SCIENCE AND PRACTICE OF PHARMACOTHERAPY II

PSAP

SURVEY RESEARCH METHODS IN PHARMACY PRACTICE

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Learning Objectives

1. Plan a survey research study.
2. Write questionnaire items and construct a quality survey instrument.
3. Assess the quality of collected survey data by examining the reliability and validity of the survey instrument used.
4. Apply probability and/or nonprobability sampling techniques when selecting a sample in a survey research study.
5. Assess the potential for response bias and nonresponse bias in a survey research study.
6. Distinguish between the different types of data collection methods in survey research studies.
7. Calculate a response rate.
8. Develop an understanding of coding, analyzing, and reporting survey data.

Using Surveys in Pharmacy Practice

Pharmacists are using surveys more than ever to measure health care quality, patient satisfaction, quality of life, health outcomes, medication-taking behaviors, and other pharmacy practice-related issues. In a health care system that emphasizes health outcomes and quality improvement, survey research is becoming an important tool for pharmacy practitioners. Surveys are useful in situations where pharmacists are attempting to explore, describe, or explain an issue. Most often the issues pertain to knowledge, attitudes, and behaviors, or more specifically perceptions, preferences, beliefs, or decisions.

Because pharmacists today often use surveys to measure knowledge, attitudes, or behaviors of patients, physicians, employees, and other pharmacy stakeholders, it is imperative that pharmacists understand survey methodology. Conducting a survey appears easy; however, without careful planning and thought, the data collected may not provide the information needed. For example, data collected from a poorly designed survey or using a biased sampling technique can lead to erroneous conclusions. It is also important to follow Institutional Review Board regulations when conducting a survey research project, although ethical issues are not discussed in this chapter. This chapter provides a summary of appropriate survey research methods used in pharmacy practice.

Survey Process

A survey research project should follow the scientific inquiry process that is used in any research project. Pharmacists must first clearly define the research question, the study purpose and objectives, or the research hypotheses. A critical mistake often made by pharmacy investigators is to define the study purpose and objectives so broadly that they are difficult to accomplish with one survey. Defining the study purpose clearly and narrowly is essential. It is also important to conduct a literature search to determine research that has been done previously.

After conducting a literature search and defining the study objectives and/or hypotheses, it is time to select the appropriate study design. A survey conducted at one point in time is called a cross-sectional survey. When surveying different study samples about the same issue at different points in time, a time-series study is appropriate. Another option for study design is to survey the same sample at different points in time, for example, a before-and-after study, a longitudinal cohort study, or a panel study. A panel is a group of participants who have agreed to be surveyed at multiple points in time. By determining the study intent and the type of study design needed, pharmacists will be able to select the most appropriate survey methods to use.

There are four main considerations when conducting a survey: sampling, data collection, survey instrument design, and data analysis and reporting, as shown in Figure 1-1. These are similar to any other research project. As depicted in Figure 1-1, this survey research process is not usually a linear process. For example, the data collection method

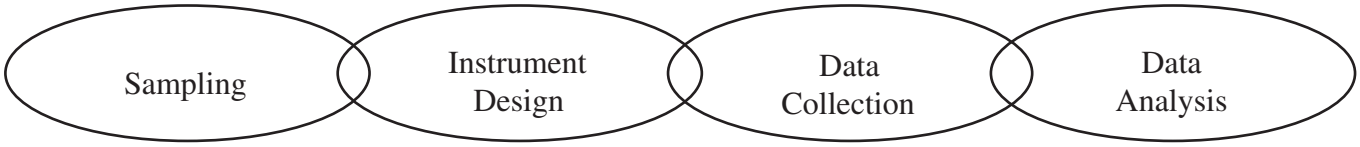

Figure 1-1. Survey process.

may influence how the sample is selected or how the survey instrument is designed. Each of the steps in conducting a survey are discussed in the remainder of the chapter, but it is important to remember that these steps are intertwined.

As with all studies, there are limitations in survey research studies that should be mitigated or avoided if possible. Survey researchers must consider study constraints such as time, money, and research sponsor. Conducting a survey in the most desired way must often be balanced with the budget.

Sampling

Sampling is the selection of the participants to represent the entire population. Obviously, by counting or gathering data from a sample compared to the entire population, the pharmacy researcher saves time and money. Selecting a sample to represent the population should be done with careful thought; if done incorrectly, the results of the study may be biased and may not be generalizable to the study population.

Definitions

The study population includes all those of interest from which a sample can be selected. Before defining a population and selecting a sample, the sampling unit should be determined. Often, the sampling unit is an individual person (e.g., patient or physician). However, the sampling unit may also be pharmacies, families, households, clinics, hospitals, or other groupings. For example, the question may be how many pharmacies have a dress code policy. For this purpose, it would not make sense to survey all pharmacists; rather, the population would be better defined as "all pharmacies." It is important to define the population specifically. Defining the population as all pharmacies would indicate the pharmacy researcher is interested in studying all types of pharmacies across the world, when actually he or she may only be interested in retail pharmacies or only pharmacies in a specific state, region, or country.

Once the population and sampling unit have been defined, a sample frame can be developed. The sample frame is the operational definition of the population that will be used to select the sample. The sample frame is often a list that identifies all the sampling units in the population to be studied (e.g., list of pharmacies from a state board of pharmacy) or a set of instructions that explicitly provide inclusion and exclusion criteria to define the study population. An example of a set of instructions/criteria to define a sample frame is as follows:

"The sampling frame is all women over age 65 on the e-chart list with ICD/9 diagnosis of 410-414, 429.2, who are admitted to the Cardiac Care Unit or the Inpatient Cardiology Service at the University Hospital. The exclusion criterion is any woman who has an ICD-9 diagnosis of dementia."

