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How to interpret surveys in medical research: A practical approach

■ ABSTRACT

Surveys are being used increasingly in health-care research to answer questions that may be difficult to answer using other methods. While surveys depend on data that may be influenced by self-report bias, they can be powerful tools as physicians seek to enhance the quality of care delivered or the health care systems they work in. The purpose of this article is to provide readers with a basic framework for understanding survey research, with a goal of creating well-informed consumers. The importance of validation, including pretesting surveys before launch, will be discussed. Highlights from published surveys are offered as supplementary material.

■ KEY POINTS

Most survey reports do not adequately describe their methods.

Surveys that rely on participants' self-reports of behaviors, attitudes, beliefs, or actions are indirect measures and are susceptible to self-report and social-desirability biases.

Informed readers need to consider a survey's authorship, objective, validation, items, response choices, sampling representativeness, response rate, generalizability, and scope of the conclusions.

SURVEYS ARE COMMON in medical research. Although survey research may be subject to inherent self-report bias, surveys have a great impact on policies and practices in medicine, often forming the basis for recommendations or new guidelines.^{1,2} To interpret and use survey research results, clinicians should be familiar with key elements involved in the creation and validation of surveys.

The purpose of this article is to provide readers with a basic framework for evaluating surveys to allow them to be more informed as consumers of survey research.

■ IMPORTANT TOOLS IN MEDICAL RESEARCH

Surveys are important tools for answering questions on topics that are difficult to assess using other methods.³ They allow us to gather data systematically from subjects by asking questions, in order to make inferences about a larger population.^{3,4} Clinicians use surveys to explore the opinions, beliefs, and perceptions of a group, or to investigate physician practice patterns and adherence to clinical guidelines. They may also use surveys to better understand why patients are not engaging in recommended behavioral or lifestyle changes.

Survey methods include interviews (in person, by phone) and questionnaires (paper-and-pencil, e-mailed, online).⁴

A well-constructed, validated survey can provide powerful data that may influence clinical practice, guide future research development, or drive the development and provision

TABLE 1

Things to consider when reviewing the findings of surveys

- Authorship.** Who created the survey?
- Objective.** Is the research question clear?
- Validation.** Was the survey pretested?
- Understandability.** Were items and response choices understandable?
- Sampling.** Was the sample appropriate?
- Response rate.** Was the response rate adequate?
- Scope of conclusions.** Do conclusions go beyond the data?

of needed programs and services. Surveys have the potential to transform the ways in which we think about and practice medicine.

READER BEWARE

While survey research in health care appears to have grown exponentially, the quality of reported survey research has not necessarily increased over time.

For consumers of survey research, the adage “reader beware” is apt. Although a considerable number of studies have examined the effects of survey methodology on the validity, reliability, and generalizability of the results,⁴ medical journals differ in their requirements for reporting survey methods.

In an analysis of 117 articles, Bennett et al³ found that more than 80% did not fully describe the survey development process or pretesting methods. They also found limited guidance and lack of consensus about the best way to report survey research. Of 95 surveys requiring scoring, 66% did not report scoring practices.

Duffett et al⁵ noted that of 127 critical care medicine surveys, only 36% had been pretested or pilot-tested, and half of all surveys reviewed did not include participant demographics or included only minimal information.

Because journal reporting practices differ, physicians may be unaware of the steps involved in survey construction and validation. Knowledge of these steps is helpful not only in constructing surveys but also in assessing published articles that used survey research.

LIMITATIONS OF SURVEY RESEARCH

Indirect measures of attitudes and behaviors

Surveys that rely on participants’ self-reports of behaviors, attitudes, beliefs, or actions are indirect measures and are susceptible to self-report and social-desirability biases. Participants may overestimate their own expertise or knowledge in self-report surveys. They may wish to reduce embarrassment⁶ or answer in ways that would make them “look better,”⁷ resulting in social-desirability bias. These issues need to be mentioned in the limitations section in papers reporting survey research.

