

What is A Survey?

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Preface

People are accustomed to seeing the results of surveys reported in the daily press, incorporated in advertising claims, and mentioned on numerous occasions by political analysts, social critics, and economic forecasters. Much less frequent, however, is any discussion of the reliability of these surveys or what is involved in carrying them out. The wealth of reported information may easily lull the user into assuming that surveys are easy to undertake, and to overlook the many steps involved in a properly-conducted survey. If technical issues are recognized, there is a frequent tendency to assume that they should be safely left to the survey expert.

In fact, many of the surveys that appear in the daily press are conducted under great time pressure and with insufficient allowance for the many different aspects of the process that need to be controlled. Yet, unless the reader of these survey results is aware of what is involved in a

survey, and what quality controls are needed, s(he) is unable to form any opinion of the confidence to be placed in the results, and usually is not even in a position to know what questions to ask about such surveys.

In an effort to fill this gap, the Section on Survey Research Methods of the American Statistical Association appointed a committee to prepare a brochure that would describe survey operations without using technical terminology, and be understandable to interested persons not trained in statistics. The result is the present brochure which, it is hoped, will promote a better understanding of what is involved in carrying out a sample survey, and aspects that have to be taken into account in evaluating the results of surveys.

The American Statistical Association is pleased to publish the report in the hope and expectation that it will prove useful to a wide readership. The association is fortunate to have had four such able statisticians as Robert Ferber, Professor of Economics and Business, Survey Research Laboratory, University of Illinois; Paul Sheatsley, Survey Director, National Opinion Research Center, University of Chicago; Anthony Turner, Chief of International Mathematical-Statistical Staff, Statistical Methods Division, U.S. Bureau of the Census; and Joseph Waksberg, Vice President, Westat, Inc., form the committee that undertook the work. It thanks them for their efforts.

Margaret E. Martin, President

American Statistical Association 1980

Introduction

The growing popularity of surveys for throwing light on different problems has led to a tendency to overlook the fact that surveys involve many technical problems. Too many surveys seem to be conducted more or less on an ad hoc basis, with the result that the GIGO (garbage in, garbage out) principle is brought into play. This brochure seeks to help the non-statistician to avoid this danger, by providing a non-technical introduction to sample surveys of human populations and the many different ways in which such surveys are used.

The principal focus is on the design of a survey and on the collection of survey data—two areas in which the many intricacies involved are frequently overlooked. However, attention is also given to the need for proper evaluation of survey data, an essential prerequisite for assessing the value of a survey as well as a basis for proper analysis of the data. (Analysis of survey data is a major topic in itself, and is not covered here.)

This brochure can be used in a variety of ways, such as:

- * By statisticians and survey agencies, to give prospective clients some appreciation of what is involved in a sample survey.
- * By research executives, to help their non-research counterparts understand how surveys are conducted.
- * By instructors in introductory social science and other courses, to give students a brief introduction to sample surveys.

- * By international agencies and others advising in other countries, to give government officials in these other countries an understanding of the various steps of a sample survey.

It should be stressed that this brochure is not intended to provide students of statistics or prospective specialists in the field with a comprehensive understanding of survey methods. For this purpose, the books listed at the end of the brochure need to be used, plus many of the specialized sources dealing with the techniques of survey design and data collection. This brochure is meant for non-specialists, for the users of survey data. If it leads them to have a better appreciation of what is involved in a sample survey, its purpose will have been served.

Characteristics of Surveys

The Need Any observation or investigation of the facts about a situation may be called a survey. But today the word is most often used to describe a method of gathering information from a number of individuals, a "sample," in order to learn something about the larger population from which the sample has been drawn. Thus, a sample of voters is surveyed in advance of an election to determine how the public perceives the candidates and the issues. A manufacturer makes a survey of the potential market before introducing a new product. A government agency commissions a

survey to gather the factual information it needs in order to evaluate existing legislation or draft new legislation. For example, what medical care do people receive, and how is it paid for? Who uses food stamps? How many people are unemployed?

It has been said that the United States is no longer an industrial society but an "information society." That is, our major problems and tasks no longer focus merely on the production of the goods and services necessary to our survival and comfort. Rather, our major problems and tasks today are those of organizing and managing the incredibly complex efforts required to meet the needs and wishes of nearly 220 million Americans. To do this requires a prompt and accurate flow of information on preferences, needs and behavior. It is in response to this critical need for information on the part of the government, business and social institutions that so much reliance is placed upon surveys.

