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# *Using Probability vs. Nonprobability Sampling to Identify Hard-to-Access Participants for Health-Related Research: Costs and Contrasts*

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This article compares the recruitment costs and participant characteristics associated with the use of probability and nonprobability sampling strategies in a longitudinal study of older hemodialysis patients and their spouses. Contrasts were made of people who accrued to the study based on probability and nonprobability sampling strategies. Probability-based sampling was more time-efficient and cost-effective than nonprobability sampling. There were no significant differences between the respondents

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identified through probability and nonprobability sampling on age, gender, years married, education, work status, and professional job status. Respondents from the probability sample were more likely to be Protestant and less likely to be Catholic than those from the nonprobability sample. Respondents from the probability sample were more likely to be Black, whereas those from the nonprobability sample were more likely to be White. There are strengths and shortcomings associated with both nonprobability and probability sampling. Researchers need to consider representativeness and external validity issues when designing sampling and related recruitment plans for health-related research.

**Keywords:** *sampling; patient selection; recruitment strategies; hemodialysis*

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*Accrual of participants* into gerontological research studies often accounts for a substantial portion of project time and budgets (Ory et al., 2002). Moreover, generalizability of study results depends in large part on the methods chosen to sample the target population. Yet, typical descriptions of sampling strategies are limited and do not enable replication or judgment of the extent to which study findings are generalizable (Levkoff, Prohaska, Weitzman, & Ory, 2000). When the research topic is sensitive in nature, the research design is a longitudinal survey, and the target population is narrowly defined, the challenge for researchers is to make sampling decisions wisely so that scientific rigor is maintained despite significant barriers and finite resources. This article contrasts the costs and outcomes of probability and nonprobability sampling strategies as experienced in a study of patients with end stage renal disease (ESRD) and their spouses.

The essential characteristic of probability sampling is that the likelihood that each person would be included in the sample can be specified. In the simplest case, each member of the population has the same probability of being included, although this is not a necessary condition (Seltiz, Wrightsman, & Cook, 1976). It is only with probability sampling that representative sampling plans are possible because only probability sampling includes random selection at some point in the process. It is this reliance on random methods of sample selection that provides protection against selection bias and that enables calculation of a probability for each element in the population (Pedhazur & Schmelkin, 1991). In spite of its appeal, random sampling is not often

used in social science research. From a practical perspective, the task of selecting a random sample from a list can be extremely tedious and time consuming. Lists of population members are often difficult, if not impossible to identify. Additional constraints arise when the population of interest is geographically dispersed and the research requires a personal interaction between respondents and the research team (Pedhazur & Schmelkin, 1991).

Nonprobability sampling is a catch-all term referring both to samples of convenience (e.g., accessible, volunteer) as well as to more purposive methods of selection (e.g., judgment sampling, quota sampling). These methods account for the overwhelming majority of social gerontological research. Although considerations of feasibility and economic constraints often make nonprobability sampling methods optimal (e.g., when the goal is to recruit a sample with a relatively low prevalence rate in the general population), their parameters as well as their limitations are critical to understand (Pedhazur & Schmelkin, 1991). With nonprobability sampling there is no way of estimating the probability that each element has of being included in the sample, and no assurance that every element has some chance of being included. Moreover, nonprobability sampling makes it impossible to estimate sampling errors, thereby limiting the extent to which valid inferences to a population can be made (Seltiz et al., 1976).

Research indicates that there is no single best strategy for recruiting older persons to health-related research studies (Ory et al., 2002). Reported outcomes vary widely, depending on the nature of the study, where it was conducted, the selection criteria, and the barriers and facilitators unique to each situation. Most health-related recruitment studies have described using a combination of methods (e.g., medical record reviews, media campaigns, mass mailings, community outreach efforts, telephone contacts, and reliance on referrals), focusing resources on those methods that proved to be most efficient and effective (e.g., Adams, Silverman, Musa, & Peele, 1997; Patrick, Pruchno, & Rose, 1998; Ory et al., 2002).

Probability and nonprobability sampling are associated with different recruitment strategies. These different recruitment strategies derive from the fact that with a probability sample the universe of elements or the population can be identified, whereas with a nonprobability sample, it cannot. Although nonprobability sampling is often associated

with community outreach efforts such as advertising, reliance on referrals, and media advertisements, probability sampling is more often associated with letters or phone calls targeting a specific person with an invitation to participate. Individual cases can be selected using simple random sampling, such as when individual cases are selected using a list of random numbers. They can also be selected after dividing the population into meaningful strata. In this case, a simple random sample is taken from each stratum, and the subsamples are joined to form the total sample.