Questions and response choices

The data derived from surveys are only as good as the questions that are asked.⁸ Stone⁹ noted that questions should be intelligible, unambiguous, and unbiased. If respondents do not comprehend questions as researchers intended, if questionnaire response choices are inadequate, or if questions trigger unintended emotional responses,¹⁰⁻¹⁴ researchers may unwittingly introduce error, which will affect the validity of results. Even seemingly objective questions, such as those related to clinical algorithm use, practice patterns, or equipment available to hospital staff, may be interpreted differently by different respondents.

In their eagerness to launch a survey, clinician researchers may not realize that it must be carefully constructed. A focus on question development and validation is critical, as the questions determine the quality of the data derived from the survey.⁸ Even the position of the question or answer in the survey can affect how participants respond,¹⁵ as they may be guided to a response choice by preceding questions.¹⁶

WHAT DO YOU NEED TO KNOW ABOUT ASSESSING SURVEY RESEARCH?

What follows are questions and a basic framework that can be used to evaluate published survey research. Recommendations are based on the work of survey scientists,^{4,7,10,14,15,17,18} survey researchers in medicine and the social sciences, and national standards for test and questionnaire construction and validation (TABLE 1).^{4,19,20}

Respondents may wish to avoid embarrassment or may answer in ways that make them ‘look better’

Analysis of methods reported in several survey studies: Example 1

Critical care delivery in the United States: distribution of services and compliance with Leapfrog recommendations

ANGUS DC, SHORR AF, WHITE A, DREMSIZOV TT, SCHMITZ RJ, KELLEY MA; COMMITTEE ON MANPOWER FOR PULMONARY AND CRITICAL CARE SOCIETIES (COMPACCS). CRIT CARE MED 2006; 34:1016–1024.

Summary

The survey, published in 2006, investigated the organization and staffing models of intensive care units (ICUs) in the United States. A stratified random sample of hospital-appointed ICU physician directors at all adult noncardiac ICUs was used for the survey.

Results

The survey was completed by 393 ICU directors (response rate 33.5%). The article reported that most ICUs were located in nonteaching community hospitals (71%) and hospitals of fewer than 300 beds (62%). More than half of ICUs (53%) reported no intensivist coverage. In-house physician coverage outside weekday daylight hours was rare (12% reported coverage on weeknights and 10% reported coverage on weekend nights). According to Angus et al, only 4% of adult ICUs in the United States appeared to meet the full recommendations outlined in the Leapfrog standards.

Implications

The paper pointed out significant deficiencies in staffing models in US ICUs. Survey results reignited discussion over the need to increase the workforce of ICU physicians and the need for 24/7 intensive care coverage in the United States.

Analysis of methods

Survey authorship. The survey was created by a panel of subject matter experts (the Committee on Manpower for the Pulmonary and Critical Care Societies). Questionnaire design experts were involved in the creation of the survey, but this was not mentioned in the article.

Research question or objective. The objective was explicitly stated, as recommended by survey scientists.

Validation. The use of an expert panel provides evidence for content validity. Although it is assumed that instrument pretesting was performed, this was not mentioned in the article.

Survey items and response choices. The survey was described in general terms. As the survey instrument was not available for review and not provided in the supplemental material, we are unable to evaluate whether any items may have been problematic in terms of readability or understandability.

Sampling. Authors used a stratified random sample, which “permits individuals with specified characteristics to be oversampled to ensure a balance of particular characteristics” (www.abtassoc.com/reports/chest2pdf). Authors reported demographics of the population of interest. The sample appears to be representative of the population of ICUs across the United States.

Response rate. The response rate for ICU directors was fairly low (33.5%), but recommended procedures were followed. Each ICU director received a questionnaire by mail. Reminder letters were sent 2 to 3 weeks after the initial mailing, and reminder phone calls were made to those who did not respond within 1 to 2 weeks. Representativeness of the sample helps to offset a low response rate.

Scope of conclusions. The article was published in 2006, but the survey was administered 9 years earlier and provides an estimate of ICU physician staffing from 1997. With a response rate of 33.5% for ICU directors, the conclusions might have been tempered a bit more.

Who created the survey?

How did they do it?

How the survey was created should be sufficiently described to allow readers to judge the adequacy of instrument development.^{3–5} It is

generally recommended that feedback from multiple sources be solicited during survey creation. Both questionnaire-design experts and subject-matter experts are considered critical in the process.⁴

What question was the survey designed to answer?

