Sample designs and sampling methods for the Collaborative Psychiatric Epidemiology Studies (CPES)

STEVEN G. HEERINGA,[1] JAMES WAGNER,[1] MYRIAM TORRES,[1] NAIHUA DUAN,[2] TERRY ADAMS,[1] PATRICIA BERGLUND[1]

1   Institute for Social Research, University of Michigan, USA.
2   Department of Biostatistics, University of California, Los Angeles, USA.

Abstract

This paper provides an overview of the probability sample designs and sampling methods for the Collaborative Psychiatric Epidemiology Studies (CPES): the National Comorbidity Survey Replication (NCS-R), the National Study of American Life (NSAL) and the National Latino and Asian American Study of Mental Health (NLAAS). The multi-stage sample design and respondent selection procedures used in these three studies are based on the University of Michigan Survey Research Center's National Sample designs and operations. The paper begins with a general overview of these designs and procedures and then turns to a more detailed discussion of the adaptation of these general methods to the three specific study designs. The detailed discussions of the individual study samples focus on design characteristics and outcomes that are important to analysts of the CPES data sets and to researchers and statisticians who are planning future studies. The paper describes how the expected survey cost and error structure for each of these surveys influenced the original design of the samples and how actual field experience led to changes and adaptations to arrive at the final samples of each survey population.

Key words: population surveys, probability samples, stratification, multi-stage sampling, household screening, disproportionate sampling, responsive design, two-phase sampling

Introduction

Three national surveys of Americans' mental health comprise the Collaborative Psychiatric Epidemiology Studies (CPES): the National Comorbidity Survey Replication (NCS-R), the National Study of American Life (NSAL) and the National Latino and Asian American Study of Mental Health (NLAAS). The CPES surveys are funded by the National Institute of Mental Health (NIMH). Although each survey programme had unique features and topical questionnaire modules, they shared a common core of scientific objectives and survey instrumentation in their respective measurements of primary mental health diagnostic symptoms, symptom severity and use of mental health services (Kessler et al., 2004; Jackson et al., 2004; Alegria et al. 2004).

The NIMH-CPES survey data collections were each based on a multi-stage area probability sample selected using the sampling frames and sample selection procedures that are common to the University of Michigan Survey Research Center's (SRC) National Sample design (Heeringa et al., 1984; Heeringa et al., 1994). The national area probability samples for the individual studies include unique features designed to optimize the cost and error properties of the study-specific samples (Groves, 1989; Lessler and Kalsbeek, 1992). The general features of each study sample are summarized in Table 1.

Including this introduction, this paper is organized into six sections. The second section provides a description of the multi-stage area probability sampling method that is common to each of the three

Table 1. Key features of the Consortium in Psychiatric Epidemiology Studies (CPES) sample designs.

Sample design feature	National Comorbidity Survey Replication (NCS-R)	National Survey of American Life (NSAL)	National Latino and Asian-American Study of Mental Health (NLAAS)
Survey population	All adults, age 18+ residing in households in the coterminous United States. Exclusions include institutionalized persons, those living on military bases and non-English speakers.	African-American, Afro-Caribbean, and non-Hispanic white adults, age 18+ residing in households in the coterminous United States. Exclusions include institutionalized persons, those living on military bases and non-English speakers.	Latino and Asian-American adults, age 18+ residing in households in the coterminous United States, Alaska and Hawaii. Exclusions include institutionalized persons and those living on military bases.
Sample frame	Four-stage national area probability sample.	Four-stage national area probability sample with special supplement for Afro-Caribbean adults.	Four-stage national area probability sample with special supplements for adults of Puerto Rican, Cuban, Chinese, Filipino and Vietnamese national origin.
Sample size	13,054 sample housing units screened for eligible adults.	26,495 sample housing units screened for eligible adults.	27,026 sample housing units screened for eligible adults.
	9,282 completed interviews with eligible respondents.	6,199 completed interviews with eligible respondents.	4649 completed interviews with eligible respondents.
Special features	Selection of two adult respondents in a subsample of households. Special study of main survey nonresponse.	Two-phase sample design to control survey costs in final stages of data collection.	Sample linked to NCS-R for statistical comparisons. Selection of two adult respondents in a subsample of households. Two-phase sample design to control survey costs in final stages of data collection.

CPES sample designs. A detailed description of the NCS-R survey population, sample plan and sampling methods is given in the third section. The fourth and fifth sections describe the sampling plans, methods and the special features of the NSAL and NLAAS sample designs.

General features common to each CPES sample design

The selection of a probability sample of respondents for each study's interview required a four step sampling process – a primary stage sampling of US Metropolitan Statistical Areas (MSAs) and counties, followed by a second stage sampling of area segments, a third stage sampling of housing units within the selected area segments and concluding with the random selection of eligible respondents from the sample housing units.

Primary stage sampling

The primary stage units (PSUs) of SRC's National Sample are either MSAs, single counties, or a grouping of geographically contiguous counties with small populations. In each CPES sample design, PSUs are assigned to explicit sampling strata based on MSA/non-MSA status, PSU size, geographic location, and population characteristics. Depending on the CPES study sample design, from 12 to 20 of the primary stage strata contain only a single *self-representing* (SR) metropolitan PSU. Each SR PSU is included in the sample with certainty in the primary stage of selection. The remaining *non-self-representing* (NSR) primary stage strata in each design contain more than one PSU. From each of these NSR strata, one PSU is sampled with probability proportionate to its size measured in occupied housing unit counts reported at the most recent census.

Second stage of sampling

The designated second-stage sampling units (SSUs) in each CPES sample design are termed area segments. Area segments were formed by linking geographically contiguous census blocks to form units

with a minimum number of occupied housing units (typically 50 to 100 based on the needs of the study). Within primary stage units, area segments were stratified at the county level by geographic location and race/ethnicity composition of residents' households. The race/ethnicity stratification of area segments played a particularly important role in the NSAL and NLAAS sample designs where it was used both to improve the sampling precision of the design and as a basis for more cost-effective oversampling in area segments with higher densities of households for targeted race and ethnicity subpopulations. Within each second stage stratum, the actual probability sampling of area segments was performed with probabilities proportionate to census counts of the occupied housing units for the census blocks that comprise the area segment.

Third-stage and fourth-stage sampling of housing units and eligible respondents
The SRC field staff conducted an up-to-date enumeration or 'listing' of all housing units located within the physical boundaries of the selected area segments for each CPES sample design. A third-stage sample of housing units was then selected for screening interviews according to a predetermined sampling rate. The third-stage sampling rates for selecting households in the CPES multi-stage area probability samples were computed using the following 'selection equation' (Kish, 1965):

$$f = f_1 \times f_2 \times f_3$$

$$= \frac{MOS_{psu}}{MOS_{stratum}} \times \frac{b_{psu} \times MOS_{ssu}}{MOS_{psu}} \times \frac{C_{stratum}}{MOS_{ssu}}$$

where: f = the overall multi-stage sampling rate for housing units;
MOS_{psu} = total population measure of size in the selected PSU;
$MOS_{stratum}$ = total population measure of size in the design stratum;
b_{psu} = number of area segments selected in the PSU;
MOS_{ssu} = total household measure of size for the area segment;
$C_{stratum}$ = a stratum-specific constant =
$(f \times MOS_{stratum})/b_{psu}$.

The third-stage sampling rate for selecting an equal probability sample from the listed housing units for the area segment was:

$$f_3 = \frac{f}{f_1 \times f_2} = \frac{f \times MOS_{stratum}}{b_{psu} \times MOS_{ssu}}$$

The third stage sampling rate was computed for each selected area segment in the CPES sample design. This rate was then used to select a systematic random sample of actual housing units from the area segment listing.