Surveys come in many different forms and have a wide variety of purposes, but they do have certain characteristics in common. Unlike a census, they gather information from only a small sample of people (or farms, businesses or other units, depending on the purpose of the study). In a bonafide survey, the sample is not selected haphazardly or only from persons who volunteer to participate. It is scientifically chosen so that each individual in the population has a known chance of selection. In this way, the results can be reliably projected to the larger public.

Information is collected by means of standardized questions so that every individual surveyed responds to exactly the same question. The survey's intent is not to describe the particular individuals who by chance are part of the sample, but to obtain a statistical profile of the population. Individual respondents are never identified and the survey's results are presented in the form of summaries, such as statistical tables and charts.

The sample size required for a survey will depend on the reliability needed which, in turn, depends on how the results will be used. Consequently, there is no simple rule for sample size that can be used for all surveys. However, analysts usually find that a moderate sample size is sufficient for most needs. For example, the well-known national polls generally use samples of about 1,500 persons to reflect national attitudes and opinions. A sample of this size produces accurate estimates even for a country as large as the United States with a population of over 200 million.

When it is realized that a properly selected sample of only 1,500 individuals can reflect various characteristics of the total population within a very small margin of error, it is easy to understand the value of surveys in a complex society such as ours. They provide a speedy and economical means of determining facts about our economy and people's knowledge, attitudes, beliefs, expectations, and behavior.

Who Does Surveys?

We all know of the public opinion polls which are reported in the press and broadcast media. The Gallup Poll and the Harris Survey issue reports periodically, describing national public opinion on a wide range of current issues. State polls and metropolitan area polls, often supported by a local newspaper or TV station, are reported regularly in many localities. The major broadcasting networks and national news magazines also conduct polls and report their findings.

But the great majority of surveys are not exposed to public view. The reason is that, unlike the public opinion polls, most surveys are directed to a specific administrative or commercial purpose. The wide variety of issues with which surveys deal is illustrated by the following listing of actual uses:

1. The U.S. Department of Agriculture conducted a survey to find out how poor people use food stamps.
2. Major TV networks rely on surveys to tell them how many and what types of people are watching their programs.
3. Auto manufacturers use surveys to find out how satisfied people are with their cars.
4. The U.S. Bureau of the Census conducts a survey every month to obtain information on employment and unemployment in the nation.
5. The National Center for Health Statistics sponsors a survey every year to determine how much money people are spending for different types of medical care.

6. Local housing authorities make surveys to ascertain satisfaction of people in public housing with their living accommodations.
7. The Illinois Board of Higher Education surveys the interest of Illinois residents in adult education.
8. Local transportation authorities conduct surveys to acquire information on people's commuting and travel habits.
9. Magazine and trade journals utilize surveys to find out what their subscribers are reading.
10. Surveys are used to ascertain what sort of people use our national parks and other recreation facilities.

Surveys of human populations also provide an important source of basic social science knowledge. Economists, psychologists, political scientists and sociologists obtain foundation or government grants to study such matters as income and expenditure patterns among households, the roots of ethnic or racial prejudice, comparative voting behavior, or the effects of employment of women on family life. (Surveys are also made of non-human populations, such as of animals, soils and housing; they are not discussed here, although many of the principles are the same.)

Moreover, once collected, survey data can be analyzed and reanalyzed in many different ways. Data tapes with identification of individuals removed can be made available for analysis by community groups, scientific researchers and others.

Types of Surveys

Surveys can be classified in a number of ways. One dimension is by size and type of sample. Many surveys study the total adult population, but others might focus on special population groups: physicians, community leaders, the unemployed, or users of a particular product or service. Surveys may be conducted on a national, state or local basis, and may seek to obtain data from a few hundred or many thousand people.

Surveys can also be classified by their method of data collection. Thus, there are mail surveys, telephone surveys, and personal interview surveys. There are also newer methods of data collection by which information is recorded directly into computers. This includes measurement of TV audiences carried out by devices attached to a sample of TV sets which automatically record in a computer the channels being watched. Mail surveys are seldom used to collect information from the general public because names and addresses are not often available and the response rate tends to be low, but the method may be highly effective with members of particular groups; for example, subscribers to a specialized magazine or members of a professional association. Telephone interviewing is an efficient method of collecting some types of data and is being increasingly used. A personal interview in a respondent's home or office is much more expensive than a telephone survey but is necessary when complex information is to be collected.

