SAMPLING CHILDREN FOR A STUDY OF THE STATE CHILDREN'S HEALTH INSURANCE PROGRAM

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I. INTRODUCTION

The purpose of this paper is to present the survey design for an evaluation of a social program designed to provide health insurance for children. A survey design for a social program can involve a number of operational issues caused by the nature of the population under study, the availability of lists of members of the study population, and the quality of the data in these lists. The survey design for this study of the State Children's Health Insurance program (SCHIP) also requires the inclusion of study populations that recently entered the program (new enrollees) or left the program (recent disenrollees). The data sought for these two study populations are highly time sensitive because information is needed about experiences prior to entering or leaving the program. In this paper, we discuss issues related to the sampling frames, the quality of the data and other implementation issues in order to provide others with some insights about the complexity of surveying populations like these and with our solutions to these issues.

II. STUDY OBJECTIVES AND SURVEY METHODS

Congress established the State Children's Health Insurance program (SCHIP) in 1997 with an objective to reduce the number of uninsured children in the United States. The program provides funds for states to provide health insurance to low-income children. Individuals eligible for coverage under SCHIP include children under age 19 who are not eligible for Medicaid with family incomes below 200 percent of the federal poverty level (FPL), or higher in states already having extensive coverage under Medicaid.

States have considerable control over decisions about design, benefit package, structure, eligibility thresholds, and cost sharing in the SCHIP program. States can choose between expanding their Medicaid programs, creating a separate state program or implementing a combination approach. SCHIP includes such features as maintenance of Medicaid eligibility thresholds at pre-SCHIP levels and a screening process to ensure all SCHIP applicants eligible for Medicaid are enrolled in Medicaid rather than SCHIP. Finally, in order to discourage states from insuring children who are eligible for commercial insurance coverage, Congress allows states to use waiting periods and other mechanisms.

The main goals of the SCHIP evaluation are increasing policymakers' knowledge of the structure and effects of SCHIP programs as well as providing important new information about barriers to enrollment in SCHIP, the overall experience of children who enroll in SCHIP, and the extent and reasons for entrance and exit of children from the programs. Furthermore, the evaluation will provide information on the experiences of children enrolled in Medicaid in conjunction with information on the SCHIP program, an overall picture of children covered by this type of health insurance.

A survey of parents or guardians of children currently and previously covered by SCHIP and Medicaid will provide a detailed description of the characteristics of these children, their movement in and out of the program, and their access, use, and experience with health services. The survey is being conducted in 10 study states and consists of three distinct sample domains: (1) new enrollees, which include children who have been enrolled in SCHIP for at most two months at the time of sampling; (2) established enrollees, which include children who have been enrolled in SCHIP for five months or more at the time of sampling; and (3) disenrollees, which include children who have exited SCHIP within one month of sampling.

III. SAMPLE DESIGN AND SAMPLE SELECTION

For the evaluation, we selected new and established SCHIP enrollees and recent disenrollees in 10 states and conducted an interview with the child's parent or guardian. In 2 of these 10 states, new and established Medicaid enrollees and recent disenrollees were also surveyed.

The sample for the SCHIP survey of new enrollees, established enrollees, and recent disenrollees was designed so that study findings could be used to make inferences about these SCHIP enrollment domains for each of the 10 states participating in the SCHIP evaluation and, to make

comparisons across these states[1]. Another objective is to provide as much information as possible about SCHIP nationally, while restricting the sample to the 10 selected states. The 10 states included the states with the largest enrollments (CA, NY, TX, FL, NC, and IL) and some with small enrollments (LA and CO).

The sample for the Medicaid survey of new enrollees, established enrollees, and recent disenrollees was designed so that study findings could be used to make inferences about these Medicaid enrollment domains for 2 states chosen from the 10 states included in the SCHIP evaluation. Data across states and within states for the Medicaid program will be compared as well as SCHIP and Medicaid enrollment domains.

The sample was selected basically in three steps:

- Households with eligible children were selected.
- If two or more eligible children were in the household and they were in different study populations (domains), we selected a specific domain.
- Within the selected domain, we selected one child.

