February 2018

2019 Health Center Patient Survey

Deliverable 9: Statistical Design Plan

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1. Introduction

The 2019 Health Center Patient Survey (HCPS), sponsored by the Health Resources and Services Administration (HRSA), aims to collect data on patients who use health centers funded under Section 330 of the Public Health Service Act. Results from the study will guide and support the Bureau of Primary Health Care (BPHC) in its mission to improve the health of the nation's underserved communities and vulnerable populations by assuring access to comprehensive, culturally competent, quality primary health care service. The 2019 HCPS will collect data from the patients of health centers funded through four BPHC grant programs: the Community Health Center (CHC) program, the Migrant Health Center (MHC) program, the Health Care for the Homeless (HCH) program, and the Public Housing Primary Care (PHPC) program.

Our goal is to recruit 210 grantees and complete 9,000 interviews, among them 5,100 interviews for the CHC funding program, 1,480 interviews for the MHC funding program, 1,660 interviews for the HCH funding program, and 760 interviews for the PHPC funding program. Patients from PHPC, MHC, and HCH funding programs will be oversampled. In addition, to meet BPHC's research interests in race/ethnicity groups, patients of American Indian/Alaska Native (AIAN), Native Hawaiian/Pacific Islanders (NHPI), and Asian categories will be oversampled. Patients aged 65 and older will also be oversampled. The target sample sizes in three design domains, namely funding program, race/ethnicity, and age group, are shown in ***Table 1-1***. BHPC is also interested in increasing the veteran patient sample in the 2019 HCPS; however, the target sample size for veteran patients is not specified.

Table 1-1. Target Sample Sizes for the 2019 HCPS

Funding Program	Target Sample Size	Race/Ethnicity	Target Sample Size	Age Group	Target Sample Size
CHC	5,100	Hispanic	3,170	17 and younger	2,130
MHC	1,480	Non-Hispanic White	2,250	18–64	5,770
HCH	1,660	Non-Hispanic Black	1,920	65 and older	1,100
PHPC	760	Non-Hispanic Asian	650		
		Non-Hispanic AIAN	670		
		Non-Hispanic NHPI	200		
		Non-Hispanic Others	140		

In this report, we define the target population of the 2019 HCPS in ***Section 2***. An overview of sample design is presented in ***Section 3***, and a detailed discussion of the proposed three-stage sample design is presented in ***Sections 4*** through ***6***. An illustrative example of the grantee sample using the 2016 BPHC's Uniform Data System (UDS) data is also presented. In ***Section 7***, we discuss sample sizes and power calculation in the context of the illustrative example. ***Section 8*** details the procedure for calculating sample weights. Data collection schedules and costs are presented in ***Section 9***. In ***Section 10***, we list some strengths and limitations of the statistical design.

2. Target Population

The target population for the 2019 HCPS is composed of persons who meet the definition of a health center patient used in the BPHC's UDS. These persons receive face-to-face services from a CHC, MHC, HCH, or PHPC grantee clinical staff member who exercises independent judgment in the provision of services.[1] Patients from grantees located within the 50 United States and the District of Columbia are included, while patients from grantees within U.S. territories and possessions are excluded.

Only persons who received services through one of these grantees at least once in the year prior to the current visit are considered eligible for the survey. This eligibility criterion will be used because many of the questions in the survey ask about services received in the past year; individuals without previous visits will not be able to answer these questions and, therefore, are not considered eligible. This eligibility criterion was also implemented in the BPHC's 2014 HCPS, 2009 Primary Health Care Patient Surveys (PHCPS), the 2002 Community Health Center Survey, and the 2003 Healthcare for Homeless Survey.

[1] To meet the criterion for "independent judgment," the provider must be acting on his/her own when serving the patient and not assisting another provider.

3. Overview of Sample Design

In the 2019 HCPS, the primary analytic units are patients who receive services from health center sites[2] in funded grantees. The patients are clustered within sites and the sites are clustered within grantees. RTI International[3] will use a stratified three-stage sample design. The grantees are the first stage of selection units, also known as the primary sampling units (PSUs). Sites within selected grantees are the second stage of selection units, and patients within selected sites comprise the third stage of selection units. We expect to achieve the target sample sizes for race/ethnicity by oversampling grantees and site(s) with patients concentrated in one of the three race/ethnicity categories (AIAN, Asian, NHPI) at the first and second stages, and oversampling patients in three race/ethnicity categories at the third stage. We will identify and oversample sites with patients concentrated in the 65 and older age group or veteran patients at the second stage, and oversample those patients at the third stage as well.

At the first stage, grantees will be selected using the stratified probability proportional to size (PPS) sampling method (Kish, 1995). Grantees participating in PHPC, MHC, and HCH funding programs and grantees with AIAN-, Asian-, and NHPI-concentrated patients will be oversampled. The oversampling is achieved by stratification and application of different selection probability among strata. The explicit stratification is based on the type of funding a grantee receives; the stratum of grantees receiving CHC funding only is further stratified according to the proportions of patients in one of the three oversampling race/ethnicity categories. In addition, sorting the grantee frame by region, urbanicity, and grantee size (large, medium, or small[4]) before selecting grantee sample serves as the implicit stratification, and ensures that the grantee sample has good coverage of regions, urban and rural areas, and grantee sizes. Because of the high costs associated with recruiting a grantee and hiring a field interviewer (FI) to perform the data collection, we will select an independent site and patient sample from each funding program for grantees receiving multiple funding programs.

At the second stage, sites will be selected within participating grantees, and a maximum of three sites per funding program is allowed in each grantee. If a grantee has three or fewer sites in a funding program, all eligible sites will be selected, assuming they are in reasonable proximity for an FI. A grantee with more than three sites in a funding program will have three sites selected using PPS sampling, based on the number of patients served. When all sites for a funding program in a grantee have small patient volumes, more than

[2] We refer "health center sites" as "sites" throughout this document.
[3] RTI International is a trade name of Research Triangle Institute.
[4] Eligible grantees are sorted by the patient volume in each grantee, and then the top third of grantees are as classified large, the middle third of grantees as medium, and the bottom third of grantees as small.

three sites could be selected to alleviate difficulties of completing assigned interviews because of low patient volumes. Again, to ensure successful oversampling of AIAN, Asian, NHPI patients, patients aged 65 and older, and veteran patients, sites with patients concentrated in those subgroups will be identified and oversampled.

At the third stage, patients will be selected as they enter the site and register with the receptionist. Patients in three oversampling race/ethnicity categories, patients aged 65 and older, and veteran patients will be identified and oversampled; that is, they will have a higher probability of selection than patients who are not in the oversampling subgroups. The receptionist will refer the first eligible patients who are not in the oversampling subgroups to the FI when the FI indicates he/she is ready for the next interview. The receptionist will refer patients in oversampling subgroups to the FI more frequently. We are considering developing a computer-based system for receptionists to screen and refer patients. For each funding program, the same number of patient interviews will be completed from each grantee to reduce unequal weighting effects (UWE) and maintain a balanced workload across grantees. However, we may increase the number of patient interviews for grantees with patients concentrated in oversampling race/ethnicity subgroups. The total number of patient interviews within a grantee will be divided among multiple sites if more than one site is selected for a funding program.

In our design, we take every measure to meet the design goals and reduce the design effect (*Deff* [5]) caused by clustering and oversampling. In summary, we present key elements of the sample design and the associated benefits in ***Table 3-1***.

[5] The design effect (*Deff)* is a measure of the precision gained or lost by using the more complex design instead of a simple random sample. For a multistage cluster sample like the 2019 Health Center Patient Survey, *Deff* is a function of the clustering effect and the unequal weighting effect (*UWE)* and can be defined as *Deff = UWE*(1 + (m-1)*ICC),* where *m* is the number of patient interviews within a grantee, *ICC* is the intracluster correlation coefficient that measures the degree of similarity among elements within a cluster, and *UWE* measures variation in the sample weight. *Deff* can be reduced by reducing either *UWE* or the clustering effect or both.