Some surveys combine various methods. Survey workers may use the telephone to "screen" for eligible respondents (say, women of a particular age group) and then make appointments for a personal interview. Some information, such as the characteristics of the respondent's home, may be obtained by observation rather than questioning. Survey data are also sometimes obtained by self-administered questionnaires filled out by respondents in groups, e.g., a class of school children or a group of shoppers in a central location.

One can further classify surveys by their content. Some surveys focus on opinions and attitudes (such as a pre-election survey of voters), while others are concerned with factual characteristics or behavior (such as a survey of people's health, housing or transportation habits). Many surveys combine questions of both types. Thus, a respondent will be asked if s(he) has heard or read about an issue, what s(he) knows about it, his (her) opinion, how strongly s(he) feels and why, interest in the issue, past experience with it, and also certain factual information which will help the survey analyst classify the responses (such as age, sex, marital status, occupation, and place of residence).

The questions may be open-ended ("Why do you feel that way?") or closed ("Do you approve or disapprove?"); they may ask the respondent to rate a political candidate or a product on some kind of scale; they may ask for a ranking of various alternatives. The questionnaire may be very brief-a few

questions taking five minutes or less, or it can be quite long-requiring an hour or more of the respondent's time. Since it is inefficient to identify and approach a large national sample for only a few items of information, there are "omnibus" surveys which combine the interests of several clients in a single interview. In such surveys, the respondent will be asked a dozen questions on one subject, half a dozen more on another subject, and so on.

Because changes in attitude or behavior cannot be reliably ascertained from a single interview, some surveys employ a "panel design," in which the same respondents are interviewed two or more times. Such surveys are often used during election campaigns, or to chart a family's health or purchasing pattern over a period of time. They are also used to trace changes in behavior over time, as with the social experiments that study changes by low-income families in work behavior in response to an income maintenance plan.

What Sort of People Work on Surveys?

The survey worker best known to the public is the interviewer who calls on the phone, appears at the door, or stops people at a shopping center. Though survey interviewing may occasionally require long days in the field, it is normally part-time occasional work and is thus well suited for individuals who do not seek full-time employment or who wish to

supplement their regular income. Previous experience is not usually required for an interviewing job. Most research companies will provide their own basic training for the task. The main requirements are an ability to approach strangers, to persuade them to participate in the survey, and to conduct the interview in exact accordance with instructions.

Behind the interviewers are the in-house research staff who design the survey, determine the sample design, develop the questionnaire, supervise the data collection, carry out the clerical and computer operations necessary to process the completed interviews, analyze the data, and write the reports. In most survey research agencies, the senior people will have taken courses in survey methods at the graduate level and will hold advanced degrees in sociology, statistics, marketing, or psychology, or they will have the equivalent in business experience. Middle-level supervisors and research associates frequently have similar academic backgrounds, or they have advanced out of the ranks of clerks, interviewers or coders on the basis of their competence and experience.

Are Responses Confidential?

The privacy of the information supplied by survey respondents is of prime concern to all reputable survey organizations. At the U.S. Bureau of the Census, for example, the confidentiality of the data collected is protected by law (Title 13 of the U.S. Code). In Canada, the Statistics

Act guarantees the confidentiality of data collected by Statistics Canada, and other countries have similar safeguards. Also, a number of professional organizations that rely on survey methods have codes of ethics that prescribe rules for keeping survey responses confidential. The recommended policy for survey organizations to safeguard such confidentiality includes:

1. Using only code numbers for the identity of a respondent on a questionnaire, and keeping the code separate from that of the questionnaires.
2. Refusing to give names and addresses of survey respondents to anybody outside of the survey organization, including clients.
3. Destroying questionnaires and identifying information about respondents after the responses have been put onto computer tape.
4. Omitting the names and addresses of survey respondents from computer tapes used for analysis.
5. Presenting statistical tabulations by broad enough categories that individual respondents cannot be singled out.

How a Survey Is Carried Out

As noted earlier, a survey usually has its beginnings when an individual or institution is confronted with an information need and there are no existing data which suffice. A politician may wish to tap prevailing voter opinions in his district about a proposal to build a superhighway through

the county. A government agency may wish to assess the impact on the primary recipients and their families of one of its social welfare programs. A university researcher may wish to examine the relationship between actual voting behavior and expressed opinion on some political issue or social concern.

