

## B. Collection of Information Employing Statistical Methods

The purpose of the NPRA Pilot Survey is to evaluate and refine the NPRA questionnaire, sample design, and data collection operations in preparation for the main survey implementation. The questionnaire (see Attachment A) has been tested through cognitive interviews and will be further evaluated in the pilot. With regard to sampling, the pilot study will examine the estimated eligibility rates and response rates to develop a more efficient stratification and allocation. The variability of key measures will be evaluated, including total expenditures for performing R&D and the amount of funding provided for research purposes. Moreover, the pilot study serves as a trial run for the data collection procedures for the main survey, allowing a chance to verify that the procedures work effectively and to modify them as needed.

### B.1. Respondent Universe

#### Target Population and Sampling Frame

The target population for the NPRA Pilot Survey includes all nonprofit organizations categorized by the Internal Revenue Service (IRS) as 501(c)(3) public charities, 501(c)(3) private foundations, and other exempt organizations [e.g., 501(c)(4), 501(c)(5), 501(c)(6)]. As recorded on the IRS Exempt Organizations Business Master File (November 2015), there are 1.5 million tax-exempt organizations. Nearly 1.2 million of these organizations filed an information return with the IRS in the past 24 months. Certain organizations are not required to file an information return (e.g., churches), but those that are required to file an information form must file Form 990, 990-N, 990-EZ, or 990-PF, according to their organization type and financial size (see Table B.1.1).

**Table B.1.1: Criteria for Filing IRS Exempt Organization Forms**

Type of Exempt Organization	Required to file
<b>Public Charity and Other Exempt Organizations:</b>	
<b>Gross receipts normally <math>\leq</math> \$50,000</b>	990-N
<b>Gross receipts <math>&lt;</math> \$200,000, and Total assets <math>&lt;</math> \$500,000</b>	990-EZ
<b>Gross receipts <math>\geq</math> \$200,000, or Total assets <math>\geq</math> \$500,000</b>	990
<b>Private Foundations</b>	990-PF

Small organizations, those with gross receipts under \$50,000 are allowed to file Form 990-N (“e-postcard”), which does not require the organization to report financial data. Nearly half of the filing organizations filed Form 990-N. The remaining organizations filed Forms 990, 990-EZ, or 990-PF, which require financial reporting.

The financial information on Forms 990, 990-EZ, and 990-PF is captured on the National Center for Charitable Statistics (NCCS) Core Financial Files. We will use the circa 2013 versions of the core files to construct the sampling frame for the NPRA Pilot Survey. The files are labeled “circa”

2013 because the data may be from different fiscal years. The due date for 990s is rolling based on the 15th day of the fifth month after the end of the organization’s taxable year. At the time of the core file construction, most organizations had filed for their 2013 fiscal year; however, a few organizations had filed only for FY 2012 or had already filed for FY 2014. Further, if an organization did not file a return, but is presumed to be still active, NCCS uses the form from the latest filing. As shown in Table B.1.2, three separate core files are available.

**Table B.1.2: NCCS Core Financial Files and Number of Records**

Core File	Number of Records
501(c)(3) public charities that file Form 990 or 990-EZ	382,401
Other exempt organizations that file Form 990 or 990-EZ	140,219
501(c)(3) private foundations (Form 990-PF)	95,992
<b>Total</b>	<b>618,612</b>

The core files include a total of 618,612 organizations with unique employee identification numbers (EIN) that we will use as our sampling frame. Of those, 95,992 represent private foundations of all sizes that complete Form 990-PF. The other 522,620 represent public charities and other exempt organizations that filed Form 990 or Form 990-EZ. Typically, these organizations have gross receipts over \$50,000, because those with gross receipts under \$50,000 are allowed to file Form 990-N and are not recorded on the core files. The distribution of organizations in the core files is presented by form type and fiscal year in Table B.1.3.

**Table B.1.3: Circa 2013 Financial Core Files: Fiscal Year and Form Type**

	Total	990	990-EZ	PF
2010	1	0	0	1
2011	11,169	3,788	5,554	1,827
2012	41,638	18,446	19,137	4,055
2013	473,161	23,2705	160,730	79,726
2014	92,643	44,522	37,738	10,383
<b>Total</b>	<b>618,612</b>	<b>299,461</b>	<b>223,159</b>	<b>95,992</b>

## Frame Coverage

Using the core financial files as a sampling frame excludes most public charities and other exempt organizations with gross receipts under \$50,000 (note some file Form 990 or Form 990-EZ).<sup>2</sup> While organizations with gross receipts under \$50,000 represent 70% of the public charities and other exempt organizations, they represent approximately 0.1% of the total gross receipts generated by public charities and other exempt organizations.<sup>3</sup> Exclusion of these small organizations is a limitation because they will not be covered by the sampling frame (i.e., undercoverage). Alternatively, the IRS Exempt Organization Business Master File (EO/BMF)

<sup>2</sup> Based on the filing requirements code, 126,377 organizations on the core file are not required to file a Form 990, 990-EZ, or 990-PF.

<sup>3</sup> Based on gross receipts on the 2013 Exempt Organization Business Master File. For zero-filers, most of whom are allowed to file Form 990-N and we have no record of their income, we assumed the maximum threshold (\$50,000) to calculate the gross receipts percent. The percentage was 0.8% with this maximum threshold assumption.

includes all exempt organizations regardless of financial size. However, the financial variables on the EO/BMF are limited to gross receipts, revenue, and total assets. The additional financial information available on the core files will be used in developing a propensity score model to improve the sample stratification (see Attachment F. NCCS Core File Description for a list of the variables on the core files). Although exclusion of these small organizations is a limitation in coverage, we believe the likelihood that these organizations are performing and/or funding R&D is small and the impact on the estimate of the total research expenditures will be negligible.

