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D R A F T

Nonsampling errors in surveys *

by

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** The views expressed in this paper are those of the author and do not imply the expression of any opinion on the part of the United Nations Secretariat.

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Chapter Seven: Nonsampling errors in surveys

7.1. Introduction

1. Both sampling and *nonsampling errors* need to be controlled and reduced to a level at which their presence does not defeat or obliterate the usefulness of the final sample results. In the preceding chapters on survey design and estimation methodology, the focus was on sampling errors as the only source of variation. There are, however, other sources of variation in surveys caused by *nonsampling errors*. Such errors are particularly harmful when they are nonrandom and cause biased estimates from household surveys.

2. All survey data are subject to error from various sources. The broad fundamental distinction of errors is between errors in the measurement process and errors in the estimation of population values from measurement of a sample of it, thus, sampling errors.

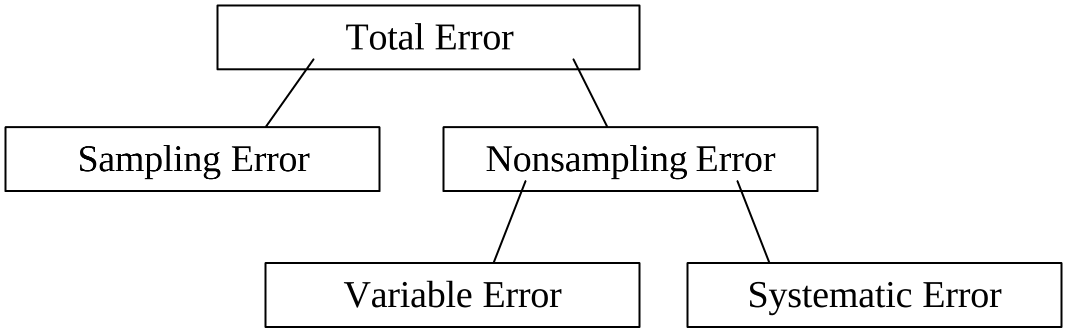
3. In the preceding chapters it has been assumed that each unit *Yi* in the population is associated with a value *yi* called the true value of the unit for character *y*. It has also been assumed that whenever *Yi* is in the sample the value of *y* reported or observed on it is *yi*. In some situation this may be true. For example in countries with viable and comprehensive registration of vital events through birth certificates this may be attainable. You may have a true age of a respondent reported. However, in other situations such as a qualitative assessment of one's health it may be harder to define. For example a sick person may rate himself/herself fit depending on the circumstances.

4. In practice the assumption that the value reported or observed on unit *Yi* is always *yi* irrespective of who reports it and under what circumstances it is obtained, is an oversimplication of the problem. Actual survey experience does not support that. There are many examples to show that errors of measurement or observation, or errors of response and coverage occur, whenever a survey is carried out. (Examples)

5. The reason for making the assumption of the absence of errors in the preceding chapters was to focus attention on sampling errors alone. I addition to response errors, surveys are subject to errors of coverage, processing errors etc. The quality of a sample estimator of a population parameter is a function of total survey error, comprising both *sampling* and *nonsampling errors*. *Sampling errors* arise solely as a result of drawing a probability sample rather than conducting a complete enumeration. *Nonsampling errors*, on the other hand, are mainly associated to data collection and processing procedures.

6. *Total survey error,* therefore is equal to *sampling error* plus *nonsampling error*. The former is as a result of selecting a sample instead of canvassing the whole population, while the latter is mainly due to adopting wrong procedures in the system of data collection and/or processing.

Figure 1. Total Survey Error



7. *Nonsampling errors,* therefore, arise mainly due to misleading definitions and concepts, inadequate frames, unsatisfactory questionnaires, defective methods of data collection, tabulation, coding, incomplete coverage of sample units etc. These errors are unpredictable and not easily controlled. Unlike in the control of *sampling error* this error may increase with increases in sample size. If not properly controlled *nonsampling* error can be more damaging than sampling error for large-scale household surveys.

7.2. Sources of nonsampling errors

8. We reiterate that *nonsampling errors* arise due to various causes right from initial stage when the survey is being planned and designed to the final stage when data are processed and analysed.

9. A household survey programme is a set of rules, which specify various operations. The rules, for instance, describe the population under coverage, specify concepts, definitions to be used, methods of data collection and measurements to be made. If various survey operations are carried out according to the rules laid down, it is possible to obtain a *true value* of the characteristic under study for every unit in the population. However, even though the various survey operations are strictly carried out and expected to yield the true value *yi,* of the characteristics under study, this is rarely achieved in practice.

