STUDY DESIGN FOR SURVEY RESEARCH

Stanley W. Hatch, OD, MPH, FAAO

Chapter Overview

Objectives

On completion of this chapter, its case study and study questions, the student of survey research should be able to:

- Describe some topics or public health questions most suited to survey research.
- Identify sources of bias in survey research
- Develop a sampling method for a survey study
- Evaluate the validity of a survey question item

Public Health Principles in Survey Research

Survey research methodology grew from social science where it is often used in business, marketing, politics, and economics. Because those disciplines measure human behavior and much of public health depends on behavior, the social science principles of survey research are directly applicable to much of public health.

Social science survey research is important because it not only tries to measure past and present behavior but also future behavior. The political opinion poll, for example, is designed to measure public attitudes to predict how people will vote in elections. Surveys in public health may investigate current health behaviors such as how much vegetables do people eat, how often do they exercise, do they smoke, have they tried to quit smoking, do they plan to quit smoking, do they wear seat belts, do they wear safety eye protection, how often do they get routine eye exams, or physical exams, etc. Futures studies seek to predict how to change behavior. People without health insurance can be surveyed with questions such as how much they would be willing to pay for various health insurance benefits, how likely they would get an eye exam if it was a covered benefit. People can be asked if fresh vegetables were cheaper would they eat more, if a free smoking cessation program was offered at work would they participate, and has their seatbelt use changed since a mandatory seat belt law went into effect.

Subjects most suited to survey research are those which can be accurately measured by subject response (1). Some physical measures can be accurately surveyed if subjects have standardized equipment. Height, weight, blood pressure, blood sugar, exercise, and nutrition can be easily surveyed when subjects use standardized instruments and timetables to measure these on their own. Most medication use can be surveyed from a subject's prescription information. Clinical findings, however, are often not subject to survey research because they require a health care provider to perform the measure. Health care

utilization is appropriate for surveys because responses can be obtained from subjects, providers, insurance records, or written records such as a calendar. Disease incidence and prevalence are more difficult because they require accurate diagnosis. Mental illnesses are an exception since many are diagnosed by survey scores in or out of the office.

Survey Study Validity

The validity of survey research is assessed by the same measures as a basic science or clinical research project. The population of interest must be defined and a representative sample obtained. Do the methods of measurement actually measure the target variables accurately and precisely or is there misclassification? Are there other variables that affect the outcomes such as confounding bias? Are variables appropriately quantified, are appropriate statistical tests applied, and is there adequate power to detect statistical significance? To whom can the results of the study be generalized too?

Sources of bias in Survey Research

SAMPLING ERROR

The most challenging source of bias in survey research is sampling. Once the target population is defined, a random or representative sample must be chosen and those chosen agree to participate. Some populations are easy to define and sample. A sample from a clinic population can be randomly drawn based on medical record numbers. Inclusion or exclusion criteria, such as condition, age range, gender, treatment prescribed, can be sorted before sampling. Patients with established relations with the office or researcher are more likely to accept calls or letters of invitation to participate.

The majority of populations are more difficult to find and enroll. Suppose the target population is adults in a medium size city in Midwestern United States. The first challenge is to identify all adults within the geographic region. What sources could be used? Telephone listings are one source but some residents have unlisted numbers, some only use cell phones, and some do not have phones. Should business numbers be included or excluded? Persons working in a business with a listed phone number will have a higher chance of being selected if they also have a listed home phone number in the area. Commuters would have a chance of selection; where they part of the target population? Census records are better alternative, but there are problems. Census records may be outdated by years. Transient and homeless people would not be registered.

Contacting the subjects can lead to sampling error. If a telephone or door to door survey is performed, what day of the week and what time of day should it occur? Surveys on weekdays are more likely to miss working adults and more likely to get stay at home parents or retirees. Evening surveys will miss shift workers. Are daytime out of home workers likely to have different baseline characteristics then persons at home? They probably will be more likely to be

female, more likely to be older, and more likely to be middle class or upper class economically.

The biggest challenge in survey research is response rate. Potential subjects, in general, get annoyed with anything resembling telemarketing. Caller identification is more common, so many people elect not to answer unknown callers. Mail surveys are often ignored. Repeated attempts raise response rate slightly, but most survey's are lucky to get a 10% response rate. Do those who are willing to participate in a survey have different characteristics than those who are unwilling? It is likely they do, so the lower the response rate the more likely sampling error is present.