The pharmacy researcher wants the study population and sampling frame to be as similar as possible. Therefore, the researcher needs to be careful when using a list or developing criteria for the sampling frame so that she does not omit potential participants, duplicate participants, or include participants who are not part of the study population. After the sampling frame is defined, a sample can be selected.

Sampling Design

The part of the research plan that details how the sample will be selected is the sampling design. Both probability and nonprobability sampling designs can be used.

Probability Sampling

Probability sampling means that each sampling unit has a known probability of being included in the sample. Because there is a known probability of being included, the laws of mathematical probability can be used to make inferences about the population, and the results can be generalized to the study population. Probability sampling techniques also reduce the potential for the researcher to select sampling units in a biased manner.

Random Sampling

Random sampling means each sampling unit is randomly selected to participate. In simple random sampling, each sampling unit has a known and equal chance of participating in the survey. To select a simple random sample, a random number generator or a table of random numbers can be used to select the sample from the sample frame. To select a systematic random sample, Nth name sampling can be used, where N is calculated by dividing the number of sampling units on the list by the sample size. The list of sampling units can be generated in many ways, such as an alphabetical list of employees or a sequential list of patients admitted to a ward. Then after selecting a random starting point, every Nth name is selected from the list of sampling units.

Stratified Sampling

Stratified sampling refers to grouping a study population according to some demographic characteristic or other variable and then selecting random samples from each strata (group). For example, hospital employees can be grouped by department, and then within each group, five employees can be randomly selected. There may be situations where a stratified sample is preferred; however, the sampling frame does not include the characteristics needed to stratify. For example, a pharmacist may want to stratify the sample by gender so that 50% of the respondents are women and 50%

are men. If the list of employees does not specify gender, it would be best to use a random sampling technique and then specify a stratified sample. Using an interviewer to collect the survey data works well with this type of sampling design. From the random sample, the interviewer can collect data from each sampling unit while considering how many men and women have responded. Once the target number of women is reached (e.g., 50 women), then the interviewer can skip women but continue collecting data until an equal number of men are surveyed.

Cluster Sampling

Cluster sampling refers to selecting participants randomly who are naturally grouped by either geographic location or time. Within cluster sampling, there are single-stage clustering and multistage clustering. In single-stage clustering, the pharmacy researcher may randomly select clusters and then survey all sampling units within the clusters. For example, a pharmacist may randomly select days of the year to distribute surveys in the clinic and then survey all patients attending clinic on the randomly selected days. Multistage clustering means clusters are randomly selected and then sampling units within the clusters are selected. In this situation, the unit that is clustered is called the primary sampling unit and the unit selected within the cluster to be surveyed is the secondary sampling unit. For example, a pharmacist may randomly select clinics to distribute surveys, and then at each selected clinic, the pharmacist may randomly select patients to complete the survey. The primary sampling unit is the clinic and the secondary sampling unit is the patient. In contrast, a pharmacist using a single-stage clustering technique would randomly select clinics and then survey all patients at each clinic.

Nonprobability Sampling

Nonprobability sampling means there is not a known probability of being included in the sample. Although confidence intervals and sampling error can be computed from a nonprobability sample, these statistics would be technically invalid. However, there are times when a nonprobability sampling technique is acceptable because of the purpose of the study or because it is the only way to select participants for a study. For example, it may be best to use a nonprobability sampling technique when surveying hard-to-identify groups (e.g., patients who are homeless or individuals who abuse drugs) or specific groups (e.g., patients who live in a hospice facility). Also surveys used in pilot situations to explore issues may require only a nonprobability sample.

Convenience Sampling

Convenience sampling is when a researcher selects a group of individuals from the study population who are easily accessible to participate in the study. For example, asking pharmacists who attend a continuing education program at a local institution to complete a survey on attitudes toward emergency contraception uses a convenience sampling technique.

Snowball Sampling

Snowball sampling is selecting people to participate and then asking these participants to supply names of other potential participants.

Quota Sampling

Quota sampling divides the population into groups or strata, such as by race, age, or gender, and determines how many sampling units per strata are needed (e.g., 10 men and 10 women). Then the researcher selects anyone in the population to fill the quotas at his or her discretion.

Sampling Considerations

Although probability and nonprobablity sampling designs have been discussed separately in this chapter, pharmacy researchers must be creative and combine these sampling techniques to obtain the best sample. Thus, a random sampling technique may be used to select pharmacies to participate in the study, but a convenience sampling technique may be used to select patients at the pharmacies to participate in the study. The intent of sampling is to obtain data from a group of people representative of the population being studied. Study participants should be selected in a way that will not introduce bias into the study results. When selecting the sampling design, the researcher should consider what the purpose of the study is, what the available resources are, and how data will be collected. Furthermore, the sampling design, selection process, and sample size will influence the precision of the statistical results.

Selection Bias

The sampling design will influence how the sample is actually selected. The pharmacy researcher must attempt to avoid sample selection bias, whereby participants with certain characteristics become overrepresented or underrepresented in the sample. There are several sampling biases to be aware of, as listed in Table 1-1.

Sample Size

Within the sampling design, the researcher should indicate the desired sample size. Although sample size calculations are beyond the scope of this chapter, researchers consider the study budget, purpose, desired statistical power, and statistical plan when determining sample size. Experienced survey researchers often consider a sample of 100 respondents as a minimum and a sample of 1000 respondents as a maximum for large population studies.

In survey research, the sample size reflects the number of completed surveys desired. It is unlikely that all surveys distributed will be completed. Thus, once the sample size is determined, the researchers must take into consideration the number of people who may not respond.