Each sample housing unit was contacted in person by an interviewer. Within each cooperating sample household, the interviewer conducted a short screening interview with a knowledgeable adult to determine if household members met the study eligibility criteria. If the informant reported that one or more eligible adults lived at the sample housing unit address, the interviewer prepared a complete listing of household members and proceeded to randomly select a respondent for the study interview. The random selection of the respondent was performed using a special adaptation of the objective household roster/selection table method developed by Kish (1949).

Sample plans and responsive design
The initial multi-stage sample plans for the NCS-R, NSAL and NLAAS sample designs were developed based on design objectives that included the investigators' specifications of sample sizes and sample allocation. These sample sizes and sample allocations were chosen to achieve targeted levels of sample precision for specific survey estimates and/or power to detect intergroup differences in statistics for sample subclasses. The design plan also incorporated response goals for the screening and interview phases as well as expected eligibility rates for successfully screened sample households. Response rate expectations were based on previous experience in field studies. Household eligibility rate assumptions were developed using the most recently available US census data.

Responsive design techniques (Heeringa and Groves, 2004) were also employed in the management of the CPES samples during the production phases of the studies. The first of these techniques was the replication of the full sample of households. Sample replicates were random subsamples of the complete

sample of housing units. Each replicate of the sample was a proper probability sample that represented the same domain or collection of strata that the full sample was designed to represent. Replication of the sample served several purposes. First, the ability to increment the sample size progressively by adding replicates allowed field managers to balance interviewers' workloads – ensuring that each interviewer had adequate sample lines to remain productive but few enough that they found it easy to prioritize initial calls to housing units, callbacks and interview appointments. Second, the sequential release of sample replicates provided the project director and statisticians time to review accumulating empirical data on survey eligibility, response rates and other survey cost factors (screening difficulty, travel, interview length). If these survey design parameters and costs deviated substantially from the original expectations for the sample plan and budget, the project director could make needed adjustments in sample size or sample allocation by controlling the release of sample replicates.

The second sample design feature that was used extensively in the NSAL and NLAAS studies was the ability to disproportionately sample geographic domains of the survey population. Both the NSAL and NLAAS sample designs combined core, nationally representative samples of US households with supplemental samples that were restricted to census geographic areas that exceeded a minimum population density for a rarer population of interest (Afro-Caribbeans for NSAL, Latinos and Asian Americans for NLAAS). Eligible NSAL or NLAAS respondents who lived in a higher density (HD) population domain had two chances of being selected for interview, one chance through the core area probability sample and a second through the supplemental area probability sample for the high-density domain. The overall probability of selection for a household located in one of the CPES high-density domains was

$$f_{overall} = f_{core} + f_{HD} - f_{core} \times f_{HD}$$

where f_{core} and f_{HD} are the probabilities that a household was selected independently from the core and 'high density' area probability samples. Sampling weights, inversely proportional to these joint selection probabilities, are used in survey analysis to compensate for differences in inclusion probabilities for population

members who reside inside and outside the high-density area domains. Disproportionate sampling of households from the higher density area domains significantly reduced the survey costs needed to identify a specified sample size of eligible persons belonging to a rare population – the greater the oversampling of the high density area domain, the higher the empirical eligibility rate in the sample and the lower the screening costs.

A third responsive design feature that was applied in the NCS-R, NSAL and the NLAAS was the use of two-phase subsampling of non-final cases as each survey entered the final months of the field period. The length of the field periods for these studies ranged from 18 to 25 months (see Pennell et al., 2004). As the end of the study field period approached, the costs of contacting, screening and interviewing the remaining unresolved sample lines rose dramatically. To more optimally balance the survey costs and errors of this final 'clean-up' phase of the survey field period, SRC used a procedure in which all sample cases that did not have a final disposition as of a certain date, were randomly subsampled for continued follow-up. A subsample of cases (for example, a half or a third) was designated for continued follow up. The complementary subsample was deactivated and received no further follow up. The advantage of this methodology for the CPES studies was that it permitted the field staff to devote a budgeted level of effort to a subsample of the outstanding cases and in the process produced higher response rates and potentially better data quality for these final stage cases.

The representation of cases that were removed from the sample in the two-phase procedure did not disappear through a survey statistician's sleight of hand – their representation of the survey population was transferred to the retained cases in the form of an extra weight factor to be applied in data analysis. For example, if a two-phase sample was used to retain half of the outstanding cases in the field after time, t, the retained subsample of cases would receive an extra weight factor of W = 1/0.5 = 2. This weight was applied to the sample selection weight factor for each case and was used in the computation of eligibility rates and response rates. The approach therefore comes with a price. The weighting factors that are needed to compensate for the subsampling increased the variances of unbiased estimates of survey statistics relative to unweighted estimation based on same-sized samples.

The amount of this variance increase depends on the sample design and the properties of the variables that contribute to the statistic of interest but it is generally true that the larger the difference in the weight factor the greater the increase in variance.

Final response rates for the CPES samples were computed using the American Association of Public Opinion Research (AAPOR, 2004) guidelines for response rate calculation formula 3(RR3). These guidelines for samples that incorporate disproportionate sampling, household screening and two-phase sampling for non-response follow up can be found at the following URL:

http://www.aapor.org

National Comorbidity Study Replication (NCS-R) sample design

The 2001–2 NCS survey programme included two major survey components: the NCS-R replication study and the National Comorbidity Survey-2 reinterview study. The NCS-2 was a longitudinal study that attempted to recontact and reinterview all surviving respondents from the 1992 National Comorbidity Survey (Kessler et al., 1994). The focus of the discussion here is on the NCS-R, a new cross-sectional sample survey of the U.S. adult population.

NCS-R survey population

The survey population for the NCS-R included all US adults aged 18 years and older residing in households located in the coterminous 48 states. Institutionalized persons including individuals in prisons, jails, nursing homes and long-term medical or dependent care facilities were excluded from the survey population. Military personnel living in civilian housing were eligible for the study but due to security restrictions residents of housing located on a military base or military reservation were excluded. Adults who were not able to conduct the NCS-R interview in English were not eligible for the survey.

Multi-stage area probability sample design

The NCS-R was designed to be a cross-sectional replication of the original 1992 National Comorbidity Survey (NCS; Kessler, 1994). To improve the statistical efficiency for cross-time comparison of results from these two surveys, a decision was made early in the NCS-R planning process to maximize the overlap in the primary and secondary stages of the multi-stage sample designs for the two studies. Data from the 2000 US census were not available at the time of the NCS-R sample selection. Therefore, the primary stage design for the NCS-R was carried forward directly from the 1992 NCS multi-stage sample selection with no changes in primary stage strata or PSU definitions and no adjustment to the 1990 census-based measures of size or primary stage selection probabilities. The shared NCS/NCS-R primary stage sample design consisted of a single PSU selection from each of 62 primary stage strata. As shown in Table 2, 16 of these NCS-R PSUs were the largest self-representing MSAs. A total of 31 non-self-representing PSU selections represented the remaining MSAs in the US survey population. More rural non-MSA counties were represented by 15 non-self-representing PSU selections.