The use of incentives and reminders can increase response rates. A mail survey, for example, will get an initial response rate of less than 10% in most cases. A post card or phone call reminder may improve response rate by a few percentage points.

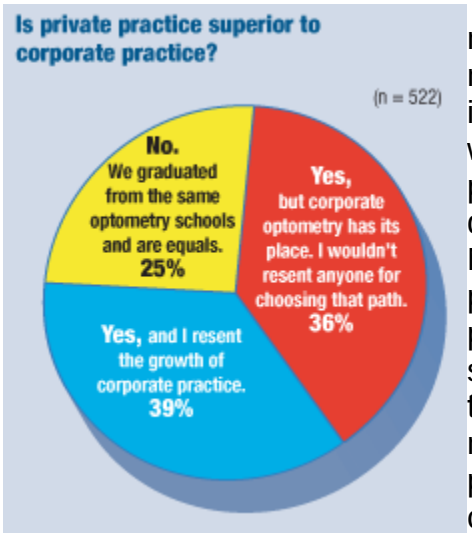
Some survey's include a few dollars cash as a thank you in advance. It is just enough money to guilt some recipients into filling out the survey without being much more costly then the time and expense of reminder cards and calls. Other surveys promise a check for more money after the survey is filled out and mailed. There may also be an option of donating the check to one of several charities.

There exists an entire science devoted just to survey sampling. For an introduction, see Kalton's book, Introduction to Survey Sampling (2).

MISCLASSIFICATION

Misclassification or information bias is error in the measurement of variables. If physical measures, such as height, weight, blood pressure, or blood sugar are surveyed, subjects will be using different scales, blood pressure cuffs, and glucometers. If results vary in any direction, it is called random misclassification and should not effect study results especially if the sample size is large. However, if instruments on average consistently over estimate or underestimate within groups, misclassification may change the results. For example, if most glucometers underestimate blood glucose in persons without diabetes and overestimate in persons with diabetes, then a larger discrepancy may be reported and a type I statistical error occur.

Recall error is especially problematic in survey studies. As discussed in chapter 5, human memory cannot be expected to maintain many details of life which seem unimportant at the time. The closer an event occurred, the more likely the memory will be accurate. If something happened at the same time as a big event, such as the birth of a child, the attack of 9-11, memory tags or associations are more likely to pinpoint the answer sought. But most things happen from day to day and any survey attempting to gain information from past behaviors will inevitably be wrought with inaccuracy.



Survey questionnaires and interview methods can be subjective sources of misclassification. A question in a survey instrument is called an item. Writing items where one and only one interpretation is possible is very difficult. Take for example the question reported in Review of Optometry, November 2008 (3). The question "Is private practice superior to corporate practice" was posed to readers of the journal who self selected. The question is subjective and open to varied interpretation. What does "superior" mean? It could mean more respected by the public, colleagues, or other health providers. It could mean higher personal quality of life or personal income. It could mean more fun or personal satisfaction. It could mean providing better care. There are many possible interpretations of superior. What comprises private practice compared to corporate practice? Many optometrists have independent private practices within a retail establishment. Some will define these practices as private; others as corporate. A similar confusion exists for a franchise practice.

The question also violates a basic rule in survey science: the item is constructed to associate one answer with a positive connotation and another with a negative connotation. The question does not allow the possibility that corporate practice is superior to private practice.

The authors divided answers into three arbitrary groups as shown. This is odd for a yes or no question. It is unclear from the article if the initial question allowed for three different responses with the qualifications provided or if the question was open ended and the answers are summary interpretations by the author(s). Since there is no option for neither or didn't respond, it seems the qualifications were added after the study. Rarely would 100% of a sample of 522 obtain all yes or no responses.

The biggest problem with the above survey is the sampling. The questions were published in the journal and respondents self selected. This means the opinions provided were from a population whose motivations may be very different from optometrists in general. Thus, the results cannot be generalized to any population other than the respondents.

Constructing questionnaire items is challenging in many ways. Answers can be dichotomous, *yes or no*, *high or low*, *present or absent*, or ordinal, *never, sometimes, frequently, always*. They may be forced choice where an answer must favor one side over another such as *strongly agree, agree, disagree, or strongly disagree*, or they may include a neutral *neither agree or disagree*. In general, short questions limited to one narrow subject is best. For example:

How often does either eye itch?
Less than once a day

Once a day
Twice a day
More than twice a day

Answers must not overlap. If asking a subject's age, 0-10, 10-20, 20-30, etc allows a 10 or 20 year old two options. The corrected version would be: 0-10, 11-20, 21-30 etc. though this still leaves the potential for error since a 10 year 11 month old subject might report being 10 or 11. The best scale which allows for only one answer from each subject is: <10, 10 - <20, 20 - <30, etc. In this instance, the moment one is 10 years old until the moment they turn 20, they can only choose the 10 – <20 option.