Is the objective of the study articulated in the paper?^{3,20} To judge survey research, readers need to know if the survey appears to adequately address the research question or questions and the objectives of the study in terms of methods used.⁴

Was evidence on validity gathered?

Instrument pretesting and field testing are considered best practices by the American Association for Public Opinion Research, a professional organization for US survey scientists.⁴

Pretesting can include cognitive interviewing, the use of questionnaire appraisal tools, and hybrid methods, all of which are aimed at addressing validity issues.²¹ Pretesting with a group of participants similar to the target population allows for assessment of item ambiguity, instrument ease of use, adequacy of response categories (response choices), and time to completion.^{4,12}

Cognitive interviewing is designed to explore respondents' comprehension of questions, response processes, and decision processes governing how they answer questions.^{4,7,10,11} In cognitive interviewing, respondents are generally interviewed one on one. Techniques vary, but typically include "think alouds" (in which a respondent is asked to verbalize thoughts while responding to questions) and "verbal probing" (in which the respondent answers a question, then is asked follow-up questions as the interviewer probes for information related to the response choice or question itself).⁷ These techniques can provide evidence that researchers are actually measuring what they set out to measure and not an unrelated construct.^{4,19}

Field testing of a survey under realistic conditions can help to uncover problems in administration, such as issues in standardization of key procedures, and to ensure that the survey was administered as the researchers intended.^{21,22} Field testing is vital before phone or in-person interviews to ensure standardization of any critical procedures. Pilot testing in a sample similar to the intended population allows for further refinement, with deletion of problem items, before the survey is launched.¹⁵

Because even "objective" questions can be somewhat subjective, all research surveys should go through some type of pretesting.^{4,21} Based on the results of pretesting and field testing, surveys should then be revised before launch.^{4,21} If an article on a self-report survey makes no mention of survey validation steps, readers may well question the validity of the results.

Are the survey questions and response choices understandable?

Is the meaning of each question unambiguous? Is the reading level appropriate for the sample population (a critical consideration in patient surveys)? Do any of the items actually ask two different questions?¹³ An example would be: "Was the representative courteous and prompt?" as it is possible to be courteous, but not prompt, and vice versa. If so, respondents may be confused or frustrated in attempting to answer it. If a rating scale is used throughout the questionnaire, are the anchors appropriate? For example, a question may be written in such a way that respondents want to answer "yes/no" or "agree/disagree," but the scale used may include response options such as "poor," "marginal," "good," and "excellent." Items with Likert-response formats are commonly used in self-report surveys and allow participants to respond to a statement by choosing from a range of responses (eg, strongly disagree to strongly agree), often spaced horizontally under a line.

It is recommended that surveys also include options for answers beyond the response choices provided,²⁰ such as comment boxes or fill-in-the-blank items. Surveys with a closed-response format may constrain the quality of data collected because investigators may not foresee all possible answers. Surveys need to be available for review either within the article itself, in an appendix, or as supplementary material that is available elsewhere.

Does the sample appear to be appropriate?

Articles that report the results of surveys should describe the target population, the sample design, and, in a demographic table, respondents and nonrespondents. To judge appropriateness, several questions can be asked regarding sampling:

Target population. Is the population of interest (ie, the target population) described,

Because even 'objective' questions can be somewhat subjective, all research surveys should go through some type of pretesting

Analysis of methods reported in several survey studies: Example 2

Use of electronic health records in U.S. hospitals

JHA AK, DESROCHES CM, CAMPBELL EG, ET AL. N ENGL J MED 2009 360:1628–1638.

Summary

The survey, published in 2009, investigated the use of electronic medical record systems in acute-care hospitals that were members of the American Hospital Association (AHA).

Results

Authors reported that of 63% of hospitals responding, only 1.5% had a comprehensive electronic medical record system available. Approximately 8% of hospitals reported having a basic electronic system, and 17% reported having computerized provider-order entry for medications.

Implications

Survey results suggested that very low levels of electronic medical record adoption currently exist in the United States and that major investments are needed to ensure the achievement of health care performance goals that depend on the adoption of and updates to health information technology systems.