Another source of undercoverage is from new organizations that have not filed a Form 990, 990-EZ or 990-PF. Similarly, a source of overcoverage is organizations that are no longer in existence (e.g., out of business) at the time of the survey. However, we anticipate that these coverage errors will be small due to an increase of only 1.1% of organizations between the 2014 and 2015 core files.

### Frame Exclusions

The core files include some organizations that are not in the scope of this study, such as organizations outside the United States, churches, and government organizations. These organizations are excluded from the sampling frame based on the criteria below. Table B.1.4 presents a summary of the exclusion criteria.

**Table B.1.4: Summary of Organizations Excluded From the Frame**

	All NPOs
<b>Total Organizations on NCCS Core Files</b>	618,612
<b>Exclusions</b>	
<b>1) IRS subsection code: Exclude organizations with subsection code not equal to 3, 4, 5, or 6<sup>4</sup></b>	57,282
<b>2) Foundation code: Exclude organizations with foundation code 10=Church or 14=Government</b>	6,613
<b>3) State: Exclude organizations outside the U. S.</b>	1,321
<b>4) North American Industry Classification System (NAICS): Exclude organizations with NAICS code 92=Public Administration</b>	14
<b>5) “Out of Scope” based on NCCS Coding<sup>5</sup></b>	32

<sup>4</sup> Most exclusions were based on the following 501(c) subsection codes: 02 - Title holding corporations for a tax-exempt organization; 07- Social and recreational clubs; 08- Fraternal beneficiary societies and associations; 09 - Voluntary employees' beneficiary associations; 10 - Domestic fraternal societies; 12 - Benevolent life insurance associations, mutual ditch or irrigation companies, etc.; 13 - Cemetery companies, providing burial and incidental activities for members; 14 - State-chartered credit unions, etc.; and 19 - Post or organization of war veterans. The full list of the 501(c) subsection codes is available on the data dictionary for the NCCS Core Financial files, available at <http://nccsweb.urban.org/PubApps/showDD.php#Core%20Data>.

<sup>5</sup> NCCS assigns a “G” identifying organizations that are considered government entities and “N” identifying organizations that have a physical IRS contact address, but nearly all program operations are conducted/focused outside the U.S. A total of 33 cases had a code of N or G. One organization coded as G was retained as a hospital: Christiana Care Health Services. The remaining 32 were eliminated.

## Response Rate

One of the main objectives of this testing is to determine how to maximize response rates. Response rates will be calculated using the American Association for Public Opinion Research standard definitions.<sup>6</sup> This survey was last conducted in 1996-97 and yielded a 41% response rate. However, the 1996-97 methodology was based on a mail survey, while the current iteration is a web survey. See section B.3. for a discussion of the methods we plan to use to maximize response rates for the pilot survey.

## B.2 Statistical Methodology

### Identifying Likely Performers and Likely Funders of R&D

One of the biggest challenges with this research is the expectation that organizations performing and/or funding R&D will be rare and difficult to target. We use two strategies to increase the sampling efficiency of locating performers and funders: (1) frame truncation, and (2) stratification. Both the frame truncation and stratification use the core financial information and classification codes to identify organizations that are more likely to perform or fund research.

To identify the core financial variables related to performing and/or funding research and evaluate the impact of frame truncation, we identified a set of “likely performers” and a set of “likely funders” on the frame. The likely performers and likely funders are a subset of organizations identified from auxiliary sources that strongly indicate that they are performing or funding research. These sources identified 1,655 likely performers and 1,116 likely funders. The auxiliary sources and the process for matching to the frame are described in Attachment G. Likely Performer and Funder Sources.

Organizations not identified as a likely performer or a likely funder will be referred to as “unknown.” The unknown organizations will be a mix of those performing or funding research (but not flagged via the auxiliary sources), as well as those not conducting any R&D. Whereas, we expect nearly all of the organizations flagged as a “likely” performer and/or funder to be conducting R&D. By comparing the organizations identified as “likely” performers or funders with organizations of unknown status, we will identify characteristics associated with R&D and use this information to stratify the organizations.

Table B.2.1 presents the likely performer and likely funder organizations by form type. There were 102 organizations that were classified as both a likely performer and a likely funder. Most of these organizations (96) filed Form 990 while two filed 990-EZ, and four filed 990-PF. A large majority of the likely performers filed Form 990. However, the likely funders are split between Form 990 (60%) and Form 990-PF (39%).

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<sup>6</sup> (AAPOR, 2015) The American Association for Public Opinion Research. *2015 Standard Definitions: Final dispositions of case codes and outcome rates for surveys*. 8<sup>th</sup> edition. Oak Terrace, IL: Author.

**Table B.2.1: Likely Performers and Likely Funders by Form Type**

	All NPOs	Likely Performer	Both	Likely Funder	Likely Performer or Funder
<b>Form 990</b>	257,969	1,434	96	336	1,866
<b>Form 990-EZ</b>	199,546	75	2	7	84
<b>Form 990-PF</b>	95,835	30	4	668	702
<b>Total</b>	553,350	1,539	102	1,011	2,652
<b>Likely Performers</b>		<b>1,641</b>			
<b>Likely Funders</b>			<b>1,113</b>		

## Financial Truncation

To increase the efficiency of reaching organizations that perform or fund research, we will impose a financial threshold. Table B.2.2 presents the mean revenue, assets, and expenses for the likely performers and the likely funders, as well as those not identified as either.