Accurately maintained records of the original NCS second stage sample area segment probabilities and listings permitted a second opportunity for improved statistical and cost efficiency in the NCS-R sample. As shown in Table 2, the NCS-R sample – like the original NCS sample – included a total of 1,001 area segment selections. To achieve the statistical advantages of correlated samples over time (Kish, 1987), a decision was made to maximize the reuse of original NCS area segments whenever the original listing

Table 2. Primary and secondary stage sample allocation for the NCS-R

Domain of Primary stage strata	Number of NCS-R primary stage units (PSUs)	Number of NCS-R second stage units (SSUs)	
		Total NCS area segments	New listing needed
Total	62	1001	174
SR MSA	16	395	24
NSR MSA	31	402	48
NSR Non-MSA	15	204	102

would support a new sampling (without replacement) of housing units. In these original NCS area segments, SRC interviewers did not prepare a completely new housing unit listing. Instead they updated the original listing for new construction, demolitions or other changes that had occurred since the original listing had been completed in late 1991. A total of 174 of the original 1,001 NCS area segments lacked sufficient unused sample listings to support the third stage sampling for the NCS-R. In these 174 cases, an objective method was used to expand the original area segment definitions to include adjacent census blocks and update the selection probabilities for these expanded area segments. A housing unit listing was then prepared for the new census blocks that had been linked to the original area segment definition.

An equal probability sample of housing unit listings was selected from the master data base of new or updated housing unit listings for the 1,001 NCS-R area segments. At the time the NCS-R equal probability sample was selected, the sample of housing unit listings was divided into 12 random replicates (10 base-sample and two reserve-sample replicates) of approximately equal size. Eight of the 10 base-sample replicates were released for screening at the start of the survey field period in February 2001. A ninth replicate was added to the sample in late Fall of 2001. A total sample of 13,054 selected sample housing units was fielded for the NCS-R yielding an effective sampling rate of $f = 0.00011$ or approximately 1 in every 9,100 housing units in the survey population. The occupancy rate for this sample of households was 87.6%, resulting in attempted screening contacts with 11,443 households. During the screening contact, the interviewer recorded the gender and age of all adults in the screened household on the sample coversheet. One eligible adult was then randomly selected as an NCS-R respondent using the objective procedure described by Kish (1949). In approximately 20% of screened households with two or more eligible adults, a second random respondent (often the spouse of the primary respondent) was also designated to complete the NCS-R interview.

NCS-R responsive design
During the NCS-R field period, the field staff experienced several localized problems in gaining access to sample housing units in locked buildings or residential communities. The problem of locked buildings was especially prevalent in higher income residential areas

in New York and other large MSAs. In several area segments in New York City, large numbers of housing unit selections were concentrated in locked, restricted-access apartment buildings. After repeated attempts to gain access or to contact selected HUs through in-person contact or mailings, a decision was made to replace these locked building selections with randomly chosen lines from adjacent buildings in the same area segment. In several other area segments with locked buildings or safety and security problems, the decision was made to select a random subsample of the lines for intensive interviewer follow up. The random substitution and subsampling for lines with problems of restricted access involved fewer than 200 of the 13,054 lines in the NCS-R sample. (Since the decision to subsample restricted access sample lines was based on knowledge gained during the actual implementation of the sample, the NCS-R final response rates reported in Table 3 include appropriate weighting of results for housing units that were retained in the sample.)

The NCS-R sample design included one additional unique feature that was responsive to information gained during the study field period. With the exception of the subsampling of restricted access housing units described above, NCS-R did not employ a large Phase 2 subsampling of sample addresses. Instead, near the completion of the study when all conventional methods for interview incentives and refusal conversion had been tried, non-respondents were offered a special monetary incentive of $100 to complete a short form of the NCS-R CIDI interview. This short interview option was offered only to selected respondents who were understood to be physically and mentally able to complete the interview – 2,143 of 2,929 designated primary respondents for the main interview and 334 of 337 main interview second adult respondents. The NCS-R short-form interview data was collected solely as a basis to investigate potential non-response bias in the main interview data set (Kessler et al., 2004). Short-form interview completions are not included in the main interview response rate calculations reported in Table 3.

NCS-R sample design outcomes
A total of 11,222 households completed the NCS-R screening interview resulting in a household screening response rate of 98.1%. Each successfully screened household provided information needed to determine the eligibility of adult members of the household and

Table 3. NCS-R final sample dispositions.

	Main interview		Short-form interview	
	Primary	Secondary	Primary	Secondary
Completed interviews	7,693	1,589	399	155
AAPOR RR3 response rate (%)	70.9	80.4	18.6	46.4
Eligible respondents	10,622	1976	2143	334

to randomly select the NCS-R respondents. A total of 10,622 English-speaking adults aged 18 to 74 were designated as primary respondents for the main NCS-R interview (see Table 3). A subsample of 1,976 eligible adults in households with two or more eligible persons comprised the NCS-R secondary respondent group for the main interview. The final response rate for NCS-R primary respondents was 70.9%. This response rate value corresponds to the AAPOR RR3 response rate formula (AAPOR, 2004). The response rate for the NCS-R secondary respondents was 80.4%.

National Study of American Life (NSAL) sample design

The NSAL is an integrated national household probability sample survey of 3,570 African-Americans, 1,006 non-Hispanic whites, and 1,623 black adults of Caribbean descent, for a total interviewed sample of 6,199 adults aged 18 and over.

NSAL survey population

The NSAL survey populations included all US adults in the three target groups who were age 18 and older and resided in households located in the coterminous 48 states. The African-American survey population included only black adults who did not identify ancestral ties in the Caribbean. The Afro-Caribbean survey population was limited to black adults who self-identified as being of Caribbean ancestry. The white survey population included all Caucasian adults except persons of self-reported Hispanic ancestry. Institutionalized persons including individuals in prisons, jails, nursing homes and long-term medical or dependent care facilities were excluded from the study population. Military personnel living in civilian housing were eligible for the study but residents of housing located on a military base or military reservation were excluded. The NSAL survey populations were restricted to adults who were able to complete the interview in English.

The core multi-stage area probability sample design for the NSAL

The NSAL multi-stage sample design combines a 'core' national area probability sample of households with a special supplemental sample of households in areas of higher Afro-Caribbean residential density. The NSAL Core national sample is designed to be optimal for a national study of the African-American survey population. The design of the NSAL Core sample closely resembles that used for the 1979–80 National Survey of Black Americans (NSBA) (Hess, 1985; Jackson, 1991). The NSAL Supplement design served solely to augment the sample size from the Afro-Caribbean survey population in a cost and statistically efficient manner and did not contribute to the representative samples of the NSAL's African-American and white survey populations. The NSAL national area probability sample was selected independently of the sample for the NCS-R and the NLAAS although as described in the preceding sections, the three designs share many common features such as PSU and area segment definitions and sample selection methods.

The Survey Research Center (SRC) 1990 National Sample of US households (Heeringa et al., 1994) was the starting point for NSAL sample selection. To adapt the sample to be optimal for a national study of the African-American survey population for NSAL, some modification to the primary stage of the basic 1990 SRC National Sample design was needed. The definitions of the primary sampling units in the primary stage frame for the SRC National Sample remained unchanged, but measures of size used in the PPS selection of PSUs were changed from 1990 census counts of total occupied households to African-American occupied households. Some reorganization (combining, splitting) of 1990 'A' National Sample strata (Heeringa and Redmond, 1994) was also required to transform the design from one that was optimal for surveys of all US households to one that emphasized precision for samples of African-Americans.

As shown in Table 4, the NSAL Core primary stage design includes 64 PSU selections. The eight largest self-representing MSA PSUs in the 'A' partition of the SRC National Sample remained self-representing (SR) selections in the NSAL primary stage sample. An additional 13 MSA PSUs were designated as self-representing PSUs for the NSAL on the basis of the size of their African-American population, bringing the total number of NSAL SR PSUs to 21. The NSAL primary stage design includes 43 NSR selections, 14 PSUs selected from strata representing the MSA and non-MSA regions of the census Northeast, Midwest and West regions and 29 PSUs selected from MSA and non-MSA strata representing the census south – the region that includes almost 50% of the US African-American population. The primary stage sample allocation for the urban and rural areas of the census South region was deliberately increased to improve sample precision for national estimates derived from the African-American sample. The PPS selection of the 43 NSAL NSR PSUs used a probability sampling method that maximized the overlap of the NSAL primary stage sample with the 1990 SRC National Sample 'A' partition selection for the design stratum. The objective in maximizing the overlap of the NSAL primary stage sample with the 1990 SRC National Sample was, where possible, to take advantage of experienced, trained SRC staff in the National Sample primary stage sample locations.