Table 3-1. Summary of Features and Benefits of the Sample Design

Key Design Features	Pros, Cons, and Comments
First Stage: Grantee Sample Selection (recruit 210 grantees)	
Stratification	**PROS**: Ensures a representative grantee sample and enough grantees are selected for each funding program; ensures the selected grantees have good coverage of patients in oversampling race/ethnicity subgroups.
Oversample PHPC, MHC, and HCH grantees; grantees with a high proportion of patients in three oversampling race/ethnicity categories.	**PROS**: Achieves oversampling goals in funding type, and ensures selecting grantees with patients concentrated in three oversampling race/ethnicity subgroups. **CONS**: Disproportionate sampling increases UWE. **COMMENTS**: Selecting a PPS grantee sample from each stratum can reduce UWE. Grantee sample allocation is determined by minimizing UWE.
Select independent sample for each funding program if grantee received grants from multiple programs.	**PROS**: Reduces data collection costs and helps to reduce clustering effect.
Second Stage: Site Sample Selection (up to three sites per funding program)	
Select multiple sites if a grantee has more than one site. Up to three sites will be selected for each funding program per grantee. More than three sites could be selected in special situations (e.g., all sites for a funding program have low patient volume).	**PROS**: Reduces clustering effect. For the funding program with more than three sites, PPS selection of sites reduces UWE, too. **CONS**: Site selection process is tedious. Managing data collection from multiple sites can be costly. **COMMENTS**: Select sites within reasonable proximity for an FI.
Oversample sites with patients concentrated in three oversampling race/ethnicity categories, patients aged 65 and older, and veteran patients	**PROS**: Achieves oversampling goals. **CONS**: Disproportionate sampling increases UWE.
Third Stage: Patient Sample Selection (complete 9,000 interviews)	
Within each funding program, allocate the same number of interviews to each grantee. For grantees with patients concentrated in oversampling race/ethnicity subgroups, the number of interviews may be increased.	**PROS**: Creates even workload for FIs and reduces clustering effect.
Select random sample as patients enter site and are registered.	**PROS**: Is suitable for the mobile nature of some of the target population.
Allocate interviews evenly to sites that are selected through PPS.	**PROS**: Maintains roughly equal weights within a stratum, thus reducing UWE; creates even workload for FIs.
Allocate interviews to sites proportional to patient size at sites (for grantees with two or three sites).	**PROS**: Reduces UWE.
Oversample patients in three oversampling race/ethnicity categories, patients aged 65 and older, and veteran patients.	**PROS**: Achieves oversampling goals. **CONS**: Disproportionate sampling increases UWE. **COMMENTS**: Screen patients and divide them into oversampling or non-oversampling subgroups.

4. Grantee Sample Selection

This section discusses the first stage of sample selection: the selection of grantees. It covers sample frame construction, stratification, sample allocation, and selection of stratified PPS grantee samples. An illustrative grantee sample is also presented, and the calculation of grantee selection probability is discussed.

4.1 Sampling Frame Construction

BPHC UDS grantee-level data from the most recent available year will be used to construct a sampling frame for the first stage of selection. The UDS is compiled each year from annual data submissions by each Section 330-funded grantee. The UDS contains data on the number of patients served; grantee characteristics, such as the type(s) of grant funding received; state; urbanicity; and number of sites. The grantee characteristics will be used in stratification. In this report, we use data from the 2016 UDS to illustrate the statistical design plan. Once the Office of Management and Budget (OMB) approval has been received, the final sample will be drawn using the most current UDS data.

The 2016 UDS data were collected from 1,367 grantees. Of these, 42 grantees are excluded from the sampling frame, including:

- thirty grantees located in U.S. territories or possessions (i.e., those in Puerto Rico, the Virgin Islands, and the Pacific Basin);
- three grantees with fewer than 300 patients;
- nine grantees that received MHC funding only and that served clients through a voucher program; and
- any grantee that has exited or will soon be exiting the Section 330 Program.

There was no grantee in the 2016 UDS, which operated only in schools. The grantee sampling frame includes 1,325 eligible grantees that reported in 2016. We show the distribution of key grantee characteristics in ***Tables 4-1***, ***4-2***, and ***4-3***. Table 4-1 breaks down the grantees by funding program, region, urban/rural status, and number of sites within a grantee. In the grantee sampling frame, 933 grantees had a single funding program, while 392 grantees received funding from multiple programs. A total of 1,258 grantees (94.9%) received CHC funding, either solely or in combination with other funding programs; 288 grantees (21.7%) received HCH funding, either solely or in combination with other funding programs; 158 grantees (11.9%) received MHC funding, either solely or in combination with other funding programs; and only 97 grantees (7.3%) received PHPC funding, either solely or in combination with other funding programs. Roughly 66.0% of grantees received CHC funding solely.

Table 4-1. Grantee Characteristics in the Sampling Frame (2016 UDS)

Domain Category	Number of Grantees	Percent Distribution
Funding Program Received		
C	874	65.96
H	52	3.92
M	1	0.08
P	6	0.45
CH	159	12.00
CM	117	8.83
CP	34	2.57
MH	1	0.08
PH	7	0.53
CMH	24	1.81
CMP	5	0.38
CPH	35	2.64
CMPH	10	0.75
Total	**1,325**	**100%**
Region[a]		
Northeast	233	17.58
Midwest	259	19.55
South	445	33.58
West	388	29.28
Total	**1,325**	**100%**
Urban/Rural Location		
Urban	751	56.68
Rural	574	43.32
Total	**1,325**	**100%**
Number of Sites		
1	134	10.11
2	181	13.66
3	150	11.32
4–9	526	39.70
10–14	166	12.53
15–19	69	5.21
≥ 20	99	7.47
Total	**1,325**	**100%**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program; multiple acronyms used together indicate that funding was received from multiple programs (e.g., CMH = a grantee received CHC, MHC, and HPC funding; CMP = a grantee received CHC, MHC, and PHPC funding).

[a] "Region" refers to the census region.

Table 4-2. Distribution of Patients Served in 2016

Patient Distribution	Number of Patients
Range of Number of Patients	
Minimum	341
25th percentile (Q1)	5,535
Median	11,722
75th percentile (Q3)	23,589
Maximum	203,922
Mean Number of Patients per Grantee	**19,145**
Total Number of Patients Across All Grantees	**25,367,510**

The number of sites within a grantee ranged from 1 to 89, and 1,010 grantees had at least 3 sites, with an average of about 7.7 sites per grantee. The South had 445 grantees, while the West had 388 grantees. The Northeast and Midwest had roughly the same number of grantees each: 233 and 259, respectively. More grantees were in urban areas than were in rural areas.

Another important grantee characteristic is the number of patients served in 2016 (Table 4-2). Among the 1,325 eligible grantees in the grantee sampling frame, the number of patients receiving at least one face-to-face encounter for services during 2016 varied among the grantees, ranging from 341 to 203,992 and averaging 19,145. The total number of patients was approximately 25.4 million. Table 4-3 displays the patient distributions of race/ethnicity, age group, and veteran status. It shows that patients in AIAN, Asian, and NHPI race/ethnicity categories; patients aged 65 and older; and veteran patients are under-represented. They need to be oversampled to achieve the target sample sizes.

Table 4-3. Patient Population and Target Patient Sample Distribution

Domain Category	Number of Patients Served in 2016	Patient Population Distribution	Target Sample Size	Target Sample Distribution
Race/Ethnicity				
Hispanic	8,467,989	33.38%	3,170	35.22%
Non-Hispanic White	9,216,856	36.33%	2,250	25.00%
Non-Hispanic Black	4,791,854	18.89%	1,920	21.33%
Non-Hispanic NHPI	129,149	0.51%	200	2.22%
Non-Hispanic AIAN	245,522	0.97%	670	7.44%
Non-Hispanic Asian	861,583	3.40%	650	7.22%
Non-Hispanic Others	797,946	3.15%	140	1.56%
Unreported	856,611	3.38%	n/a	n/a
Total	**25,367,510**	**100%**	**9,000**	**100%**

(continued)

Table 4-3. Patient Population and Target Patient Sample Distribution (continued)

Domain Category	Number of Patients Served in 2016	Patient Population Distribution	Target Sample Size	Target Sample Distribution
Age Group				
0–17	7,853,690	30.96%	2,130	23.67%
18–64	15,412,358	60.76%	5,770	64.11%
65+	2,101,462	8.28%	1,100	12.22%
Total	**25,367,510**	**100%**	**9,000**	**100%**
Veteran Status				
Veteran	328,162	1.29%	n/a	n/a
Non-veteran	25,039,348	98.71%	n/a	n/a
Total	**25,367,510**	**100%**	**9,000**	**100%**

4.2 Stratification

As shown in Table 4-1, majority of grantees receive CHC funding, while relatively few grantees receive PHPC, MHC, or HCH funding. A random selection of grantees without any stratification would result in very small grantee sample sizes for PHPC, MHC, and HCH funding programs. We selected 210 grantees using the simple random sampling method, and repeated it 100 times. ***Table 4-4*** displays the expected number of grantees[6] yielded for each funding program from unstratified random grantee samples.