**Table B.2.2: Mean Revenue, Assets, and Expenses**

		Mean
<b>Likely Performer (n=1,641)</b>	Total Revenue	\$112,281,164
	Total Assets	\$187,083,005
	Total Expenses	\$104,143,339
<b>Likely Funder (n=1,113)</b>	Total Revenue	\$53,710,685
	Total Assets	\$310,315,452
	Total Expenses	\$33,886,742
<b>Not likely performer or funder (n=550,698)</b>	Total Revenue	\$3,170,711
	Total Assets	\$6,417,830
	Total Expenses	\$2,863,612

We examined cut-offs based on revenue, assets, and expenses. For each variable, we evaluated the percentage of organizations remaining in the frame and the percentage of likely performers or funders remaining in the sample. The goal is to retain organizations that are likely to be performing or funding research, while eliminating organizations that are unlikely to be performing or funding research. Therefore, we would like the percentage of likely performers in the frame to remain high, while reducing the number of total organizations on the frame, thus increasing the density of likely performers. We ran the financial truncation separately for organizations filing Form 990-PF (private foundations) and those filing Forms 990 or 990-EZ (public charities and other exempt organizations).

## Forms 990 or 990-EZ

Table B.2.3 compares the three financial measures where the percentage of likely performers or funders is 90%, as well as 85%. Expenses and revenues perform better than assets in reducing the overall organizations, while maintaining a high percentage of likely performers. An expenses

threshold of \$260,000 or more removes 65% of the overall organizations, yet 90% of the likely performers and funders remain in the frame. An expenses threshold of \$460,000 or more removes 74% of the total organizations, while maintaining 85% of the likely performers and funders. Similarly, a revenues cut-off of \$250,000 reduces the number of overall organizations by 63% while retaining 90% of the likely performers and funders; a revenues cut-off of \$490,000 reduces the number of overall organizations by 74% while retaining 90% of the likely performers and funders.

**Table B.2.3: Financial Thresholds to Achieve 90% and 85% of Likely Performers in the Frame: Forms 990 or 990-EZ**

Financial Threshold	Likely Performers/Funders		990, 990-EZ Organizations	
	N	%	N	%
No Threshold	1,950	100%	457,515	100%
<b>90% Threshold</b>				
Total Expenses >\$260,000	1,747	90%	159,423	35%
Total Revenue > \$250,000	1,747	90%	167,423	37%
Total Assets > \$180,000	1,751	90%	208,919	46%
<b>85% Threshold</b>				
Total Expenses >\$460,000	1,650	85%	118,568	26%
Total Revenue > \$490,000	1,651	85%	118,423	26%
Total Assets > \$380,000	1,650	85%	157,183	34%

To find a balance between the density of R&D performers/funders and the coverage of R&D performers/funders, we measured the percentage decrease in organizations when increasing to threshold (t) from the previous threshold (t-1)  $\text{diff}_t = (p_{t-1} - p_t)$ , where t runs from \$10,000 to \$1 million in increments of \$10,000. Then we modeled the change as a function of the increase in t for likely performers or funders and for all organizations. If the slopes between all organizations and the likely performers and funders were significantly different at 0.05 testing level, we eliminated organizations that did not meet threshold t. We repeated this process until the slopes were no longer significantly different at 0.05 testing level. The threshold where this occurred became the final threshold.

At a threshold of \$520,000 in expenses, 84% of likely performers remain in the frame, while only 24% of all organizations remain in the frame. For thresholds beyond this point, the percentage decrease in likely performer or funder organizations is no different than the percentage decrease for all organizations. Similarly, a threshold of \$470,000 in revenues results in 85% of likely performers or funders remaining and 26% of all organizations remaining. After these points, there is no additional gain in efficiency.

Revenues and expenses perform similarly in increasing the frame efficiency. Table B.2.4 presents a cross-tab of the revenues and expenses cut-offs (both rounded to \$500,000). Only 18 likely performers/funders met the expenses threshold, but did not meet the revenues threshold. Similarly, only 27 likely performers/funders met the revenues threshold, but did not meet the expenses threshold. Given the high concordance of these two measures and the higher density of likely

performers/funders for expenses (calculated from Table B.2.4), we will use \$500,000 in expenses as the financial threshold, which includes 84% of the likely performers/funders and 24% of all organizations. The 113,297 organizations that meet these criteria represent 97% of total revenue, 98% of total expenses, and 96% of total assets.

**Table B.2.4: Comparison of Financial Thresholds: Expenses $\geq$ \$500,000 and Revenue $\geq$ \$500,000**

		Revenue $<$ \$500,000	Revenue $\geq$ \$500,000
<b>Expenses<math>&lt;</math>\$500,000</b>	<b>All organizations</b>	335,930	8,288
	<b>Likely performers/funders</b>	285	27
<b>Expenses<math>\geq</math>\$500,000</b>	<b>All organizations</b>	4,522	108,775
	<b>Likely performers/funders</b>	18	1,620

### Form 990-PF

Table B.2.5 compares the three financial measures where the percentage of likely funders is 90%, as well as 85%. Assets perform better than revenue and expenses in reducing the overall organizations while maintaining a high percentage of likely performers or funders. An assets threshold of \$1,650,000 or more removes 74% of the total organizations, while maintaining 90% of the likely funders. Similarly, a threshold of \$2,750,000 eliminates 86% of the overall organizations, while maintaining 85% of the likely performers/funders.