In the two states where we will evaluate both SCHIP and Medicaid programs, the SCHIP and Medicaid sampling was done in combination. Thus the frame of households containing one or more SCHIP- or Medicaid-eligible children may contain children in up to six domains (3 domains of SCHIP children and 3 domains of Medicaid children). We used the same sample selection process regardless of the number of domains.

1. Objectives

To evaluate each state's SCHIP or Medicaid program individually and to compare to other states, sample sizes had to be sufficiently large. For efficient comparisons of enrollment domains within and across states, we needed to allocate equal sample sizes to each SCHIP enrollment domain across the 10 states and to each Medicaid enrollment domain in the subset of 2 states. Based on a power analysis, a sample size of 600 in each domain was determined to be sufficient for analytic purposes, a total sample of 21,600 interviews.

Since our projected response rate of 80% is virtually impossible to achieve for a telephone-only survey with low-income populations, we decided to do face-to-face interviewing in a small number of geographic areas (clusters).

The high costs and clustered nature of face-to-face interviews led to our dual frame sample design which combines:

- An unclustered sample interviewed by telephone only.
- A clustered sample interviewed by telephone, with face-to-face follow-up of non-telephone households.

With this approach, we sought to achieve the greater precision associated with the unclustered design, while retaining the enhanced response and coverage rates of the face-to-face approach.

2. Target Populations

The target population for both the SCHIP portion or Medicaid portion of the evaluation was restricted to children who, at the time of frame construction, were newly enrolled or established enrollees of SCHIP or Medicaid or who had recently disenrolled from SCHIP or Medicaid. The target population is further limited to children living in the 10 states at the time of data collection. The populations were also restricted to SCHIP or Medicaid enrollees age 18 and younger and recent SCHIP or Medicaid disenrollees age 19 and younger.

In states with both a Medicaid-expansion SCHIP program (M-SCHIP) and a separate SCHIP program (S-SCHIP), both SCHIP programs in the target population were included. The sample was proportionally allocated in each enrollment domain to the ratio of SCHIP enrollees in the Medicaid-expansion program and in the separate SCHIP program.

Enrollment status was defined based on the enrollment status data recorded in the SCHIP and Medicaid databases delivered by each state. Explicit operational definitions for the three SCHIP enrollment domains (and the three Medicaid enrollment domains) were developed within the logistical constraints of the enrollee databases obtained from the 10 states (and the Medicaid enrollee databases from the subset of 2 states being evaluated). The logistical constraints included the state's enrollment process and availability and reliability of application dates and/or determination dates.

The operational definitions used for the three enrollment domains for the Medicaid and SCHIP samples were:

- *New enrollees* are children who were enrolled in the program for at most the last two months at the time of frame construction.
- *Established enrollees* are children who were enrolled for five or more consecutive months

[1]Brenda Cox developed the original sample design while she was at Mathematica Policy Research.

in the program at the time of frame construction.

- *Recent disenrollees* are children who were disenrolled from the program at the time of frame construction but who were enrolled in the preceding month.

These definitions are, however, not exhaustive of all SCHIP and Medicaid enrollees, so the surveys cannot produce estimates for the full population of either SCHIP or Medicaid program enrollments in the study states. Although such estimates would be desirable, the precision for such estimates would be poor and additional costs could not be justified.

The definitions of the enrollment domains were separately addressed for each state in both SCHIP and Medicaid surveys. In some states, for example, children are not determined to be eligible for SCHIP before one or more months after application (retrospective enrollment). Other states add records to their enrollment database at the time of application, so that the database contains "presumptive eligibles" that may later be determined as ineligible. For this survey, only children for whom the determination process has been completed and eligibility has been confirmed were included. Further, the enrollment domains were defined as of the determination date.

3. Sampling Frame

The sampling frame of a survey is the list or mechanism used to identify population members for sample selection purposes. For this study, state SCHIP and Medicaid eligibility and enrollment files were used to construct the frames.

The sampling information required from each state includes the name of the enrollee or recent disenrollee; the names, addresses, and telephone numbers of parents or guardians; social security numbers, if available; and demographics characteristics of the child, such as age, race, and sex.

4. Sample Design

The design relies on telephone interviewing when telephone numbers can be located for the sample child's household, but includes face-to-face data collection to ensure adequate coverage of sample children living in nontelephone households. For convenience, we adopted the following operational definitions:

- *Telephone households* are defined as those households with telephone service for which telephone numbers can be located.
- *Nontelephone households* are defined as those households without telephone service, and those households for which a telephone number cannot be located.