This article describes and compares two approaches to accruing a sample for a longitudinal study with a narrowly defined population. A longitudinal study of patients with ESRD and their spouses provides the backdrop to the analyses that follow. The opportunity to contrast probability and nonprobability sampling derived from events unfolding during the course of attempting to identify a sample of older people with ESRD and their spouses who would participate in a longitudinal study. The initial sampling approach relied on nonprobability sampling and employed a variety of recruitment strategies. The second strategy, undertaken later in the course of the study when direct access to the population became available, involved the use of a probability-based stratified random sample using a two-staged mailing as recruitment strategy. Participation rates, demographics, recruitment strategies, time, and costs associated with the two different sampling approaches are contrasted.

### *Methods*

This goal of the study was to identify a sample of 275 patients with ESRD and their spouses for a longitudinal study of (a) the end-of-life treatment preferences held by hemodialysis patients and their spouses, (b) whether and how these preferences changed over time, and (c) the effects of these preferences and the extent of their implementation near the end of the patient's life on the bereaved spouse's sense of burden, grief response, and mental health. Inclusion criteria stipulated that patients be at least 55 years old, be currently receiving hemodialysis for ESRD with a cumulative treatment length of at least 6 months, and be currently married or partnered and coresiding for

at least 5 years. Both patients and their spouses or partners needed to be cognitively intact, English-speaking, able to speak and hear well enough to engage in individual telephone interviews, and both patient and spouse had to agree to participate in the study. Data collection required up to four annual structured individual interviews, each lasting about 90 minutes. Interview content included questions about health and function, preferences for treatment if the patient's health should change in the future, quality of life, values and beliefs, and personal relationships.

### *RECRUITMENT ACTIVITIES*

#### *Nonprobability Sample*

The original plan for this study called for a nonprobability sample and was limited to the hemodialysis population located in eastern Massachusetts and Rhode Island. Recruitment strategies included contacting local dialysis centers; purchasing paid newspaper advertisements; developing newsletter articles, press releases, and targeted mailings; canvassing the community; and following up on snowball referrals. The geographic scope of the nonprobability sample was expanded to a national level 8 months after recruitment began when it became evident that the number of local couples who were both eligible and interested in participating would fall short of enabling identification of the targeted number of couples.

*Dialysis center collaboration.* This strategy offered the most targeted approach to reaching the desired population. Because patient privacy policies did not permit direct access of nonemployees to patients in dialysis centers, permission was obtained from the appropriate executives of two national dialysis companies—as well as from medical directors and administrators at each of 43 dialysis center affiliates in the greater Boston area—to make study information available to patients. Because physicians' workloads precluded their involvement, renal social workers or nurse managers were designated by the facilities to serve as intermediaries. Garnering their help and support despite their own workloads was a time-consuming but essential step.

Virtually all agreed to provide study brochures to eligible patients or spouses, and some publicized the study in newsletters and placed brochures in waiting rooms. Couples interested in learning more about the study were advised to contact the study office.

*Newspaper advertisements.* A total of 50 newspaper ads were placed between May and December of 2001. Venues included large daily and smaller weekly community papers as well as shoppers' circulars. The largest set of ads was a one-time mailing to 24 community newspapers in the greater Boston area with a combined circulation of 410,000. The most frequently used paper was the largest Boston daily that ran a weekly medical research volunteer section. Because of their high cost, all ads were small, boxed notices in large print, with content limited to identification of the target population, the use of interviews, study sponsor, and contact information.

*Press releases.* Two press releases, each sent to more than 2,800 newspapers throughout the country, were distributed, the first in February 2002 and second in June 2002. These notices contained the same information listed in the study brochure, which described the purpose of the study, the interview content and process, eligibility criteria, potential risks and benefits, identification of study sponsor and investigators, and contact information.

*Newsletters.* Several renal patient support group newsletters and Web sites featured stories about the study, as did several publications designed for health care professionals. A local university-sponsored directory of research opportunities for ethnically diverse elder volunteers also listed the study. All provided information contained in the study brochure.