To determine the point where no further efficiency is gained, we measured the percentage decrease in organizations when increasing to threshold (t) from the previous threshold (t-1)  $\text{diff}_t = (p_{t-1} - p_t)$ , where t runs from \$50,000 to \$10,000,000 in increments of \$50,000. Then we modeled the change as a function of the increase in t for likely performers/funders and for all organizations. If the slopes between all organizations and the likely providers were significantly different at 0.05 testing level, we eliminated organizations that did not meet threshold t. We repeated this process until the slopes were no longer significantly different at 0.05 testing level. The threshold where this occurred became the final threshold. The point where the slopes are no longer significantly different occurs at a threshold of \$2,750,000 in total assets. After this point, the percentage of likely funder organizations removed is not significantly different from the overall organizations removed when increasing the assets threshold. This financial threshold includes 88% of the likely funders and 19% of all organizations. The 18,107 organizations that meet this threshold represent 90% of total revenue, 93% of total expenses, and 94% of total assets.

**Table B.2.5: Financial Thresholds to Achieve 90% and 85% of Likely Performers or Funders in the Frame: Form 990-PF**

Financial Threshold	Likely Funders		All organizations	
	N	%	N	%
<i>No Threshold</i>	702	100%	95,835	100%
<b>90% Threshold</b>				
Total Expenses >\$20,000	633	90%	29,662	31%
Total Revenue > \$270,000	633	90%	25,366	26%
Total Assets > \$1,650,000	632	90%	25,054	26%
<b>85% Threshold</b>				
Total Expenses >\$50,000	594	85%	17,588	18%
Total Revenue > \$310,000	596	85%	18,997	20%
Total Assets > \$3,700,000	597	85%	14,854	16%

## Stratification

After financial truncation, the frame includes 113,297 Form 990 and Form 990-EZ organizations and 18,107 Form 990-PF organizations. Table B.2.6 includes the number of organizations meeting the financial threshold by form type.

**Table B.2.6: Number of Organizations Meeting the Financial Truncation Threshold**

	All Organizations	Likely Performers/ Funders
<b>Form 990</b>	113,216	1,637
<b>Form 990-EZ</b>	81	1
<b>Form 990-PF</b>	18,107	615

To increase the sampling efficiency, we will stratify the organizations based on frame variables associated with R&D. The stratifying variables will be codes available on the frame, such as National Taxonomy of Exempt Entities (NTEE) codes (e.g., hospitals, research institutes), as well as a propensity score measuring the likelihood that the organization is performing or funding research.

The propensity score is developed from logistic regression models, with likely performer or funder as the outcome, and codes and financial characteristics from the core files as the predictor variables. The propensity scores will be used to classify organizations into density strata, where organizations with high propensity scores will be classified into the high-density stratum, and the organizations with low propensity scores will be classified into the low-density stratum. Because we expect the percentage of performers or funders in the high-density stratum to be higher than the low-density stratum, we will oversample the high-density stratum to increase the likelihood of sampling a performer or funder.

The financial fields available on the core files depend on the IRS form filed by the organization. There are 73 financial fields available for organizations filing Form 990, with a subset of 42 available for those filing Form 990-EZ. Further, the 106 financial variables for the organizations filing Form 990-PF are largely different from those filing Forms 990 or 990-EZ, although there

are 12 variable equivalents across the form types. The variables available on the core files are presented in Attachment F. NCCS Core File Description. Due to the difference in available information across the three forms, we will build two separate models, one for Form 990 organizations (public charities and other tax exempt organizations) and one for Form 990-PF organizations (private foundations). We will exclude the Form 990-EZ organizations from the frame. After the financial truncation, there were only 81 organizations that filed Form 990-EZ, including a single likely performer. Because all of the financial variables are not available from Form 990-EZ, excluding these organizations from the frame simplifies the stratification. The propensity score models are presented in Attachment G. Propensity Models for Performer and Funder Stratification.

As described in the following sections, the propensity score strata will be combined with other stratifiers to form the final stratification (see Table B.2.7).

**Table B.2.7: Final Stratification for the Pilot**

Strata	Substrata
1. Likely performers or funders	a. Both a likely performer and funder b. Likely performer, not likely funder c. Likely funder, not likely performer
2. Hospitals (NTEE = E2 )	
3. Research organizations <sup>7</sup>	
4. Form 990 organizations	a. High density (top decile of propensity scores) b. Medium density (deciles 8, 9) c. Low density (deciles 1–7)
5. Form 990-PF organizations	a. High density (top decile of propensity scores) b. Medium density (deciles 7–9) c. Low density (deciles 1–6)

## Density Stratification

Using the propensity scores resulting from the final models, we classify organizations into three strata for Forms 990 and 900-PF: 1) high, 2) medium, and 3) low density. The stratification is based on the deciles with high density representing the organizations with the highest propensity scores. Our recommended density stratification is below. As seen in Table B.2.8, the highest stratum for Form 990 includes 67% of the likely performers and 75% of the likely funders; the medium density stratum represents nearly 20% of likely performers and 15% of likely funders. The Form 990-PF model results in 46% of likely funders in the highest high stratum and 34% in the medium stratum. Although there are few likely performer organizations, most fall in the high stratum.

<sup>7</sup> Research organizations are defined as 1) NTEE major group = H-Health - Disease Specific (research) or U-Science and Technology; 2) Common Code = 05-Research Institutes and/or Public Policy Analysis; and 3) Non-Private Foundation Reason Code = 05-Medical Research.

