POPULATION COVERAGE IN THE NATIONAL HOUSEHOLD SURVEY ON DRUG ABUSE

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Introduction

For the purposes of this paper, we take a broad view of survey coverage in household screening surveys. We include weighted person response rates, weighted household response rates, and a measure of frame coverage based on recent experience from the National Household Survey on Drug Abuse (NHSDA).

This paper presents a brief description and history of the NHSDA, a description of the household screening process, definitions of the coverage terms reported in this paper, a summary of overall measures across recent years, and some results by selected domains.

Description And History of NHSDA

The NHSDA has provided information on substance abuse since 1971. Because of the sensitive nature of the data collected, the data collection methodology over this period has included a combination of interviewer-administered in-person interviews and self-administered answer sheets for the more sensitive data including all drug abuse questions.

The content of the NHSDA has included core questions on the use and abuse of alcohol, tobacco, marijuana (and hashish), cocaine, inhalants, hallucinogens, heroin, and medicinal drugs taken for nonmedicinal purposes. It has also included selected special topics.

The target population in recent years has been U.S. civilian, non-institutionalized persons aged 12 or older. Non-institutionalized group quarters residents have been included in the NHSDA since 1991. Alaska and Hawaii were also added to the geographic target area in 1991. The sample size for the study has increased over time from about 3,200 in 1971 to over 25,000 in 1998.[1]

Screening has been used to select younger age groups at higher rates over all years. Since 1985, screening has also been used to oversample Hispanics and non-Hispanic blacks. During the 1994 and 1995 surveys, screening was used to identify cigarette smokers and select them at a higher rate as a means of identifying more drug abusers.[2] Special geographic populations were also targeted in some years but the oversampling was achieved by first-stage sample allocation rather than through screening.[3]

The Sampling and Screening Process

The sample has been a multi-stage area probability sample. First-stage units were counties or groups of contiguous counties.[4] Second-stage units were small areas consisting of one or more Census blocks[5] and were called segments or area segments. Field staff were asked to list all dwelling units (including both Census housing units and qualifying group quarters units) within each sampled segment; these dwelling units were the third-stage sampling units. Systematic sampling with a random start was used to select sample dwelling units leading to non-compact clusters.[6] Finally, in a sample of dwelling units, field interviewers obtained limited descriptive data (age, gender, race, and relationship to householder[7]) for all persons aged 12 or older from a household resident who was 18 or older. A question on military status was used to eliminate persons in the military. In recent years, special residency requirements were also implemented to clearly associate residents with the household by quarter; to be eligible for the study a household resident must live

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[2]Cigarette smoking was found to be correlated with certain drug abuse behaviors and oversampling of cigarette smokers was used to try to include more drug users in the survey.

[3]The Washington DC metropolitan area was targeted in 1990, six metropolitan areas in 1991, 1992, and 1993, a rural supplement in 1994, and Arizona and California in 1997 and 1998.

[4]Large first-stage units were sometimes selected with probability one and treated as self-representing strata.

[5]In earlier years when complete Census block data were not available, segments were defined in terms of block groups or enumeration districts in places where block data were not available.

[6]Generally non-compact clusters are considered more effective in controlling the variance effects due to clustering, but less effective in producing good coverage (e.g., Kish 1965: 314).

[7]Cigarette smoking behavior was also obtained in 1994 and 1995. Gender and relationship to householder were collected only to help identify selected respondents since no names were recorded during the household screening process.

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[1]Partially based on Gfroerer (1992). For a better historic perspective of the NHSDA, see Gfroerer (1991) or Gfroerer, Gustin, and Turner (1992).

"here" for most of the time during the months defining the current quarter, e.g., January, February, March. The screening and person interviews are scheduled by quarter and generally start early in the first month of the quarter with a goal of reserving the last month of the quarter for finalizing cases and general cleanup. During the actual interview, we are able to check for false positives on the age eligibility rule; persons who report an age of less than 12 years are treated as ineligibles.

The half-open interval rule is used to identify and include a sample of dwelling units that were missed during the listing process or added since listing. We establish a conventional order of listing and then provide interviewers with the address of both the selected dwelling unit and the next listed dwelling unit. During the screening interview, interviewers ask about other dwelling units at the current address. After leaving the screened dwelling unit, the interviewer also checks for any new dwelling units between the selected unit and the next unit. These added dwelling units are automatically added to the sample; if large numbers are found, subsampling is allowed and the subsampling fraction is included in the design-based weight. Dwelling units that are destroyed, become vacant, or have no eligible residents are eligible to be selected, and are coded out as ineligible during the screening interview. As a protection against overcoverage, interviewers also verify that selected dwelling units are actually within the boundaries of the selected area segment; those outside the boundaries are also coded as ineligible. The listing and screening process is designed to identify the current eligible dwelling units even when current dwelling units were omitted from the listing. Listers are asked to include structures when in doubt, so that a substantial number of sample addresses become ineligible at the time of screening.[8]

In summary, the NHSDA field procedures build in some protection for both the false positive and false negative detection at the dwelling unit frame development level. At the within-dwelling unit frame development stage (listing of dwelling unit members 12 or older), the field procedures protect mainly against false positives, but interviewers are directed to verify the roster lists and prompt screening respondents to identify any other eligible persons at the dwelling unit.