Table 4-4. Expected Grantee and Patient Yields from Unstratified Random Sampling

Grantee Funding Type	Number of Grantees Selected	Target Number of Complete Patient Interview	Number of Patients Required per Grantee
C	199	5,100	25.6
H	45	1,480	32.9
M	26	1,660	63.9
P	16	760	47.5
Total	**286**	**9,000**	**42.9**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program.

[6] For a selected grantee participating in multiple funding programs, we take an independent sample for each funding program. For example, if a grantee receiving both CHC and MHC funding is recruited, this grantee would be counted as a CHC grantee, and an MHC grantee as well.

The unstratified random samples yield 199 CHC grantees, 45 HCH grantees, 26 MHC grantees, and only 16 PHPC grantees. To meet the target of completed interviews for each funding program, we have to complete a large number of interviews for the PHPC and MHC funding programs, which has two implications: (1) the difficulty in recruiting many patients from PHPC and MHC grantees within a short period of data collection because of the low patient volumes in PHPC or MHC grantees; and (2) the clustering effect is inflated as the number of completed interviews per grantee increases, and consequently the estimates will have low precision and the statistical power of comparison will be reduced.

Stratification is needed to achieve target sample sizes for four funding programs with relatively small cluster sizes.[7] We will group grantees into four exclusive strata according to the types of funding they receive. These four groups will serve as the first-level strata and are defined in ***Table 4-5***.

Table 4-5. Definition of First-Level Stratification

First-Stage Strata	Grantee Funding Type	Number of Grantees in Sampling Frame
Stratum 1: Grantees received PHPC funding solely or in combination with other programs.	P; CP; PH; CMP; CPH; CMPH	97
Stratum 2: Grantees received MHC funding solely or in combination with other programs.	M; CM; MH; CMH	143
Stratum 3: Grantees received HCH funding solely or in combination with other programs.	H; CH	211
Stratum 4: Grantees received CHC funding solely.	C	874
Total		**1,325**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program. Multiple acronyms used together indicate that funding was received from multiple programs (e.g., CMH = a grantee received CHC, MHC, and HPC funding; CMP = a grantee received CHC, MHC, and PHPC funding).

AIAN, Asian, and NHPI patients are not evenly distributed among all grantees. They tend to be clustered in a few grantees: 1,032 grantees had fewer than 100 AIAN patients, 1,134 grantees had fewer than 100 NHPI patients, and 678 grantees had fewer than 100 Asian patients. The 20 grantees with highest proportion of AIAN patients account for 34.0% of total AIAN patients in all 1,325 grantees; 20 grantees with highest proportion of NHPI patients account for 41.9% of total NHPI patients; and 20 grantees with highest proportion of Asian patients account for 29.9% of total Asian patients. Thus, to achieve target sample sizes in three race/ethnicity categories, grantees with patients concentrated in those three race/ethnicity categories must be identified and selected at the first-stage selection.

[7] Cluster size is measured as the number of completed interviews within a grantee for a funding program.

Grantees with more than 20% of patients in one of the three race/ethnicity categories are considered patient-concentrated grantees. Stratum 4 (CHC funding solely) has over 86% of such grantees, and very few such grantees are from Strata 1, 2, and 3. Therefore, to effectively select grantees with concentrated patients in three race/ethnicity categories, Stratum 4 is further divided into four second-level strata according to whether a grantee has patients concentrated (over 20%) in one of the three race/ethnicity categories. The result is a total of seven final grantee strata, shown in ***Table 4-6***.

Although some grantees have a high proportion of patients aged 65 and older, these older patients are distributed more evenly than the patients in three race/ethnicity categories. The 20 grantees with the highest proportion of patients aged 65 and older only account for 2.69% of total patients aged 65 and older. As a result, oversampling grantees with concentrated patients aged 65 and older at the first stage of selection will not be as effective as oversampling grantees with patients concentrated in the three race/ethnicity categories. Thus, we decide not to oversample grantees with patients concentrated in the 65 and older group.

There are no grantees with patients concentrated in the veteran category; the highest proportion of veteran patients was 16.1%. Thus, oversampling grantees with patients concentrated in the veteran category will not be considered.

Table 4-6. Grantee Sample Final Stratification

First-Stage and Second-Stage Strata	Grantee Funding Type	Final Stratum	Number of Grantees in Sampling Frame
Stratum 1: Grantees received PHPC funding solely or in combination with other programs.	P; CP; PH; CMP; CPH; CMPH	1	97
Stratum 2: Grantees received MHC funding solely or in combination with other programs.	M; CM; MH; CMH	2	143
Stratum 3: Grantees received HCH funding solely or in combination with other programs.	H; CH	3	211
Stratum 4: Grantees received CHC funding solely.	C		
Stratum 4.1: Grantees with more than 20% of AIAN patients.	C	4	34
Stratum 4.2: Grantees with more than 20% of Asian patients.	C	5	33
Stratum 4.3: Grantees with more than 20% of NHPI patients.	C	6	8
Stratum 4.4: All remaining grantees in Stratum 4.	C	7	799
Total			**1,325**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program. Multiple acronyms used together indicate that funding was received from multiple programs (e.g., CMH = a grantee received CHC, MHC, and HPC funding; CMP = a grantee received CHC, MHC, and PHPC funding).

4.3 Grantee Sample Allocation

Before selecting a grantee sample from each final stratum, we need to determine the grantee sample allocation for each final stratum. To minimize the variation in sample weights introduced by oversampling grantees who received funding from PHPC, MHC, or HCH programs, we allocate the grantee sample such that a minimum UWE is achieved. We employed a nonlinear optimization procedure OPTMODEL in SAS,[8] which minimizes the UWE with the following constraints:

- Select 210 grantees.
- Complete 9,000 interviews.
- Complete 5,100 CHC interviews, 1,480 MHC interviews, 1,660 HCH interviews, and 760 PHPC interviews.
- Complete interviews per grantee: 26 for CHC, 25 for MHC, 25 for HCH, and 17 for PHPC.
- Select at least one grantee from each grantee type.[9]

The optimum sample allocation to each grantee type is presented in ***Table 4-7***. After aggregating grantee allocations to the seven final strata and selecting all grantees in Strata 4, 5, and 6, the grantee sample allocation to the seven strata along with the sampling rates in each stratum are presented in ***Table 4-8***. The sampling rates for Strata 1, 2, 4, 5, and 6 are much higher than the overall sampling rate (21.1%), indicating that we oversample grantees in these strata.

Table 4-7. Optimum Grantee Sample Allocation

Domain Category	Number of Grantees	Grantee Sample Allocation
Funding Program Received		
C	874	94
H	52	3
M	1	1
P	6	1
CH	159	23
CM	117	30
CP	34	12

(continued)

[8] http://support.sas.com/documentation/cdl/en/ormpug/59679/HTML/default/viewer.htm#optmodel.htm

[9] Grantee type is defined according to what funding program(s) a grantee participated or received funding from, there are 13 grantee types as shown in Table 4-7.

Table 4-7. Optimum Grantee Sample Allocation (continued)

Domain Category	Number of Grantees	Grantee Sample Allocation
MH	1	1
PH	7	7
CMH	24	13
CMP	5	5
CPH	35	10
CMPH	10	10
Total	**1,325**	**210**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program; multiple acronyms used together indicate that funding was received from multiple programs (e.g., CMH = a grantee received CHC, MHC, and HPC funding; CMP = a grantee received CHC, MHC, and PHPC funding).

