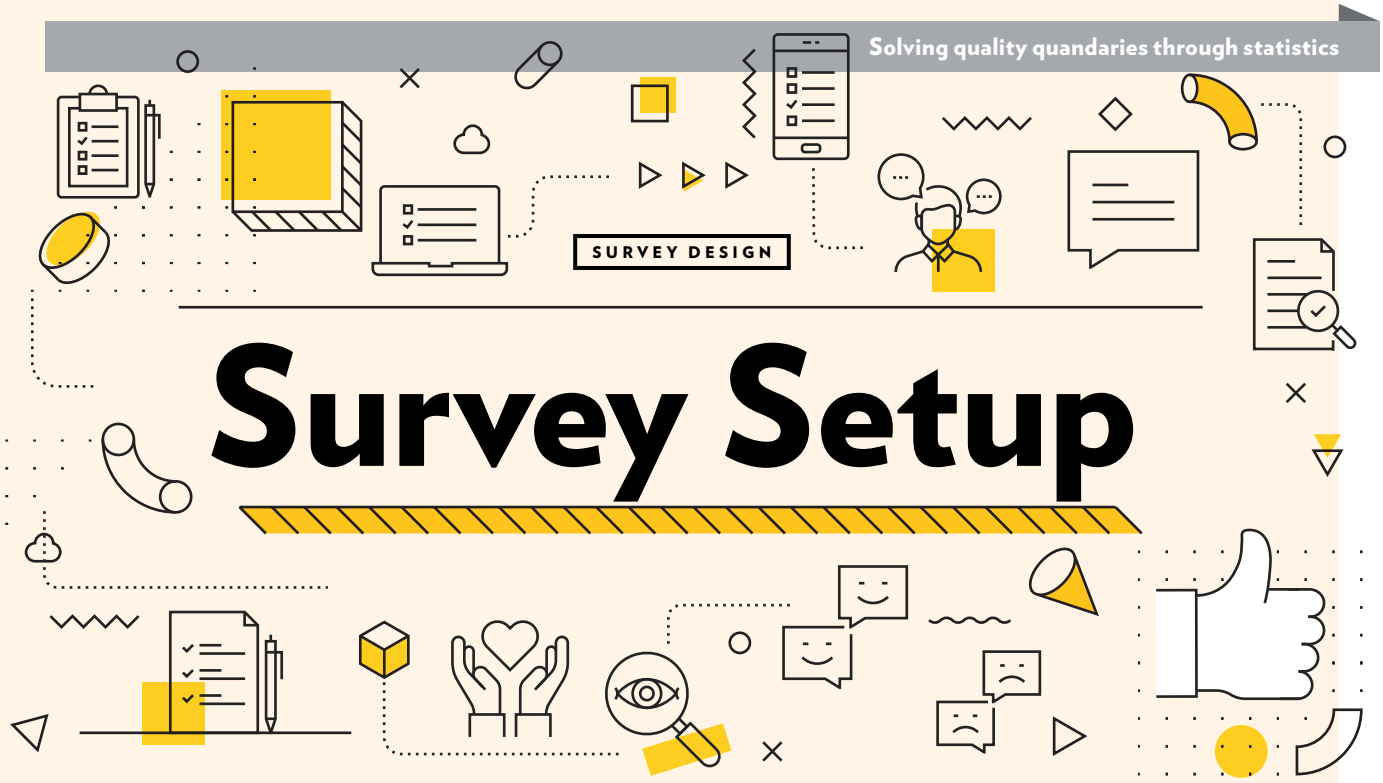
Solving quality quandaries through statistics



Survey Setup

An overview of quality survey design and implementation by Julia E. Seaman and I. Elaine Allen

Surveys are used for a wide variety of tasks including the U.S. Census, electoral poll predictions, market research and academic studies. At a basic level, surveys are a list of questions for an audience sample to answer, but they also can be seen as complex products with interactive parts that must be designed with precision and totally integrated. Otherwise, the result may be low response rates, inaccurate information and biased results.