Response Rate

The researcher must account for nonresponse. Some people will not receive the survey, some will refuse to answer it (e.g., due to the topic or time constraints), and some will not be able to complete the survey (e.g., illiterate or too sick). To calculate the response rate, the researcher divides the number of completed surveys by the number of surveys distributed and received. Thus, if 10 surveys are returned by the post office because of incorrect addresses,

Table 1-1. Sources of Sampling Bias

1. *Accessibility bias.* Some respondents are more readily selected or included in the sample so they are overselected.
2. *Affinity bias.* Respondents who are most attractive to the interviewer are more often selected, so they are overrepresented.
3. *Cluster bias.* The respondents selected are too closely clustered, so they are more similar to one another than to the population as a whole.
4. *Nonresponse bias.* Respondents of a certain type more often refuse to participate, so they are underrepresented.
5. *Order bias.* The order of respondent selection overselects or underselects those of a certain type because they are in a certain place.
6. *Self-selection bias.* Respondents are allowed to volunteer and those of a certain type more often do so, so they are overrepresented.
7. *Termination bias.* Respondents of a certain type more often prematurely withdraw their participation in a continuing task, so they are underrepresented.
8. *Visibility bias.* Some types of respondents are more easily identified or recognized than others, so they are more often selected.

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these 10 would be subtracted from the denominator. The usable response rate can be calculated by dividing the number of returned surveys that are usable by the number of surveys distributed and received. Usable means the survey is complete enough for the researcher to include it in the analysis; usually, at least 50% of survey questions would need to be answered to be usable.

There is no optimal response rate except that a higher response rate is better. In mail surveys of the general population, it is common to see response rates of 10%–20%. For interview-type surveys, response rates are often much higher, ranging from 50% to 80%.

The researcher must reduce the amount of nonresponse and then evaluate whether the nonresponse is a source of bias. A couple of common methods to determine if there is nonresponse bias are to obtain data for key variables from a sample of the nonresponders and compare with data for these variables in the responders, and compare the first 10% of responders to the last 10% of responders; the assumption is that the late responders are similar to the nonresponders. If there are differences in the data between the two groups by either method, then it is likely that there is nonresponse bias. Statistical methods, such as corrective weighting of the survey data by using specific demographic variables, can be used to correct for nonresponse bias.

Data Collection Methods

Another important consideration when conducting a survey is to determine how the data will be collected. Data collection can be the most expensive and time-consuming part of the study. Study aspects to consider when selecting a data collection method include the population characteristics, the sampling technique, the potential response rate, the availability of resources (e.g., a computer-aided telephone system), the survey topic, and the questionnaire design. For example, if one is surveying a population that is not literate, it may be more practical to do a personal or telephone interview compared with a self-administered survey where the respondent would have to read and respond to the questions independently. Alternatively, if surveying a population about their drug abuse, it may be best to ask them to complete a questionnaire because they may be embarrassed or uncomfortable talking with someone about the issues.

Based on the study aspects, the survey method could be a self-administered survey, personal interview survey, telephone survey, or electronic survey, as reviewed below. One of the main differences in these methods is the intensity of contact between the researcher and the study participant.

Self-Administered Survey

A self-administered survey is completed by the respondent independently and is commonly distributed personally or by mail. It is important for the survey tool to look professional and be visually appealing. The survey should be printed using black ink on high-quality stock paper, with 12-point font (larger font may be necessary if the population has vision problems). There should be plenty of white space, as survey pages that are text-heavy are unappealing to the respondent.

Distributing surveys through personal interaction may be used when the pharmacy researcher has personal contact with the potential respondent. The pharmacy researcher should explain the purpose of the study, the time commitment, and any incentive to participate. The potential participant should not be coerced into completing the survey. If the person agrees, the cover letter, survey instrument, and incentive should be provided to the person. In addition, the person should be given the time and privacy to complete the survey confidentially.

Mail surveys are commonly conducted to reach large numbers of potential participants in dispersed locations at a relatively low cost. Mail surveys avoid any potential that the pharmacy researcher may directly influence the responses. To conduct a mail survey, it is important to have an accurate list of mail addresses. The disadvantages of using a mail survey include potential for low response rate, the need for several weeks to collect the data, and the difficulty to present any type of stimuli or complex survey design (e.g., presenting an education brochure for respondents to react to or having respondents skip certain sets of questions based on previous responses).

The mail survey packet consists of several components. It is optimal to use a mailing envelope that does not give the appearance of "junk mail." Although metered or bulk mail is often used to lessen cost, it is best to place a stamp on the envelope. A stamp makes the envelope look like personal mail, making it more likely to be opened and not discarded as "junk mail." Often researchers spend so much time developing the questionnaire that they fail to create an effective cover letter. One purpose of the cover letter is to persuade the person to complete and return the survey. The

letter communicates what the study is about, why the person was selected to participate, whether the survey responder will remain anonymous, how the survey data will be used, and the time commitment. The letter should be signed by the researcher and provide a contact number for the potential participant to call if there are questions. A return envelope should be provided so that the respondent can return it at no charge. Two common ways are to provide a stamped envelope with a return address on it or a business reply envelope where the expense per envelope is more; however, postage is only charged for surveys returned. Also, any type of participation incentive that is being provided should be included in this original mailing. An effective incentive in mail surveys is $1 as a token of appreciation for the time and effort to complete the survey. Other examples of incentives include offering a final report of the results, entering the responder into a raffle, or offering coupons or gift cards. These incentives can be used with other data collection methods as well.

For any survey, response rate is increased by emphasizing the importance of participation in the study and decreasing the burden of participating. For mail surveys, it is important to have more than one contact with each potential participant. An initial letter should be sent to potential participants informing them that a survey is being mailed to them. Then the initial survey packet should be sent. After a couple of weeks, a reminder postcard should be sent to remind them to complete and return the survey if they have not done so. If the researcher is able to identify who has and has not responded, another mailing of the survey instrument may be done within 2 or 3 weeks to those who have not responded. It is possible to identify returned surveys and yet preserve anonymity. For example, an identification number on the back of the survey or at the bottom of the last page could be linked to the sampling list. When a survey is returned, the number is trimmed off the page and the respondent's name is removed from the mailing list. Thus, reminders and follow-up surveys will not be mailed to participants who have completed the survey. Most surveys will be returned within 3–4 weeks of the initial mailing. It is advised to monitor the response rate and select a cutoff date.

