SUBSTANTIAL RESPONSE BIAS MAY REMAIN WHEN RECORDS ARE USED IN A TELEPHONE SURVEY

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Introduction

Record use is considered to be an effective method for reducing response bias in surveys. Use of records can aid in the 1) recall of past events, 2) provide detailed numerical information, and 3) provide detailed financial and expenditure information. Examples of record keeping devices include diaries, existing personal records such as income tax forms and vaccination records (i.e., shot cards), and record keeping forms such as event history calendars provided to the respondent at the time of the survey.

The U.S. Census Bureau has conducted extensive research on the benefits of record use in The Survey of Income and Program Participation (SIPP). Marquis (1995) reported that record use improved the accuracy for the amounts of income received for three of five income sources, but did not the change the number of income sources reported. The main interest in the survey that we report on here is number of vaccinations received by young children, which is conceptually similar to income amounts.

This paper examines the use and impact of vaccination records in a national random-digit-dialing telephone survey of children age 19 to 35 months designed to estimate the percent of children who are up-to-date on their vaccinations. Our primary finding is that among respondents who use such records and indicate that the children are *not* up-to-date, provider record checks show that *61%* of the children *are* actually up-to-date.

The National Immunization Survey

One of the Healthy People 2000 objectives is to have at least 90% of 2-year-old children fully vaccinated with the recommended schedule of vaccines. Timely estimates of vaccination coverage levels for children 19 to 35 months of age are needed to monitor these levels. The National Immunization Survey (NIS) is being conducted in 78 Immunization Action Plan (IAP) areas, consisting of the 50 states, the District of Columbia, and 27 large metropolitan areas, to obtain timely quarterly data on vaccination coverage levels. Using the same methodology in each IAP area, the NIS has the advantage of producing vaccination coverage levels that are comparable among IAP areas.

Beginning with the second quarter of 1994 and continuing through the fourth quarter of 1997, the NIS data collection effort consists of quarterly surveys in each of the 78 IAP areas. This design will make it possible to combine four consecutive quarters of survey data to provide annualized estimates of the coverage levels for nine antigens: (diphtheria and tetanus toxoids and pertussis vaccine [DTP]; poliovirus vaccine [Polio]; measles, mumps, and rubella vaccine [MMR]; *Haemophilus influenzae* type b vaccine [Hib]; and hepatitis b vaccine [Hep B]) within each of the 78 IAP areas with an acceptable degree of precision. For 1994, the first year of data collection, the estimates were based on data collected over three calendar quarters because the initial data collection activities did not begin until April of 1994. Subsequent estimates combine data from four consecutive calendar quarters.

NIS Sample Design

The NIS uses a two-phase sample design (Ezzati-Rice et al., 1995). First, to locate households with one or more children 19 to 35 months of age, a random-digit-dialing (RDD) sample of telephone numbers is drawn from each IAP area on a quarterly basis. Interviewers then call the sampled telephone numbers and use a screening questionnaire to identify households with age-eligible children. If a household is eligible, the interviewer determines who in the household is most knowledgeable about vaccinations. That person is then questioned on the vaccinations received by all age-eligible children.

As part of the 1994 National Health Interview Survey (NHIS), the National Immunization Provider Record Check Study (NIPRCS) collected vaccination information for children 19 to 35 months of age from their providers. These provider reports, in most cases, are considered to be an accurate measure of the vaccinations actually received by children. Results of the NIPRCS suggest that household reports of vaccinations often contain errors (Ezzati-Rice et

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al., 1996). Examples include memory recall errors and the use of a shot card that fails to show all the vaccinations received. Accordingly, in the NIS, a second-phase sample of providers is selected to supply the data needed to improve the accuracy of the vaccination coverage estimates (Zell et al., 1995). Interviewed households are asked to give the name and address of their child's health care provider(s), although some households are unable or unwilling to furnish the requested information. A mail survey of the identified providers collects vaccination information for the children. Some providers fail to respond to the mail survey. The provider survey thus yields vaccination information for a subsample of children identified in the first-phase NIS sample.

NIS Estimation

Standard estimation procedures for this type of two-phase sample (Cochran 1977, Chapter 12) are then used to form the estimates of vaccination coverage. The estimation procedure uses information from both the first-phase sample of households and the second-phase sample of provider reports, as well as supplemental information from several data sources (Zell et al., 1995).

The first-phase sample information, either on the 4:3:1:3 combination of vaccinations (at least 4 DTP, 3 Polio, 1 MMR, and 3 Hib) or on Hep B, is used to classify the children into strata, according to whether the household's response was based on a shot card and whether the household reported the child as up-to-date on all vaccinations in the 4:3:1:3 combination or on Hep B, respectively. The use of strata based on the 4:3:1:3 combination incorporates all the vaccinations except Hep B into the adjustment process, and it avoids inconsistencies among the estimates of vaccination coverage. Hep B has its own set of strata because it was added to the pediatric schedule after many of the children in the survey were born.

The second-phase sample information is used to compute the proportion of children in each stratum who are actually up-to-date on the particular vaccination series (for example, with 3 or more doses of Hib vaccine, with all vaccinations in the 4:3:1 combination, or with 3 or more doses of Hep B vaccine).