For this survey, the following two designs were adopted:

- **An unclustered design with telephone-only data collection** (low cost option). Unclustered samples have the important attribute of efficiently representing geographic variations in SCHIP enrollment and disenrollment. However, nontelephone households cannot be represented with a telephone-only approach. This would lead to lower representation of some population subgroups with lower rates of access to telephones.
- **A clustered design with face-to-face data collection** (high-cost option). Face-to-face interviewing requires a geographically clustered sample to limit data collection costs. Clustering effects associated with geographic variation reduce the precision of survey estimates relative to those of an unclustered design. However, the face-to-face design makes it possible to include those nontelephone households that would not otherwise be interviewed.

In each state, two independent samples were selected for the SCHIP and Medicaid surveys—one clustered and one unclustered. Telephone households were interviewed in both samples. Nontelephone households were interviewed only in the clustered sample. Across both designs, telephone households were interviewed by telephone only. We used face-to-face methods in the clustered design to interview nontelephone households.

Each design was replicated up to three times depending on the number of children in each domain. States with larger enrollment required at most two replicates (the third replicate was not needed). States with smaller enrollments (i.e., CO and LA) required three replicates. These replicates consisted of sampled children from each SCHIP enrollment domain and, in the two states, from each Medicaid enrollment domain. These replicate samples were drawn in such a way that we minimized sampling multiple children from the same household or sampling households for more than one replicate. Each sample draw was derived from the universe existing at the time of sampling.

5. The Clustered Sample Design

For the clustered design with face-to-face follow-up, the first step in sample selection for each program was defining primary sampling units (PSUs). These PSUs were geographic areas that meet a specified minimum size constraint in terms of total enrollees and recent disenrollees. These areas were defined based on zip code areas or counties. The same set of PSUs was used for all sample draws for both the Medicaid and SCHIP samples.

A composite size measure strategy was used in selecting sample PSUs and in selecting households and children for interview. As the first step, a composite size measure $S(h,i,j)$ was developed for each household j for PSU i *in* state h ($h=1,2,...,10$) containing one or more eligible children from the three SCHIP and (if appropriate) the three Medicaid enrollment domains (Folsom et al. 1987). Let $C_d(h,i,j)$ be the total number of domain d children in household j from PSU i of state h. Let $f_d(h)$ be the desired sampling rate for domain d members in state h or:

$$f_d(h) = \frac{m_d(h)}{C_d(h,+,+)},$$

where $m_d(h)$ is the desired sample from domain d ($d=1,2,...,D$) in state h and $C_d(h,+,+)$ is the total number of domain d in state h. Then the composite size measure $S(h,i,j)$ for household j from PSU i of state h is defined as:

$$S(h,i,j) = \sum_{d=1}^{D} f_d(h) C_d(h,i,j) \cdot$$

This composite size measure was summed over all households in PSU i and state h to produce the size measure $S(h,i,+)$ for PSU i in state h, which was used in selecting the first-stage sample of PSUs.

A total of 30 PSUs were selected from each state, with probability proportional to this composite size measure and with minimal replacement using Chromy's procedure (1979). In selecting the 30 PSUs from the frame of $N(h)$ PSUs in state h, Chromy's procedure partitions each state's $N(h)$ PSUs into 30 zones of equal aggregate composite size, based on the size measure $S(h,i,+)$. Exactly one PSU was selected from each zone. The zones were formed so that all possible pairs of PSUs have a chance of appearing together in the sample, a requirement for unbiased estimation of sampling variances. Using controlled ordering of the PSUs, this zoned sequential selection makes possible a deep, implicit stratification of PSUs that ensures that sampled PSUs are as representative as possible on the ordering variables.