Another form of a self-administered survey is a fax survey. The same general principles of mail surveys apply to fax surveys. Fax surveys are usually one or two pages. The main advantage to a fax survey is the quick distribution and receipt time. Thus, results from a fax survey can be available quickly. Response rates for fax surveys can be at least as good as mail surveys.

Personal Interview Survey

Another way to collect data is to interview study participants. This method is more expensive than mail surveys, because interviewers must be hired and trained to collect data. Because it costs more per respondent, the interview is more practical for a small sample size than a large sample size. It is the optimal method when population characteristics require an interview-style survey or when the survey instrument is complex or contains visual stimuli (i.e., pictures, videos, or other visual images that the respondent would need to view before answering the questions). The most difficult part of the personal interview survey process is training and supervising interviewers. The researcher must be aware of the potential for interviewing bias, where interviewer behaviors may influence a respondent's answers. Tone of voice, facial expressions, distorting or rewording questions, and interjecting opinions and comments are examples of how an interviewer can influence the answers provided. Another consideration when using multiple interviewers is interrater reliability or whether the interviewers are measuring variables consistently. Interrater reliability of 0.70 may be acceptable for some studies; however, most researchers want interrater reliability to be at least 0.80. Reliability is further discussed later under the topic of survey quality.

Computer-assisted personal interviewing allows the interviewer to use a computer to facilitate the interview. A computer can facilitate the survey process by directing the flow of the interview and controlling the sequence of questions. The interviewer can then enter data directly into the computer, eliminating the two-step process of recording answers and then entering data into a computer as a separate activity. Also, computer fields can be set to respond to certain keystrokes to prevent invalid responses from being entered.

Telephone Survey

Another option similar to the personal interview survey is the telephone survey. Telephone surveys are usually less expensive than personal interview surveys, yet the interviewer still has the opportunity to talk to the respondent. When considering the population characteristics or the survey instrument design, it may be beneficial for the interviewer to talk directly to the respondent. Similar to the personal interview survey, interviewers have to be selected, trained, and monitored, and interviewing bias and interrater reliability must be assessed.

As with the other data collection methods, often a multi-contact strategy is needed. The pharmacy researcher may want to send a letter informing participants of the study or call to schedule an interview.

Technology has also facilitated the use of telephone surveys. Random digit dialing allows the computer to randomly call numbers, including those that are unlisted or new numbers.

Computer-aided telephone interviewing systems can be used to help with call scheduling and directing the flow of the interview. These systems also allow the interviewer to enter data directly into the computer.

Electronic Survey

The fourth option is electronic surveys conducted through e-mail or the Internet. With the availability of computers and survey software programs (e.g., Survey Monkey at *www.surveymonkey.com*), electronic surveys are becoming more common. They offer efficiencies: cost per respondent for electronic surveys is less than for other data collection methods; time to collect data is much less than with mail surveys or interview surveys; and printing, postage, and data entry that accompanies the other data collection methods are eliminated.

Although electronic surveys offer several efficiencies, there are also precautions. The pharmacy researcher has to consider whether the study population has access to e-mail or the Internet, and whether the connection is high-speed.

Some people are concerned with privacy issues when asked to complete an electronic survey. It is advised to give the respondent the option of printing the survey and faxing or mailing it back. The pharmacy researcher must also consider the sampling design when conducting an electronic survey. If an Internet-based survey is conducted, a user identification should be required so that only participants have access to the survey. Response rates can also be an issue with electronic surveys, as it is easy for potential respondents to delete the survey instrument from the e-mail or avoid going to the survey Internet site. Thus, as with all other data collection methods, it is recommended to use a multi-contact strategy. For example, the pharmacy researcher may want to send a letter or e-mail informing the participant that he or she will be receiving an electronic survey (in a few days) before sending the survey.

When designing a survey instrument to be posted electronically, it is important to consider how the survey instrument will appear on the participants' computer screens and to use common response formats, similar to those found on paper surveys. According to a few case studies, participants are more likely to answer open-ended questions when completing the survey electronically compared with pen and paper.

Survey Instrument Design

The survey instrument design should be chosen with considerations for the population to be surveyed and the data collection method. Researchers are often interested in variables that cannot be directly seen like beliefs, pains, emotions, needs, and other abstract concepts. These abstract variables are often called constructs. Measurement instruments are then developed to measure them. To measure the study constructs and variables of interest, researchers have the choice of using developed scales and existing instruments, adapting scales and survey questions from previous surveys, or developing a new set of questions and scales for their survey instrument. If the third option is chosen, researchers must be knowledgeable of the topic and study population. It is sometimes advised to do an exploratory study before designing a survey. The results of in-depth interviews or focus groups can be helpful when deciding which questions should be asked and how the questions should be worded.

Question Writing

Survey questions are used to elicit responses from respondents for data collection. The time and energy spent developing a clear question will pay dividends to the researcher during later stages of the study. Clearly written questions improve reliability, as all respondents will interpret the questions in the same way. Each survey question should be written so that it is measuring only one variable. It is best to write short questions and use simple sentences. To ensure that respondents interpret the questions similarly, it is advised to use wording appropriate for the population, which includes writing questions at the appropriate reading level for the respondents and avoiding slang or language that the respondents may not be familiar with.