Within the 64 NSAL Core sample primary areas, a sample of 456 area segment units was selected with probabilities proportionate to 1990 census counts of African-American households for the area segment. SRC field staff prepared housing unit listings for each of the selected segments and a third stage sample of housing units was selected for the screening stage of the study in which the eligible samples of African-American, white, and Caribbean adults were identified and designated for interview.

The NSAL Core sample was a stratified probability sample of US households. Since the NSAL probability sample was developed prior to the release of 2000 census data, the two major domains of the NSAL Core national sample were defined based on the 1990 census proportions of African-American households. The first domain included all census block groups in which 10% or more of 1990 census households were reported to be African-American. The NSAL Core sampling rate for the equal probability selection of housing units in this 'high density' domain was f = 0.0004 or approximately 1 in every 2,500 households. The second domain of the NSAL Core sample included all census block groups in which the 1990 Census reported <10% density for African-American households. This domain was labelled the Wide Area Screening Procedure (WASP) domain due to the special screening procedure employed there to locate sparsely distributed African-American households (Jackson, 1991). Households in the WASP domain of the NSAL Core were sampled with equal probability at an overall sampling rate f = 0.0001 or 1 in 10,000. Although by design the survey cost and error properties of this NSAL Core sample are more suitable for the study of the US African-American population, it also serves as a less statistically efficient basis for national probability sampling of other target groups of the US population including the non-Hispanic whites and Afro-Caribbeans that are of comparative interest in this study.

A trained SRC interviewer contacted each sample housing unit in person and asked an adult household informant to supply the age, gender, race and Hispanic and Caribbean ancestry status of each household member. This demographic data for household members was recorded on a household roster. The interviewer identified on the roster form the subset of household members who were eligible to be selected as the NSAL respondent. African-American and

Table 4. Primary and secondary stage sample allocation for the NSAL Core sample

Domain of primary stage strata	Number of NSAL primary stage units (PSUs)	Number of NSAL second stage units (SSUs)
Total	64	456
SR MSA	21	198
NSR MSA	27	162
NSR Non-MSA	16	96

Afro-Caribbean adults were always eligible for respondent selection. A special stratified subsample of age eligible non-Hispanic white adults was also eligible for respondent selection (see below). The Kish (1949) procedure for objective respondent selection was used to randomly designate one of the eligible adults as the NSAL respondent.

NSAL African-American sample

The NSAL sample of African-Americans was identified exclusively from the screening of the sample of housing units selected from the 456 NSAL Core area segment listings. The NSAL Core sample of housing units was screened for African-American households using both traditional methods and the WASP procedure developed and first employed in the 1979-1980 NSBA (Hess, 1985; Jackson, 1991). The standard screening procedure described above was used in the 386 'high density' NSAL Core area segments. The WASP procedure was used to screen for African-American households in the 70 NSAL Core area segments in which less than 10% of households were expected to be African-American. At WASP sample addresses, informants were asked to provide screening data for their households and to identify addresses for any African-American households residing on their block. The expectation was that the overlapping reports from the WASP area segment households would identify all eligible African-American households in the area segment. Due to cost considerations, no validation of this screening assumption was conducted as part of the NSAL. However, a validation study of these same procedures was conducted during the 1980 NSBA. In the NSBA test, traditional door-to-door screening procedures to locate African-American respondents were used in 20% of the segments that had previously used the WASP approach. This evaluation revealed that no eligible African-American households were missed by the WASP screening procedure (Jackson, 1991).

NSAL Afro-Caribbean sample

The NSAL sample of Afro-Caribbean households was identified through samples selected from two overlapping area probability sample frames. The first sample source for Afro-Caribbean respondents was from the screening of households in the nationally representative NSAL Core sample. As described above, all sample housing units in this national probability sample were contacted and a screening interview was conducted with each eligible, cooperating household. In total, 266 adult Afro-Caribbeans were successfully interviewed in the NSAL Core national sample. Therefore it was necessary to supplement the NSAL Core sample in order to achieve the original NSAL target sample size of 1,600 Afro-Caribbeans.

The NSAL Caribbean Supplement augmented the NSAL Core sampling with a second area probability sample of housing units from geographic areas with a relatively high density of persons of Caribbean ancestry. The population represented by the Caribbean Supplement was nested within the full national population of Afro-Caribbeans, which is represented by the smaller sample of eligible persons identified in the NSAL Core sample screening. Eligible Afro-Caribbeans who lived outside the geographic domain represented by the NSAL Caribbean Supplement had only a single equal probability of selection (through the NSAL Core sampling). Those who lived in the Supplemental sample domain had two chances of being selected and interviewed – once from the core sampling, which represented the nation, and once from the supplemental sample of the high-density Caribbean domain.

Construction of the NSAL Caribbean Supplement sample began with the selection of a stratified sample of eight supplemental PSUs. The eight primary areas were selected in the five states and Washington DC, which together contain more than 80% of the Caribbean descent population in the US: New York (2 PSUs), New Jersey, District of Columbia, Florida (2 PSUs), Connecticut and Massachusetts. Five of these special Caribbean Supplement PSUs were self-representing PSUs that were also included in the NSAL Core sample of 64 PSUs. The primary stage of the NSAL Caribbean Supplement included three non-self-representing PSU selections, two of which were used only in the supplemental sampling of Afro-Caribbean households.

From these eight PSUs, 86 area segments were selected from the set of qualifying census block groups within the PSUs. To qualify for the Caribbean Supplement, a block group population needed to be at least 10% Afro-Caribbean (based on the 1990 census estimates). Once the primary and secondary stage sampling units were selected, field staff visited each area segment to list housing units. A third stage equal probability sample of housing units ($f = 0.00420$) was selected from this supplemental Afro-Caribbean area probability frame.

Table 5. Primary and secondary stage sample allocation for the NSAL Caribbean Supplement

Domain of primary stage strata	Number of NSAL primary stage units (PSUs)	Number of NSAL second stage units (SSUs)
Total	8	86
SR MSA	5	66
NSR MSA	3	20

Sample housing units for the Caribbean Supplement were contacted and screened using procedures identical to those for the NSAL Core with the exception that only Afro-Caribbean adults were eligible for selection in Supplement sample households.

The NSAL white sample

The NSAL white sample was a stratified, disproportionate sampling of non-Hispanic white adults in the US household population. Although in the strictest sense it may be described as a nationally representative sample of white adults, it is not optimal for descriptive analysis of the US white adult population. Instead, the NSAL white sample was designed to be optimal for comparative descriptive and multivariate analyses in which residential, environmental and socio-economic characteristics are carefully controlled in the black-white statistical contrasts. As described above, the NSAL sample of white adults was identified by screening the national probability sample of housing units selected for the NSAL Core. The original completed interview target for the NSAL white sample was set at n = 1,800. Later in the study period, a decision was made to reduce this target to n = 1,000 white adult interviews based on survey costs and updated analysis objectives for the NSAL project (see below). By the nature of its equal probability national sampling of all US households, the NSAL Core screening for eligible African-American and Afro-Caribbean households was projected to identify far more eligible white households

than required to meet the sample size target. Therefore, subsampling of eligible white adults at the screening stage was employed to bring the sample of interviews with this group in line with the study targets.