Often, an introduction describing the survey is helpful to get the subject thinking about the issues. An introduction may be several sentences leading to one item or a paragraph preceding several items on the same subject. For example:

The next several questions deal with common symptoms of eye irritation. These may occur at home or work, morning, mid day, or evening. They may be present when doing certain vision activities such as computer work, outdoor work, work in a factory or workshop. For each question, give the answer that best describes a typical day for you. If you work standard business hours of 9:00-5:00, Monday through Friday, this would be a typical work day rather than a vacation day or weekend. If your schedule varies, think about a day which is most common for you. Circle the answer that best describes your eye comfort.

In a typical day, how often does either eye itch?
Less than once a day
Once a day
Twice a day
More than twice a day
How often does either eye get red?
Less than once a day
Once a day
Twice a day
More than twice a day
How often does either eye feel dry?
Less than once a day
Once a day
Twice a day
More than twice a day
How often does either eye water, tear, or express any discharge?
Less than once a day
Once a day
Twice a day
More than twice a day

No matter how specific an item is written, some subjects will ask for clarification. It is very important, especially if the survey is done orally, not to try to interpret the question for the subject. For instance, if the subject states: "Some days my eyes water three times a day and other days they never water. So what should my answer be?" The examiner can only restate the initial instructions such as: "I understand there may be different frequencies on different days. Your answer needs to be what best describes your experience on a typical day." It is acceptable to repeat the item several times until the subject gives an answer or refuses to answer. Refusal to answer is usually not an option, so the data will just be left blank for that item. This can be accounted for in statistical analysis later.

To avoid ambiguity, items should not include "double vision", "double negatives", "implicit negatives", words with multiple meanings, and "knee jerk" answer options (4). "Double vision" occurs when the item stem provides two or more subjects from which different answers could apply. For example:

How often do your eyes itch and burn?
Never Sometimes Often Always

The person whose eyes itch often but never burn can't answer the question accurately. Anytime the words "and", "either", "or" occur in the stem there is potential for "double vision". When writing items, avoid those words at all costs. The question can be revised by writing two questions.

How often do your eyes itch?
Never Sometimes Often Always
How often do your eyes burn?
Never Sometimes Often Always

The astute reader will immediately note that the word "either" was used in the earlier examples in the stem. This illustrates one unique challenge to writing survey items for eye care. Most people have two eyes! The survey is usually designed to elicit symptoms that effect one or both eyes. In this case, the researcher is not interested in whether one or both eyes have the symptom, they are interested in the frequency of either one or both eyes, so the use of "either" is acceptable and should not introduce systematic misclassification.

Double negatives are implicitly confusing.

Wrong: *When reading do you not use dim light?*
Better: *Do you use bright light when reading?*

Implicit negatives are stems that suggest one answer is better than another. A respondent may tend to answer in the direction the stem suggests. Push polling in politics is an extreme example.

Wrong: *Do you wear your contact lenses longer than recommended by your eye doctor?*

Better: *On average, how long do you wear your contact lenses?*
<4 hours per day 4-8 hours per day >8 hours per day but not overnight occasionally overnight one night overnight 2-6 nights >6 nights

Other examples of leading stems:

Do you feel optometrists, who are not medical doctors, should be allowed to perform surgery, such as laser vision procedures?

or

Do you feel optometrists, doctors who specialize in the eye and optics, should have licenses expanded to provide laser vision correction?

The former question on laser vision states what optometrists are <u>not</u> and link laser vision correction with surgery in general. Thus, it leads some readers towards answering no. The latter question states what optometrists <u>are</u> and highlights their <u>specialization</u> and may lead readers to answer yes. The phrase "be allowed" implies a paternalistic attitude-that is optometrists are like children who must get permission. The phrase "licenses expanded" suggests an expertise already present. Both questions are true factually but may lead to very different reports of public opinion.

Knee jerk responses, answers which are immediately recognized or stand out from among others, can lead to systematic misclassification. Subjects looking for the best or "right" answer are more likely to choose an answer that is common or familiar. Words should not be repeated in the stem and an answer. Synonymous words should also be avoided between the stem and one answer.

