Encyclopedia of Survey Research Methods

Nonprobability Sampling

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Sampling involves the selection of a portion of the finite population being studied. Nonprobability sampling does not attempt to select a random sample from the population of interest. Rather, subjective methods are used to decide which elements are included in the sample. In contrast, in probability sampling, each element in the population has a known nonzero chance of being selected through the use of a random selection procedure. The use of a random selection procedure such as simple random sampling makes it possible to use design-based estimation of population means, proportions, totals, and ratios. Standard errors can also be calculated from a probability sample.

Why would one consider using nonprobability sampling? In some situations, the population may not be well defined. In other situations, there may not be great interest in drawing inferences from the sample to the population. Probably the most common reason for using nonprobability sampling is that it is less expensive than probability sampling and can often be implemented more quickly.

Nonprobability sampling is often divided into three primary categories: (1) quota sampling, (2) purposive sampling, and (3) convenience sampling. Weighting and drawing inferences from nonprobability samples require somewhat different procedures than for probability sampling; advances in technology have influenced some newer approaches to nonprobability sampling.

Quota Sampling

Quota sampling has some similarities to stratified sampling. The basic idea of quota sampling is to set a target number of completed interviews with specific subgroups of the population of interest. Ideally, the target size of the subgroups is based on known information about the target population (such as census data). The sampling procedure then proceeds using a nonrandom selection mechanism until the desired number of completed interviews is obtained for each subgroup. A common example is to set 50% of the interviews with males and 50% with females in a random-digit dialing telephone interview survey. A sample of telephone numbers is released to the interviewers for calling. At the start of the survey field period, one adult is randomly selected from a sample household. It is generally more difficult to obtain interviews with males. So, for example, if the total desired number of interviews is 1,000 (500 males and 500 females), and the researcher is often able to obtain 500 female interviews before obtaining 500 males interviews, then no further interviews would be conducted with females and only males would be selected and interviewed from then on, until the target of 500 males is reached. Females in those latter sample households would have a zero probability of selection. Also, because the 500 female interviews were most likely obtained at earlier call attempts, before the sample telephone numbers were thoroughly worked by the interviewers, females living in harder-to-reach households are less likely to be included in the sample of 500 females.

Quotas are often based on more than one characteristic. For example, a quota sample might have interviewer-assigned quotas for age by gender and by employment status categories. For a given sample household, the interviewer might ask for the rarest group first, and if a member of that group were present in the household, that individual would be interviewed. If a member of the rarest group were not present in the household, then an individual in one of the other rare groups would be selected. Once the quotas for the rare groups are filled, the interviewer would start to fill the quotas for the more common groups.

Quota sampling is sometimes used in conjunction with area probability sampling of households. Area probability sampling techniques are used to select primary sampling units and segments. For each sample **[p. 524 ↓]** segment (e.g. city block) the interviewer is instructed to start at a corner of the segment and proceed around the segment contacting housing units until a specifie number of interviews are completed in the segment.

In another example, one might select an area probability sample of housing units using multi-stage sampling. At the segment level, the interviewers would be supplied with quotas for adults, assuming one adult is interviewed in each household. The instructions might consist of something simple as alternating between interviewing available males and females in the households they make contact with. In random-digit dialing, a probability sample of telephone numbers can be drawn and a quota sampling method can be used to select one adult from each sample household. In telephone surveys conducted under tight time constraints, the selection of a male or female adult from the household can be limited to adults who are at home at the time the interviewer calls. This eliminates the need for callbacks.

The most famous limitation of this type of quota sampling approach is the failure of the major preelections polls, using quota sampling, to accurately predict the results of the 1948 presidential election. The field interviewers were given quotas (with estimates based on 1940 census figures) to fill based on characteristics such as age, gender, race, degree of urbanicity, and socioeconomic status. In addition to the inaccurate quotas, the interviewers were then free to fill the quotas without any probability sampling mechanism in place. This subjective selection method resulted in a tendency for Republicans being more likely to be interviewed within the quota groups than Democrats. The sample thus contained too many Republicans, causing the pre-election polls to incorrectly predict Thomas E. Dewey (the Republican candidate) as the winner.