[8]Some exceptions to the half-open interval rule were allowed when major changes occurred in the segment between the time of listing and interviewing or where a part of the segment was obviously omitted by the lister (e.g., a large group quarters unit that was assumed to be in institutional use by the lister). In these cases, the additional dwelling units were added to the listing and sampled at the same rate as the originally listed dwelling units.

Analysis Weights

The procedures for developing analysis weights during the recent past included the following steps:

- Develop design-based weights for all selected dwelling units.
- Adjust dwelling unit weights for screening nonresponse.
- Develop design-based weights for all selected persons from responding dwelling units.
- Adjust person weights for person nonresponse.
- Trim extreme weights at one or more of the above steps.
- Adjust all person weights further by post-stratification to intercensal projections by selected demographics.[9]

The nonresponse adjustments at both the screening and interviewing levels were internal to the sample. The poststratification adjustment which adjusts for all other frame coverage problems was based on adjustment of the sample estimates to external estimates thought to be very precise in comparison with the survey estimates.

Coverage Rate Concepts and Definitions

We have interpreted coverage in a broad sense to include response rates in the selected sample as well other coverage problems related to coverage error in the sampling frame.[10] Our analyses are limited to fairly recent NHSDA history (1993-1998) where we had access to archival files that allowed us to develop some comparable coverage statistics across time. For that period, we have computed raw and weighted screening response rates, raw and weighted interview response rates, and an average poststratification adjustment for selected domains.

The raw screening response rates were simply the ratios of successfully screened dwelling units to the total number selected. The weighted screening response rates were developed using design-based weights for all

[9]Control totals used for poststratification varied depending on special geographic emphasis of the current survey year, but always included age group (12-17, 18-25, 26-34, 35-49, 50+), gender, Hispanic indicator, and race (white, black, Indian, Asian).

[10]Groves (1989:83) limits his definition of *coverage error* to errors relating to the sampling frame and does not treat nonresponse error as a component of coverage error. In practice we attempt to adjust for both types of errors and the data records we actually analyze are the result of the compounded effects of coverage error and nonresponse error. Kish (1965:527-528) distinguishes between noncoverage and nonresponse and defines the term *errors of nonobservation* as the combined effect of these two sources of error. Lessler and Kalsbeek (1992:362) note that many authors allow the term coverage errors to include both terms.

selected dwelling units and limiting the numerators of the weighted rates to the responding domain.

Raw interview response rates were the ratio of responding eligible persons to selected eligible persons. Weighted interview response rates were developed using design-based person weights adjusted for screening nonresponse. These weights were applied to all eligible selected persons persons to establish the bases for the rates. The numerators were limited to the domain of responding eligible persons.

We have not recently conducted any special evaluations of the frame coverage as it relates to the target population for the NHSDA.[11] Further, we assume that our area frame is complete as it relates to the state target population definition. Assuming a complete inventory of area segments is addressable by the sample design, the major opportunities for frame coverage problems arise in the listing of dwelling units within selected area segments and in the enumeration of eligible persons within selected dwelling units. Without any special studies, our only measure of the total impact of these potential errors is in the average poststratification adjustment. The poststratification adjustment is simply the ratio of the external (more precise) estimate to the weighted survey estimate after adjustment for both screening and interview nonresponse.

Summary Measures Across Years

Table 1 shows summary measures at the total population level. The weighted response rates are probably the best indicator of long-term sample coverage since they are less subject to sample allocation differences caused by special survey focuses in some years. The weighted screening response rate varied from 0.9243 in 1998 to 0.9436 in 1995. The median taken over the six years was 0.9343.

The weighted interview response rate varied from 0.7510 in 1993 to 0.7936 in 1997 with a six-year median value of 0.7687. The data on screening and interviewing response rates do not appear to exhibit any strong temporal trends.