Designing a Survey

Once the information need has been identified and a determination made that existing data are inadequate, the first step in planning a survey is to lay out the objectives of the investigation. This is generally the function of the sponsor of the inquiry. The objectives should be as specific, clearcut and unambiguous as possible. The required accuracy level of the data has a direct bearing on the overall survey design. For example, in a sample survey whose main purpose is to estimate the unemployment rate for a city, the approximate number of persons to be sampled can be estimated mathematically when one knows the amount of sampling error that can be tolerated in the survey results.

Given the objectives, the methodology for carrying out the survey is developed. A number of interrelated activities are involved. Rules must be formulated for defining and locating eligible respondents, the method of collecting the data must be decided upon, a questionnaire must be designed and pretested, procedures must be developed for minimizing or controlling

response errors, appropriate samples must be designed and selected, interviewers must be hired and trained (except for surveys involving self-administered questionnaires), plans must be made for handling nonresponse cases, and tabulation and analysis must be performed.

Designing the questionnaire represents one of the most critical stages in the survey development process, and social scientists have given a great deal of thought to issues involved in questionnaire design. The questionnaire links the information need to the realized measurement.

Unless the concepts are clearly defined and the questions unambiguously phrased, the resulting data are apt to contain serious biases. In a survey to estimate the incidence of robbery victimization, for example, one might want to ask, "Were you robbed during the last six months?" Though apparently straightforward and clearcut, the question does present an ambiguous stimulus. Many respondents are unaware of the legal distinction between robbery (involving personal confrontation of the victim by the offender) and burglary (involving breaking and entering but no confrontation), and confuse the two in a survey. In the National Crime Survey, conducted by the Bureau of the Census, the questions on robbery victimization do not mention "robbery." Instead, several questions are used which, together, seek to capture the desired responses by using more universally understood phrases that are consistent with the operational definition of robbery.

Designing a suitable questionnaire entails more than well-defined concepts and distinct phraseology. Attention must also be given to its length, for unduly long questionnaires are burdensome to the respondent, are apt to induce respondent fatigue and hence response errors, refusals, and incomplete questionnaires, and may contribute to higher non-response rates in subsequent surveys involving the same respondents. Several other factors must be taken into account when designing a questionnaire to minimize or prevent biasing the results and to facilitate its use both in the field and in the processing center. They include such diverse considerations as the sequencing of sections or individual questions in the document, the inclusion of check boxes or precoded answer categories versus open-ended questions, the questionnaire's physical size and format, and instructions to the respondent or to the interviewer on whether certain questions are to be skipped depending on response patterns to prior questions.

Selecting the proper respondent in a sample unit is a key element in survey planning. For surveys where the inquiry is basically factual in nature, any knowledgeable person associated with the sample unit may be asked to supply the needed information. This procedure is used in the Current Population Survey, where the sample units are households and any responsible adult in a household is expected to be able to provide accurate answers on the employment-unemployment status of the eligible household members.

In other surveys, a so-called "household" respondent will produce erroneous and/or invalid information. For example, in attitude surveys it is generally accepted that a randomly chosen respondent from among the eligible household members produces a more valid cross section of opinion than does the non-randomly selected household respondent. This is because a non-randomly selected individual acting as household respondent is more likely to be someone who is at home during the day, and the working public and their attitudes would be underrepresented.

Another important feature of the survey planning process is devising ways to keep response errors and biases to a minimum. These considerations depend heavily on the subject matter of the survey. For example, memory plays an important role in surveys dealing with past events that the respondent is expected to report accurately, such as in a consumer expenditure survey. In such retrospective surveys, therefore, an appropriate choice of reference period must be made so that the respondent is not forced to report events that may have happened too long ago to remember accurately. In general, attention must be given to whether the questions are too sensitive, whether they may prejudice the respondent, whether they unduly invade the respondent's privacy, and whether the information sought is too difficult even for a willing respondent to provide. Each of these concerns has an important bearing on the overall validity of the survey results.

Sampling Aspects

Virtually all surveys that are taken seriously by social scientists and policy makers use some form of scientific sampling. Even the Censuses of Population and Housing collected once every 10 years use sampling techniques for gathering the bulk of the data items, although 100 percent enumeration is used for the basic population counts. Methods of sampling are well-grounded in statistical theory and in the theory of probability. Hence, reliable and efficient estimates of a needed statistic can be made by surveying a carefully constructed sample of a population, as opposed to the entire population, provided of course that a large proportion of the sample members give the requested information.