It is difficult to have only one question, often called a survey item, that accurately measures constructs like professionalism and trustworthiness. Thus, several questions or items may be combined into a composite score to measure the construct. The score therefore reflects the level and amount of the variable present, although not directly seen. This collection of items is often referred to as a scale. A developed scale should be tested for validity and reliability. Researchers can find many developed scales in the literature. When there is not a developed scale for a construct of interest, researchers may decide to develop a scale, realizing scale development is a lengthy process.

Not all variables of interest will be constructs and not all questions will be scales. For example, variables, such as age, gender, number of visits to the pharmacy, or experience with a drug product, may be directly measured through one or more questions on the survey.

Instrumentation Bias

Writing questions that mislead the respondent or may be interpreted in multiple ways leads to instrumentation bias. Below are examples of question types that have been seen in pharmacy surveys that may lead to instrumentation bias, and therefore, should be avoided:

- Avoid double-barreled questions or multiple questions in the same question (e.g., "Have you eaten well and exercised regularly this week?").
- Do not provide examples in the question that may introduce bias, like "How many nonprescription products like ibuprofen have you bought in the past week?" Some may consider how many times they have bought ibuprofen this past week, others may consider how many times they have bought pain relief products in the past week, and others may consider how many nonprescription products in general they have bought in the past week.
- Do not ask questions that require a long recall period. It is difficult for people to remember their thoughts and behaviors after a long time period. An acceptable recall period is usually 4 weeks or less.
- Do not use leading questions that guide or suggest that the respondent should answer in a certain way, like "Do you not trust your pharmacist?"

Response Bias

Another source of bias that is seen in pharmacy surveys is response bias. This bias is not a function of the instrument but is introduced because of the perception or feelings of the respondents. It is important to be aware of this type of bias when writing survey questions, as well as when considering the data collection method and interpreting the results. Examples of response bias are listed in Table 1-2.

Question Response Format

Questions can be written to elicit two basic response formats: open-ended and close-ended. Open-ended questions allow the respondents to give an answer in their own words. These questions are appropriate to use if researchers do not know the response choices or want to get quotes or new information from respondents. Open-ended questions, for the most part, lead the researcher into conducting a qualitative analysis. Alternatively, close-ended questions

usually provide response choices and produce standardized data that can be used in a quantitative analysis. This section focuses on close-ended questions because researchers not only have to write the reliable question but also must provide appropriate response choices.

When determining how respondents should respond, it is important to consider what types of data (i.e., nominal, ordinal, or interval/ratio) is needed for statistical analysis. If a pharmacist researcher wants to conduct multivariate analysis where interval or ratio data are required, then the response options need to be interval level data. For example, if age will be a variable included in a regression analysis, it would be best to ask "What is your age?" and not have the respondent select an age category. It is recommended to collect interval level data as much as possible as they can always be grouped into categories during the analysis if necessary. Categorical response may be best in instances where the respondent may not be comfortable writing the answer, such as income.

Survey questions often ask about perceptions, beliefs, attitudes, and other subjective states. The respondent is asked to select a category that represents his or her choice or to select along a continuum a position that represents his or her choice. This representation of categories or a continuum is called a response scale. Some conventional response scales are discussed.

Multiple choice responses provide choices or alternatives for the respondent to select and the options are considered nominal level data. An example of a multiple choice question yielding nominal level data is "which type of pharmacy do you patronize" followed by response options of chain, independent, or other. The list of categories needs to be mutually exclusive (i.e., each category is distinct) and all inclusive (i.e., all possible answers provided). Researchers may want to include the option "other" and provide a blank for the respondent to write another answer that has not been listed. Researchers should also specify on the survey if the respondent is to select only one category or to select multiple categories. Another form of the multiple choice response is the adjective checklist where the respondent selects adjectives that describe a specific object or topic.

A forced ranking scale forces the respondent to rank several items in order of preference. The respondent is asked to put a "1" by his or her first choice, and a "2" by his or her second choice. These results are considered rank or ordinal level data.

The Likert scale is one of the most commonly used response scales, due to its ease of use. For the question "How much do you agree with the following statement(s)?", one or more statements are provided and the respondent indicates on a 5-point scale whether he or she agrees or disagrees with the statement, with 1 meaning strongly agree, 2 meaning agree, 3 meaning neutral, 4 meaning disagree, and 5 meaning strongly disagree. Numerical responses that are defined are considered ordinal level data. If only the 1 and 5 are labeled, many researchers consider the data interval level. This type of response scale is often used because the scores on the individual items can be summed to provide an overall score for the measurement of a specific construct.

The linear numeric scale is a Likert-type scale. Items are measured along some dimension using a linear number scale with each end of the scale labeled appropriately. For example, a respondent may be asked to rate the importance of a certain item on a 5-point Likert-type scale where 1=not at all important and 5=very important. The other numbers on the scale are not labeled. The data are considered interval level data and can also be summed to provide an overall construct score. A 5-point and 7-point scale is commonly used. If the researcher does not want the respondent to have the option of selecting a neutral response, then an even-numbered scale may be used to force the respondent to select either a positive or negative position.

Another variation of a linear scale is the semantic differential scale. It is used to measure the image of a product, store, person, or other object by asking study participants to rate their opinion on a scale of several adjective pairings to describer their opinion. The adjective pairings are polar opposites. For example, the researcher may ask participants to rate their opinion about a drug product on several polar-opposite adjective pairings, like inexpensive-expensive, harmful-safe, or efficacious-not efficacious.