A major problem with quota sampling is the introduction of unknown sampling biases into the survey estimates. In the case of the 1948 presidential election, the sampling bias was associated with too many Republicans being selected. Another problem with quota sampling is that the sampling procedure often results in a lower response rate than would be achieved in a probability sample. Most quota samples stop attempting to complete interviews with active sample households once the quotas have been met. If a large amount of sample is active at the time the quotas are closed, then the response rate will be very low.

Purposive Sampling

Purposive sampling is also referred to as *judgmental sampling* or *expert sampling*. The main objective of purposive sampling is to produce a sample that can be considered “representative” of the population. The term *representative* has many different meanings, along the lines of the sample having the same distribution of the population on some key demographic characteristic, but it does not seem to have any agreed-upon statistical meaning. The selection of a purposive sample is often accomplished by applying expert knowledge of the population to select in a non-random manner a sample of elements that represents a cross-section of the population. For example, one might select a sample of small businesses in the United States that represent a cross-section of small businesses in the nation. With expert knowledge of the population, one would first decide which characteristics are important to be represented in the sample. Once this is established, a sample of businesses is identified that meet the various characteristics that are viewed as being most important. This might involve selecting large (1,000 + employees), medium (100–999 employees), and small (< 100 employees) businesses.

Another example of purposive sampling is the selection of a sample of jails from which prisoner participants will be sampled. This is referred to as two-stage sampling, but the first-stage units are not selected using probability sampling techniques. Rather, the first-stage units are selected to represent key prisoner dimensions (e.g. age and race), with expert subject matter judgment being used to select the specifie jails that are included in the study. The opposite approach can also be used: First-stage units are selected using probability sampling, and then, within the selected first-stage, expert judgment is employed to select the elements from which data will be collected. “Site” studies or evaluation studies will often use one of these two approaches. Generally, there is not interest in drawing inferences to some larger population or to make national estimates, say, for all prisoners in U.S. jails.

A clear limitation of purposive sampling is that another expert likely would come up with a different sample when identifying important characteristics and picking typical elements to be in the sample. Given the subjectivity of the selection mechanism, purposive sampling is generally considered most appropriate for **[p. 525 ↓]** the selection of small samples often from a limited geographic area or from a restricted population definition, where inference to the population is not the highest priority. Clearly, the knowledge and experience of the expert making the selections is a key aspect of the “success” of the resulting sample, but it would be difficult to quantify that characteristic of a sample.

Convenience Sampling

Convenience sampling differs from purposive sampling in that expert judgment is not used to select a representative sample of elements. Rather, the primary selection criterion relates to the ease of obtaining a sample. Ease of obtaining the sample relates to the cost of locating elements of the population, the geographic distribution of the sample, and obtaining the interview data from the selected elements. Examples of convenience samples include *mall intercept interviewing*, unsystematically recruiting individuals to participate in the study (e.g. what is done for many psychology studies that use readily available undergraduates), visiting a sample of business establishments that are close to the data collection organization, seeking the participation of individuals visiting a Web site to participate in a survey, and including a brief questionnaire in a coupon mailing. In convenience sampling, the representativeness of the sample is generally less of a concern compared to purposive sampling.

For example, in the case of surveying those attending the Super Bowl using a convenience sample, a researcher may want data collected quickly, using a low-cost method that does not involve scientific sampling. The researcher sends out several data collection staff members to interview people at the stadium on the day of the game. The interviewers may, for example, carry clipboards with a questionnaire they may administer to people they stop outside the stadium an hour before the game starts or give it to people to have them fill it out for themselves. This variation of taking a convenience sample does not allow the researcher (or the client) to have a clear sense of what target population is being represented by the sample. Although convenience samples are not scientific samples, they do on occasion have value to researchers and clients who recognize their considerable limitations—for example, providing some quick exploration of a hypothesis that the researcher may eventually plan to test using some form of probability sampling. On the other hand, some researchers naively treat such samples as equivalent to simple random samples and calculate standard errors based on simple random sampling. Doing this does not produce valid statistical information.