The procedure for combining household and provider data to produce provider-adjusted estimates of vaccination coverage involves three main steps:

1. Categories of household responses are formed based on the availability of a shot card (yes, no) and the response to vaccination status on the 4:3:1:3 combination or Hep B (e.g., up-to-date on 4:3:1:3, don't know). The resulting response categories (e.g., up-to-date on 4:3:1:3, reported as numbers of shots from a shot card; missing on Hep B) each contain adequate provider data.

2. Adjustment factors are calculated using the provider data as the gold standard. Within each response category, the adjustment factor for each vaccination (or combination) is the proportion of children in the provider sample who, according to their providers, are up-to-date on that vaccination.

3. The adjustment factors are applied to the entire NIS sample for each individual IAP area. The estimation process multiplies the adjustment factor by the number of children in that response category to produce an estimate of the number of children in that category who are up-to-date. Summing these numbers over the set of 4:3:1:3 (or Hep B) response categories and dividing by the total number of NIS children yield an overall estimate of the proportion of children who are up-to-date on the particular vaccination.

The information from both phases of the sample makes it possible to form estimates of vaccination coverage that are more accurate than would be obtained from only a sample of households or from only provider reports.

Record Use and Response Bias in the NIS

For the third quarter of 1994 through the second quarter of 1995 (i.e., July 1994 to June 1995), respondents for about 47% of the 35,440 children in the NIS used a vaccination record to report on vaccinations received. Information from providers is available for 5,669 of the 16,469 children for whom a vaccination record was used. For these children, the household report of number of vaccinations received and the vaccination dates can be compared with the provider information which is considered to be more accurate. The percent of children who are 4:3:1:3 up-to-date according to the provider information is shown below in Table 1. In the NIS, 90.5% of children who were reported as being 4:3:1:3 up-to-date from a shot card were actually up-to-date according to the provider information. However, for those children who were reported as not being 4:3:1:3 up-to date from a shot card, provider information indicates that 61.4% were actually up-to-date. In the NIS, a majority of the children who were reported as not being up-to-date from a shot card were actually up-to-date. This indicates that substantial response bias can exist even when records are being used in a telephone survey. It is very likely that for some of the children with multiple providers, not all providers are identified by the respondent. The actual percent up-to-date may therefore be even higher than 61.4%.

Because children in the NIS are 19 to 35 months old, the vaccinations reported in the RDD survey were received no more than 35 months prior to the interview. The NIS screening procedure ensures that the adult most knowledgeable about the child's vaccinations is interviewed. These aspects of the survey might have been expected to result in accurate reporting, but this only occurred for respondents who indicated that the child was 4:3:1:3 up-to-date. As poor as the actual results are for those who are not up-to-date, use of records does reduce response bias. When records are not used, 78.0% of those reported as being up-to-date were actually up-to-date, and 64.8% of those reported as not being up-to-date were actually up-to-date.

For illustrative purposes, the actual household and provider shot dates for one child who was actually up-to-date is shown below in Table 2. The household reported a total of five visits to the provider. The provider however indicates a total of seven visits. The household report did not include a DTP vaccination received on May 18, 1993 and a HIB vaccination received on December 7, 1993.

Causes of Response Bias in the NIS

There are several potential causes of response bias in the NIS. The primary cause is likely to be that the shot card is not brought to all visits or is not updated at the time of the visit. Other causes include unreadable handwriting or the use of abbreviations, recording of multiple vaccinations received at a single visit on one line of the shot card, respondent error in reading from the shot card during the NIS interview, and interviewer error in recording the vaccination information.

Impact of Response Bias in the NIS

Among children for whom a shot card was used in the NIS, the 4:3:1:3 up-to-date estimate for the U.S. is 59.6% when only the household reporting is taken into account. For the children with provider information, 73.9% are 4:3:1:3 up-to-date based on only the provider information. The stratified two-phase 4:3:1:3 estimate that incorporates both the household and provider information is 78.8%, a 19.2 percentage point increase, as compared with the household report, in the estimate of the percent of children in the U.S. who are up-to-date.

The specific record type used in the NIS can be characterized as a form that lists several different types of vaccines, and is generally updated on a ongoing basis, typically by a person other than the respondent. These findings indicate that substantial response bias may exist even when records of this type are used in the telephone survey.

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Table 1: Agreement of Household Reports with Provider Information

HOUSEHOLD RESPONSE	NUMBER OF CHILDREN WITH PROVIDER INFORMATION	PERCENT UP-TO-DATE ACCORDING TO PROVIDER
4:3:1:3 UP-TO-DATE	2,654	90.5%
NOT 4:3:1:3 UP-TO-DATE	3,015	61.4%

Table 2: Household and Provider Vaccination Dates for One Child

HOUSEHOLD REPORT	PROVIDER INFORMATION
DTP 19JAN93	DTP 19JAN93
DTP 16MAR93	DTP 16MAR93
	DTP 18MAY93
DTP 23JUN94	DTP 23JUN94
POLIO 19JAN93	POLIO 19JAN93
POLIO 16MAR93	POLIO 16MAR93
POLIO 23JUN94	POLIO 23JUN94
MMR 23JUN94	MMR 23JUN94
HIB 19JAN93	HIB 19JAN93
HIB 16MAR93	HIB 16MAR93
	HIB 7DEC93
TOTAL VISITS:	**TOTAL VISITS:**
5 VISITS	7 VISITS