Table 1 also shows a raw and weighted dwelling unit eligibility rate. This rate does not reflect on the quality of survey coverage. This can be viewed as the true positive

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[11]Special studies have been conducted to evaluate coverage of persons outside target population definitions used in NHSDA; e.g., multiple frame approaches were tested for covering additional population components through a series of multiple frame sampling approaches applied within the District of Columbia metropolitan area (e.g., see Bray and Marsden 1999).

rate for the dwelling unit listing stage of the sampling frame development. Only about 85 percent of the listed addresses were actually eligible dwelling units at the time of the screening interview. The listers are instructed to list all addresses that might contain a dwelling unit and to error on the side of inclusion when in doubt. This can be viewed as a protection against frame undercoverage.

The final row of Table 1 shows the estimated frame coverage for each survey year based on the inverse of the poststratificaton adjustment. Data are shown only for 1993 through 1996; in 1997 and 1998, an adjustment for dwelling unit undercoveage was imposed at the segment level and could not reliably be extracted from the archived weight files. Note that it ranges from 0.8951 in 1995 to 0.9202 in 1993 with a four-year median of 0.9040. Values greater than 1 are possible, since the poststratification adjustment is based on independent estimates, both subject to some sampling error. This is the most difficult ratio to estimate with confidence. Several factors contribute to difficult interpretation. First, we know that the Census also suffers from both undercount and overcount, and this measure is relative to Census projections which anchor back to the 1990 Census. Second, the Census intercensal estimates are subject to error of unknown amounts. Finally, our eligibility criterion is defined for quarterly surveys as discussed above; it focuses on avoidance of double counting, and may error on the side of excluding some persons based on short-term residence within the quarter when they would be viewed as part of the total civilian non-institutional population by the Census definitions. We are not able to sort out how much our estimated frame coverage statistics reflect these other factors and how much they reflect the success of the frame development process within the survey: namely, the completeness of the dwelling unit listing within selected area segments and the completeness of the dwelling unit rosters within selected dwelling units. In subsequent sections, we discuss frame coverage statistics for selected domains; these comparative analyses are meaningful even if the absolute level of frame coverage is not always easy to interpret.

Results for Selected Domains

Only weighted rates are discussed in the domain analysis.

Screening coverage: Table 2 shows screening response coverage annual statistics by selected segment characteristics. We note that owner occupancy has a positive effect on screening rates. Segments with over 50 percent owner occupancy achieved a six-year median rate of 0.9401. The lowest screening success was experienced in segments that were less than 10 percent owner occupied at 0.9082. The order held up in all years

except 1994. Rural dwelling units were screened with higher success than urban dwelling units in all years, but differences varied considerably. The six-year median for rural segments was 0.9488 and for urban segments, 0.9318. We also looked at predominant race/ethnic characteristics of segments. A higher screening success was experienced in the predominantly Hispanic segments with a six-year median of 0.9497. Little difference was noted between predominantly black and the remaining segments.

Interview coverage: Table 3 shows interview response coverage annual statistics by gender, age, and race/ethnicity. We have consistently obtained a higher interview response rate from females than from males; the median over six years was 0.7940 for females and 0.7373 for males. The youngest age group, age 12 to 17, has consistently had the highest interview response rates with a six-year median of 0.8242. Although not consistent across all years, interview response rate appears to drop with increasing age to a low of 0.7616 (six-year median) for the 50 or older population. Among the three race/ethnicity groups shown in Table 3, Hispanics have consistently had the highest interview response rate with a six-year median of 0.8046 with non-Hispanic blacks in second place at 0.7855, and the other group last at 0.7626.

Frame coverage: Table 4 shows annual coverage statistics by gender, age, and race/ethnicity. As noted earlier, results are limited to 1993 through 1996. The results by gender are similar to those for interview response rates with females showing higher frame coverage in all years studied. A very different picture from that for response coverage emerges among the age groups for frame coverage. The highest frame coverage is noted for the 50 or older group with a four-year median of 0.9618. Second place is held by the 35 to 49 year-old group also at 0.9182. The poorest frame coverage is attained at the 18 to 25 age group with a six-year median of 0.8262. The 12 to 17 age group at 0.8512 and the 26 to 34 age group at 0.8684 hold the intermediate positions. Non-Hispanic blacks show the poorest frame coverage with a four-year median of 0.8550. Hispanic coverage is mixed across year, but has the highest four-year median.

Summary and Conclusions

NHSDA surveys provide a large sample base for studying overall coverage rates including those associated with both nonresponse error and frame coverage error. Results presented on frame coverage have been based on comparisons of nonresponse-adjusted estimates to external data sources. Since both are subject to error some of the frame coverage rates need to be interpreted with caution. In particular, the Hispanic population coverage is shown to be higher than other groups, but may be an artifact of the intercensal projections for Hispanics rather than a true measure of frame coverage.