Table 4-8. Grantee Sample Allocation and Sampling Rates in Final Grantee Strata

First-Stage and Second-Stage Strata	Final Stratum	Number of Grantees in Sampling Frame	Grantee Sample Allocation	Grantee Selected (Assuming 75% Recruitment Rate)	Sampling Rate
Stratum 1: Grantees received PHPC funding solely or in combination with other programs.	1	97	45	60	61.9%
Stratum 2: Grantees received MHC funding solely or in combination with other programs.	2	143	45	60	42.0%
Stratum 3: Grantees received HCH funding solely or in combination with other programs.	3	211	26	35	16.6%
Stratum 4: Grantees received CHC funding solely.					
Stratum 4.1: Grantees with more than 20% of AIAN patients.	4	34	26	34	100.0%
Stratum 4.2: Grantees with more than 20% of Asian patients.	5	33	25	33	100.0%
Stratum 4.3: Grantees with more than 20% of NHPI patients.	6	8	6	8	100.0%
Stratum 4.4: All remaining grantees in Stratum 4.	7	799	37	50	6.1%
Total		**1,325**	**210**	**280**	**21.1%**

4.4 Select Stratified PPS Sample of Grantees

As mentioned in ***Section 4.1***, the grantees differ widely in the number of patients served. PPS sampling is a commonly used method of unequal probability sampling to handle the large variation in patients served among grantees. In this method, the probability of a grantee being sampled is proportional to a size measure. The size measure will be the number of patients who visited the grantee for services from the 2016 UDS file. We will use PPS sampling to select the grantee sample from each final stratum.

A PPS grantee sample will be selected using the SAS SURVEYSELECT[10] procedure with predetermined sample allocation in Table 4-8 for each final stratum. During the selection, in addition to the seven strata for grantee sample selection discussed previously, we will sort the sampling frame by region (Northeast, Midwest, South, and West), urban/rural location, and the grantee size (large, medium, small) when applying Chromy's (1981) probability minimal replacement sequential PPS selection procedure. Sorting the sampling frame by these key grantee characteristics and then applying the PPS sequential procedure induces implicit stratification according to the order of the units in a stratum. Therefore, the selected grantee samples will be distributed among various regions, urban/rural locations, and various grantee sizes to ensure a representative grantee sample is selected.

4.5 An Illustrative Stratified Grantee Sample

In this section, we present an illustrative example of a stratified grantee sample based on a simulation study where 100 independent grantee samples are selected, and the results are averaged over the 100 samples.

In this example, 210 grantees were selected with the sample allocation for the final seven strata specified in Table 4-8. The PPS sequential method was used to select the grantees from each of the seven strata, and this process was repeated 100 times. As stated in ***Section 4.2***, an independent sample was selected for each funding program, if a selected grantee participated in multiple funding programs. This process yielded 369 grantees for four funding programs: 206 CHC grantees, 61 HCH grantees, 57 MHC grantees, and 45 PHPC grantees, as shown in ***Table 4-9***. To achieve the interview targets for each funding program, the expected number of complete interviews per grantee for each funding type was calculated, as displayed in Table 4-9.[11]

[10] http://support.sas.com/documentation/cdl/en/statug/63033/HTML/default/viewer.htm#surveyselect_toc.htm

[11] Note that during the sampling plan implementation, the sample realization may yield a slightly different distribution of grantees for each funding type.

Table 4-9. Expected Yield of the Grantee Funding Type and Patients of a Stratified Disproportionate Sampling

Funding Program	Number of Grantees for Each Funding Program	Average Number of Patients per Grantee	Number of Completed Interviews for Each Funding Program
C	206	24.8	5,100
H	61	27.2	1,660
M	57	26.0	1,480
P	45	16.9	760
Total	**369**		**9,000**

NOTE: C = Community Health Center program; H = Healthcare for Homeless program; M = Migrant Health Center program; P = Public Housing Primary Care program.

Table 4-10 displays the grantee sampling frame and expected sample distribution by region, urban/rural area, and grantee size from the illustrative example. In the distribution of regions, the West has a higher proportion in the grantee sample, while the proportions of the other three regions in the grantee sample are lower compared to the grantee sampling frame. This difference is mainly because of oversampling grantees with AIAN- and NHPI-concentrated patients, and most of these grantees are in the West region (Alaska and Hawaii). The grantee sample has higher proportions in urban areas compared to the grantee sampling frame; the reason for this difference is that we oversample PHPC grantees and they are mainly in urban areas. The grantee sample has lower proportions of small- and medium-size grantees compared to the grantee sampling frame. This disparity occurs because of the PPS sampling method employed in grantee sample selection, which gives grantees with large patient volume a better chance of being selected than grantees with a small patient volume. A best practice is to select more large grantees to lower data collection costs a large patient volume ensures that the quota per grantee (as shown in Table 4-9) can be easily met within the data collection time period.

In general, our proposed grantee sample selection algorithm generates grantee samples that represent different regions, urban/rural areas, and grantee size very well.

Table 4-10. Expected Grantee and Patient Sample Distribution by Region, Urban/Rural Area, and Grantee Size

	Grantee Frame		Expected Grantee Sample	
Domains	**N**	**%**	**n**	**%**
Region	1,325	100.00	210	100.00
Northeast	233	17.58	33	15.67
Midwest	259	19.55	38	18.02
South	445	33.58	48	22.72
West	388	29.28	92	43.59
Urban/Rural	1,325	100.00	210	100.00
Urban	751	56.68	140	66.76
Rural	574	43.32	70	33.24
Grantee Size	1,325	100.00	210	100.00
Large	451	34.04	151	71.70
Medium	437	32.98	36	17.10
Small	437	32.98	24	11.21

NOTE: The grantee sample sizes and proportions are the average from the 100 repeated samples. The sample sizes may not add up to 210, and proportions may not be exactly the sample sizes divided by 210 because of rounding.

To evaluate the effectiveness of oversampling grantees with patients concentrated in the oversampling race/ethnicity categories (AIAN, NHPI, and Asians), we calculated the coverage rates[12] of the three race/ethnicity categories from the sampled 210 grantees (see ***Table 4-11***). The 210 selected grantees cover 30.8% of patient population from all 1,325 grantees. The coverage rate for AIAN patients is 48.1%, 46.7% for NHPI patients, and 52.6% for Asian patients, while the coverage rate for races other than AIAN, NHPI and Asian is 27.4%. With the high coverage rates from the selected grantees, additional oversampling of sites with patients concentrated in the selected categories at the second selection stage, and oversampling of patients in the three race/ethnicity categories at the third selection stage, we are confident that we can achieve the oversampling goals in the three race/ethnicity categories. The oversampling procedure at the second and third stages of selection is discussed in ***Sections 5*** and ***6***.

[12] Coverage rate is the ratio of (number of patients in the selected 210 grantees/number of patients in all 1,325 grantees).

Table 4-11. Patient Coverage Rates of 210 Grantees in Race/Ethnicity

Race/Ethnicity	Patient Coverage Rate
American Indian/Alaska Native	48.1%
Asian	52.6%
Native Hawaiian/Pacific Islander	46.7%
Races Other Than AIAN, NHPI and Asian	27.4%
Overall	**30.8%**

4.6 Grantee Selection Probability

The selection probability for the i^{th} grantee within the h^{th} stratum can be calculated as

$$G_{hi} = n_h \frac{S_{hi}}{\sum_i S_{hi}}, \quad (1)$$

where h stands for the strata (h = 1, 2, …, 7, corresponding to 7 final strata); i is the index for grantees on the frame within each stratum; n_h is the number of grantees to select in the h^{th} stratum; and S_{hi} is the size measure, which is the number of patients served by each grantee. Note that we assume a 75% participation rate among grantees based on the results of the 2014 HCPS. As a result, n_h will be inflated to account for nonresponse among sampled grantees.

We are aware that applying different sampling rates for each stratum and oversampling at the second stage and the third stage will cause deviations from a self-weighting design. As a result, the variations in sample weights will be increased and variances in survey estimates will be inflated, thereby reducing precision or statistical power in data analysis. To maintain a near self-weighting design within each stratum, we will select sites within grantees using PPS sampling at the second stage of selection and select the same number of patients per grantee in the third stage.