Consistent with the design objective of maximizing the geographic and socio-economic overlap with the African-American sample adults, the stratified subsampling plan outlined in Table 6 was used to subselect eligible white respondents for interview. The initial plan stratified the US white population based on the density of the African-American population in the Census block group in which the household resided. If the NSAL Core screening identified a white household in a census block group with 60%+ expected African-American households, the initial plan called for sampling one eligible adult from each such screened household – white households in this stratum had the same probability of being selected as their African-American neighbours. In the three strata of census block groups with lower proportions of African-American households, white households were subsampled for respondent selection at sequentially lower rates: 2/3 for whites in block groups with 30%-59% African-American households, 1/5 in neighbourhoods with 10% to 29% African-American households; and 1/15 in the more segregated census block groups in which less than one in 10 households were expected to be African-American. The lowest density African-American stratum is the geographic stratum in which the WASP procedure was used to

Table 6. Stratified subsampling of eligible white households in the NSAL Core sample

White stratum	Black households in block group (%)	Area segment selections	White subsampling rate	Mid-study sample censoring rate	Implicit final subsampling rate
1	0–9.9	70	1/15	1/15.6	1/235.2
2	10.0–29.9	73	1/5	1/1.71	1/8.6
3	30.0–59.9	81	2/3	1/2.10	1/3.2
4	60.0–100.0	232	1/1	1/1.59	1/1.6

identify all eligible African-American households within the selected area segment (see above). Such unequal probabilities of selection require weighting to obtain unbiased estimates of characteristics for the white population (see Heeringa and Liu, 1998).

In January of 2002, approximately mid-way through the two-year field period for the NSAL, higher than expected survey costs and a data-driven update to the survey objectives resulted in a decision to reduce the targeted completed interview sample size for white adults from 1,800 to 1,000. Over 700 white interviews had already been completed at that point, so that major change in design objectives forced a suspension of further interviewing of white adults until a new sub-sampling plan could be put in place. NSAL Core screening data on eligible white households continued to be recorded in anticipation of a new white sample release later in the study period. In early summer of 2002, and again in early fall 2002, two replicate samples of screened eligible white households were released to the field interviewers for contact and screening. To minimize field costs to complete the NSAL white sample, SRC interviewers only attempted to recontact and interview eligible white adults who had provided a recontact telephone number in the screening process. The mid-study suspension of the fieldwork for the original NSAL white subsample design is strictly speaking a non-random censoring of this study sample. The extent of bias associated with this censoring of the white sample is not known. The censoring of the sample makes it very difficult to estimate a true response rate and a design-based sampling weight for the final NSAL white sample. In all initial response-rate calculations and weight development for the NSAL white sample, SRC sampling statisticians assumed a model under which the sample censoring was random with respect to all characteristics except the socio-economic characteristics of the white household's geographic stratum. The simple assumptions implicit in this model of the sample censoring are being investigated further and the results will be the subject of a future paper.

NSAL responsive design
The NSAL Core and Caribbean Supplement samples utilized the responsive design technique of two-phase sampling. Phase 1 of the sample period extended from the time of the first interviewer training in January 2001 through 20 November 2002. Prior to the start of

Phase 2, a 50% subsample of all outstanding sample cases with no final disposition was selected to continue in the active sample. The remaining 50% of outstanding cases became inactive and were removed from the Core and Supplement sample prior to the November 20, 2002 transition date.

NSAL sample design outcomes
Over the course of the more than two-year study period, sample replicates totalling 16,539 sample housing unit selections were introduced into the NSAL Core screening and field data collection. Of these, field staff determined that 13,640 (82.5%) were occupied and met the study definition of a permanent residence. During Phase 1, 11,103 of these households were successfully screened and received a final survey disposition (for example, interview, refusal, ineligible). A total of 3,788 (34.1%) of these screened households contained one or more eligible African-American respondents and 3,312 (87.4%) selected respondents completed the study interview. Eligible Afro-Caribbean respondents were identified in 259 (2.3%) of the Phase 1 households and 255 (98.5%) completed the study interview. The Phase 1 screening yielded 5145 eligible white households (46.4%). Of these 1444 (28.1%) were subsampled to be respondents and 1,006 (69.7%) were eventually interviewed. (See discussion of the white respondent subsample above.) Phase 2 began with a sample of 2,537 NSAL Core cover sheets that had not to that point been assigned a final survey disposition. A 50% subsample of these non-final coversheets was selected by a one in two sampling of area segment clusters. Of the 1,220 cover sheets retained by this subsampling, 804 (65.9%) were determined or estimated to have one or more eligible African-American respondents and 258 (32.1%) of these African-American households yielded an interview. The response rate for the estimated 18 Afro-Caribbean households in the NSAL Core Phase 2 sample was 61.1%.

Combining the Phase 1 and 2 samples, the total completed interview counts for the NSAL Core were: African-American (n = 3,570), Afro-Caribbean (n = 267) and non-Hispanic white (n = 1,006). Applying the AAPOR RR3 (AAPOR, 2004) response rate formula for the two-phase sample procedure, the final weighted response rates in the NSAL Core sample data collection were: African-American (70.9%); Afro-Caribbean (93.9%) and non-Hispanic

Table 7. NSAL final sample dispositions

| Design outcome | NSAL Core sample | | | | NSAL Afro-Caribbean Supplement |
| | NSAL national sample | Subpopulation | | | |
		African-American	Caribbean origin	White	
Total completed interviews	4,842	3,570	267	1,006	1,357
AAPOR RR3 response rate for NSAL samples (%)	71.5	70.9	93.9	69.7	76.4
Phase 2 sample (P2)					
P2 interviews	269	258	11	0	77
P2 response rate (%)	32.7	32.1	61.1	–	29.4
P2 designated respondents	822	804	18	0	262
Phase 1 sample (P1)					
P1 interviews	4573	3312	255	1006	1280
P1 response rate (%)	83.3	87.4	98.5	69.7	94.3
P1 designated respondents	5491	3788	259	1444	1358

white (69.7%). The overall response rate for the NSAL Core Sample was 71.5%.

The two-phase sample for the NSAL Caribbean Supplement yielded n = 1,357 completed interviews, 1,280 in Phase 1 and 77 in Phase 2. The final AAPOR RR3 response rate for the NSAL Supplement is 76.4%.

National Latino and Asian American Study of Mental Health (NLAAS) Sample Design

The probability sample for the NLAAS was among the most complex designs ever developed and fielded by the University of Michigan Survey Research Center. The following sections describe the NLAAS sample, focusing on the perspective of an analyst of these survey data.

NLAAS survey population

The survey populations for the NLAAS study included all Latino and Asian American adults who resided in households in the US states and Washington DC. Latinos were divided into four strata of interest: Mexican, Puerto Rican, Cuban and all Other Latinos. The Asian American survey population was also stratified based on eligible adults' ancestry or national origin: Chinese, Filipino, Vietnamese, and all other Asians. This stratification of the NLAAS survey populations relied on self-reports by household members at

the time of the household screening. In cases where a member of the survey population reported that they belonged to more than one Latino or Asian American target population, the following order of priority was used to assign individuals to a single group for the purpose of the stratified sample selection:

1. Vietnamese;
2. Cuban;
3. Filipino;
4. Puerto Rican;
5. Chinese;
6. Mexican;
7. other Asian; and
8. other Latino.

Institutionalized persons including individuals in prisons, jails, nursing homes and long-term medical or dependent care facilities were excluded from the study populations. Military personnel living in civilian housing were eligible for the study, but due to security restrictions residents of housing located on a military base or military reservation were excluded.