Screening response, interview response, and frame coverage have been discussed separately as if they were independent processes. In fact, this is not the case. Poor screening response can have differential effects on frame coverage if the non-screened dwelling units tend to be ones that have a higher proportion of a certain domain, e.g., younger persons or blacks. This confounding of the screening coverage and frame coverage occurs because the development of dwelling unit rosters within dwelling units is actually the final stage of frame development. This confounding of effects may provide further support for studying all forms of undercoverage--screening nonresponse, interview nonresponse, and frame noncoverage--as an overall phenomenon.

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Table 1. NHSDA Annual Coverage Statistics; 1993 through 1998

| Measure | Survey year | | | | | | Median |
	1993	1994	1995	1996	1997	1998	Value
Screening response rate:							
Raw	0.9386	0.9377	0.9421	0.9272	0.9268	0.9295	0.9336
Weighted	0.9415	0.9340	0.9436	0.9289	0.9345	0.9243	0.9343
Interview response rate:							
Raw	0.7920	0.7783	0.8061	0.7861	0.7832	0.7697	0.7847
Weighted	0.7510	0.7550	0.7905	0.7772	0.7936	0.7601	0.7687
Dwelling unit eligibility rate							
Raw	0.8966	0.8540	0.8500	0.8488	0.8504	0.8537	0.8521
Weighted	0.8797	0.8517	0.8520	0.8491	0.8448	0.8492	0.8505
Estimated frame coverage	0.9202	0.9063	0.8951	0.9016	--------	--------	0.9040

Table 2. NHSDA Screening Response Rate Statistics by Segment Characteristics; 1993-1998

| Domain | Survey year | | | | | | Median |
	1993	1994	1995	1996	1997	1998	Value
50-100% Owner Occupied	0.9476	0.9409	0.9489	0.9355	0.9393	0.9343	0.9401
10-50% Owner Occupied	0.9315	0.9146	0.9379	0.9146	0.9271	0.9158	0.9215
< 10% Owner Occupied	0.9054	0.9176	0.9094	0.9070	0.9056	0.9139	0.9082
Rural	0.9590	0.9399	0.9617	0.9510	0.9470	0.9488	0.9488
Urban	0.9369	0.9324	0.9385	0.9229	0.9312	0.9240	0.9318
>50 % Hispanic .	0.9585	0.9599	0.9476	0.9322	0.9505	0.9489	0.9497
>50% non-Hispanic Black.	0.9289	0.9396	0.9311	0.8917	0.9335	0.9326	0.9319
Other	0.9419	0.9323	0.9445	0.9321	0.9338	0.9283	0.9331

Table 3. NHSDA Interview Response Rate Statistics by Gender, Age, and Race/Ethnicity ; 1993-1998

| Domain | Survey year | | | | | | Median |
	1993	1994	1995	1996	1997	1998	Value
Male	0.7285	0.7336	0.7606	0.7410	0.7742	0.7324	0.7373
Female	0.7696	0.7731	0.8139	0.8055	0.8084	0.7825	0.7940
12 to 17	0.8281	0.8202	0.8439	0.8194	0.8555	0.8133	0.8242
18 to 25	0.7612	0.7733	0.8056	0.7698	0.7976	0.7687	0.7716
26 to 34	0.7466	0.7638	0.7889	0.7728	0.8096	0.7505	0.7683
35 to 49	0.7416	0.7438	0.7756	0.7643	0.7752	0.7602	0.7622
50 or older	0.7340	0.7326	0.7811	0.7796	0.7800	0.7438	0.7617
Hispanic	0.8368	0.7927	0.8121	0.7971	0.8229	0.7926	0.8046
Non-Hispanic Black	0.7754	0.7563	0.7999	0.7860	0.8233	0.7850	0.7855
Other	0.7378	0.7499	0.7864	0.7731	0.7859	0.7520	0.7626

Table 4. NHSDA Frame Coverage Statistics by Gender, Age, and Race/Ethnicity; 1993 to 1996

| Domain | Survey year | | | | Median |
	1993	1994	1995	1996	Value
Male	0.9061	0.8937	0.8797	0.8856	0.8897
Female	0.9332	0.9180	0.9093	0.9165	0.9172
12 to 17	0.8570	0.8815	0.8455	0.8369	0.8512
18 to 25	0.8695	0.8325	0.8147	0.8200	0.8262
26 to 34	0.8928	0.8809	0.8560	0.8501	0.8684
35 to 49	0.9403	0.9209	0.9003	0.9156	0.9182
50 or older	0.9617	0.9476	0.9620	0.9715	0.9618
Hispanic	0.8689	0.9781	0.8866	0.9155	0.9468
Non-Hispanic Black	0.8783	0.8626	0.8457	0.8473	0.8550
Other	0.9318	0.9042	0.9031	0.9077	0.9060