Table 1-2. Sources of Response Bias

1. *Social desirability.* Response based on what is perceived as being socially acceptable or respectable.
2. *Acquiescence.* Response based on respondent's perception of what would be desirable to the sponsor.
3. *Yea-saying and nay-saying.* Response influenced by the global tendency toward positive or negative answers.
4. *Prestige.* Response intended to enhance the image of the respondent in the eyes of others.
5. *Threat*. Response influenced by anxiety or fear instilled by the nature of the question.
6. *Hostility.* Response arising from feelings of anger or resentment engendered by the response task.
7. *Auspices.* Response dictated by the image or opinion of the sponsor rather than the actual question.
8. *Mental set.* Cognitions or perceptions based on previous items influence response to later ones.
9. *Order.* The sequence in which a series is listed affects the responses to the items.
10. *Extremity.* Clarity of extremes and ambiguity of mid-range options encourage extreme responses.

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Survey Construction

In addition to carefully written questions and response options, the survey instrument should be assembled in a logical manner. The survey instrument should have a title on the first page. The instrument should conclude by thanking respondents for participating in the survey and informing them of any other details, such as how to return the survey or when the incentive will be mailed. The pharmacy researcher must be careful to balance the number of questions with the amount of time the respondent is expected to complete the survey. Questions should be grouped according to the topic, the response format, or a combination of both techniques. Directions on how to answer questions should be provided,

and transition statements between major topic changes should be considered. Although the location may depend on the topic or purpose of the study, it is often advised to put the demographics at the end of the survey. Demographics are put at the end of the survey so that the respondent begins immediately answering questions about the topic; therefore, if the respondent does not complete the entire survey, the researcher may be able to use the survey data or results if most of the key questions about the topic were answered.

The researcher should ask the minimum number of questions needed to accomplish the study purpose. Although there is no optimal length, it is best to keep the survey short, as length is one factor in response rate. Surveys with 12–15 questions are considered short. Participants may become less willing to complete the survey as the number of questions nears 100. The importance of the topic, characteristics of the study population, the data collection method, and the incentive will influence how tolerant respondents are to the survey length. Respondents may be more willing to spend 60–90 minutes completing a face-to-face interview but only 15–30 minutes completing a mail survey.

Once the survey instrument has been drafted, it should be pretested. Pretesting is the final step for improving the survey instrument before the study begins. A pretest consists of administering the survey instrument to a small number of people, usually between 5 and 30, who have characteristics similar to those of the target group of respondents. The pretest helps the researcher identify questions that are not clear, directions that are misleading, and other potential problems.

Survey Quality

Two measures of the quality of a survey instrument are its reliability and validity.

Reliability

One aspect of the quality of the survey instrument is the reliability of the measures on the instrument. It is important that the measurement process be consistent and reproducible. There are several indicators of reliability as discussed below.

Internal consistency is one indicator of reliability. It is measured by calculating a statistic called Cronbach's coefficient alpha. This number reflects the homogeneity of the scale; that is, how well the different items in a scale are measuring the same variable. An alpha value greater than 0.70 is desired. If the coefficient is lower, it can usually be improved by adding items to the scale or rewording questions for clarity. Even when the reliability of a developed scale has been published, it is recommended to recalculate the Cronbach's coefficient during data analysis to determine the reliability of the scale when used in the respective study population.

Another way to evaluate reliability is comparing responses from different people or the same people on different occasions. One of the most commonly used methods is the test-retest method. This method measures the stability of responses over time usually in the same participants by administering the survey to a sample at two different points in time. The responses are then compared by calculating correlation coefficients. Coefficients greater than 0.70 are considered good.

A third way to evaluate reliability of a survey instrument is to create alternative forms of the survey instrument. The pharmacy researcher may reword questions or response options, or reorder questions on an alternate version of the survey, with the intent of measuring the same variables. The original instrument is given to a sample and then at a later time the alternate version is given to the same sample. Correlation coefficients are then calculated. This method attempts to avoid the potential problem of the test-retest approach where participants may remember their responses from the previous administration and answer accordingly. The difficulty of this method is creating multiple versions of the survey instrument that measure the same variables.

A variation of this approach is the split-halves method. When the sample is large enough, half of the sample can receive one version of the survey instrument and the other half can receive the alternate version of the survey instrument. Then the results from the two groups are compared. A major consideration with this method is ensuring that the sample is randomly divided and that there are no differences in the groups that would cause them to respond differently to the questions.

Validity

The other aspect of the quality of the survey instrument is the validity of the measures on the instrument. In addition to having survey questions measure variables consistently, it is equally important that the questions measure what the researcher intended them to measure. Validity refers to how well the survey instrument or scale is measuring what it is intended to measure. Validity should be assessed each time a scale or instrument is used, especially if it is a newly created scale or if it is used for a different purpose or in a different population than originally developed. Similar to reliability, there are multiple ways to assess validity.

Content validity assesses whether the topic of interest is adequately addressed. People with expertise and experience in the topic are asked to evaluate whether the instrument has content validity. They are asked to determine whether the questions represent the topic adequately, whether the questions are appropriate, and whether any important features of the topic have been missed. Content validity may be assessed during the process of developing the survey instrument. One aspect of content validity is face validity. Face validity is assessed by a few nonexperts who provide a cursory view of items to see whether they look acceptable. In other words, after the instrument is developed, lay people are asked whether the survey looks like it measures what it is supposed to measure.

Criterion-related validity evaluates whether the measure is correlated with other measures or events that logically would be correlated. For example, if measuring medication adherence, the researcher may correlate the self-reported answer to a medication refill history. One would expect a person who reports high medication adherence to refill his or her medications regularly. It is not reasonable to expect perfect correlations. A challenge is finding appropriate criterion with which to correlate the measure. Other forms of criterion-related validity include concurrent validity and predictive validity. Concurrent validity may correlate the scale score with a gold standard measure, and predictive

validity evaluates how well the measure predicts (or is correlated with) future events.

Construct validity is an ongoing process that tests the theoretical link between an observable behavior or attribute and an underlying factor. It assesses the theoretical relationships of a study variable to other study variables. For these relationships to have any meaning, it is important to ensure that each measure is measuring the study variable of interest. Factor analysis is a statistical tool that is useful in assessing construct validity. It can help determine whether different items are measuring the same construct.