**Table B.2.8: Deciles for the Likely Performer and Funder Models**

Form		Decile	Total Orgs	Likely Performer or Funder		Likely Performers		Likely Funders	
				n	%	n	%	n	%
990	High	10	10,922	1028	9.4%	818	7.5%	289	2.6%
		Medium	9	10,923	175	1.6%	141	1.3%	41
	8		10,923	108	1.0%	90	0.8%	20	0.2%
	Low	7	10,923	66	0.6%	58	0.5%	9	0.1%
		6	10,923	51	0.5%	39	0.4%	15	0.1%
		5	10,923	43	0.4%	38	0.3%	5	0.0%
		4	10,923	22	0.2%	18	0.2%	4	0.0%
		3	10,923	16	0.1%	15	0.1%	1	0.0%
		2	10,921	6	0.1%	6	0.1%	0	0.0%
		1	11,494	11	0.1%	6	0.1%	5	0.0%
990-PF	High	10	1,809	271	13.6%	12	0.6%	263	13.3%
		Medium	9	1,810	108	4.8%	2	0.1%	106
	8		1,810	49	2.9%	2	0.1%	47	2.8%
	7		1,809	58	2.4%	0	0.0%	58	2.4%
	Low	6	1,810	38	1.6%	2	0.1%	36	1.5%
		5	1,810	33	1.7%	1	0.0%	32	1.6%
		4	1,809	18	0.9%	0	0.0%	18	0.9%
		3	1,810	18	0.9%	1	0.0%	17	0.8%
		2	1,810	19	0.7%	0	0.0%	19	0.7%
		1	1,810	3	0.2%	1	0.0%	2	0.2%

### Final Stratification

The final stratification will be based on classification codes available on the core files, the propensity score, and the likely performer and likely funder flags. The likely performer and likely funder flags have been used to evaluate classification codes and financial variables highly associated with research performance and funding.

As shown in Table B.2.9, a number of classification codes on the core files are strong predictors of likely performer or funder. Because of the high percentage of likely performers and funders found in these four categories of organizations, we will stratify these organizations into a “Research organization” stratum. We will then stratify all other organizations on the basis of the density stratum described below in Table B.2.10.

**Table B.2.9: Classification Codes Identifying Research Organizations**

Code	Value	Total Orgs	Likely Performers or Funder	Likely Perform %	Likely Fund %
<b>NTEE major group</b>	H-Health-Disease Specific (research)	846	194	16.5%	7.9%
	U-Science and Technology	826	196	22.0%	4.4%
<b>Common Code</b>	05-Research Institutes and/or Public Policy Analysis	897	103	10.5%	2.0%
<b>Non-Private Foundation Reason Code</b>	05-Medical Research	183	62	33.9%	2.2%

**Table B.2.10: Stratification for Pilot Survey**

Organization Stratum	Density Stratum	Total Orgs	Likely Performers or Funder	Likely Perform %	Likely Fund %
<b>Hospitals</b>	All	3,428	111	3.1%	0.2%
<b>Research organizations</b>	All	2,565	491	16.1%	4.7%
<b>Other 990 Organizations</b>	High	8,765	558	4.7%	2.1%
	Medium	21,635	275	1.0%	0.3%
	Low	76,947	215	0.2%	0.1%
<b>Other 990-PF Organizations</b>	High	1,758	262	0.5%	14.6%
	Medium	5,394	211	0.0%	3.9%
	Low	10,831	129	0.0%	1.1%

## Sample Allocation

The pilot study has two primary sampling objectives. First, obtain 200 survey responses from performers and 200 from funders. Second, allocate sufficient sample size to each stratum to estimate the incidence of performers and funders by stratum to optimize the sample allocation for the full study. On the basis of these two sampling objectives, we established two criteria:

- 1) Obtain 200 performer surveys and 200 funder surveys
- 2) Minimum sample sizes of 180 returned surveys for each density stratum and for research organizations

In order to limit respondent burden on this pilot study, but still achieve a spectrum of responses from nonprofit organizations, the maximum sample size that could be selected was constrained to 4,000 total organizations. For clarity, we will use the following terminology in describing the sample allocation:

- 1) Selected sample—organizations selected from the sampling frame
- 2) Survey responses—survey responses from an organization that may or may not be a performer or funder

- 3) Performer/funder surveys— survey responses from an organization that identifies as a performer or funders

To determine the sample allocation for the pilot, we made some assumptions about the percentage of performers and funders in each stratum. We assumed high incidence for the organizations flagged as likely performers or funders; moderate incidence for those identified as research institutes and those in the high-density stratum; and low incidence for those in the medium- and low-density strata. On the basis of the assumed incidence of performers and funders, we estimated the stratum population sizes for performers (P) and funders (F). The incidence assumptions and estimated population sizes are presented in Table B.2.11.

We also used the assumed incidence to estimate the relative cost per performer/funder survey in each stratum (C). All costs are scaled to the expected performer/funder surveys in the Likely Performer and Funder stratum. In this stratum, we expect 1.5 performer/funder surveys per every survey response (note that we allow an organization that funds and performs research to count toward the performer and funder sample size). In the Likely Performer stratum, we expect 0.75 performer/funder surveys per survey response. Therefore, the cost ratio is 2:1. The cost ratios per stratum are presented in Table B.2.11.