Analysis of methods

Survey authorship. The authors examined and synthesized prior hospital-based surveys of electronic records systems or related functionalities. They used an expert panel and survey experts to develop the survey, as recommended by survey scientists.

Research question or objective. Survey methodology appeared to be appropriate in terms of answering the question posed.

Validation. The survey was initially drafted after evaluation by experts who had led hospital-based surveys. Subsequently, the instrument was shared with chief information officers and survey experts. It is unclear whether instrument pretesting was completed, as this was not described in the article.

Survey items and response choices. The survey instrument included 32 items that were selected based on previous survey research. The survey is available through supplementary material. Items appear to meet generally accepted standards for readability and comprehensibility.

Sampling. The population of interest (target population) was all acute-care hospitals in the United States. Authors collaborated with the AHA to survey AHA member hospitals. A sampling strategy was not reported. While the sample appears to be regionally representative, about 50% more respondents were from the Midwest and the South. It is unclear if this mirrors the geographic distribution of the population of US acute-care hospitals. The demographic features of the population of US hospitals were not reported.

Response rate. The survey response rate (63%) was within the norm for survey research, given declining response rates for survey research in medicine. Recommended procedures were followed to increase response rate.

Scope of conclusions. If pretesting did not occur, it is possible that survey respondents may not have understood all items the way researchers intended, which can affect validity. In addition, results reflect the opinions of survey respondents and may not reflect actual adoption of an electronic medical record system in all acute-care hospitals across the United States, especially larger hospitals. Authors pointed out that large hospitals were more likely to have electronic health records. As 130 large hospitals were nonrespondents and large hospitals appeared to make up only 10% of the sample of respondents, the results may not be generalizable to all large acute-care hospitals across the United States.

including regional demographics, if applicable? The relationship between the sample and the target population is important, as a nonrepresentative sample may result in mis-

leading conclusions about the population of interest.

Sampling frame. Who had an opportunity to participate in the survey? At its simplest,

Analysis of methods reported in several survey studies: Example 3

Blood glucose control in critically ill adults and children: a survey on stated practice

HIRSHBERG E, LACROIX J, SWARD K, WILLSON D, MORRIS AH. CHEST 2008;133:1328–1335.

Summary

The survey, published in 2008, sought to document clinicians' blood glucose-control practice patterns in pediatric and adult intensive care units (ICUs) in North America.

Results

Response rates ranged from 58% for clinicians (163 of 282 physicians) to 96% for institutions (50 of 52 institutions). Adult and pediatric ICU physician respondents defined hyperglycemia differently. Adult and pediatric ICU clinician respondents defined hypoglycemia similarly. Authors noted that hypoglycemia was thought to be more dangerous than hyperglycemia by more pediatric ICU physicians (84.5%) than adult ICU physician respondents (59.1%). According to the authors, glucose management algorithms varied across clinician respondents and institutions.

Implications

Authors noted that this may be the first survey (2008) to explore practice patterns of adult and pediatric intensivists in terms of blood glucose-control practice patterns. Authors noted that results of the survey may help in designing algorithms and defining blood glucose-control target ranges for future studies.

Analysis of methods

Survey authorship. Authors included practicing clinicians, fellows, and an informatics specialist. It is unclear if a survey design expert was enlisted.

Research question or objective. The objective was to explore clinical practice patterns and beliefs of adult and pediatric intensivists in North America.

Validation. The instrument was pretested in semistructured interviews. A clinical sensibility assessment was performed by practicing adult and pediatric intensivists, who rated the questionnaire in a number of categories, including clarity and utility. Pretesting is recommended as a best practice by survey scientists.

Survey items and response choices. The survey was described in general terms. We were unable to access the full questionnaire with the link provided.

Sampling. The population of interest (target population) was intensivists practicing in North American ICUs. Demographic data of the target population (including total number of adult and pediatric intensivists in North America) were not reported. A sample was obtained by contacting members of three research networks. Intensivists who were not members of these research networks would not have been sampled. A description of survey respondents was included. Nonrespondents were not described. It is unclear whether the sample was regionally representative (for the United States and Canada).