The particular type of sample used depends on the objectives and scope of the survey, including the overall survey budget, the method of data collection, the subject matter and the kind of respondent needed. A first step, however, in deciding on an appropriate sampling method is to define the relevant population. This target population can be all the people in the entire nation or all the people in a certain city, or it can be a subset such as all teenagers in a given location. The population of interest need not be people; it may be wholesale businesses or institutions for the handicapped or government agencies, and so on.

The types of samples range from simple random selection of the population

units to highly complex samples involving multiple stages or levels of selection with stratification and/or clustering of the units into various groupings. Whether simple or complex, the distinguishing characteristics of a properly designed sample are that all the units in the target population have a known, nonzero chance of being included in the sample, and the sample design is described in sufficient detail to permit reasonably accurate calculation of sampling errors. It is these features that make it scientifically valid to draw inferences from the sample results about the entire population which the sample represents.

Ideally, the sample size chosen for a survey should be based on how reliable the final estimates must be. In practice, usually a trade-off is made between the ideal sample size and the expected cost of the survey. The complexity of a sample plan often depends on the availability of auxiliary information that can be used to introduce efficiencies into the overall design. For example, in a recent Federal Government survey on characteristics of health-care institutions, existing information about the type of care provided and the number of beds in each institution was useful in sorting the institutions into "strata," or groups by type and size, in advance of selecting the sample. The procedure permitted more reliable survey estimates than would have been possible if a simple random selection of institutions had been made without regard to size or type.

A critical element in sample design and selection is defining the source

of materials from which a sample can be chosen. This source, termed the sampling frame, generally is a list of some kind, such as a list of housing units in a city, a list of retail establishments in a county or a list of students in a university. The sampling frame can also consist of geographic areas with well-defined natural or artificial boundaries, when no suitable list of the target population exists. In the latter instance, a sample of geographic areas (referred to as segments) is selected and an interviewer canvasses the sample "area segments" and lists the appropriate units-households, retail stores or whatever-so that some or all of them can be designated for inclusion in the final sample.

The sampling frame can also consist of less concrete things, such as all possible permutations of integers that make up banks of telephone numbers, in the case of telephone surveys that seek to include unlisted numbers. The quality of the sampling frame -- whether it is up-to-date and how complete -- is probably the dominant feature for ensuring adequate coverage of the desired population.

Conducting a Survey

Though a survey design may be well conceived, the preparatory work would be futile if the survey were executed improperly. For personal or telephone interview surveys, interviewers must be carefully trained in the survey's concepts, definitions, and procedures. This may take the form of

classroom training, self-study, or both. The training stresses good interviewer techniques on such points as how to make initial contacts, how to conduct interviews in a professional manner and how to avoid influencing or biasing responses. The training generally involves practice interviews to familiarize the interviewers with the variety of situations they are likely to encounter. Survey materials must be prepared and issued to each interviewer, including ample copies of the questionnaire, a reference manual, information about the identification and location of the sample units, and any cards or pictures to be shown to the respondent.

Before conducting the interview, survey organizations frequently send an advance letter to the sample member explaining the survey's purpose and the fact that an interviewer will be calling soon. In many surveys, especially those sponsored by the Federal Government, information must be given to the respondent regarding the voluntary or mandatory nature of the survey, and how the answers are to be used.

Visits to sample units are scheduled with attention to such considerations as the best time of day to call or visit and the number of allowable callbacks for no-one-at-home situations. Controlling the quality of the field work is an essential aspect of good survey practice. This is done in a number of ways, most often through observation or rechecking of a subsample of interviews by supervisory or senior personnel, and through

office editing procedures to check for omissions or obvious mistakes in the data.

When the interviews have been completed and the questionnaires filled out, they must be processed in a form so that aggregated totals, averages or other statistics can be computed. This will involve clerical coding of questionnaire items which are not already precoded. Occupation and industry categorizations are typical examples of fairly complex questionnaire coding that is usually done clerically. Also procedures must be developed for coding open-ended questions and for handling items that must be transcribed from one part of the questionnaire to another.

Coded questionnaires are keypunched, entered directly onto tape so that a computer file can be created, or entered directly into the computer. Decisions may then be needed on how to treat missing data and "not answered" items.

Coding, keypunching and transcription operations are subject to human error and must be rigorously controlled through verification processes, either on a sample basis or 100 percent basis. Once a computer file has been generated, additional computer editing, as distinct from clerical editing of the data, can be accomplished to alter inconsistent or impossible entries, e.g., a six-year old grandfather.