From the decision to design a survey to analysis and evaluation of the responses, there are choices that will affect the quality of the final product that's similar to quality control methods used to assess the performance of complicated devices, processes and machines. This column provides an overview of the important issues to consider before initial survey design.

Survey research is widely used across industries, but there are key strengths and weaknesses that should be considered before starting the design process. Surveys are useful for describing the characteristics of a large population and can be cost effective. Surveys also allow for flexibility and comprehensiveness in their ability to include many questions on a given topic.

While surveys usually have high reliability, their validity may be low. This means, given multiple times, the responses can be replicated, but also may be replicating the same issues, such as sampling bias of one group of individuals never responding to your survey.

A survey also is inflexible in that it cannot be altered after it's in the field. The limitations in a questionnaire survey mean it is not ideal for measuring highly complex or "expert" knowledge, past behavior or attitudes, or subconscious influences. Finally, it is not guaranteed that respondents will be truthful in surveys, especially about personal or stigmatized behavior that a respondent is unlikely to admit. There are modest solutions to these weaknesses that can make your survey more valid and unbiased.

Some basics

Typically, individuals are the unit of analysis. However, a survey in education, for example, might have a school district rather than an individual as the survey respondent. The questionnaire is generally referred to as the "research instrument." Steps and tasks in conducting a survey include:

- **Planning:** Form of implementation.
- **Sampling:** Population size, cost of sample and time to administer.
- **Design and construction of questionnaire:** Types of questions.

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TABLE 1

Survey methods—advantages and disadvantages

Method	Advantages	Disadvantages	Tips to remember
Self-completion	■ Cheap. ■ Covers wide area. ■ Anonymity protected. ■ Interviewer bias doesn't interfere. ■ People can take their time.	■ Low response rate (and possible bias from this). ■ Questions need to be clear and simple. ■ No control over interpretation. ■ No control over who fills it out.	■ Simplify questions. ■ Include an introduction and description. ■ Send a reminder. ■ Offer to send the survey results.
Telephone survey	■ Can do it all from one place. ■ Can clarify answers. ■ People may be relatively happy to talk on the phone (or not). ■ Relatively cheap. ■ Quick.	■ People may not have home phones/only have cell phones. ■ You may get wrong person or call at wrong time. ■ May be a bias from whose name is listed vs. who's at home. ■ Easy for people to break off. ■ No context to interview.	■ Because you rely totally on verbal communication, questions must be short and words easy to pronounce. ■ Minimize number of response categories (so people can remember them).
Face-to-face interview	■ High response rate. ■ High control of the interview situation. ■ Ability to clarify responses.	■ Slow. ■ Expensive. ■ Interviewer presence may influence way questions are answered. ■ If there is more than one interviewer, may have interviewer bias.	■ Important that interviewer is nonthreatening. ■ Interviewer can clarify questions, but not give elaborations that may affect the content. ■ Aim to ask questions in a clear, standardized way. ■ If the list of possible responses is long, show them to the respondent for them to read while the question is read out.

- **Data collection:** One type (email, mail, paper, interview) or many.
- **Cleaning and translating data:** Open-ended questions, which may need coding.
- **Data analysis and tabulation:** Frequencies, statistics and testing.
- **Reporting results:** Who receives the results?

Survey administration

It is easy to send your survey via email, or post it in an online forum or on a social media page to wait for respondents to fill out your survey. If your interest is simply getting a large number of respondents, this could be a good strategy. This kind of distribution, however, can result in biased results, and the response rate (the number of respondents completing the survey and the number of individuals seeing your survey or link) actually will be quite low. In general, there are three types of survey implementation:

1. Self-administered (mailed or emailed directly to a respondent) surveys, web-based surveys, group (that is, classroom) surveys.
2. Telephone surveys.
3. Face-to-face surveys.

Table 1 highlights some of the reasons to do—or not do—a type of survey implementation.

Creating your sample

How you sample depends on some connected issues. What do you want to find out? How frequently do you believe it occurs in the population you are sampling? How large is the population? How complex is it? Do you need to stratify respondents? How large are your resources? How much time to you have to gather your data?