The composite size measure was used to ensure that the desired sample sizes are achieved for the domains of interest— specifically, SCHIP new and established enrollees, and SCHIP recent disenrollees and, when appropriate, for the equivalent Medicaid enrollment domains. Thus, with this procedure, we tried to obtain equal selection probabilities within states for children in each of the enrollment domains. The composite size measure for PSU i in state h was defined as:

$$S(h,i,+) = \sum_{j} S(h,i,j) = \sum_{d=1}^{D} \sum_{j} f_d(h) C_d(h,i,j),$$

where $C_d(h,i,j)$ is the number of children in domain *d* of household j of PSU i from state h, and $f_d(h)$ is the desired overall sampling rate for domain *d* in state *h*. Prior to selection, a controlled ordering procedure was again used, this time for the households within each PSU. We used zip code and, if available, race/ethnicity as the ordering variables to achieve deep, implicit stratification of the households and to enhance the representativeness of the sample.

For each selection of the i th PSU from the h th state, $n(h)$ households were selected, with probability proportional to their composite size. When multiple enrollee domains were present within a household, the enrollee domain to interview was randomly determined using differential probabilities based on the desired state h sampling rates $f_d(h)$ for domain *d*. If multiple children were present in the sampled household for the selected enrollee domain, one child was randomly selected from the sampled enrollee domain to be selected. Using the composite size measure for each household allows us to oversample households with multiple eligible children while ensuring that the selection probabilities are equal within enrollment domains regardless of household size.

In selecting the households for sample replicate 2 and, for CO and LA, sample replicate 3, we designed procedures to prevent or minimize the selection of households selected for a previous sample replicate. The composite size measure was adapted to ensure that households were not selected multiple times across replicates while maintaining nearly equal sampling weights within each state by enrollment domain combination. For that purpose, household-level weights were created for each sample replicate, after the first, that reflects the probability of not being selected in the previous sample replicate. This household-level weight was constructed as follows:

- Households sampled for a previous sample replicate received a weight of zero.
- Households that were on the frame used on previous sample replicate were assigned a weight that is the inverse of the probability of nonselection across all sample replicates.

- Households not on the frames for the previous sample replicates received a weight of 1.

The composite size measure defined for each household was then modified to incorporate this weight. Households were then selected following the procedures outlined above, but with this modified composite size measure. This approach prevented multiple selection of the same household while ensuring nearly equal selection probabilities across sample replicates.

6. The Unclustered Sample

For the unclustered, telephone-only design, we first sampled households and then children within households. Households with multiple children eligible for interview had one child randomly selected for interview. Prior to sample selection, the households were sorted by domain, race and zipcode. A composite size measure was defined for each household that reflect its number of eligibles and their desired overall selection probabilities for the unclustered design. Households were selected with probability proportional to their composite size measures. For sampled households with multiple survey eligibles, we used the desired subsampling rates for the enrollee domains when randomly sampling one child for interview. The composite size measure approach ensured we achieve equal selection probabilities within each state for each enrollee domain, regardless of household size. Steps also were taken to ensure the unclustered sample did not include households already sampled as part of the clustered sample.

For the second and, in CO and LA, the third sample replicate, a weight that reflected the probability of not being selected in previous sample replicates, as well as not being selected in the current sample replicate of the clustered sample was developed. This weight was incorporated into the composite size measure to prevent the selection of households already selected in previous sample replicate or selected for the clustered sample component of the current sample replicate.

IV. DATA FILE ACQUISITION

For the implementation of this study of SCHIP to be successful, program data to support the sampling and analytical objectives of the study must be available and reliable. The study requires SCHIP program data (Title XXI) from ten states and Medicaid program data (Title XIX) from two states.

Acquisition of the data required frequent and detailed conversations with state technical staff. The data from SCHIP and Medicaid management information systems is crucial in drawing samples of the desired populations and for sample location. The data must also provide key measures for an analysis of program processes, including application, redetermination, disenrollment, and a longitudinal analysis of enrollment. Our discussions focused on data elements that would support sampling criteria and analytical criteria, the source of program data, the format of the data available for our use, timeliness of the data, and periodic data extract and delivery.

Data elements that support the survey sampling and future analytical effort included:

1. Application date(s) and status codes
2. Eligibility determination dates and reason codes
3. Eligibility method (retroactive or presumptive)
4. Enrollment start and end dates
5. Disenrollment dates and reason codes
6. Individual and household identifiers
7. Parent/guardian names
8. Street Address
9. City, state and zip code
10. Telephone number
11. Parent/guardian social security number

Timeliness of the data is an important issue and includes topics such as state-level delay in processing initial applications and redetermination, as well as the use of retroactive enrollment or enrollment based on application dates. Delays in updating the eligibility histories could affect our timely construction of sampling frames and sampling selection. Discussion with state technical staff also focused on delivery of data by the state within two weeks of the specified data extract cutoff date.