When a "clean" file has been produced, the survey data are in a form where

analysts can specify to a computer programmer the frequency counts, cross-tabulations or more sophisticated methods of data presentation or computation that are needed to help answer the concerns outlined when the survey was initially conceived.

The results of the survey are usually communicated in publications and in verbal presentations at staff briefings or more formal meetings. Secondary analysis is also often possible to those other than the survey staff by making available computer data files at nominal cost.

Shortcuts to Avoid

As we have seen, conducting a creditable survey entails scores of activities, each of which must be carefully planned and controlled. Taking shortcuts can invalidate the results and badly mislead the user. Four types of shortcuts that crop up often are failure to use a proper sampling procedure, no pretest of the field procedures, failure to follow up nonrespondents and inadequate quality control.

One way to ruin an otherwise well-conceived survey is to use a convenience sample rather than one which is based on a probability design. It may be simple and cheap, for example, to select a sample of names from a telephone directory to find out which candidate people intend to vote for. However, this sampling procedure could give incorrect results since persons without telephones or with unlisted numbers would have no chance

to be reflected in the sample, and their voting preferences could be quite different from persons who have listed telephones. This is what happened with the Literary Digest presidential poll of 1936 when use of lists of telephone owners, magazine subscribers and car owners led to a prediction that President Roosevelt would lose the election.

A pretest of the questionnaire and field procedures is the only way of finding out if everything "works," especially if a survey employs a new procedure or a new set of questions. Since it is rarely possible to foresee all the possible misunderstandings or biasing effects of different questions and procedures, it is vital for a well-designed survey plan to include provision for a pretest. This is usually a small-scale pilot study to test the feasibility of the intended techniques or to perfect the questionnaire concepts and wording.

Failure to follow up nonrespondents can ruin an otherwise well-designed survey, for it is not uncommon for the initial response rate to most surveys to be under 50 percent. Plans must include returning to sample households where no one was home, attempting to persuade persons who are inclined to refuse and, in the case of mail surveys, contacting all or a subsample of the nonrespondents by telephone or personal visit to obtain a completed questionnaire. A low response rate does more damage in rendering a survey's results questionable than a small sample, since there is no

valid way of scientifically inferring the characteristics of the population represented by the nonrespondents.

Quality control, in the sense of checking the different facets of a survey, enters in at all stages-checking sample selection, verifying interviews and checking the editing and coding of the responses, among other things. In particular, sloppy execution of the survey in the field can seriously damage the results. Without proper quality control, errors can occur with disastrous results, such as selecting or visiting the wrong household, failing to ask questions properly, or recording the incorrect answer. Insisting on proper standards in recruitment and training of interviewers helps a great deal, but equally important is proper review, verification and other quality control measures to ensure that the execution of a survey corresponds to its design.

Using the Results of a Survey

How Good is the Survey? The statistics derived from a survey will rarely correspond exactly with the unknown truth. (Whether "true" values always exist is not important in the present context. For fairly simple measurements-the average age of the population, the amount of livestock on farms, etc. -- the concept of a true value is fairly straightforward. Whether true values exist for measurements of such items as attitudes toward political candidates, I.Q.'s, etc., is a more complex matter.)

Fortunately, the value of a statistic does not depend on its being exactly true. To be useful, a statistic need not be exact, but it does need to be sufficiently reliable to serve the particular needs. No overall criterion of reliability applies to all surveys since the margin of error that can be tolerated in a study depends on the actions or recommendations that will be influenced by the data. For example, economists examining unemployment rates consider a change of 0.2 percent as having an important bearing on the United States economy. Consequently, in the official United States surveys used to estimate unemployment, an attempt is made to keep the margin of error below 0.2 percent. Conversely, there are occasions when a high error rate is acceptable. Sometimes a city will conduct a survey to measure housing vacancies to determine if there is a tight housing supply. If the true vacancy rate is very low, say one percent, survey results that show double this percentage will not do any harm; any results in the range of zero to two or three percent will lead to the same conclusion -- a tight housing market.

In many situations the tolerable error will depend on the kind of result expected. For example, during presidential elections the major television networks obtain data on election night from a sample of election precincts, in order to predict the election results early in the evening. In a state in which a large difference is expected (pre-election polls may indicate that one candidate leads by a substantial majority and is likely

to receive 60 percent of the vote), even with an error of five or six percent it would still be possible to predict the winner with a high probability of being correct. A relatively small sample size may be adequate in such a state. However, much more precise estimates are required in states where the two candidates are fairly evenly matched and where, say, a 52-48 percent vote is expected.