5. Site Sample Selection

As discussed previously, more than 75% of grantees have three or more sites. In general, grantees with more sites tend to have more patients. At the first stage of selection, grantees are selected with the PPS method, which means that grantees with large numbers of patients have a higher probability of being selected in the sample. As a result, we expect a fair number of recruited grantees to have more than three sites. We will spread the sample of patients across multiple sites to reduce the within-grantee clustering effect and increase the precision of the analysis. We will select up to three sites for each funding program within a grantee for the 2019 HCPS. When all sites for one funding program in a grantee have low patient volumes, more than three sites could be selected. This section discusses the second stage of selection: the selection of sites from participating grantees that have multiple sites.

5.1 Determine Eligible Sites within Participating Grantees

Once a grantee is recruited and agrees to conduct the study in its sites, our recruiters will work with the grantee's administration to identify eligible sites. The following eligibility criteria will be used, and we will consult with the BPHC Contracting Officer Representative (COR) to determine the site eligibility on a case-by-case basis whenever it is necessary.

- The site should participate in at least one of the four specific funding programs and must have been operating under the grantee for at least 1 year.
- The site is not a school-based health center.
- The site is not a specialized clinic, except clinics providing OB/GYN services.
- The site does not provide services only through the migrant and seasonal farmworker voucher screening program.
- A site serves at least 100 patients.

After eligible sites are identified, we will collect from or verify with each participating grantee the following information:

- number of eligible sites serving each patient type (i.e., migrant and seasonal farmworkers, homeless, public housing, and general patients);
- address and contact information for each eligible site;
- number of patients served in each eligible site, overall and by type of patient (CHC, MHC, HCH, and PHPC); and
- sites with patients concentrated in one of the three race/ethnicity categories (AIAN, Asian, or NHPI), patients aged 65 and older, or veteran patients.

5.2 Evaluate Distances between Eligible Sites

In most cases, one FI will be hired to collect data for each participating grantee. Therefore, selected sites must be within manageable distances for the FI(s). The grantees tend to operate sites in relatively localized areas. Our sampling staff will evaluate distances between the administrative office/central site and the associated sites. For a specific funding program, the site with the largest patient volume could be used as the central site. Typically, sites will be excluded if they are located more than 100 miles from the central site. However, we will consult with the BPHC COR to determine whether special data collection arrangements should be made for remote sites.

5.3 Oversampling Sites with Patients Concentrated in Oversampling Subgroups

To achieve our target sample sizes of AIAN, Asian, and NHPI patients, we will not only oversample grantees with patients concentrated in these three race/ethnicity groups at the first stage of selection, but we will also identify sites with patients concentrated in at least one of the three targeted race/ethnicity categories. Sites with patients concentrated in the 65 and older group or veteran patients will also be identified. These sites will be selected with higher probabilities than sites without patients concentrated in these categories.

5.4 Site Selection and Selection Probability

If there are three or fewer sites for a patient type (i.e., migrant and seasonal farmworkers, homeless, public housing, and general patients) and they are within a manageable distance for one FI, all the sites will be included in the study. If one site is far from the other sites and the other sites are close to one another, the two sites that are close to each other will be selected. However, if all three sites are far from one another, we will select the site with the largest patient volume. Similarly, when two sites for a specific funding program are far from each other, the one with the largest number of patients will be selected. Again, these special cases will be reviewed with the COR.

For grantees with more than three sites for a patient type, we will use a PPS sampling method similar to the one for grantees discussed in ***Section 4.4*** to select three sites from the sites within a manageable distance. The number of patients served by each site under a specific funding program will serve as the size measure in the PPS sampling. For the grantees that participate in multiple funding programs, an independent PPS selection of sites will be conducted for each funding program, if needed. When sites within a grantee have low patient volume for a funding program, we may allow selecting more than three sites so that it is easier to meet the patient interview quota for that grantee.

The selection probability for the j^{th} site within the i^{th} grantee for funding program f is given by

$$C_{fij} = \begin{cases} 1 \quad , \text{ if } 3 \text{ or fewer sites are all selected, or} \\ \dfrac{3s_{fij}}{\sum_j s_{fij}} \quad , \text{ if } 3 \text{ sites are selected through PPS sampling,} \end{cases} \tag{2}$$

where s_{fij} is the number of patients in site j within grantee i for funding program f. Based on our experience with the 2014 HCPS, we expect nearly all selected sites within participating grantees to participate in the 2019 HCPS.

6. Patient Sample Selection

Because some of the target populations of this study are quite mobile, a random sample of patients will be selected for interview as they enter the site and register with the receptionist for services. An FI will visit a selected site for a predetermined number of days and time slots in the sampling period to conduct interviews. This section of the report presents the methodology and specifications for selecting patients from participating sites.

6.1 Patient Interview Allocation to Grantee

To achieve the near self-weighting sample of patient interviews within each grantee stratum, the same number of patients will be interviewed from the grantees in each funding program. As shown in Table 4-9 in ***Section 4.5*** from the illustrative grantee sample example, 206 CHC grantees, 57 MHC grantees, 61 HCH grantees, and 45 PHPC grantees are to be recruited. To achieve 5,100 completed interviews for CHC, we will need to complete 24–25 patient interviews per CHC grantee. We will need 25–26 completed interviews per MHC grantee to achieve 1,480 interviews for MHC; 26–27 completed patient interviews per HCH grantee to yield a total of 1,660 interviews for HCH; and 16–17 completed interviews per PHPC grantee to yield a total of 760 interviews for PHPC.

We may increase the patient interview quota for some grantees with patients concentrated in the oversampling race/ethnicity categories to achieve the target sample sizes if necessary.

6.2 Patient Interview Allocation to Sites within Grantee

Within each grantee, we will use different methods to allocate patient interviews to multiple sites for grantees with three or fewer sites in a funding program and grantees with more than three sites in a funding program. For grantees with three or fewer sites, the number of patient interviews within that grantee will be allocated proportionally to the patient size of the sites. That is,

$$n_{fij} = n_{fi} \frac{s_{fij}}{\sum_j s_{fij}},$$

where n_{fi} is the number of patients selected from a grantee for funding program *f*. For grantees with more than three sites that are selected through PPS, the number of selected patients will be divided equally among three selected sites. Doing so will help to reduce the UWE.

6.3 Patient Screening and Selection

RTI will design a screening sheet that the receptionist can use to screen and select patients when a patient enters the site and registers for service. A patient will be considered eligible

if the patient received service through one of the grantees supported by BPHC funding programs at least once in the past 12 months prior to the current visit. The receptionist will ask eligible patients questions about their race/ethnicity, age, and veteran status to determine whether they belong to the oversampling subgroups. If a patient belongs to a subgroup that will not be oversampled, the receptionist will refer the first eligible patient registered after the FI has informed the receptionist that he/she is ready for the next interview. We are considering developing a computer-based system to track patient eligibility and referral status wherever feasible. If a patient belongs to one of the oversampling subgroups, the receptionist will always refer the patient. The receptionist will first read a brief script about the study to the referred patient and direct the patient to the FI for questions or participation. ***Table 6-1*** shows the oversampling and non-oversampling subgroups.

Table 6-1. Oversampling and Non-Oversampling Patient Subgroups

Patient Subgroup	Patient Aged 64 and Younger	Patients Aged 65 and Older
Race/Ethnicity		
AIAN	Yes[a]	Yes
Asian	Yes	Yes
NHPI	Yes	Yes
Races Other Than AIAN, ASIAN, and NHPI	No[b]	Yes
Veteran Status		
Veteran	Yes	Yes
Non-Veteran	No	Yes

[a] Yes – oversampling.

[b] No – non-oversampling.

The receptionist will be asked to keep track of the number of patients who enter the site, the number of patients who are eligible, and number of patients selected while the FI is at the site to conduct data collection for each patient subgroup, as shown in Table 6-1. The receptionist will either use tally marks to count patients as they enter or complete a table based on the sign-in sheet or appointment list before the FI leaves the site. The patient count sheets for each FI data collection visit will be sent to RTI for data entry, and counts will be used to calculate the analysis weights for the study. For sites that have more than one receptionist, all receptionists must track number of visited, eligible, and selected patients even though we may only recruit patients using one receptionist. As mentioned above, if a computer-based system is developed, it will be used to replace this process in capturing patient eligibility and referral information.

If a site is chosen for data collection in multiple funding programs, the FI will screen participating patients to determine patient population type (i.e., homeless, migrant and seasonal farmworkers, public housing, or low income) and will use the appropriate questionnaire to conduct the patient interview.