Data Processing and Analysis

After the data have been collected, they have to be processed and analyzed to provide results. Although data processing will vary slightly depending on the data collection method, the basic principles are the same.

Data Receipt and Coding

When a survey is received, the date should be recorded and the survey should be given an identification number. The identification number is used to link the paper documents to the database entry. The pharmacy researcher should look at the survey and assess it for completeness. The researcher will have to decide how much of a survey has to be completed for it to be considered usable. A few missing items are generally considered acceptable.

Most survey responses need to be recorded in numerical form, rather than words; therefore, surveys need to be coded. If computer technology is used and the responses are entered directly into a software program, the survey is coded before data collection. If the question asks for a numerical answer or has a linear-type scale with a numerical value, the number response is recorded. However, if categories are listed, then each category response is given a numeric code. Codes are given to missing data. A codebook can be generated that provides the code for each question so that all data entry clerks are using the same codes.

If the data have not been entered directly into a spreadsheet or database, data entry clerks will need to enter the data. Usually the rows represent different respondents and the columns represent different study variables. Data entry should be checked for accuracy after 10% of surveys have been entered.

After all the data are entered into a database, the data need to be cleaned and edited. It is advised to run frequencies for all variables and look for inappropriate responses. When inappropriate responses are found, the data must be checked against the paper version or discarded as missing data. Other ways to identify problems in the data include checking deviations from variable range or spot checking various entries for accuracy. The researcher will have to consider how to handle missing data depending on their type. Examples of approaches to handle missing data include deleting an observation if it is missing any data, replacing a missing observation with the sample mean of the variable, or using a regression model to estimate the missing variable of interest. Statisticians can provide guidance on how to handle the missing data.

Data Analysis

When a sample is surveyed, statistical analysis is conducted so that inferences can be made to the population. Statistical analysis allows the researcher to compute the probability that the values obtained from the sample are within a specific range of those for the population. Statistical analysis helps the researcher describe the population, identify trends, and identify relationships.

After statistical analysis, the pharmacy researcher should interpret the results and report the findings through publication or presentation. When disseminating the results, it is important to tell the purpose for conducting the survey, how the survey was conducted, a description of the survey instrument and the reliability and validity properties of the survey, who was sampled, the response rate, and the study limitations.

Conclusion

This chapter provides an overview of the survey research process. By carefully considering the data collection method, survey instrument design, sampling design, and data analysis plan, a well-designed survey can be conducted. Results from a survey can provide insight into people's beliefs, attitudes, and behaviors and inform pharmacy stakeholders about various issues facing pharmacy practice.

Annotated Bibliography

1. Desselle SP. Constructing mail survey questionnaires to maximize rates of return and assure the validity and reliability of responses. J Manag Care Pharm 2002;8:225–31.

   This article is written with a pharmacist audience in mind. The author describes how to write survey questions and develop a survey instrument. When writing survey questions and developing a survey instrument, it is critical to consider the respondent. The author provides justification for how the survey design influences the response rate in mail surveys. The data collection section of the article provides in-depth information pertaining to assembling the survey piece (i.e., cover letter and survey instrument) and using multiple mailings to increase the response rate. This article would be beneficial for someone who is doing a mail survey questionnaire for the first time. It will provide helpful hints in designing and mailing a survey that will improve the response rate.

2. Desselle SP. Implementing mail survey questionnaires. J Manag Care Pharm 2002;8:157–63.

   This article provides an overview of using mail survey questionnaires. The author walks the reader through a step-by-step process for conducting a mail survey. The steps include deciding the purpose of the project, selecting the research design, selecting a sample, selecting a scaling method, constructing the survey instrument, pilot testing the survey, evaluating the validity and reliability of the scale, evaluating nonresponse bias, and analyzing the results. The author spends considerable time discussing how a scale is developed to measure a specific construct and how to

determine the reliability and validity of the measurement scale used in the survey. The author advises collaborating with an experienced survey researcher when developing scales to be used in questionnaires. The strength of this article is that it provides a general outline of survey methodology and it provides extensive references to find more information about each topic.

3. DeVellis RF. Scale Development: Theory and Applications, 2nd ed. Thousand Oaks: Sage Publications, Inc., 2003.

   This book is recommended for researchers interested in developing their own scales to measure specific constructs. This book is an introduction into psychometrics, which is concerned with measuring social and psychological variables, such as perceptions, beliefs, and attitudes. In psychometrics, scales are developed and used to measure these abstract variables. This book provides a summary of scale development for novice survey researchers that goes beyond what this chapter covers. The author specifically distinguishes between reliability and validity and how to measure these when developing a new scale. An entire chapter is devoted to factor analysis, which is a common statistical method used in scale development. This book would be useful to a pharmacist who is developing a survey instrument. By reading the book, the pharmacist will be more informed about measurement concepts and, therefore, likely to develop a better survey instrument and obtain more reliable and valid results.

4. Dillman DA. Part 2: tailoring to the survey situation. In: Mail and Internet Surveys: The Tailored Design Method, 2nd ed. New York: John Wiley & Sons, 2000:217–413.

   Technology is changing the way surveys are conducted. With the availability of computer software to design online surveys, the use of electronic surveys is becoming more common. This section provides an excellent description of how to tailor the survey design to match the various technologies. Although technology has made surveys less expensive, it is still important to conduct the survey in a reliable and valid manner. The survey process is similar regardless of the data collection method; however, there are some computer issues like privacy and connection speed to consider when conducting an e-mail or Internet survey, as described in the data collection section of this section. The author challenges the survey researcher to think about sampling, selection bias, nonresponse bias, and other potential survey problems when conducting an electronic survey.