*Targeted mailings.* Informational mailings, consisting of a cover letter and study brochures, were used to reach groups who were likely to have contact with patients or spouses, and who might share information about the study with them. Locally, mailings were sent to non-emergency patient transportation services ( $n = 58$ ), visiting nurse associations ( $n = 74$ ), home health agencies ( $n = 191$ ), assisted living and retirement communities ( $n = 154$ ), and faith-based congregations ( $n = 2,280$ ). Following ethics board approval by the state's Executive

Office of Elder Affairs, study information was also distributed to the Massachusetts Councils on Aging ( $n = 340$ ), area agencies on aging ( $n = 30$ ), and senior centers ( $n = 50$ ). Nationally, an informational mailing was sent to the patient services coordinators at each of the 18 ESRD networks. These regional organizations are contracted by the Centers for Medicare and Medicaid Services (CMS) to monitor the quality of ESRD care within designated geographic areas and to coordinate communication among the federal government, care providers, and patients. Several of these coordinators publicized the study by printing brochure content in newsletters or provided dialysis center contact information for brochure mailings.

*Community canvassing.* For reasons similar to the use of targeted mailings, approximately 500 study brochures were posted on local community bulletin boards found in libraries, pharmacies, supermarkets, and health centers in ethnically diverse Boston neighborhoods and surrounding communities.

*Snowball referrals.* All study participants ( $N = 630$ ) were asked at the end of the baseline interview if they knew of anyone else who met the study's inclusion criteria who might also be interested in volunteering.

#### *Probability Sample*

Ten months after nonprobability sampling and recruitment activities began, the researchers learned of the possibility of collaborating with CMS to access contact information for a random sample of hemodialysis patients from the U.S. Renal Data System (USRDS). The USRDS tracks all ESRD patients in the United States in conjunction with Medicare's ESRD program. Study staff worked with Research Data Assistance Center to apply for access. Research Data Assistance Center is a consortium of research experts from several universities that assists researchers with applying for access and using Medicare and Medicaid data sets. Permission was granted for a one-time only, two-stage informational mailing that invited couples to contact the project's recruitment office if interested (an opt-in approach). USRDS released the names and mailing addresses of



37,000 patients, aged 55 and older, who had been on hemodialysis for at least 6 months. African Americans, who are disproportionately represented in the ESRD population, were purposely oversampled because of expected lower eligibility and response rates. They accounted for 50% of the listed sample.

The sample is best characterized as a stratified random sample. It was developed from a population of 94,874 eligible patients by first separating into Black ( $n = 35,598$ , or 37.5%) and non-Black ( $n = 59,276$ , or 62.5%) racial groups. Within each of these groups, a random number generator function was used to assign a random number to each patient. The two groups were sorted by the assigned random number and then the first 18,500 patients from each group were selected for the sample. Contrasts of the selected and nonselected persons indicate that the distributions for all eligible Black patients were very close to those for the sample Black patients. Similarly, the distributions for all eligible non-Black patients resembled those for the sample of non-Black patients. The USRDS list was checked against the list of those who contacted the study through strategies used to recruit the nonprobability sample to ensure that no patient already known to the study received a mailing.

To manage the mailings efficiently and respond to inquiries promptly, the sample was divided into seven groups, with the first five groups containing 5,000 names each, and the past two comprised of 6,000 names each. Mailings were handled by a subcontracted mailing house, and sent approximately monthly between July 2002 and April 2003, except for November and December, which were skipped because of historically low response rates during the holiday season. Each group's known racial composition was 50% Black. Except for the first group's mailing, which was inadvertently sent first class (and was incidentally noted to produce twice the number of responses as subsequent mailings), all others were sent bulk rate as a cost-saving measure. The first part of the mailing was a required beneficiary notification letter, signed by the CMS privacy officer, that advised patients of the study and of CMS's cooperation in providing the investigators with a list of potential participants and that they would be receiving written information about the study from the investigators. It assured them that there was no obligation to respond and that their privacy rights were protected. The study

brochure with cover letter followed about 2 weeks later. Those interested could contact the study by return postcard or calling the toll-free number. In accordance with CMS requirements, no further patient contact was initiated except to respond to their inquiries.