NLAAS multi-frame sample design

The NLAAS is based on a stratified probability sample design that includes multiple area probability sample components:

- an NLAAS Core sampling of PSUs, area segments and housing units that is designed to be nationally representative of all US populations including Latinos and Asians; and
- the NLAAS-High Density (HD) supplemental samples, targeted oversamples of geographic areas with greater than 5% residential density for individual national origin groups of interest in the NLAAS.

The NLAAS Core sample is designed to provide a nationally representative sample of Latinos and Asian Americans without regard to geographic residential patterns. The price for the national representation under the NLAAS Core sample design was a high per unit cost of data collection for eligible respondents. This high cost per interviewed case was due to the fact that many area segments in the Core sample had very low density of the populations of interest in NLAAS and there was a need to screen large numbers of households to identify the targeted samples of Latinos and Asians. Even for the more prevalent and widely distributed Mexican or Chinese ancestry groups, it was very costly to screen a general national area probability sample to identify and interview a large nationally representative sample of eligible adults. Survey costs would have been prohibitively high if this method alone had been used to obtain desired numbers of sample observations of less prevalent national origin groups (such as Puerto Ricans, Cubans, Filipinos, and Vietnamese).

Therefore, supplemental NLAAS-HD sample components, consisting of oversampling of geographic areas of higher density of the target populations of Latino and Asian households, were added to the sample plan. Census block groups of moderate to high (5%+) concentrations of persons in rare national origin groups were used for the NLAAS-HD supplemental samples. Distinct NLAAS HD supplemental samples were developed for the five targeted national origin groups with low prevalence: Puerto Rican, Cuban, Chinese, Filipino and Vietnamese. For each targeted national origin group, a sample of area segments in census block groups of moderate to high (5%+) concentration of the targeted group was drawn for the supplemental sample. The proportions of the national origin groups living in these higher density areas in 2000 varied considerably by group: 64% of Puerto Ricans lived in high-density Puerto Rican

areas. Comparable proportions were 61% for Cubans, 57% for Chinese, 50% for Filipinos, and 48% for Vietnamese. The NLAAS Mexican, other Latino and other Asian population samples did not require a special supplemental oversampling since sufficient numbers of eligible adults from these groups could be identified through the Core national sample screening and as a byproduct of screening the supplemental samples for the other targeted Latino and Asian subpopulations.

Both the NLAAS Core and HD supplemental sample components involve area probability sampling of households. The geographic domains used for the NLAAS HD oversamples are nested within the national sampling frame from which the fully representative NLAAS Core sample was selected. Like the Afro-Caribbeans in the NSAL sample design, NLAAS Latino and Asian respondents residing in the high density domains had two chances of selection, one under the NLAAS Core national sample and a second under the more intensive NLAAS-HD samples of households in the 5%+ ancestry domains. The sample design requires weighting corrections for joint probabilities of selection under the multiple components of the NLAAS sample design.

The NLAAS Core National Sample
To maximize the statistical efficiency of comparisons between the NLAAS survey populations and the larger US adult population, the primary and secondary stages of the NLAAS Core national sample design were completely integrated with the National Comorbidity Survey Replication (NCS-R) national sample design. The NLAAS Core and NCS-R designs shared the same 62 primary areas representing the MSA and non-MSA strata for the 48 coterminous United States (see Tables 2 and 8). Since full representation of Asian ancestry populations was critical to the NLAAS, the Honolulu HI MSA was added to the primary stage sample as a metropolitan self-representing PSU bringing the total number of NLAAS National Sample PSUs to 63.

The second stage of the NLAAS national sample design component was also fully integrated with the second stage of the NCS-R national sample. The two designs did not share exactly the same area segments and housing unit listings; however, each selected NLAAS Core area segment was paired with an NCS-R area segment and the paired segments from the two

Table 8. Primary and secondary stage sample allocation for the NLAAS Core national sample

Multi-stage sample design units	Primary stage sample domain*		
	Total	SR	NSR
NLAAS Core primary stage sample units (PSUs)			
Core PSUs in original NCS-R national sample (plus Honolulu)	63	17	46
Core PSUs not fielded due to near zero expected interviews	25	1	24
Core PSUs fielded in NLAAS household screening	38	16	22
NLAAS Core second stage sample units (SSUs)			
Core SSUs matched to NCS-R national sample (plus Honolulu)	474	204	270
Core SSUs not fielded due to near zero expected interviews	157	13	144
Core SSUs fielded in NLAAS household screening	317	191	126
Not high density for special HD oversample populations	263	137	126
High-density Puerto Rican	17	17	0
High-density Cuban	4	4	0
High-density Chinese	15	15	0
High-density Filipino	14	14	0
High-density Vietnamese	4	4	0

* SR: self-representing strata; NSR: non-self-representing strata.

samples were physically adjacent to one another – maximizing the 'geographical/ecological correlation' of the two samples (Kish, 1987). The decision to introduce geographic 'overlap' with the NCS-R to the NLAAS Core national sample was based on statistical aims for the NLAAS. A primary aim of the NLAAS was to enable comparisons of mental health characteristics both among the NLAAS survey populations of Latinos and Asians and with the larger US population. Full geographic linkage of the NLAAS national sample area segments to the NCS-R maximized the geographic and socio-economic correlation of the two samples. Since both the NCS-R and the NLAAS Core were designed to be nationally representative, this 'correlation of designs' produced no major inefficiencies for stand alone analysis of the NLAAS survey data but significantly reduced the variance of statistical analyses designed to contrast the populations from the two studies.

The actual probability sampling procedure used to link the NLAAS Core sample of area segments to the NCS-R was as follows. First, the existing sample of 1001 NCS-R area segments was ordered by PSU stratum number and by geographic location within PSU. A systematic random sample of 469 area segments was selected from this ordered list – a procedure designed to proportionately reduce the size of the sample of NLAAS area segments but at the same time to preserve the stratification inherent in the original NCS-R

sample design. Using the original SRC national sample frame, each of the subsampled NCS-R area segments was then linked to the next available area segment in the original frame order. That area segment became its designated paired segment in the NLAAS national sample design. Since the Honolulu MSA PSU was not included in the NCS-R national sample design, an independent sample of eight new area segments was chosen from this MSA and included in the second stage of the NLAAS national sample design.

Based on analysis of 2000 census data for the block groups that contained these 474 second-stage units, many were not expected to include any eligible Latino or Asian respondents. Prior to the start of the NLAAS fieldwork, a decision was made to delay screening of the Core sample for PSUs in which Census data suggested the prevalence of eligible Latino or Asian households would be extremely small. Table 8 shows that 157 area segments in 25 PSUs were expected to yield 0 to 0.5 interviews with eligible respondents. Due to the extreme cost inefficiency of screening large samples of housing units in these PSUs with virtually no expected interview yield for the selected area segments, these PSU samples were never released for field screening. The final Core national sample that was actively screened for eligible Asian and Latino households included 38 PSUs with a combined total of 317 area segments.

Following standard SRC National Sample procedures, field staff prepared an enumerative housing unit listing for each of the area segments in the NLAAS Core national sample design component. A third stage sample of housing units was selected from the area segment listing. The NLAAS national sample of housing units was then divided into 10 equal replicates. At the start of the NLAAS field period 6 of the 10 random replicates were released for fieldwork. The remaining four random replicates of the selected sample were held in reserve to be introduced as needed later in the survey field period.

Each selected housing unit was screened for persons belonging to one of the eight targeted national origin groupings:

1. Mexican;
2. Puerto Rican;
3. Cuban;
4. other Latino;
5. Chinese;
6. Filipino;
7. Vietnamese;
8. other Asian.

Initially, a single NLAAS respondent was randomly chosen from each household that included one or more eligible Mexican, Puerto Rican, Cuban, Chinese, Filipino or Vietnamese adults. Due to a need to control final sample sizes for the Mexican, other Latino and other Asian subpopulations, a designated respondent was randomly chosen in only a subsample of the eligible NLAAS Core households belonging to these three groups.