In order to support survey sampling and future analytical efforts, a uniform data structure was designed. The uniform structure reduced the need for unique state specific sample programming. It also provided a consistent format for analytical programming. The uniform file contains only one record per client based on the state level client recipient number. The single uniform record described the client's participation by month in SCHIP. In two states, the uniform record described client participation in both S-SCHIP and M-SCHIP and in two other states the uniform record described client participation in both S-SCHIP and Medicaid. All fields use the same data element naming convention and data definitions.

Data provided by each state required state specific programming in order to move the data into the uniform file structure. The source, format, and delivery of data varied with the state. In two states, data were extracted from a mainframe management information system and provided in EBCDIC format on cartridge. In other states, data were extracted from a data warehouse or UNIX system and delivered by FTP, CD, or e-mail. All required data elements are provided in a single record from three

SCHIP states and one Medicaid state. The data fields were easily renamed and applied to the uniform client record. From seven SCHIP states and one Medicaid state, client data was provide in a multi-record format. Four states provide data in a multi-file format.

The actual data collection and application process must occur within a very short time frame. Data from ten states must be obtained and processed within four weeks of the extract cutoff date. With few exceptions, the states were timely in their delivery of data. Staff at MPR sent a reminder to state staff two weeks prior to the specified cutoff date.

All of the initial data extracts were processed and applied to the uniform file. With the exception of a very large state we created only one stream of uniform generation files for each state. For the very large state, SCHIP and Medicaid data reside in separate uniform files. The second step in the processing of state extract data was an update to the uniform file. After the initial round of data acquisition, data receipt and processing was completed, and update programs were developed for the production of generation files. Subsequent data acquisition required considerably less processing time.

The following is a brief list of problems we encountered:

1. Client contact information is very limited and of noticeably poor quality in three states. We have requested supplemental data but have only successfully acquired these data in two states.
2. The enrollment process varies by state. In three states, active enrollment begins after the application is approved. In seven states, SCHIP enrollment begins on the first day of the application month after the application is approved. If the application is on June 15 and the approval occurs on August 15, the client's start-point is June 1st. For Medicaid clients, enrollment may be retroactive for as long as three months prior to the application date. In three states, useful data elements were not available to assist in determining application dates and determinations dates. In three other states, the data elements are available but not useful. The application date and determination dates can be the original dates and not the most recent.
3. Only two states were very slow to respond to requests for discussions regarding data. Three states have been very slow in providing data.
4. Unique recipient identifying numbers are important for use in constructing individual records in the uniform files. Case identifying numbers are important for use in identifying household groups. In one state, recipient identifying numbers are not present. Additional client characteristic data such as social security numbers or birth dates are either not available or unreliable. In three states, case identifying numbers were either not present or not reliable.

V. IMPLEMENTATION ISSUES

Sampling children for a study of the state children's health insurance program was difficult because it depends on the quality of the administrative record data. First, the enrollment process varied by state, we had to adapt our definitions accordingly. Second, the availability and reliability of enrollment data differed across states. We needed to define the key domains based on available data. Finally, because of the poor quality of the contact information in some states, we expanded locating activities and in-field locating in PSUs.

The composite size measure was useful in controlling sample sizes in key domains. It was very useful in forming primary sampling units (PSUs) with sufficient sample sizes of eligible children in each domain. The composite size measure procedure also facilitated the selection of the PSUs and the sample of children in each domain. The use of the composite size measure was made difficult by the multiple samples selected (the clustered and unclustered samples and the replicates). It should be noted that in the two states with surveys of both SCHIP and Medicaid children, some children were in two domains (e.g., a recent disenrollee from SCHIP was a new enrollee in Medicaid and vice versa). The composite size measure accommodated this well.

In sum, the design and implementation of sampling children for a study of the state children's health insurance program needed to be adaptive to:

- State definitions of program eligibility
- State-specific enrollment processes and procedures
- Availability and relialibility of the administrative data.

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