#### *FINANCIAL COSTS OF RECRUITMENT*

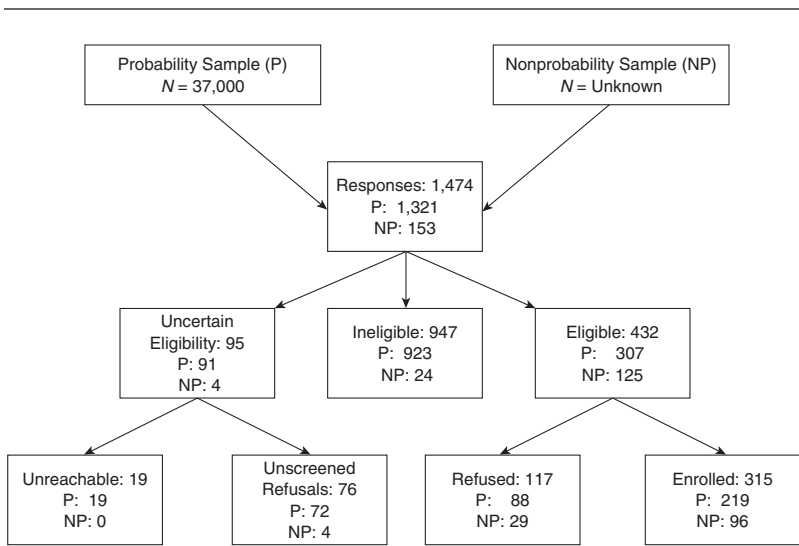
The USRDS charged a time-based fee for randomization, data compilation, and statistical information. The mailing house charge for the CMS mailings included stuffing envelopes, printing and affixing address labels, sorting, and postage. A separate *postage* expenses category reflects the cost of mailing consent forms to and from interested respondents. Printing costs included the expense of printing all stationary and copies of the study brochure as well as cover letters for the CMS mailings. The cost of targeted mass mailings was calculated separately and included cover letters, envelopes, and postage. Advertising expenses covered all newspaper ads. Telephone charges were for phone cards used to contact cooperating agencies as well as interested couples.

The cost of salary and benefits included a full-time recruitment manager, 20% of the project director's time for the first 16 months of recruitment, and hourly wages for five temporary, nonbenefited, part-time recruitment assistants hired to help with timely responses to inquiries generated by the CMS mailings. Work covered by salary included recruitment planning, design of recruitment materials, personal or phone contacts with all cooperating agencies, responses to all inquiries from interested couples, preparation of all in-house mailings, training and supervision of recruitment staff, recruitment database management, and production of weekly reports for staff meetings.

### *Results*

#### *COMPARISON OF RESPONSE RATES AND STUDY ENROLLMENT*

Figure 1 compares the response rates generated from recruitment efforts with the nonprobability sample with those from the probability sampling frame. A total of 1,474 responses from all sources were received. The mailing to the probability sample yielded 1,321 inquiries, reflecting a response rate of 3.57% (with the denominator being 37,000



**Figure 1.** Responses received from the probability sample (P) and the nonprobability sample (NP).

mailings), whereas the recruitment strategies for the nonprobability sample yielded 153 inquiries. Because it is not possible to determine how many patients were actually reached through the use of recruitment strategies for the nonprobability sample, a response rate for this group is not calculable.

Of those who responded, 64.3% ( $n = 947$ ) were ineligible, representing 69.9% ( $n = 923$ ) of persons responding from the probability sample and 15.7% ( $n = 24$ ) of those identified from nonprobability sources. The most common reasons for ineligibility were more characteristic of the probability-generated sample and included patient death ( $n = 580$ ), not married or married or partnered less than 5 years ( $n = 205$ ), no longer on hemodialysis ( $n = 49$ ), cognitive impairment ( $n = 30$ ), and non-English-speaking ( $n = 27$ ). Almost all notifications of patient death were received from immediate family members in response to the beneficiary notification letter sent to the probability sample. Complaints received about the mailing were extremely rare and were associated with either concern about how patients were identified or recently bereaved family member distress.

The eligibility of 95 (6.5%) respondents could not be determined. Nineteen of these, all from the probability sample, could not be reached to be screened. The remaining 76, all but 4 of whom also represented the probability sample, contacted the study only to indicate that they did not wish to participate.

Among all respondents, 432 (29.3%) couples were eligible. Of these, 117 elected not to participate. Those who spoke directly with a recruiter were invited to share reasons for declining. The most common explanations were lack of interest ( $n = 65$ ), patient or spouse too sick ( $n = 34$ ), and insufficient time ( $n = 17$ ). Only a few couples specifically declined because of a lack of financial remuneration. In addition, 20 couples verbally agreed to participate but failed to return signed consent forms. Motivation among those who enrolled was not assessed directly, but many couples volunteered their desire to help others in similar circumstances.