The NLAAS 'high density' (HD) supplements

As designed, the NLAAS Core national sample would not have provided sufficient numbers of interviews for separate analysis of persons of Puerto Rican, Cuban, Chinese, Filipino, and Vietnamese national origin. Therefore, the NLAAS Core national sample was augmented with five supplemental area probability samples of housing units selected from geographic domains of areas with relatively high residential densities (5% or higher) of these five national origin groups.

The NLAAS-HD supplement samples were small multi-stage national samples that were designed to be optimal for each of the individual target groups: Puerto

Rican, Cuban, Chinese, Filipino, and Vietnamese. Each NLAAS-HD supplemental sample was not entirely nationally representative for its target population since its coverage was restricted to census block groups that had 5% or more population in the specific group of interest. The NLAAS-HD supplemental samples were also not exclusive to the specific target group. Eligible adults from other target populations could be sampled based on the screening of households in another group's NLAAS-HD supplement (for example, a Chinese household living in a HD Filipino area segment). However, when the samples of targeted national origin groups were combined together with the NLAAS Core and properly weighted for sample inclusion probabilities, the pooled Core and HD samples would, in theory, provide sample-based coverage of the full national population.

Ideally, the primary stage units of the NLAAS-HD samples could have been restricted to the 63 PSUs in the NLAAS Core. However, the NLAAS Core primary stage sample was designed to be optimal for studies of the full US national population and is not the most efficient design for subpopulations with highly concentrated residential distribution in that larger population. Many NLAAS Core PSUs had extremely small populations of Puerto Ricans, Cubans, Filipinos or Vietnamese. Conversely, many counties and MSAs that contain high concentrations of persons in these national origin groups may by chance not have been selected to the NLAAS Core primary stage sample. For example, persons of Cuban origin are highly concentrated in the MSAs and counties of south and eastern Florida. A primary stage sample that did not take this into account would not be efficient to represent Cubans.

Therefore, the multi-stage sample design for each of the five NLAAS-HD supplements began with a new primary stage stratification and sample allocation that was more nearly optimal for the given national origin group. Based on 2000 Census data, which became available before the NLAAS sample was selected, a new primary stage sample was developed for each of the five NLAAS-HD supplemental designs. The primary stage units were the same MSA and non-MSA county PSUs defined for the SRC National Sample design. The population measures of size used in developing strata and for assigning sampling probabilities to individual PSUs were 2000 census population counts for census block groups (BG) in which 5% or more of

the BG population belonged to the target population. For each national origin group sample, a set of primary stage strata was developed. Table 9 summarizes the number of primary stage strata in the NLAAS-HD sample designs for the five national origin groups.

Due to the relatively high levels of residential concentration of Puerto Rican, Cuban, Chinese, Filipino, and Vietnamese populations in the US, the numbers of PSUs that were self-representing, and the proportions of the relevant populations in them, were very large: 12 of 20 Puerto Rican HD PSUs were self-representing, as were seven out of nine Cuban PSUs, 13 out of 17 Chinese PSUs, 10 out of 18 Filipino PSUs, and 12 out of 18 Vietnamese PSUs.

Within the NLAAS-HD sample PSUs, area segments were formed in the standard fashion (see above) with the exception that area segments could only be formed from census blocks in block groups with 5%+ population of the national origin group. The minimum size of each NLAAS-HD area segment was 100 housing units. Table 9 provides the total count of area segments selected for each of the five NLAAS-HD supplement samples. In cases where, by chance of its earlier selection, one of the 477 area segments in the NLAAS Core national sample design was located in an NLAAS HD PSU and qualified as a high density segment for one or more target national origin group, that segment qualified for inclusion in both the national NLAAS Core sample and the HD oversample. Table 8 identifies the numbers of Core area segments that also qualified as high-density area segments for the supplemental HD samples. Third-stage sampling rates for these 'dual-role' segments were calculated to reflect their expected sample housing unit contribution to each sample design component.

Within PSUs and area segments selected for each separate HD oversample, an equal probability sample of housing units was selected for interviewer contact and screening. Each selected housing unit was screened for eligible adults. All Latinos and Asian Americans were eligible to be recruited from any of the Census blocks selected for any of the supplemental samples. However, eligible persons from the Mexican, other Asian and other Latino national origin groups identified in screening an NLAAS HD supplemental sample were subsampled to in order to control the total sample size for these groups.

The white control component of the NLAAS sample
As noted previously, a specific aim of the NLAAS is to compare rates of mental illness and treatment for the Latino and Asian samples to comparable rates for non-Hispanic white populations. An important step in this analysis involves distinguishing effects that are cultural or ancestral from localized socio-economic and geographic or 'neighbourhood effects'. This aim is best achieved if there is geographical matching for the NLAAS population samples and subsamples of white 'controls'. The main NCS-R sample provided significant

Table 9. Primary and secondary stage sample allocation for the NLAAS high-density (HD) samples

NLAAS-HD supplemental samples: Multi-stage sample design units	Primary stage sample domain*		
	Total	SR	NSR
NLAAS-HD primary stage sample units (PSUs)			
High-density Puerto Rican PSUs	20	12	8
High-density Cuban PSUs	9	7	2
High-density Chinese PSUs	17	13	4
High-density Filipino PSUs	18	10	8
High-density Vietnamese PSUs	18	12	6
NLAAS-HD second stage sample units (SSUs)			
High-density Puerto Rican SSUs	51	34	17
High-density Cuban SSUs	70	66	4
High-density Chinese SSUs	46	34	12
High-density Filipino SSUs	51	32	19
High-density Vietnamese SSUs	60	43	17

* SR: self-representing strata; NSR: non-self-representing strata.

numbers of interviews with non-Hispanic white adults living in segments geographically contiguous to Asian and Latino respondents selected for the NLAAS Core. These existing NCS-R interviews provided an adequate sample of geographically matched white statistical controls for the comparative analysis involving the NLAAS Mexican, Puerto Rican, other Latino, and other Asian samples. However, the matched NCS-R sample did not provide an adequate number of geographically matched white controls for NLAAS respondents from the high-density Cuban, Chinese, Filipino, and Vietnamese areas. At the survey design stage, it was obvious that the screening of the NLAAS high-density domain samples for Cubans, Chinese, Filipinos and Vietnamese would select and screen out many households of white, African-American or other race/ ethnic groups. A subsample of these otherwise ineligible persons could easily be retained and interviewed to constitute a control sample. Prior to the start of NLAAS data collection, the decision was made to retain a subsample of the non-Hispanic whites screened in the NLAAS samples of high-density Cuban, Chinese, Filipino and Vietnamese HD area segments. A total of 215 such white control interviews was completed within the first months of the field period but, to save costs, the interviewing of white controls was discontinued at about the mid-point in the NLAAS survey data collection period (see below).

NLAAS responsive design
The design of the NLAAS sample was by its nature built to be responsive to the experiences of the NCS-R and NSAL, which preceded it into the field and flexible in order to adapt to the uncertainty of sampling eight distinct national origin groupings each with unique patterns of population distribution. The linkage of the NLAAS-Core sample to the NCS-R sample selection, the combination of a representative core national sample and targeted HD oversamples, and the replication of each sample component were design features that capitalized on existing data and analytic potential.