5. Branson RD. Anatomy of a research paper. Respiratory Care 2004;49:1222–8.

   This paper is about presenting survey results and any research results. Because it is critical for researchers to disseminate their results, the authors specifically discuss the steps to publishing research data. As mentioned in the chapter, the last step in the survey process is to present and/or publish the results. This article provides a template for writing a research paper from the title page to the conclusion. In addition, the author provides insight into deciding who should be an author and who should be the corresponding author, how funding agencies or others should be acknowledged, how conflicts of interest should be addressed, and the importance of referencing.

6. DiIorio CK. Knowledge tests. In: Measurement in Health Behavior: Methods for Research and Education. San Francisco: Jossey-Bass, 2005:75–102.

   Pharmacists often use surveys to measure a patient's knowledge of a particular subject. This chapter is devoted to developing high-quality knowledge tests. There are six levels of learning: knowledge, comprehension, application, analysis, synthesis, and evaluation. Test questions should be written to measure these various levels of learning. One strength of this chapter is the examples of test questions that measure knowledge. The chapter concludes with an overview of three methods to evaluate the quality of each test question as well as the entire test. These methods include item-objective congruency, difficulty index, and item discrimination index.

7. Aday L, Cornelius LJ. Designing and Conducting Health Surveys: A Comprehensive Guide. San Francisco: Jossey-Bass, 2006.

   This book is highly recommended because it applies all the survey methodologies to health situations. This comprehensive guide to conducting health surveys would be helpful to even the more experienced survey researcher as it provides technical information and many health survey examples. At the back of the book is an excellent compilation of cover letter examples, survey examples, and a list of developed health surveys. Another strength of the book is that each chapter contains a section devoted to special populations such as patients with low health literacy or patients of different cultural or ethnic backgrounds. An entire chapter is devoted to the conceptual design of the study. Researchers need to consider theoretical models and the relationships between the study variables; clearly state the hypotheses; operationalize the study variables; and consider measurement issues and analysis when designing a survey tool.

8. Alreck PL, Settle RB. Part 2: Developing survey instruments. In: The Survey Research Handbook, 3rd ed. Chicago: McGraw-Hill Irwin, 2004:87–178.

   Part two of this book contains three chapters devoted to developing a survey instrument. The advantage of this book over other books is it provides examples of each comment or point that is made in the text. It provides an example of the right way and the wrong way to write survey questions. The authors provide checklists to help the survey researcher avoid instrumentation bias and response bias. The authors describe how to write questions, how to select appropriate response options, and how to construct the questionnaire, focusing on the organization of the instrument.

9. Cala S, Crismon ML, Baumgartner J. A survey of herbal use in children with attention-deficit-hyperactivity disorder or depression. Pharmacotherapy 2003;23:222–30.

10. Wittkowsky AK, Sekreta CM, Nutescu EA, Ansell J. Barriers to patient self-testing of prothrombin time: national survey of anticoagulation practitioners. Pharmacotherapy 2005;25:265–9.

    Both of these articles (References 9 and 10) provide examples of published survey results pertaining to pharmacy issues. The survey of herbal use is an example (Reference 9) of surveying patients or caregivers about a particular topic; in this case, the caregivers were surveyed about the use of herbal therapy in children. The authors describe the study sample, the development and administration of the 23-item questionnaire, and the statistical analysis used. Limitations of the study include a small sample, a convenience sample, and a nonvalidated survey instrument. The second cited article (Reference 10) pertains to a national survey of pharmacists about barriers to patient self-testing. The authors describe the sample frame as a registration list from the 2003 annual

meeting of the Anticoagulation Forum. An initial mailing was conducted, followed by a reminder postcard. The response rate was 43.7%. The limitations of the second survey include a sample frame that may be biased and include only patients who self-test and who are monitored in an anticoagulation clinic. These two articles provide real examples of how survey research is conducted in pharmacy and how results are interpreted given the study limitations.

11. Fink A. Analyzing and organizing data from surveys. In: How to Conduct Surveys: A Step-by-Step Guide, 3rd ed. Thousand Oaks: Sage Publications, Inc., 2006:69–90.

    This chapter is much improved from the previous versions of this book. Because most people will use a computer program to code and analyze data, the survey researcher needs to know how to code data and handle missing data. The author also provides an overview of statistical analysis methods often used with survey data and gives examples of each statistical technique. The author reviews some basic statistical concepts like Type 1 error, Type 2 error, and power. This chapter is recommended to those who are new to survey research. Reading this chapter before beginning a survey project can help guide the researcher operationalize the study variables and help establish an analysis plan.

12. Groves RM, Fowler FJ, Couper MP, Lepkowski JM, Singer E, Tourangeau R. Survey interviewing. In: Survey Methodology. Hoboken, NJ: John Wiley & Sons, 2004:269–301.

    This is a more technical book in that it provides methodological research results that have guided the development of survey methodology. The book is intended for an audience that has some training in research design and statistics. Although the book is an advanced survey methodology textbook, the chapter on survey interviewing expands what is provided on interviewing in this chapter and can be helpful when using this data collection method. This chapter describes the role of the interviewer, how to reduce interviewer bias, how interviewers should begin the interview, how to ask probing questions, and how to record responses accurately.

13. Fowler FJ. Survey Research Methods, 3rd ed. Thousand Oaks: Sage Publications, Inc., 2002.

    This excellent book provides an overview of survey research methods for an affordable price. It is a relatively short book that provides information on how to avoid common survey mistakes and improve the quality of a survey. Of particular interest is the chapter on sampling, which describes different sampling techniques as well as discusses sample size and weighting the sample data to reflect the population. The disadvantage to this book is that it does not provide many graphics, tables, or examples the way many of the other textbooks do. It is an overview of the entire survey process, and therefore, one should seek a specialty book for in-depth information about a particular step in the survey process.