The remaining 315 couples were enrolled; 219 (69.5%) were recruited from the probability sample, and 96 (30.5%) were from nonprobability sources. With the number of responses in respective groups serving as the denominator, the recruitment rate was 16.6% for the probability sample and 62.3% for the nonprobability sample. Calculating the participation rate using the number of eligible respondents as the denominator indicates recruitment rates of 71.3% for the probability sample and 76.8% for the nonprobability sample.

*EFFECTIVENESS OF RECRUITMENT STRATEGIES  
USED WITH THE NONPROBABILITY SAMPLE*

Table 1 outlines the strategies used to recruit couples in the nonprobability sample, the number of responses received from each, and the number of couples ultimately enrolled as a result of each method. The most effective strategies were those most likely to reach dialysis patients or their spouses directly: dialysis center intermediaries, publicity through cooperating ESRD networks, and features in renal-related news media resulted in a total of 66 enrolled couples. The interest of the dialysis staff and network coordinators in the study was a key asset. Other news sources attracted 28 additional couples, and the remaining two were recruited through snowball referrals from other participants. Targeted mailings, on the other hand, produced only

Table 1  
*Nonprobability Recruitment Strategies: Use, Responses, and Couple Enrollment*

<i>Strategy</i>	<i>Total N</i>	<i>Responses</i>		<i>Enrolled</i>	
		<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>
Local dialysis centers	43	40	26.1	33	34.4
Advertisements and articles					
Paid newspaper advertisements	50	23	15.0	9	9.4
Newspapers that were sent press releases	5,664	27	17.7	17	17.7
Renal patient or provider newsletter articles	7	25	16.3	15	15.6
Unknown newspaper or newsletter	N/A	6	3.9	2	2.1
Subtotal		81	52.9	43	44.8
Local targeted mailings					
Nonemergency patient transportation services	58	0	0.0	0	0.0
Visiting nurse associations	74	0	0.0	0	0.0
Home health agencies	191	0	0.0	0	0.0
Assisted living and retirement communities	154	0	0.0	0	0.0
Councils on aging	340	1	0.7	0	0.0
Area agencies on aging	30	0	0.0	0	0.0
Senior centers	50	0	0.0	0	0.0
Faith-based congregations	2,280	0	0.0	0	0.0
Subtotal		1	0.7	0	0.0
National targeted mailings (end stage renal disease networks)	18	27	17.7	18	18.8
Community canvassing		1	0.7	0	0.0
Snowball referrals (requested of all participants)		3	2.0	2	2.1
Total		153	100.0	96	100.0

one inquiry and no enrollment; community canvassing was equally ineffective.

#### COMPARISON OF DEMOGRAPHIC CHARACTERISTICS

Table 2 compares the demographic characteristics of the nonprobability sample with the probability sample. As a whole, both groups were similar in average age (68.9 and 70.2 years, respectively), and both were comparable to that of the total population from which the probability sample was extracted (70.57 years, range 55.04 to 101.59) (USRDS, 2003). Male patients were overrepresented (when compared with their known numbers in the population) in both samples. Both samples were also comparable in terms of years married, percentage

Table 2  
*Comparison of Patient Demographic Variables According to Sampling Method*

<i>Demographic Variable</i>	<i>Patient</i>				<i>t / <math>\chi^2</math></i>
	<i>Nonprobability Sample</i>		<i>Probability Sample</i>		
	<i>M</i>	<i>%</i>	<i>M</i>	<i>%</i>	
Age (in years)	68.9		70.2		-1.33
Male		70.8		74.0	.33
Years married	40.8		41.6		-.53
Working for pay		13.5		6.8	3.69
Professional job status (range: 1 to 9)	6.7		6.5		.58
Years of education	14.3		14.2		.48
Religion					
Protestant		51.0		63.5	4.29*
Catholic		35.4		22.4	5.85*
Other		13.5		14.2	.02
Race					
White		91.7		82.2	4.72*
Black		7.3		12.3	1.76
Other		1.0		5.5	3.32
Total months end stage renal disease treatment	66.6		84.2		-1.92
Total months hemodialysis	54.8		68.4		-1.96

\* $p < .05$ .