The NLAAS data collection began in April of 2002 with an emphasis on the Latino interviewers and sample areas. The interviewing staff for the Asian sample completed training and began fieldwork in June of 2002. The majority of interviewers in each group began their work with replicates of sample housing units from area segments belonging to the high-density strata including high-density Mexican area segments selected by chance for the NLAAS Core. This field management decision was made in order to give the interviewers experience in productive sample areas before adding an extensive screening burden to their workload. The decision to start work in the HD samples and then progress to the more intensive screening of NLAAS Core sample in areas with lower densities of Latinos and Asians also served as a hedge against undesired outcomes such as unexpectedly high survey costs. Large screening workloads in the low density areas where costs per case would be high were delayed until data on survey costs the higher density sample areas became available.

After about 6 months' experience with NLAAS screening and interviewing, field cost data clearly indicated that the survey cost per completed case was much higher than budgeted and that immediate cost-saving actions were needed. Several cost-saving decisions were made with respect to the sample. As noted above, additional data collection with non-Hispanic white controls was suspended. Further screening was also eliminated in the NLAAS Core sample area segments in which the 2000 Census indicated there would not be one eligible Latino or Asian respondent (see above). To increase the sample of eligible persons without incurring the high costs of additional sample screening, in n = 1,640 cooperating NLAAS households where an interview with a primary respondent had been completed, a second eligible adult was selected for interview.

Like the NSAL, NLAAS used the two-phase approach to focus screening and interviewing effort for end-of-study recruitment of primary and secondary adult respondents.

NLAAS sample design outcomes
The NLAAS data collection was completed in late Fall of 2003. A combined total of 27,026 sample housing units was selected for the NLAAS Core and HD samples. Final dispositions were obtained for 19,434 sample lines in the Phase 1 field periods for the NLAAS Core and HD component samples. Interviewers identified 17,255 sample households in Phase 1 field operations for a Phase 1 occupancy rate of 88.5%. Based on the eligibility criteria and subsampling procedures described above, 1,787 Latino respondents and 1459 Asian respondents were designated for interview in the Phase 1 screening and

respondent selection. Phase 1 interviews were completed with 1,721 Latino and 1,407 Asian designated respondents.

Prior to the second phase of the NLAAS field period, 7,592 primary sample lines remained active with no final sample disposition. Across all components of the NLAAS sample, stratified random subsamples of 3,196 (42.1%) of these active cases were subsampled for continued contact, screening and interview efforts. Continued Phase 2 screening determined that 2,824 (88.3%) of these active lines were occupied by households. Based on actual screening outcomes and estimated eligibility for households that could not be screened, the Phase 2 households were expected to yield 639 Latino and 460 Asian designated primary respondents. Phase 2 interviews were completed with 288 Latino and 204 Asian respondents. Combining both phases of the sampling process, a total of 2,009 Latino and 1,611 Asian primary respondents completed the full NLAAS interview. The final AAPOR RR3 two-phase weighted response rates for the NLAAS primary respondents were 75.7% overall, 77.6% for Latinos and 69.3% for Asians.

The two-phase sample for the NLAAS Second adult respondents yielded n = 1,029 completed interviews, 921 in Phase 1 and 108 in Phase 2. Second adult interviews were completed with 545 Latino and 484 Asian respondents. The final two-phase, weighted interview completion rates for the NLAAS second adult samples were 80.3% overall, 82.4% of Latinos and 73.7% for Asians.

The final AAPOR RR3 weighted response rates for the combined NLAAS samples of primary and second adult respondents were: 73.2% for the total sample; 75.5% for the Latino Sample; and 65.6% for the Asian sample.

Summary and conclusions

The current trend in social and epidemiological survey research is toward increasing complexity in sample designs, survey measurement and survey analysis methods – often in conjunction with demands for increasing cost efficiency in survey operations. This trend is certainly evident in the CPES sample designs described in this paper. This paper has described a number of the NCS-R, NSAL, NLAAS sample design features and procedures that were used to achieve a balance between the complex demands of the specific research aims and the cost limitations and essential conditions that governed the conduct of the individual survey data collections. With the benefit of hindsight it is useful briefly to look back at the CPES experience and attempt to assess the optimality of these design features for future studies.

The national probability samples employed in the NCS-R, NSAL and NLAAS proved to be robust designs for representative sampling of the nation's total population as well as the populations of Latino and Asian adults. The disproportionate sampling designs employed in the NSAL and NLAAS were a cost-effective means to achieve oversamples of Afro-Caribbeans (NSAL) as well as persons in the Mexican,

Table 10. NLAAS final sample dispositions

Design outcome	Total NLAAS sample			Primary respondent			Second Adult respondent		
	Total	Latino	Asian	Total	Latino	Asian	Total	Latino	Asian
Completed interviews	4,649	2,554	2,095	3,620	2,009	1,611	1,029	545	484
AAPOR RR3 response rate for NLAAS samples (%)	73.2	75.5	65.6	75.7	77.6	69.3	80.3	82.4	73.7
Phase 2 sample (P2)									
P2 interviews	600	348	252	492	288	204	108	60	48
P2 eligible respondents	1,408	797	611	1099	639	460	309	158	151
Phase 1 sample (P1)									
P1 interviews	4,049	2,206	1,843	3,128	1,721	1,407	921	485	436
P1 eligible respondents	4,171	2,274	1,897	3,246	1,787	1,459	925	487	438

Puerto Rican, Cuban, Chinese, Filipino and Vietnamese ethnicity/ancestry groups (NLAAS).

The NCS-R and NLAAS each permitted interviewing a second randomly selected adult within an eligible household with two or more eligible persons. The NCS-R decision to interview a second adult within a subsample of households was made at the design stage. The purpose for that design decision was twofold: 1) to reduce screening costs, and 2) to provide data for a sample of households that could be used to study intra-household correlation and other intra-household relationships for mental health diagnoses. In NLAAS, the decision to sample a second eligible adult in a fixed set of eligible households was made midway through the field period as a cost-saving strategy to maximize the number of interviews with eligible adults. In both studies, the decision to interview more than one eligible adult in a sample of eligible households certainly produced real cost savings. The impact of a second adult respondent on the total error of survey estimates is not immediately clear. The cost savings permitted interviews to be taken with larger samples of eligible adults and interviewing multiple respondents per household reduced weight variability associated with selecting respondents within eligible households – two effects that lead to reduced sampling variability for estimates. Offsetting these beneficial effects is the potential for intra-household correlation in mental health characteristics – correlation that leads to increases in variance for survey estimates relative to a sample in which a single respondent is chosen from each eligible household. Conditional response rates for the second randomly selected adults in the NCS-R and NLAAS were substantially less than 100% producing lower overall weighted population response rates. The lower weighted response could signal a potential increase in the non-response bias of sample estimates. As the analysis phases of the CPES studies progress, the magnitude of these effects can be studied empirically.

The CPES studies also used two-phase sampling in the final stages of the data collection periods. Two-phase sampling offered several clear advantages. It reduced the per-unit cost to close out the final stages of the field data collection. It resulted in increased population weighted response rates for the eligible samples and as a consequence, may have reduced non-response bias in the survey data. Offsetting the cost savings and possibility of reduced non-response error is the potential loss of sample precision due to the extra weighting that is required in design-based analysis of the two phase sample data. Here again, a more through analysis of the optimality of the two-phase sample design method employed in these three studies is work for the future and the subject of another paper.

Finally, throughout the discussion of individual sample designs for the NCS-R, NSAL and NLAAS there have been hints of the potential to combine and contrast findings for the standardized measures found in respective data sets. The Collaborative Psychiatric Epidemiology Studies working group will be addressing the prospects for such analyses over the coming year.

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Correspondence: Steven G. Heeringa, Institute for Social Research, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48104, USA.
Telephone (+1) 734 6474621.
Fax (+1)734 7648263.
Email sheering@isr.umich.edu.