**Table B.2.11: Pilot Stratification and Sample Allocation Assumptions**

Stratum		Total on Frame (N)	Assumed Performer %	Assumed Fund %	Total Performers (P)	Total Funders (F)	Relative Cost (C)
<b>Likely funders and performers</b>		99	75.0%	75.0%	74	74	1.0
<b>Likely performers (not funders)</b>		1,257	75.0%	0.0%	943	0	2.0
<b>Likely funders (not performers)</b>		896	0.0%	75.0%	0	672	2.0
<b>Hospitals</b>		3,317	3.0%	0.0%	100	0	50.0
<b>Research organizations</b>		2,074	20.0%	5.0%	415	104	6.0
<b>Form 990 Organizations</b>	High	8,207	7.5%	2.5%	616	205	15.0
	Medium	21,360	1.5%	0.5%	320	107	75.0
	Low	76,732	0.3%	0.3%	230	230	250.0
<b>Form 990-PF Organizations</b>	High	1,496	0.5%	20.0%	7	299	7.3
	Medium	5,183	0.0%	5.0%	0	259	30.0
	Low	10,702	0.0%	1.5%	0	161	100.0
<b>Total</b>		<b>131,323</b>			<b>2,705</b>	<b>2,111</b>	

On the basis of the relative cost per performer/funder survey and the estimated performer and funder population sizes, we allocated the sample to strata in three steps.

First, we optimally allocated the sample to the strata based on a combined measure of performers and funders. We weighted funders by a factor of 1.5 because fewer of them are in the frame. We allocated the sample to the strata to obtain a total of 370 performer/funder surveys. Based on our assumptions, we expect this to result in approximately 200 performers and 200 funders (30 of which do both).

The number of completed interviews allocated to stratum h is:

$$n_h = 370 \times (P_h + 1.5 \times F_h) / \sqrt{C_h} / \sum_h (P_h + 1.5 \times F_h) / \sqrt{C_h}$$

Second, we calculated the sample size required to obtain the number of completed interviews based on the assumed performer and funder incidences in each stratum and a response rate of 65%. Although we strive to maximize response to the survey (refer to B.3), we used a conservative response rate of 65% for planning the sample for the pilot survey. Because this is a new data collection, one of the objectives of this pilot survey is to measure stratum incidences and response rates. Using a conservative response rate increases the probability achieving or exceeding the sample size goals.

Finally, we adjusted the sample sizes to provide smaller strata with additional sample to measure the percentage of performers and funders. For the Research Organization stratum and the high-density 990-PF stratum, we increased the sample size to target 180 survey responses. To counterbalance the increase in these strata, we reduced the sample size in the likely performer and likely funder strata. We also decreased the sample size for the Form 990 Organizations, low- and medium- density strata to obtain 400 completed surveys. The number of organizations in these strata is large, but the expected percentage of performers and funders is low. Reducing the sample size allows us to measure response rate and incidence, yet not consume resources where the yield of funders and performers is expected to be low. Table B.2.12 presents the sample allocation.

**Table B.2.12: Optimal Allocation and Expected Number of Performer/Funder Surveys**

Stratum	Optimal Performer/Funder Allocation (nh)	Sample Selection			Survey Responses		
		Optimal	Adjustment	Total	Total	Performer	Funder
Likely funders and performers	30	60		60	40	30	30
Likely performers (not funders)	105	210	-10	200	130	100	-
Likely funders (not performers)	110	225	-25	200	130	-	100
Hospitals	2	115		115	75	2	-
Research organizations	35	220	60	280	180	35	9
Form 990 Organizations	High	35	560	560	365	25	9
	Medium	9	655	615	400	6	2
	Low	5	1,435	615	400	1	1
Form 990-PF Organizations	High	25	195	280	180	1	35
	Medium	10	335	335	220	-	10
	Low	4	380	380	245	-	4
<b>Total</b>	<b>370</b>	<b>4,390</b>	<b>-750</b>	<b>3,640</b>	<b>2,365</b>	<b>200</b>	<b>200</b>

Notes:

- 1) Selected sample—organizations selected from the sampling frame
- 2) Survey responses—survey responses from an organization that may or may not be a performer or funder
- 3) Performer/funder surveys— survey responses from an organization that identifies as a performer or funders

## Sample Selection

The sample will be a systematic (1-in-k) random sample of organizations within each stratum. Organizations will be selected with equal probability. The organizations will be implicitly stratified by size before selecting the systematic sample to ensure the sample is proportionally distributed by size. The organizations in each strata will be sorted by total expenditures for all strata.

## Estimation

### Weighting

Estimates from the NPRA Pilot Survey will be weighted to be representative of nonprofit organizations in scope for the survey. These weights will apply to all estimates derived from the survey data, such as total expenditures on R&D. The weighting process will begin with the computation of sampling weights for all selected organizations. The sampling weight is calculated as the number of organizations in the frame ( $N_h$ ) divided by the number of organizations selected ( $m_h$ ) in stratum  $h$ , or the reciprocal of the probability of selection,  $W1 = N_h/m_h$ . The base weight corrects for differential sampling rates for the strata.

We will then adjust for non-response within each stratum. The stratum non-response adjustment will be a ratio adjustment where the respondents ( $r$ ) will be weighted to account for the non-respondents ( $nr$ ). The base weight is used to calculate the adjustment factor,

$f1 = (\sum_{r+nr} W1) / (\sum_r W1)$ . The base weight is adjusted by the non-response factor,  $W2 = W1 * f1$ .

We will do a second non-response adjustment to increase the sample representativeness relative to the data on the frame (i.e., classification codes and financial variables). This will be based on a propensity score adjustment. For this adjustment, first, we build a logistic regression model with survey response as the outcome (1=respond, 0=no response). The outcome will be modeled based on the frame data. Respondents and non-respondents will be grouped into quintiles on the basis of their response propensity score. Within each quintile, the respondents ( $r$ ) will be weighted to account for the non-respondents ( $nr$ ),  $f2 = (\sum_{r+nr} W2) / (\sum_r W2)$ . The non-response adjusted weight is  $W3 = W2 * f2$ . The non-response adjustment will be conducted for Form 990 and Form 990-PF separately.