currently working for pay, professional job status (a variable reflecting work patients did for most of their lives, based on a 9-point scale, developed by the U.S. Department of Labor) and education. Religious affiliation was significantly different, with more Protestants in the probability sample (63.5% vs. 51%;  $\chi^2 = 4.29$ ;  $p < .05$ ) and more Catholics in the nonprobability sample (35.4% vs. 22.4%;  $\chi^2 = 5.85$ ,  $p < .05$ ). Despite efforts to recruit Blacks, both samples remained predominantly White, with significantly more Whites in the nonprobability sample (91.7% vs. 82.2%;  $\chi^2 = 4.72$ ,  $p < .05$ ). There was a trend toward patients from the probability sample receiving ESRD treatment longer (84.14 vs. 66.59 months;  $t = -1.92$ ,  $p < .06$ ) and being on hemodialysis longer (68.41 vs. 54.80 months;  $t = -1.96$ ,  $p < .06$ ), but these differences were not statistically significant.

*COMPARISON OF RECRUITMENT COSTS*

The total cost of recruitment was \$152,341, which represented 7.8% of the entire study budget. When all costs associated with recruitment were considered, expenditures for both samples were almost equal (\$76,510 for the nonprobability sample vs. \$75,831 for the probability sample), but the cost per enrolled couple in the nonprobability sample was more than twice that of the probability sample: \$797 vs. \$346.

Table 3 compares the major expense categories for both groups. The costliest item, salary and benefits, was higher for nonprobability strategies, due largely to the labor intensity associated with these methods, especially the time involved with gaining indirect access to dialysis centers. Also, personnel costs were lower for the probability sample in part because much of the labor-intensive follow-up was done by temporary, nonbenefited, hourly-wage staff. Advertisements and mass mailings were other sizable expenses. Telephone costs reflect only those calls charged to phone cards. They do not include most in-house calls or the use of the toll-free number (probably several thousand dollars) because the university did not charge the study for these expenses; hence, it was not possible to determine them retrospectively.

*Discussion*

It is not atypical for unplanned events to affect even the most well-designed research studies. In this case, a combination of a slow intake to the study using nonprobability sampling with an opportunity to identify potential respondents using probability sampling generated a unique chance to contrast the costs and outcomes of two methods of sample generation. These methods yielded different response rates but similar participation rates, used different recruitment strategies, and produced two samples with demographic characteristics that were similar in many respects but differed in others. Although both reflect a national scope, the probability sample is more representative of the population. Neither sample, though, fully represents the known racial diversity of the older hemodialysis population. In addition, there were substantial differences in recruitment time and costs per enrolled couple.

Table 3  
*Comparison of Nonprobability and Probability Sample Recruitment Costs (in Dollars)*

<i>Expenditure</i>	<i>Nonprobability Sample</i>	<i>Probability Sample</i>	<i>Total</i>
U.S. Renal Data System charge for centers for Medicare and Medicare services list	–	2,339	2,339
Mail house charge for centers for Medicare and Medicare services mailings	–	9,926	9,926
Postage	460	9,674	10,134
Printing	3,631	6,777	10,408
Targeted mass mailings	5,923	–	5,923
Advertisements	4,477	–	4,477
Telephone	893	375	1,268
Salary and benefits	60,432	46,490	106,922
Misc.	694	250	944
Total	76,510	75,831	152,341
Number of enrolled couples	96	219	315
Cost per enrolled couple	797	346	484

The opportunity to sample from the USRDS database was unique and, depending on changes in privacy laws, may not be replicable (Olsen, 2003). Federal privacy rules enacted after this sample was identified now greatly restrict such usage (see <http://www.resdac.umn.edu/> for link to current policy regarding access to CMS names and addresses file). However, the Medicare database has been an attractive alternative for reaching elders, and investigators have reported successful enrollment if the sample frame is sufficiently large (e.g., Boulton, Boulton, Morishita, & Pirie, 1998; Cosgrove et al., 1999; Funkhouser, Macaluso, & Wang, 2000; Picot, Samonte, Tierney, Connor, & Powel, 2001). Limiting the usage of this database bodes poorly for future research.

The ability to access a random sample of hemodialysis patients from the total population was a significant advantage, and use of the USRDS database was far superior to other population-based databases, such as voter and driver registries in which the populations are far too broad to be useful for the purposes of this study. But even this source had limitations that resulted in a relatively low response rate.



First, because database information was restricted to age, race, and length or type of treatment modality, many of those contacted were not eligible for this study, particularly because of the marital status and cohabitation requirements it included. Second, CMS required the use of an opt-in rather than an opt-out approach to recruitment, meaning that the study staff could not initiate any contact with those who were sent mailings except to respond to inquiries. Had an opt-out method been permitted, follow-up would have been possible with non-responders. This method might have resulted in higher enrollment but was perceived as more intrusive to privacy.