Weighting and Drawing Inferences from Nonprobability Samples

One issue that arises with all probability samples and for many nonprobability samples is the estimation procedures, specifically those used to draw inferences from the sample to the population. Many surveys produce estimates that are proportions or percentages (e.g. the percentage of adults who do not exercise at all), and weighting methods used to assign a final weight to each completed interview are generally given considerable thought and planning. For probability sampling, the first step in the weight calculation process is the development of a base sampling weight. The base sampling weight equals the reciprocal of the selection probability of a sampling unit. The calculation of the base sampling weight is then often followed by weighting adjustments related to nonresponse and noncoverage. Finally, post-stratification or raking is used to adjust the final weights so that the sample is in alignment with the population for key demographic and socioeconomic characteristics. In nonprobability sampling, the calculation of a base sampling weight has no meaning, because there are no known probabilities of selection. One could essentially view each sampling unit as having a base sampling weight of one.

Sometimes nonresponse and noncoverage weights are developed for nonprobability samples, but the most common technique is to use a weighting procedure such as post-stratification or raking to align the nonprobability sample with the population that one would ideally like to draw inferences about. The post-stratification variables are generally limited to demographic and socioeconomic characteristics. One limitation of this approach is that the variables available for weighting may not include key characteristics related to the nonprobability sampling mechanism that was employed to select the sampling units. The results of weighting nonprobability samples have been mixed in the situation when benchmarks are available for a key survey outcome measure (e.g. the outcome of an election).

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Recent Developments in Nonprobability Sampling

Finally, it should be mentioned that newer versions of nonprobability sampling have appeared in recent years, some driven by changes in technology. These have generally been labeled *model-based sampling approaches*, and to some degree the use of the term *model-based sampling* has replaced the term *nonprobability sampling*. Web surveys are one new example of nonprobability sampling. Web surveys are generally convenience samples of households or adults recruited to participate in surveys delivered over the Web. The samples are usually set up as panels, that is, a recruited household or adult is asked to respond to some number of surveys over their tenure in the sample. At the recruitment phase, characteristics of the households or adults can be collected. This makes it possible to limit future surveys to households or adults with a specifie characteristic (e.g. persons ages 18–24 years, female executives, retirees). Because respondents use the Web to complete the questionnaire, these nonprobability sample Web surveys can often be conducted much more quickly and far less expensively than probability samples.

Another new type of nonprobability sampling is based on selecting email addresses from companies that compile email addresses that appear to be associated with individuals living in households. Some companies set up email panel samples through a recruitment process and allow clients to send a questionnaire to a sample of email addresses in their panel. For both email and Web panel samples, the estimation methods used to attempt to draw inferences from the sample to the population are a very important consideration. The use of propensity scores and post-stratification or raking has been explored by some researchers. The calculation of standard errors, as with all nonprobability samples, is problematic and must rely on model-based assumptions.

Another relatively new nonprobability sampling method is known as *respondent-driven sampling*. Respondent-driven sampling is described as a form of snowball sampling. Snowball sampling relies on referrals from an initial nonprobability or probability sample of respondents to nominate additional respondents. It differs from multiplicity sampling in that no attempt is made to determine the probability of selection of each subject in the target population. Snowball samples are sometimes used to select samples of members of a social network in the situation when no complete list of such members exists and the costs of doing a probability sample would be prohibitive. Respondent-driven sampling has most often been employed for surveys of very rare populations in relatively small geographic areas, such as a city or county.

The use of probability sampling, as championed by Leslie Kish and other important statisticians, has resulted in probability sampling being employed in most surveys conducted by the U.S. government. For commercial research, probability sampling methods and nonprobability sampling methods have been employed. More recently, as the cost of collecting data has risen, a considerable amount of the commercial research conducted in the United States has moved to nonprobability sampling methods. For surveys conducted for the federal government, model-based sampling methods have been used in some situations. During the coming years, it is possible that the use of probability sampling will decline further. It is therefore important that more research be conducted to further assess biases from using nonprobability samples and devise strategies to both measure and adjust for these biases.

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See also

- Area Probability Sample
- Convenience Sampling
- Design-Based Estimation
- Kish, Leslie
- Mall Intercept Survey
- Model-Based Estimation
- Multiplicity Sampling
- Multi-Stage Sample
- Probability Sample
- Propensity Scores
- Purposive Sample
- Quota Sample
- Raking
- Random Sampling
- Respondent-Driven Sampling (RDS)
- Sample
- Sampling
- Simple Random Sample
- Snowball Sampling
- Stratified Sampling
- Weighting

- Web Survey

Further Readings

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