Finally, the weights will be poststratified and ratio adjusted to match the total number of nonprofit organizations on the frame. NTEE codes will be the primary poststratification variable. With this approach, the adjustments will ensure that the analysis weights sum to known frame population totals by NTEE code.

### Estimators

We will use the pilot data to evaluate estimators of research expenditures. The estimators will build off the weighted estimate of the total using the final weights from above.

Let

$i = 1 \dots n$  represents the sample of responding organizations

$W_i$  = Final weight

$y_i$  = Research expenditures from survey response

$x_i$  = Auxiliary variable available on the frame (e.g., total expenditures)

An estimate of the total research expenditures is expressed as  $\hat{Y} = \sum_{i=1}^n W_i \cdot y_i$ . Building on this, we will compute a ratio estimator,  $\hat{Y}_R = (\hat{Y}/\hat{X}) \cdot X$ , where  $\hat{X}$  is the weighted total of the auxiliary variable for the sample of organizations and  $X$  is the frame total of the auxiliary variable. Similarly, we will compute a regression estimator,  $\hat{Y}_{LR} = \hat{Y} + b(X - \hat{X})$ , where  $b = cov(x, y)/var(x)$ . We will examine these estimates based on the variance, bias, and mean squared error.

### Variance estimation

We will use successive difference replication (SDR) (Fay, Train, 1995), a replication variance method based on a variance estimator for systematic samples presented by Wolter (1985):

$$v_2 = (1 - f)/(2n(n - 1)) \sum_{j=2}^n (y_j - y_{j-1})^2$$

SDR will result in  $R$  sample replicates where each organization is weighted by a replicate factor of 1, 1.7, or 0.3. For each sample replicate, we will construct replicate weights as described above. The variance estimate for survey estimate (e.g., total research expenditures) is  $\hat{v} = (4/R) \sum_{r=1}^R (\hat{Y}_r - \hat{Y})^2$ , where  $\hat{Y}_r$  is the estimate based on replicate  $r$ .

### ***B.3 Methods to Maximize Response Rates and to Deal with Issues of Non-response***

The methodology includes features that promote increased response to surveys, including multiple contact attempts and personalized communications, the two features most effective in increasing response rates (Cook, Heath, Thompson, 2000). In addition, the methodology includes multiple modes of contact (e-mail, mail, telephone); tailoring and varying the message of contact attempts; short and to-the-point communications; clear and detailed instructions for responding to the survey; and easy survey access for multiple respondents within the organization. These features are all associated with increased response rates (Dillman, Smyth, Christian, 2008).

The initial contact for the selected nonprofit organizations will be a personalized prenotification letter sent to the head of the organization. This initial correspondence allows respondents to take immediate action by going to the survey URL and entering their organization's unique identification number without having to wait for additional communication from NSF. This immediate call to action may improve initial response and overall organizational engagement.

For authenticity of the study, the letter will be on National Science Foundation letterhead and signed by the Director of the National Center for Science and Engineering Statistics. Enclosed in the letter will be an information sheet with definitions that describe the types of information we

will be asking, as well as examples of persons in the organization who might assist with the completion of the instrument (e.g., finance department, research department).

A survey invitation will be sent by e-mail approximately 1 week after the prenotification letter. The invitation will contain a unique login for the organization. The primary contact will be able to create his or her username and password for easy access to the survey. In addition, the organization can create unique logins for an additional two (total of three per organization) people in the organization to facilitate the data collection from multiple staffers. The invitation assures the respondent that the information will be protected on a secured system.

We will send multiple reminders by mail and e-mail. Each reminder will contain a link and instructions for accessing the survey. To maximize response, each reminder will have a slightly different appeal to the respondent to participate. The first reminder will be by e-mail with a version for non-responders and a second version for those who have started, but not completed the survey. The focus of both of these reminders is that we “need your help.” The second reminder will be a postcard sent by mail. The postcard will be the picture of a calendar with the deadline date highlighted, appealing to respondents that time is running out. The third reminder will be an e-mail with a version to non-responders and a version to those who have started, but not completed the survey. The appeal to the non-responders is that we are trying to “offer you the opportunity to participate.” The appeal for those who have started, but not completed the survey is to thank them for the help so far and request that they complete it by the deadline. The final reminder will be by e-mail focusing on the pending deadline and the importance of the information “to develop comprehensive statistics on research expenditures in the U.S.” The last reminder will also bear the signature of the NSF project officer in an effort to add to the urgency and authenticity of the request.

After the initial deadline, NSF and its contractor, ICF International, will examine the performance of the sample strata. This phase will include multiple contact attempts by telephone and e-mail. The first follow-up attempt is by telephone, requesting both organizations that have partially completed and those that have not responded to log in and complete the web survey. Project staff will use a five-attempt protocol to reach each of these organizations, leaving a voice mail message on the second or third attempt. That telephone call will be followed by an e-mail signed by the NSF project officer with a link and instructions for accessing the survey. A third and final follow-up attempt will be made by telephone, using the same five-attempt protocol.