We will closely monitor the data collection and adjust the sampling rate if necessary to ensure that target sample sizes in three race/ethnicity categories and patient aged 65 and older are met, and the sample size for veteran patients is reasonably increased.

6.4 Patient Selection Probability

The selection probability of patient *k* from grantee *i*, site *j* for funding program *f* is given by

$$P_{fijk} = \frac{m_{fij}}{M_{fij}} \frac{weeks}{52}, \tag{3}$$

where M_{fij} is the number of eligible patients in the site during the sampling window (number of *weeks*) and where m_{fij} is the target number of selected patients inflated for nonresponse. We may have to estimate the proportion of patients from different funding programs if the site is selected in data collection for more than one funding program. The proportion of patients from different funding programs for the grantee or other sites within the grantee can be used as an approximation. Note that the patient selection probability will be calculated separately for each patient group as shown in Table 6-1.

6.5 Patient's Probability of Inclusion in the Study

The probability of a patient being included in the study is the product of G_{hi}, C_{fij}, and P_{fjik} in **Formulas (1)**, **(2)**, and **(3)**, respectively. That is,

$$\pi_{hfijk} = \frac{n_h s_{hi}}{\sum_i s_{hi}} \frac{3 s_{fij}}{\sum_j s_{fij}} \frac{m_{fij}}{M_{fij}} \frac{weeks}{52}. \tag{4}$$

The design is supposed to achieve near self-weighting within each grantee stratum if no oversampling is conducted when selecting sites at the second-stage selection, and no oversampling of patients is conducted at the third-stage selection. The oversampling at the second and third stages causes the deviation from a near self-weighting design, meaning probabilities in **Formula (4)** will not be equal within the same grantee stratum. As a result, the UWE will be inflated.

7. Sample Sizes and Statistical Power

Statistical tests use data from samples to determine whether a difference exists in a population or between two populations. An example of a statistical test is testing the null hypothesis that the proportion of having serious mental illness does not differ between the population of the 2019 HCPS and general population for the 2016 National Health Interview Survey (NHIS). The power of the test is the probability that the test will find a statistically significant difference between two populations given that there is a true difference between those two populations. There is always a chance that the samples will appear to support or to refute a tested hypothesis when the reality is the opposite. That risk is quantified as the statistical significance level. We use a significance level of 0.05 to calculate statistical power in this document.

To reduce data collection costs and meet the target sample sizes for four funding programs and for race/ethnicity and age groups, we propose a stratified three-stage clustering design and oversampling of certain subgroups. Large variations in sample weights caused by oversampling and the intra-class correlation among patients from the same grantee because of clustering can increase sampling error, thereby reducing statistical power and precision of survey estimates. The design effect (*Deff)* can be used to measure the loss of precision and statistical power caused by oversampling and clustering. *Deff* is a function of the clustering effect and the *UWE* and can be defined as $Deff = UWE * (1 + (m-1) * ICC)$, where m is the number of patient interviews within a grantee, *ICC* is the intracluster correlation coefficient that measures the degree of similarity among elements within a cluster, and *UWE* measures variation in the sample weight. *Deff* can be reduced by reducing either *UWE* or the clustering effect or both. The effective sample size is the target sample size divided by *Deff*.

Table 7-1 displays the power calculation for proportion estimates between the 2019 HCPS and 2016 NHIS, showing that minimum differences can be detected with 80% of statistical power at the 0.05 level for various domains. In the calculation, we used a proportion ($p=0.5$); the statistical power is the smallest for proportion estimates when the proportion is in the middle range (0.4–0.6) because the variance is the largest. The detectable differences will be smaller if the proportion estimate is out of the middle range.

Table 7-1. Detecting Differences in Percentage Estimates between the 2019 HCPS and the 2016 NHIS (Full Sample)

Domain	HCPS			NHIS[a]			Detectable Difference[c] %
	Expected Sample Size	Estimated Deff[b]	Effective Sample Size	Sample Size	Estimated Deff	Effective Sample Size	
Overall	9,000	4.0	2,250	44,135	2.0	22,068	3.1
Age Group							
17 and younger	2,130	4.0	533	11,107	2.0	5,554	6.4
18-64	5,770	4.0	1,443	24,126	2.0	12,063	3.9
65 and older	1,100	4.0	275	8,902	2.0	4,451	8.6
Race/Ethnicity							
Hispanic	3,170	4.0	793	6,212	2.0	3,106	5.5
NH-White	2,250	4.0	563	29,209	2.0	14,605	6.0
NH-Black	1,920	4.0	480	4,830	2.0	2,415	6.8
NH-Asian	650	4.0	163	2,180	2.0	1,090	11.5
NH-AIAN	670	4.0	168	424	2.0	212	14.2
NH-NHPI[d]	200	4.0	50	—	2.0	—	—
Others[d]	140	4.0	35	1,280	2.0	640	—
Health and Chronic Conditions							
Serious Mental Illness	1,003	4.0	251	914	2.0	457	10.9
Tobacco Use	2,312	4.0	578	5,340	2.0	2,670	6.4
Substance Use[e]	1,190	4.0	298	5,837	2.0	2,919	8.4
Adult Obesity (18 and older)	3,880	4.0	970	21,889	2.0	10,945	4.6
Child Obesity (17 and younger)[f]	575	4.0	144	2,996	2.0	1,498	12.0
Diabetes	1,648	4.0	412	3,540	2.0	1,770	7.6
Hypertension	3,299	4.0	825	11,664	2.0	5,832	5.2
Cardiovascular Disease	812	4.0	203	3,358	2.0	1,679	10.2

[a] Based on the 2016 NHIS full sample

[b] Deff: Design Effect, it measures the loss of efficiency resulting from the use of cluster sampling, instead of simple random sampling.

[c] Difference in percentage estimates will be detected with 80% power at the 0.05 level of significance.

[d] Projected sample size was too small for detecting differences with acceptable power.

[e] Excluding tobacco and alcohol use. The NHIS sample size was estimated using the same substance use prevalence rate as in the 2014 HCPS.

[f] Defined as obesity when BMI>=25. The NHIS sample size was estimated using the same child obesity prevalence rate as in the 2014 HCPS.

Table 7-2. Detecting Differences in Percentage Estimates between the 2019 HCPS and the 2016 NHIS (Subsample Who Had <200% FPL)

Domain	HCPS			NHIS[a]			Detectable Difference[c] %
	Expected Sample Size	Estimated Deff[b]	Effective Sample Size	Sample Size	Estimated Deff	Effective Sample Size	
Overall	9,000	4.0	2,250	14,506	2.0	7,253	3.4
Age Group							
17 and younger	2,130	4.0	533	4,063	2.0	2,032	6.8
18-64	5,770	4.0	1,443	7,846	2.0	3,923	4.3
65 and older	1,100	4.0	275	2,597	2.0	1,299	9.2
Race/Ethnicity							
Hispanic	3,170	4.0	793	3,162	2.0	1,581	6.1
NH-White	2,250	4.0	563	7,525	2.0	3,763	6.3
NH-Black	1,920	4.0	480	2,476	2.0	1,238	7.5
NH-Asian	650	4.0	163	596	2.0	298	13.5
NH-AIAN	670	4.0	168	228	2.0	114	17.5
NH-NHPI[d]	200	4.0	50	—	2.0	—	—
Others[d]	140	4.0	35	519	2.0	260	—
Health and Chronic Conditions							
Serious Mental Illness	1,003	4.0	251	544	2.0	272	12.1
Tobacco Use	2,312	4.0	578	2,476	2.0	1,238	7.0
Substance Use[e]	1,190	4.0	298	1,918	2.0	959	9.2
Adult Obesity (18 and older)	3,880	4.0	970	6,834	2.0	3,417	5.1
Child Obesity (17 and younger)[f]	575	4.0	144	1,097	2.0	549	12.9
Diabetes	1,648	4.0	412	1,406	2.0	703	8.6
Hypertension	3,299	4.0	825	3,907	2.0	1,954	5.8
Cardiovascular Disease	812	4.0	203	1,372	2.0	686	11.0

[a] Based on the 2016 NHIS who had less than 200% FPL.

[b] Deff: Design Effect, it measures the loss of efficiency resulting from the use of cluster sampling, instead of simple random sampling.