Thus, no general rule can be laid down to determine the reliability that would apply to all surveys. It is necessary to consider the purpose of the particular study, how the data will be used, and the effect of errors of various sizes on the action taken based on the survey results. These factors will affect the sample size, the design of the questionnaire, the effort put into training and supervising the interview staff, and so on. Estimates of error also need to be considered in analyzing and interpreting the results of the survey.

Sources of Errors

In evaluating the accuracy of a survey, it is convenient to distinguish two sources of errors: sampling errors, and nonsampling errors, including the effect of refusals and not-at-homes, respondents providing incorrect information, coding or other processing errors, and clerical errors in sampling.

Sampling errors Good survey practice includes calculation of sampling errors, which is possible if probability methods are used in selecting the

sample. Furthermore, information on sampling errors should be made readily available to all users of the statistics. If the survey results are published, data on sampling errors should be included in the publication. If information is disseminated in other ways, other means of informing the public are necessary. Thus, it is not uncommon to hear television newscasters report on the size of sampling errors as part of the results of some polling activity.

There are a number of ways of describing and presenting data on sampling errors so that users can take them into account. For example, in a survey designed to produce only a few statistics (such as the votes that the candidates for a particular office are expected to get), the results could be stated that Candidate A's votes are estimated at 57 percent with the error unlikely to be more than 3 percent, so that this candidate's votes are expected to fall in the range of 54-60 percent. Other examples can be found in most publications of the principal statistical agencies of the United States Government, such as the Bureau of the Census.

Nonsampling errors Unfortunately, unlike sampling errors, there is no simple and direct method of estimating the size of nonsampling errors. In most surveys, it is not practical to measure the possible effect on the statistics of the various potential sources of error. However, in the past 30 or 40 years, there has been a considerable amount of research on the kinds of errors that are likely to arise in different kinds of surveys. By

examining the procedures and operations of a specific survey, experienced survey statisticians will frequently be able to assess its quality. Rarely will this produce actual error ranges, as for sampling errors. In most cases, the analyst can only state that, for example, the errors are probably relatively small and will not affect most conclusions drawn from the survey, or that the errors may be fairly large and inferences are to be made with caution.

Nonsampling errors can be classified into two groups-random types or errors whose effects approximately cancel out if fairly large samples are used, and biases which tend to create errors in the same direction and thus cumulate over the entire sample. With large samples, the possible biases are the principal causes for concern about the quality of a survey.

Biases can arise from any aspect of the survey operation. Some of the main contributing causes of bias are:

1. Sampling operations. There may be errors in sample selection, or part of the population may be omitted from the sampling frame, or weights to compensate for disproportionate sampling rates may be omitted.
2. Noninterviews. Information is generally obtained for only part of the sample. Frequently there are differences between the non interview population and those interviewed.
3. Adequacy of respondent. Sometimes respondents cannot be interviewed and information is obtained about them from others, but the "proxy" respondent is not always as knowledgeable about the facts.

4. Understanding the concepts. Some respondents may not understand what is wanted.
5. Lack of knowledge. Respondents in some cases do not know the information requested, or do not try to obtain the correct information.
6. Concealment of the truth. Out of fear or suspicion of the survey, respondents may conceal the truth. In some instances, this concealment may reflect a respondent's desire to answer in a way that is socially acceptable, such as indicating that s(he) is carrying out an energy conservation program when this is not actually so.
7. Loaded questions. The question may be worded to influence the respondents to answer in a specific (not necessarily correct) way.
8. Processing errors. These can include coding errors, data keying, computer programming errors, etc.
9. Conceptual problems. There may be differences between what is desired and what the survey actually covers. For example, the population or the time period may not be the one for which information is needed, but had to be used to meet a deadline.
10. Interviewer errors. Interviewers may misread the question or twist the answers in their own words and thereby introduce bias.

Obviously, each survey is not necessarily subject to all these sources of error. However, a good survey statistician will explore all of these possibilities. It is considered good practice to report on the percent of the sample that could not be interviewed, and as many of the other factors listed as practicable.

Budgeting a Survey

We have seen from the preceding sections that many different stages are involved in a survey. These include tasks such as planning, sample design, sample selection, questionnaire preparation, pretesting, interviewer hiring and training, data collection, data reduction, data processing, and report preparation. From a time point of view, these different stages are not necessarily additive since many of them overlap. This is illustrated in the attached diagram which portrays the sequence of steps involved in a typical personal interview survey. Some steps, such as sample design and listing housing units in the areas to be covered in the survey, can be carried out at the same time a questionnaire is being revised and put into final form. Although they are not additive, all of these steps are time-consuming, and one of the most common errors is to underestimate the time needed by making a global estimate without considering these individual stages.