### **Nonresponse Adjustment**

To mitigate the risk of non-response bias, we will develop weighting adjustments to increase the sample representativeness relative to the data on the frame. The information on the frame includes classification codes (e.g., NAICS and NTEE) and financial variables (e.g., total expenses and revenues). As part of the non-response adjustments, we will conduct an analysis of frame variables that are related to non-response. This analysis will be based on response propensity scores using a logistic regression model with survey response as the outcome (1=respond, 0=no response). The outcome will be modeled based on the frame data. This analysis provides an evaluation of representativeness based on the frame data, which will be quantified in the form of an R-indicator

as described by Schouten et al (2009). The R-indicator measures the variability of the propensity scores ( $p$ ),  $R = 1 - 2S(p)$ . Values close to 0 indicates weak representativeness and values close to 1 indicate strong representativeness, relative to the independent variables used in the model.

## **Debriefing Interviews**

After the data collection period is over, we will conduct 40 debriefing interviews. Twenty of these interviews will be conducted with organizations that have completed the questionnaire and focus on the survey content and process. The other 20 interviews will be conducted with organizations that chose not to respond. These non-respondent interviews will examine why the decision was made not to respond. Specific issues that will be covered are general attitudes toward the survey; whether the organization received the contacts, and, if not, which modes did they not receive; whether the contacts were sent to the right person; and the frequency of attempts. Information from the debriefing interviews will be used to refine the data collection strategy for the main survey.

### ***B.4. Tests of Procedures and Methods***

The purpose of the pilot study is to evaluate the planned procedures for the main survey. No additional methodological tests are planned for the pilot.

### ***B.5. Individuals Consulted on Technical and Statistical Aspects of Design***

The NPRA Survey will be conducted by NSF's National Center for Science and Engineering Statistics. ICF International is the contractor in charge of data collection. The name, title, affiliation, and telephone numbers for those consulting on the project are below.

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## Bibliography

- Cochran, WG. 1977. *Sampling Techniques*. New York: John Wiley & Sons.
- Cook C, Heath F, Thompson R. 2000. A Meta-Analysis of Response Rates in Web- or Internet-Based Surveys. *Educational and Psychological Measurement*, 821–836.
- Dillman DA, Smyth, JD, Christian, LM. 2008. *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. Hoboken, New Jersey: John Wiley & Sons.
- Fay RE, Train GF. 1995. Aspects of survey and model-based postcensal estimation of income and poverty characteristics for states and counties. *Proceedings of the Section on Government Statistics*, pp. 154–159. American Statistical Association.
- Pettijohn SL. 2013. *The nonprofit sector in brief: Public charities, giving, and volunteering*, 2013. Available at <http://www.urban.org/research/publication/nonprofit-sector-brief-public-charities-giving-and-volunteering-2013>.
- Salamon LM. 2015. A profile of the nonprofit sector in the United States. In National Research Council (C. House, H. Rhodes, & E. Sinha, *Rapporteurs*, Committee on National Statistics, Division of Behavioral and Social Sciences and Education). *Measuring Research and Development Expenditures in the U.S. Nonprofit Sector: Conceptual and Design Issues, Summary of a Workshop*, pp. 9–26. Washington, DC: The National Academies Press.
- Schouten B, Cobben F, Bethlehem J. 2009. Indicators for the representativeness of survey response. *Survey Methodology*, 101–113.
- Wolter KM. 1985. *Introduction to Variance Estimation*. New York: Springer-Verlag.

## Attachments

- A. 2016 Pilot Survey of Nonprofit Research Activities
- B. Pilot Survey Correspondence
  - Contact 1: Prenotification Letter with 1-Page Handout [Mailing]
  - Contact 2a: Invitation [E-mail] High Likelihood
  - Contact 2b: Invitation [E-mail] Moderate/Low Likelihood
  - Contact 3a: Reminder 1 [E-mail] Follow-up/Non-responders
  - Contact 3b: Reminder [E-mail] Reminder to Complete
  - Contact 4: Reminder 2 [Mailing]
  - Contact 5a: Reminder 3 [E-mail] Non-responders
  - Contact 5b: Reminder 3 [E-mail] Reminder to Complete
  - Contact 6: Final Reminder 4 [E-mail]
  - Contact 7a: Incomplete Follow-up 1 [Telephone]
  - Contact 7b: Non-response Follow-up 1 [Telephone]
  - Contact 8: Follow-up 2 [E-mail]
  - Contact 9: Final Follow-up 3 [Telephone]
  - Contact 10: Follow-up 4 [E-mail]
  - Contact 11: Follow-up 5 [Telephone]
  - Contact 12: Final Follow-up 6 [E-mail]
  - Contact 13: Submittal Acknowledgement [E-mail]
  - Contact 14: Thank you [Letter]
- C. Comment Letter from Andrew Reamer, George Washington University
- D. Debriefing Interview Protocols
  - Protocol for Debriefing Interview with Respondents
  - Protocol for Debriefing Interview with Non-respondents
- E. Debriefing Interview Correspondence
  - Contact 1a: E-mail to NPRA Respondent
  - Contact 1b: E-mail to NPRA Non-respondent
  - Contact 2a: NPRA Debriefing Interview with Respondents Recruitment Script
  - Contact 2b: NPRA Debriefing Interview with Non-respondents Recruitment Script
  - Contact 3a: Respondents Confirmation Letter
  - Contact 3b: Non-respondents Confirmation Letter
  - Contact 4a: Respondent Electronic Meeting Invitation
  - Contact 4b: Non-respondent Electronic Meeting Invitation
  - Contact 5: Thank you letter on NSF Letterhead
- F. NCCS Core File Description
  - Variables – Private Charities and Other
  - Financial Means – Private Charities and Other
  - Variables – Private Foundations
  - Financial Means – Private Foundations
- G. Likely Performers and Funder Sources
- H. Propensity Models for Performer and Funder Stratification