[c] Difference in percentage estimates will be detected with 80% power at the 0.05 level of significance.

[d] Projected sample size was too small for detecting differences with acceptable power.

[e] Excluding tobacco and alcohol use. The NHIS sample size was estimated using the same substance use prevalence rate as in the 2014 HCPS.

[f] Defined as obesity when BMI>=25. The NHIS sample size was estimated using the same child obesity prevalence rate as in the 2014 HCPS.

Table 7-3. Detecting Differences in Percentage Estimates between the 2019 HCPS and the 2016 NHIS (Subsample Who Visited Clinics or Health Centers)

Domain	HCPS			NHIS[a]			Detectable Difference[c] %
	Expected Sample Size	Estimated Deff[b]	Effective Sample Size	Sample Size	Estimated Deff	Effective Sample Size	
Overall	9,000	4.0	2,250	10,171	2.0	5,086	3.5
Age Group							
17 and younger	2,130	4.0	533	2,736	2.0	1,368	7.1
18-64	5,770	4.0	1,443	5,641	2.0	2,821	4.5
65 and older	1,100	4.0	275	1,794	2.0	897	9.5
Race/Ethnicity							
Hispanic	3,170	4.0	793	1,995	2.0	998	6.6
NH-White	2,250	4.0	563	6,091	2.0	3,046	6.4
NH-Black	1,920	4.0	480	1,059	2.0	530	8.7
NH-Asian	650	4.0	163	441	2.0	221	14.2
NH-AIAN	670	4.0	168	263	2.0	132	16.0
NH-NHPI[d]	200	4.0	50	—	2.0	—	—
Others[d]	140	4.0	35	322	2.0	161	—
Health and Chronic Conditions							
Serious Mental Illness	1,003	4.0	251	248	2.0	124	15.1
Tobacco Use	2,312	4.0	578	1,286	2.0	643	7.9
Substance Use[e]	1,190	4.0	298	1,345	2.0	673	9.6
Adult Obesity (18 and older)	3,880	4.0	970	5,002	2.0	2,501	5.3
Child Obesity (17 and younger)[f]	575	4.0	144	739	2.0	370	13.5
Diabetes	1,648	4.0	412	856	2.0	428	9.6
Hypertension	3,299	4.0	825	2,653	2.0	1,327	6.2
Cardiovascular Disease	812	4.0	203	742	2.0	371	12.1

[a] Based on the 2016 NHIS who answered 'Clinic or health center' to the question 'What kind of place do you go to most often.'

[b] Deff: Design Effect, it measures the loss of efficiency resulting from the use of cluster sampling, instead of simple random sampling.

[c] Difference in percentage estimates will be detected with 80% power at the 0.05 level of significance.

[d] Projected sample size was too small for detecting differences with acceptable power.

[e] Excluding tobacco and alcohol use. The NHIS sample size was estimated using the same substance use prevalence rate as in the 2014 HCPS.

[f] Defined as obesity when BMI>=25. The NHIS sample size was estimated using the same child obesity prevalence rate as in the 2014 HCPS.

The power analysis estimates in Table 7-1 shows that the detectable differences are well below 8% between the 2019 HCPS and the 2016 NHIS for age group, race/ethnicity, and health and chronic condition domains, except for Non-Hispanic Asian, Non-Hispanic American Indian/Alaska Native, serious mental illness, substance use, child obesity, and cardiovascular disease. Tables 7-2 and 7-3 show the detectable differences between 2019 HCPS and two subsamples of the 2016 NHIS. Table 7-2 included respondents who had less than 200% FPL in the 2016 NHIS, and Table 7-3 included respondents who answered 'Clinic or Health Center' to the question 'What kind of place do you go to most often' in the 2016 NHIS.

8. Sample Weights

Patients, the primary analytic units for the 2019 HCPS, are selected through a three-staged sample design, as discussed in ***Sections 4–6***. Disproportionate sample selection is used at all three stages; therefore, the patient samples are not self-weighting. To make inferences about the target population or any subdomains of the target population, sample weights are needed. We will calculate base weights for each respondent reflecting each respondent's probability of inclusion in the study. To account for nonresponse, a nonresponse adjustment on the base weight will be calculated. Poststratification adjustment will also be conducted to adjust for coverage bias and reduce variance.

8.1 Grantee Sample Selection Weights

The first-stage sampling weight for each grantee will be the inverse of the probability of selection as calculated in **Formula (1)** in ***Section 4.6***. Therefore, the grantee sample selection weight for grantee *i* within the h^{th} stratum is given by

$$w^{(1)}{}_{hi} = 1/G_{hi}. \tag{6}$$

8.2 Site Sample Selection Weights

For the grantees that have more than three sites for a specific funding program, a subsample of three sites was selected as discussed in ***Section 5.4***. Thus, the site sample selection weight for the j^{th} site within the i^{th} grantee for funding program *f* is given by

$$w^{(2)}{}_{fij} = 1/C_{fij}, \tag{7}$$

where C_{fij} is calculated in **Formula (2)**.

8.3 Patient Sample Selection Weights

From the patient recruitment logs, the number of eligible patients, the number of patients who were selected by a receptionist and sent to an FI, and the number of patients who agreed to participate during the patient recruitment time periods will be determined. The number of patients selected at each site for a specific funding program within a participating grantee, summed across the days in which the sampling for that site took place, will be divided by the total number of patients the site served in the year prior to the survey year, to obtain the probability of selection for each patient as discussed in ***Section 6.4***. Thus, the patient sample selection weight for the k^{th} patient at the j^{th} site within the i^{th} grantee for funding program *f* is given by

$$w^{(3)}{}_{fijk} = 1/P_{fijk}, \tag{8}$$

where p_{fijk} is calculated in **Formula (3).**

The product of three weight components discussed above forms the design-based weights for each patient. That is,

$$w_{fijk} = w^{(1)}{}_{hi} \cdot w^{(2)}{}_{fij} \cdot w^{(3)}{}_{fijk}. \quad (9)$$

8.4 Nonresponse and Poststratification Weight Adjustments

To reduce the nonresponse bias on the estimates, the design-based weight w_{fijk} will be adjusted for nonresponse. A nonresponse adjustment will be calculated separately for each funding program. Since we have age and race information for both respondents and nonrespondents collected by receptionists, weighting classes will be formed by age group and race/ethnicity, and a ratio adjustment will be calculated within each class. The adjustment within each class is calculated as:

$$Adj_{nr} = \sum_s w_{fijk} / \sum_r w_{fijk}, \quad (10)$$

where *s* is for all selected patients and *r* is for respondents.

The poststratification is anticipated to reduce the coverage bias and variance of survey outcomes, and it will be implemented using RTI's generalized exponential model (GEM; Folsom & Singh, 2000). Coverage bias can occur when a set of individuals in a sample does not match the target population. For example, if there are more young patients in the study, then estimates based on the sample may be biased if young patients respond to survey questions differently from patients in other age groups. Poststratification adjustment adjusts weights so that weights for young patients will be adjusted downward. Thus, the youth over-representing issue in the sample is corrected. GEM can use more predictors in the model than the conventional weighting class methods. The predictors will be limited by available data from the UDS, including age, race/ethnicity, gender, and poverty level. A separate poststratification adjustment will be conducted for each funding program so that the sum of final analysis weights from all respondents in a funding program will match the total number of patients served by the corresponding funding program. The poststratification adjustment factor denotes Adj_{ps}.

The final analysis weights for 2019 HCPS are the product of the design-based weights and two adjustment factors. That is,

$$ANALWT_{fijk} = w_{fijk} \cdot Adj_{nr} \cdot Adj_{ps}. \quad (11)$$

Table 8-1 displays and explains the terms in the formulas from this section and from ***Sections 4*** through ***6*** and provides the resource of the information as well.