Wrong: *Contact lenses should be cleaned and stored after each wear with:*

a. saline
b. *contact lens cleaning solution*
c. *a multipurpose solution*
d. *hydrogen peroxide*

Better: *Contact lenses should be cleaned and stored after each wear with:*

e. saline
f. *enzyme solution*
g. *a multipurpose solution*
h. *hydrogen peroxide*

In the former example, answer "b" is a knee jerk response. Most people will associate the word "contact lens" in the answer with "contact lenses" in the stem.

They may also associate “should be cleaned” with “cleaning solution”. The better question does not use any of the stem words. That makes each answer as likely as not, and the respondent is more likely to answer with what they actually do- not what they think they should do. Though even there, the word “multipurpose” may draw some attention since the stem includes “cleaned and stored”. The former question is a good test question for optometry students as it discriminates between knowing the difference between a cleaning solution and a multipurpose solution, but it is a bad survey question.

CASE STUDY

A Veteran’s Affairs low vision clinic commissions a survey to assess the impact of low vision rehabilitation on their patients. They wish to know how much patients use devices prescribed, whether their activities of daily living were improved, and what their satisfaction with the service was.

Sample

A sample could be randomly chosen from chart numbers of patients seen in the low vision clinic. The clinic sees about 150 patients per year, so it was decided instead to survey all patients seen within a one year period. Because contact information is available, the subjects are current patients of the clinic, and most patients are retired, a phone survey is chosen.

Survey Instrument

Phone interviewers will be trained to follow all procedures for enrollment and introduction.

Hello, my name is _____ from the Pretty Good VA Clinic. May I speak to Mr. ____. Good day Mr. ____, our clinic is contacting patients who have received low vision services in the past year and asking for input. We are hoping you would be willing to spend five to ten minutes answering some questions. Whether you do or do not participate in this survey will in no way effect how we care for you at our clinic and you can decline to answer questions as you feel. Would you be willing to answer a few questions? Is this a good time or should I call back at another time?

We are interested in how the low vision services have made a difference, if any, in your activities of daily living. First, do you currently work? ____ [if yes, ask how many hours a week ___, do you use a computer___]
Are you able to read newspaper with your regular glasses? Yes or no?

Are you able to read newspaper with one of the low vision devices you received? Yes or no?

If you use a computer, are you able to use the computer with any of the low vision devices you received? The device may be special computer screen, enlarging software installed on the computer, glasses, magnifiers, or telescopes. Yes, no, doesn’t use computer

How helpful was the training you received to learn how to use the devices?
Not helpful Somewhat helpful Very helpful
On a typical day, how often do you use a low vision device

Never Sometimes Frequently Most of the time

Would you say your low vision devices enhance your ability to do daily living tasks
Not at all Somewhat Significantly

That concludes the survey. Thank you very much for participating. Do you have any questions I can help you with today? Good day Mr. ____.

Obviously, any number of questions and formats could be developed for this survey. Fowler and Mangione (5) among others give an excellent discussion. The above is one example of assessing how often the patients use the devices and if there has been a change in abilities since receiving the devices. The public health impact of such a study involves measuring patient quality of life, assessing cost benefit of low vision services, and impact on independence. The previous chapter by Dr. Stelmack reveals many instances where studies have demonstrated the success of low vision care. In the era of evidence based medicine, more and more such studies will be necessary to justify vision services to patients and to third party payers.

Study Questions

1. Survey research should have the same validity as laboratory research and thus should strive to eliminate what three sources of bias?
2. The largest challenge for population based survey research is what?
3. Describe what “double vision” and “knee jerk” mean in the context of survey instrument items.
4. Write an example of a survey instrument item which will bias a response towards a certain desired answer.

Take Home Conclusions

- Obtaining a representative sample may be impossible. To minimize selection bias or sampling error, a data base of accurate contact information for each member of the target population must be constructed. Then a random sample can be targeted, but only those who agree to participate will comprise the final sample.
- Incentives for increasing response rate include direct payment, entering the subject in a lottery for a large prize, appealing to their sense of duty or charity, promising a donation to a favorite charity, sending reminders, and careful pre survey marketing.
- Survey instruments are measurement instruments just like scales, watches, and lab tests are measurement tools.
- Survey instruments need to be constructed and tested for validity and reliability before being used in a study.

References

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