It is not surprising that the nonprobability sample was more expensive to recruit than the probability sample. The individual strategies were expensive, labor-intensive, and met with limited success. Although recruitment at dialysis centers and through several ESRD Networks was relatively successful in comparison to other strategies used with this group, enrollment nevertheless fell below initial expectations. The most likely explanation, which was supported by comments from many of the social workers, is that only a few patients at each dialysis center met all the eligibility criteria. Gatekeeping introduced selection bias in some centers where only those patients judged likely to agree were given informational brochures.

Newspaper ads were expensive and relatively low-yield strategies in this study, given the papers' sizable circulations. Responses were generated primarily from the paper with a dedicated research opportunity section, but even these resulted in only one or two calls per ad. Press releases were comparatively less expensive but more time-consuming to prepare because they were widely disseminated. It is difficult to judge their effectiveness because editors controlled publication and content decisions, usually without the researchers' awareness.

Differences in the demographics yielded as a result of probability and nonprobability sampling merit comment. Although there were no significant differences between the two samples on many of the variables, those that do exist are important. Of greatest concern is the underrepresentation of racial minorities in both samples but especially in the nonprobability sample. This is of particular concern because many of the media outlets used were those that target minorities. This trend may have existed because of regional population variations, as recruitment with this sample concentrated on

Massachusetts and Rhode Island. It may also reflect a general trend for members of minorities to not participate in research studies. Similar results are reported regarding participation in clinical trials, where African American enrollment has ranged from 3% to 20% (Swanson & Ward, 1995). To achieve adequate racial and ethnic representation in future health-related studies, alternatives such as multisite studies may be more effective and realistic (George, 2002). This option offers the advantage of employing institutions and investigators known within the community, as well as the opportunity for personal contact with potential subjects in which barriers to participation can be more readily identified and removed (Ford et al., 2004; Leonard et al., 2003). For ethnic groups such as Hispanics, in which language and subcultural differences exist, separate studies that provide for culturally appropriate methods and valid instrument translation may be the best approach.

The large number of male patients in both samples most likely reflects their higher incidence of ESRD as well as their shorter life spans, rather than a true overrepresentation. Female patients in the same older age groups are more likely to be widowed and would therefore have been ineligible. It is also not surprising that there were significantly more Catholics and fewer Protestants in the non-probability sample, given that Massachusetts and Rhode Island, where many of the patients in this group resided, have been reported to have the highest proportion of Catholics compared to all other states (Church Growth Research Center, 1990).

Actual study costs are often not reported in detail, especially for nonexperimental designs. Experience with this study underscores the importance of adequate budgets and careful planning to ensure that sampling and recruitment decisions are wisely made. In retrospect, the budget may have been more effectively spent with the nonprobability sample by limiting broad-based community recruitment strategies and focusing more intensively on reaching patients through partnerships with dialysis centers and ESRD network connections. With the probability sample, sending the CMS mailings by bulk rate may have been false economy, given the difference in returns noted with the first group's mailing and anecdotal reports from some respondents that bulk-rate mailings were received up to 3 months after they were sent.

Using two sampling methods within the same study raises important concerns regarding data analysis and reporting of findings. To deal with this issue, one of the first steps in all study analyses will be to compare the two samples for statistical differences on the variables being investigated. When differences exist, the analysis will focus exclusively on the sample accrued via the probability-based sampling frame. In several reports completed so far on the baseline data, no significant differences were found, so the samples were combined. When combined, generalizability will necessarily be limited. When the probability sample is used alone, generalizability should extend to that part of the population sharing comparable demographic characteristics.

In sum, it is unusual for a single study to employ both probability and nonprobability sampling. Had the investigators learned earlier that a population-based sampling frame was accessible, this approach would clearly have been the optimal choice. This report provides a rare opportunity to critically examine the process and outcomes of both approaches within the same study. Lessons from this experience will hopefully offer guidance to other investigators in their quest for representative samples and generalizable results. Caution regarding the generalizability of these findings is suggested, however, because the research question itself may influence the success of various recruitment methods and sampling strategies. Investigators undertaking research must seriously consider the research question, resources available, and importance of generalizability of findings as they determine the recruitment plan and sampling strategies that they will embrace.

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