Table 8-1. Description and Data Source of Terms in Formulas Calculating Sample Weights

Formula	Terms	Description	Data Source
$G_{hi} = n_h \frac{S_{hi}}{\sum_i S_{hi}}$	G_{hi}	Selection probability for the i^{th} grantee within h^{th} stratum	Output from PROC SURVEYSELECT in SAS
	n_h	Prespecified number of grantees selected for the study in h^{th} stratum	RTI calculates the sampling rates and allocates grantee samples into each stratum (see example in Table 4-8)
	S_{hi}	Number of patients served in the year prior to the survey year in i^{th} grantee within h^{th} stratum	BPHC's UDS
	$\sum_i S_{hi}$	Total number of patients the grantees served in the year prior to the survey year in h^{th} stratum	BPHC's UDS
$C_{fij} = \begin{cases} 1, or \\ \frac{3s_{fij}}{\sum_j s_{fij}} \end{cases}$	C_{fij}	Selection probability for j^{th} site within i^{th} grantee for funding program f ; equal to 1 if three or fewer sites are selected, or is calculated if three sites are selected using PPS	Output from PROC SURVEYSELECT in SAS, or equals to 1
	S_{fij}	Number of patients served in the year prior to the survey year from j^{th} site within i^{th} grantee for funding program f	RTI recruiters collect this information from the grantee or site in recruiting process
	$\sum_j S_{fij}$	Total number of patients served in the year prior to the survey year from all sites within i^{th} grantee for funding program f	Sum of S_{fij} within the grantee for a specific funding program
$P_{fijk} = \frac{m_{fij}}{M_{fij}} \frac{weeks}{52}$	P_{fijk}	Selection probability of patient k from site j of grantee i for funding program f	Calculate from the formula
	m_{fij}	Number of selected patients to yield n_{fij} complete interview from grantee i , site j for funding program f	FI keeps track of the number of selected patients sent by a receptionist for each funding program
	M_{fij}	Number of patients entered in the site during the sampling window (number of weeks)	RTI collects data from receptionists' tally sheets or computer-based system

(continued)

Table 8-1. Description and Data Source of Terms in Formulas Calculating Sample Weights (continued)

Formula	Terms	Description	Data Source
$w^{(1)}{}_{hi} = 1/G_{hi}$	$w^{(1)}{}_{hi}$	Design weight corresponding to grantee selection	Inverse of G_{hi}
$w^{(2)}{}_{fij} = 1/C_{fij}$	$w^{(2)}{}_{fij}$	Design weight corresponding to site selection	Inverse of C_{fij}
$w^{(3)}{}_{fijk} = 1/P_{fijk}$	$w^{(3)}{}_{fijk}$	Design weight corresponding to patient selection	Inverse of P_{fijk}
$w_{fijk} = w^{(1)}{}_{hi} \cdot w^{(2)}{}_{fij} \cdot w^{(3)}{}_{fijk}$	w_{fijk}	Design weights for each selected patient	Product of three design-based weight components corresponding to three selection stages
$Adj_{nr} = \sum_s w_{fijk} / \sum_r w_{fijk}$	Adj_{nr}	A weighting class nonresponse adjustment	Calculate the nonresponse adjustment within each weighting class separately for each funding program
	$\sum_s W_{fijk}$	Sum of the design weights of all selected patients for a specific funding program	Sum of w_{fijk} of all selected patients within a weighting class
	$\sum_r W_{fijk}$	Sum of the design weights of completed interview for a specific funding program	Sum of w_{fijk} of completed interviews within a weighting class
Adj_{ps}	Adj_{ps}	Poststratification adjustment done by each funding program; adjusts weights to BPHC's UDS total number of patients for various demographic domains	Generalized Exponential Model developed at RTI; control totals are from BPHC's UDS
$ANALWT_{fijk} = w_{fijk} \cdot Adj_{nr} \cdot Adj_{ps}$	$ANALWT_{fijk}$	Final analysis weight	Product of design weight, nonresponse, and poststratification adjustments

9. Data Collection

9.1 Schedule

The 2019 HCPS data will be collected over 5.5 months, from mid-July to December 2019. Typically, a work day will be divided into morning or afternoon time slots. We will send an FI to a site on predetermined days and time slots. An FI will normally work in multiple sites from one grantee or multiple grantees. We will determine the FI's time slots for each site by considering the production goal of a site, estimated patient volume in a site, the FI's working schedule, and the site's operating schedule. The production goal, which is the number of completed interviews, varies for each site; it can be as low as five or six interviews when three sites are selected for a PHPC grantee (16–17 interviews for PHPC per grantee) or it can be as high as 91–95 interviews when a site is the only site selected for data collection for all four funding programs (although that scenario rarely happens). Achieving the production goal at each site should not be difficult in a 5.5-month data collection window. However, for some sites, because of unexpected low patient volume or an unusual operating schedule, the production goal could potentially be missed. We will closely watch the data collection process, and if a delay occurs, we will send an FI more often to the site. We may have to reduce the production goal for a site and allocate more interviews to other sites if meeting the production goal proves to be extremely difficult.

9.2 Costs

The three primary field costs are FI labor, mileage incurred by FIs, and incentives paid to respondents. We estimate that we need 4.8 hours on average to obtain one interview for the CHC. MHC, PHPC, and HCH patients will require 6.7 hours for interviews done in an Asian language and 6.8 hours per interview for patients aged 65 and older. These hours include time for driving to and from a facility, waiting to be approached by eligible patients, screening potential participants, administering informed consent, administering an interview, updating field status codes and completing other administrative paper work, shipping materials back to RTI, and participating in regular conference calls with his/her field supervisor. We also assume that FIs will require reimbursement for an average of 40 miles per completed interview. Finally, we have budgeted for $25 in incentives for each survey respondent.

10. Strengths and Limitations of Study Design

10.1 Strengths

The three-stage sample design will produce a nationally representative sample of grantees, sites, and patients across the United States, across urban/rural locations, and across various grantee sizes.

We will create seven grantee strata according to funding program(s) in which a grantee participated and whether a grantee has patients concentrated in one of the three race/ethnicity categories (AIAN, Asian, and NHPI). We will oversample grantees receiving PHPC, MHC, and/or HCH funding and grantees with patients concentrated in one of three race/ethnicity categories. The stratified disproportionate sample at the grantee selection stage will yield a grantee sample with more grantees participating in PHPC, MHC, and/or HCH funding programs and grantees with a large number of patients in three race/ethnicity categories. These aspects of the design are key so that the target sample sizes for funding programs and race/ethnicity groups can be met. The optimum grantee sample allocation procedure reduces UWE. Independent site and patient samples will be selected for each funding program if a grantee participated in multiple funding programs. This step reduces data collection cost and increases sampling efficiency because of the large costs of recruiting a grantee.

Oversampling sites with concentrated patients in one of the three race/ethnicity categories, patients aged 65 and older, or veteran patients will further guarantee successfully achieving target sample sizes in the oversampling subgroups. Allocating interviews per funding program in a grantee to up to three sites when possible will help to reduce the clustering effect, thus reducing sampling error and improving precision on survey estimates. We will allow selecting more than three sites for a funding program with low patient volume so that the grantee patient interview quota can be met more easily.

We will oversample patients at the third selection stage for patients aged 65 and older, patients in race/ethnicity categories (AIAN, Asian, and NHPI), and veteran patients. We will closely monitor the data collection on a weekly basis, and adjust the sampling rates and frequency of an FI on a site to ensure target sample sizes in each subgroup will be met within the 4-month sampling window.

When the target sample for each funding program is met, BPHC can compare survey estimates among funding programs. The combined sample of patients from the four funding programs will be sufficient for comparative analyses with national estimates of U.S. residents from the NHIS on various survey outcomes at the national level and some subgroups, such as race/ethnicity, age group, health condition, etc.

10.2 Limitations

The sample size has increased from 6,600 in the 2014 study to 9,000 for the 2019 study so the precision of survey estimates should improve in the 2019 study. However, oversampling grantees, sites, and patients at all three stages can cause large variation in sample weights, thereby increasing variances associated with survey estimates and reducing statistical power in data analysis. This design efficiency loss caused by oversampling could partially offset the gain of the increased sample sizes.

An additional limitation is the capture of seasonal variation in health care needs and service utilization. The time constraints for completing the study within the contract time period limit the data collection period to 5.5 months, not a full year; thus, the study will not be able to address any seasonal fluctuations in the types of services provided to the health center patients during different seasons of the year. The short time period for data collection may also miss groups of seasonal farmworkers who move from one part of the country to another during the year. After grantee samples are selected, we will evaluate and consider the migrant farmer worker situation based on the most current National Agriculture Workers Survey results. We will plan data collection in MHC grantees accordingly.

References

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