How much time is needed for a survey? This varies with the type of survey and the particular situation. Sometimes a survey can be done in two or three weeks, if it involves a brief questionnaire, and if the data are to be collected by telephone from a list already available. More usually, however, a survey of several hundred or a few thousand individuals will take anywhere from a few months to more than a year, from initial planning to having results ready for analysis.

A flow diagram for a particular survey is very useful in estimating the cost of such a survey. Such a diagram ensures that allowance is made for the expense involved in the different tasks, as well as for quality checks at all stages of the work. Thus, among the factors that enter into an expense budget are the following:

1. Staff time for planning the study and steering it through the various stages.
2. Labor and material costs for pretesting the questionnaire and field procedures.
3. Supervisory costs for interviewer hiring, training and supervision.
4. Interviewer labor costs and travel expense (and meals and lodging, if out-of-town).
5. Labor and expense costs of checking a certain percentage of the interviews (by reinterviews).
6. Cost of preparing codes for transferring information from the questionnaire.
7. Labor and material costs for editing, coding and keypunching the information from the questionnaire onto computer tape.
8. Cost of spot-checking to assure the quality of the editing, coding and keypunching.
9. Cost of "cleaning" the final data files, that is, checking the files for inconsistent or impossible answers.
10. Programming costs for preparing tabulations and special analyses of the data.
11. Computer time for the various tabulations and analyses.
12. Labor time and material costs for analysis of the data and report preparation.

13. Telephone charges, postage, reproduction and printing costs.

An integral part of a well-designed survey, both in terms of time and of costs is allowance for quality checks all along the way. For example, checks have to be made that the sample was selected according to specifications, that the interviewers did their work properly, that the information from the questionnaires was coded accurately, that the keypunching was done correctly, and that the computer programs used for data analysis work properly. For these reasons, a good survey does not come cheap, although some are more economical than others. As a rule, surveys made by personal interview are more expensive than by mail or by telephone; and costs will increase with the complexity of the questionnaire and the amount of analysis to be carried out. Also, surveys that involve more interviews tend to be cheaper on a per interview basis than surveys with fewer interviews. This is particularly so where the sample size is less than about a thousand because "tooling up" is involved for just about any survey, except one that is to be repeated on the same group.

Where to Get More Information

Several professional organizations have memberships heavily involved in survey research. They also frequently have workshops or sessions on surveys as parts of their regional and annual meetings. The principal organizations are the following:

1. The American Statistical Association is concerned with survey techniques and with general application of survey data. It has a separate Section on Survey Research Methods which sponsors sessions on surveys at the annual meetings of the association. The many chapters of the association in the various parts of the country also periodically have meetings and workshops on survey methods, and its publications, the *Journal of the American Statistical Association* and the *American Statistician*, carry numerous articles about surveys.

2. The American Marketing Association is concerned, among other things, with the application of survey methods to marketing problems. Like the American Statistical Association, it sponsors sessions on survey methods at its annual meetings, and still other sessions are sponsored by its local chapters. Its publications, the *Journal of Marketing* and the *Journal of Marketing Research*, frequently contain articles on surveys.

3. The American Association for Public Opinion Research focuses on survey methods as applied to social and media problems. Its journal, the *Public Opinion Quarterly*, regularly carries articles on survey techniques and on the application of survey methods to political and social problems.

A number of other professional associations in North America place emphasis periodically on survey methods, for example, the *Statistical Society of Canada*, the *American Sociological Association*, the *American*

Political Science Association, the Association for Consumer Research, the American Public Health Association, the American Psychological Association, and the Canadian Psychological Association. There are also various business oriented associations such as the Advertising Research Foundation and the American Association of Advertising Agencies, that give attention to survey methods as applied to business. These and other associations publish a number of journals that carry a great deal of material on survey methods.

There are many good books on survey methods written for nontechnical readers. A few of these are:

1. Tanur, Judith, et al., *Statistics: A Guide to the Unknown*. San Francisco: Holden-Day Pub. Co., 1972.
2. Hauser, Philip, *Social Statistics in Use*. New York: Russell Sage Foundation, 1975.
3. Williams, William H., *A Sampler on Sampling*. New York: John Wiley & Sons, 1978.

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