Sampling usually is divided into probability and nonprobability. A probability sample (that is, a random sample) allows us to make inferences about the population as a whole. A nonprobability sample pertains only to the survey respondents.

Survey sampling also depends on the heterogeneity of the population, the number of subgroups you want to measure and what response rate you expect (the lower the response rate, the larger the required sample size).

The most common types of probability sampling include:

- **Representative sampling:** The respondents resemble the population from which you sample.
- **Random sampling:** Each element in the population is equally likely to be chosen.
- **Systematic sampling:** A random starting point is used, and every k^{th} element is sampled.
- **Stratified sampling:** Respondents are chosen from homogeneous subsets of the population.

The most common types of nonprobability sampling include:

- **Available subjects:** Posting your survey online and accepting all respondents.
- **Snowball sampling:** Using an initial sample to help you get more respondents.
- **Quota sampling:** Stopping the sampling after one group has sufficient responses.

After the type of sampling is decided, calculating the required sample size (and accompanying power of this estimate) depends on how precise

ADDITIONAL RESOURCES

The following resources expand on the design of surveys and types of surveys:

Andrews, Dorine, Blair Nonnecke and Jennifer Preece, "Electronic Survey Methodology: A Case Study in Reaching Hard-to-Involve Internet Users," *International Journal of Human Computer Interaction,* Vol. 16, No. 2, 2003, pp. 185–210.

Guidolin, Keegan, Steven D. Wexner, Flora Jung, Shawn Khan, Shirley Xiaoxuan Deng, Abirami Kirubarajan, Fayez Quereshy and Sami Chadi, "Strengths and Weaknesses in the Methodology of Survey-based Research in Surgery: A Call for Standardization," *Surgery*, 2021, www.sciencedirect.com/science/article/pii/S0039606021000234.

Pew Research Center, "Questionnaire Design," www.pewresearch.org/methods/u-s-survey-research/questionnaire-design.

Louisiana State University GROK Knowledge Base, "Survey Design and Administration Best Practices," https://grok.lsu.edu/article.aspx?articleid=17958.

The following online calculators can be used for sample size and confidence intervals:

Creative Research Systems, "Sample Size Calculator," www.surveysystem.com/sscalc.htm.

Conjoint.ly, "Sample Size Calculator," https://conjointly.com/blog/sample-size-calculator.

University of California San Francisco Clinical & Translational Science Institute, "Sample Size Calculators for Designing Clinical Research," https://sample-size.net.

the estimate of your primary output must be and the margin of error that is acceptable. Multiple websites will calculate this for you, depending on your type of outcome (percentage or continuous value) and your hypothesized error or standard deviation.[1]

Evaluation and reducing error

Starting with a pilot survey to a small group of your population can identify and reduce the errors common to surveys. The two most common errors are:

1. **Bad questions:** When questions are found to be ambiguous after the survey is closed and the objective cannot be examined.
2. **Poor response rates:** When the response rate is lower than expected because certain subgroups did not respond or were not able to be reached.

Key areas for evaluating the survey overall after it is completed include:

- Was the sampling procedure specified and, if it was not probability sampling, were modifications from this explained?
- Was the sample clearly identified as well as the reason this sample was chosen?
- Did the survey questions match the objectives and hypotheses identified a priori? Specifically, were field procedures for interviews specified? Were measures of reliability and validity calculated? Did the results and data analysis match the research questions?

Conducting a survey using best practices is not unlike conducting an experiment or a clinical trial. A complete design, sampling plan and analysis plan must be developed in advance, similar to a clinical protocol. After the survey is completed and analyzed, reports on how the survey was designed, sampled and implemented, and how data were collected must be reported along with the results. Overall, surveys are incredibly useful tools that, when designed and used properly, help answer a wide variety of research questions. **QP**

READ MORE

Learn how one organization with limited resources used survey tools to collect process data for quality management purposes. Access the QP article, "Survey Says," at https://tinyurl.com/2nxb8as2.

NOTE

1. www.tools4dev.org/resources/how-to-choose-a-sample-size and www.surveysystem.com/sscalc.htm will give you tables of sample size or calculators to add your own information.

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