Response rate. Response rates ranged from 58% for clinicians to 96% for institutions. The response rates reported are in line with other survey research in the literature. Recommended procedures were followed to increase response rate.

Scope of conclusions. Authors noted that survey results may not reflect practice patterns of institutions in North America that are not affiliated with universities. Survey results also may not reflect practice patterns of subpopulations of ICU intensivists across North America, given the small number of survey respondents in these categories. Generalizability to the overall population of adult and pediatric ICU intensivists in North America may be difficult due to the sampling frame selected (members of three research networks). Results also may not be generalizable to specific subpopulations of ICU intensivists, as many of the subsamples were quite small—eg, 11 (6.7%) of the 163 respondents were internal medicine intensivists.

the sampling frame establishes who (or what, in the case of institutions) should be included within the sample. This is typically a list of elements (Groves et al⁴) that acts to “frame” or define the sample to be selected. Where the target population may be all academic internal medicine physicians in the United States, the sampling frame may be all male and female US physicians who are members of particular internal medicine professional organizations, identified by their directory e-mail addresses.

Sample design. How was the sample actually selected?⁴ For example, did investigators use a convenience sample of colleagues at other institutions or use a stratified random sample, ensuring adequate representation of respondents with certain characteristics?

Description of respondents. How is the sample of respondents described? Are demographic features reported, including statistics on regional or national representativeness?⁵ Does the sample of survey respondents appear to be representative of the researcher’s population of interest (ie, the target population)?^{23,23} If not, is this adequately described in the limitations section? Although outcomes will not be available on nonrespondents, demographic and baseline data often are available and should be reported. Are there systematic differences between respondents and nonrespondents?

Was the response rate adequate?

Was the response rate adequate, given the number of participants initially recruited? If the response rate was not adequate, did the researchers discuss this limitation?

Maximum response rate, defined as the total number of surveys returned divided by the total number of surveys sent,¹⁸ may be difficult to calculate with electronic or Web-based survey platforms. When the maximum response rate cannot be calculated, this issue needs to be addressed in the article’s limitations section.

The number of surveys has increased across fields over the past few decades, but survey response rates in general have decreased.^{17,21,24,25} In fields outside of clinical medicine, response rates in the 40% range are common.¹⁷ In the 1990s, the mean response rate for surveys published in medical journals (mailed surveys)

was approximately 60%.²⁶ A 2001 review of physician questionnaire studies found a similar average response rate (61%), with a 52% response rate for large-sample surveys.²⁷ In 2002, Field et al²⁸ examined the impact of incentives in physician survey studies and found response rates ranging from 8.5% to 80%.

Importantly, electronically delivered surveys (e-mail, Web-based) often have lower response rates than mailed surveys.^{24,29} Nominal financial incentives have been associated with enhanced response rates.²⁸

A relatively low response rate does not necessarily mean you cannot trust the data. Survey scientists note that the representativeness of the sample may be more critical than response rate alone.¹⁷ Studies with small sample sizes may be more representative—and findings more valid—than those with large samples, if large samples are nonrepresentative when considering the target population.¹⁷

Do the conclusions go beyond the data?

Are the inferences overreaching, in view of the survey design? In studies with low response rates and nonrepresentative samples, researchers must be careful in interpreting the results. If the results cannot be generalized beyond the research sample, is this clear from the limitations, discussion, and conclusion sections?

In this review, we have summarized the findings of three published surveys^{1,2,30} and commented on how they appear to meet—or don’t quite meet—recommendations for survey development, validation, and use. The papers chosen were deemed strong examples in particular categories, such as description of survey authorship,¹ instrument validation,³⁰ sampling methodology,² and response rate.¹

It should be noted that even when surveys are conducted with the utmost rigor, survey reporting may leave out critical details. Survey methodology may not be adequately described for a variety of reasons, including researchers’ training in survey design and methodology; a lack of universally accepted journal-reporting guidelines³; and even journals’ space limitations. At times, journals may excise descriptions of survey development and validation, deeming these sections superfluous. Limitations sections can be critical to interpreting the results of survey research and evaluating the scope of conclusions. ■

A relatively low response rate does not necessarily mean you cannot trust the data

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