the potential of the NHIS.

Using a Total Survey Design

Designing a survey based primarily on sampling error considerations may result in a design which has overlooked the major sources of survey error. Over the past 20 years it has become apparent that the nonsampling errors in the NHIS are often large and can be caused by a wide range of both controllable and uncontrollable sources. A comprehensive quality control system is essential for the control of both sampling and nonsampling error. A major effort will be made to incorporate the principles of total survey design into the design of the NHIS. That is, the design decision will be based on a mean square error (MSE) criterion rather than strictly a sampling error criterion. In many instances, the nonsampling components of error will be impossible to measure and only crude approximations of the MSE can be made. In the redesign of the NHIS the incorporation of the principles of total survey design is a stepwise process involving:

(1) identifying the different kinds of nonsampling errors
(2) developing methods to measure the different components of nonsampling errors either through a review of results from previous studies, an evaluation of the quality of the current data, or a survey redesign
(3) developing methods to reduce nonsampling errors, and
(4) developing procedures for controlling nonsampling errors.

A series of research projects will be conducted for systematically evaluating and reducing the nonsampling error components in the NHIS. Among the projects planned are an evaluation of the use of the reinterview in the NHIS, an evaluation of the reference periods and respondent's rules use in the NHIS, and the scheduling and assignments of interviews to interviewers. The possible use of record check studies will also be examined. A number of research projects have been conducted over the past 10 years which can be used to help in the evaluation of nonsampling errors and are included in the references.

One of the by-products of this research program will be an error profile for the NHIS. Several major surveys conducted by the Bureau of the Census and other government agencies have completed error profiles. In arriving at the final survey design decisions the error profile will help to provide a balance between sampling and nonsampling considerations. The error profile is expected to be used as a basic source of information for a continuing research program, to highlight problems that have not previously been identified, to identify areas for methodological studies, and to help analysts with their interpretations of the results.

Implementation

The redesign of the NHIS will be a joint effort between the NCHS and the Bureau of the Census. It will depend upon the time schedule of the CPS redesign effort. The success of the research outlined above will ultimately be determined by the availability of resources, both people and money. We currently hope to complete all related research by the end of 1982 and introduce the revised sample plan into the field in January 1984.

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