10. In general, *nonsampling* errors may arise from one or more of the following factors:

a. Data specification being inadequate and/or inconsistent with respect to objectives of the survey.
b. Duplication or omission of units due to imprecise definition of the boundaries of area units, incomplete or wrong identification particulars of units or faulty methods of enumeration.
c. Inappropriate methods of interview, observation or measurement using ambiguous questionnaires, definitions or instructions.

d. Lack of trained and experienced field enumerators including lack of good quality field supervision.
e. Inadequate scrutiny of the basic data.
f. Errors in data processing operations such as coding, keying, verification, tabulation etc.
g. Errors during presentation and publication of tabulated results.

This list is by no means exhaustive.

7.3. Types of nonsampling errors

11. Brieumer and Lyberg (2003) identify five components of *nonsampling error,* namely specification, frame, nonresponse, measurement and processing error. We may add that estimation error is another error, which should be considered. These types or error are briefly discussed below:

7.3.1. Specification error

12. This occurs when the concept implied by the question is different from the underlying construct that should be measured. A simple question such as how many children does a person have can be subject to different interpretations in some cultures. In households with extended family member's biological children may not be distinguished from children of brothers or sisters living in the same household. In a disability survey, a general question asking people whether or not they have a disability can be subject to different interpretations depending on the severity of the impairment or the respondent's perception of disability. People with minor disabilities may perceive themselves to have no disability. Unless the right screening and filter questions are included in the questionnaire, the answers may not fully bring out the total number of people with disabilities.

7.3.2. Coverage or frame error

13. In most area surveys primary sampling units comprise clusters of geographic units generally called enumeration areas (EAs) (see chapter 4 for a full discussion on frames). It is not uncommon that the demarcation of EAs is not properly carried out during census mapping. Thus households may be omitted or duplicated in the second stage frame. For example, in Zambia some urban areas were hurriedly sketched during the 2000 Population and Housing mapping exercise. When such urban area units are used, without updating, during a survey, exclusion of sample units in some EAs and duplication of units in other EAs are highly probable.

14. Frame imperfections can bias the estimates in the following ways: If units are not represented in the frame but should have been part of the frame, this results in zero probability of selection for those units omitted from the frame. On the other hand if some units are duplicated, this results in overcoverage with such units having larger probabilities of selection.

15. Errors associated with the frame may, therefore, result in both *overcoverage* and *undercoverage*. The latter is the most common in large-scale surveys in most African countries.

In multi-stage household surveys, which are common in the Southern African Development Community (SADC) region, sampling involves a number of stages, such as selection of area units in one or more stages; listing and selection of households; and listing and selection of persons within selected households. Coverage error can arise in any of these stages.

16. It is important to emphasize that neither the magnitude nor the effect of coverage errors is easy to estimate because it requires information not only external to the sample but also, by definition, external to the sampling frame used.

17. *Noncoverage* denotes failure to include some sample units of a defined survey population in the sampling frame. Because such units have zero probability of selection, they are effectively excluded from the survey results.

18. It is important to note that we are not referring here to deliberate and explicit exclusion of sections of a larger population from survey population. Survey objectives and practical difficulties determine such deliberate exclusions. For example attitudinal surveys on marriage may exclude persons under the minimum legal age for marriage. Residents of institutions are often excluded because of practical survey difficulties. Areas in a country infested with landmines may be excluded from a household survey to safeguard the safety of field workers. When computing *noncoverage rates*, members of the group deliberately and explicitly excluded should not be counted either in the survey population or under *noncoverage*. In this regard defining the survey population should be part of the clearly stated essential survey conditions.

19. Noncoverage is often associated with problems of incomplete frames. Examples are to omissions in preparing the frame but also missed units, implying omissions due to faulty execution of survey procedures. Thus noncoverage refers to the negative errors resulting from failure to include elements that would, under normal circumstances, belong in the sample. Positive errors of overcoverage also occur due to inclusion in the sample of elements that do not belong there.

20. The term *grosscoverage error* refers to the sum of the absolute values of *noncoverag*e and *overcoverage error ra*tes. The *net noncoverage* refers to the excess of noncoverage over overcoverage. It is, therefore, their algebraic sum. The net coverage measures the grosscoverage only if overcoverage is absent. Most household surveys in developing countries suffer mainly from undercoverage errors. Most survey research practitioners agree that in most social surveys nondercoverage is a much more common problem than overcoverage. Corrections and weighting for non-coverage are much more difficult than for nonresponses, because coverage rates cannot be obtained from the sample itself, but only from outside sources.

21. The noncoverage errors may be caused by the use of faulty frames of sampling units. If the frames are not updated or old frames are used as a device to save time or money, it may lead to serious bias. For example, in a household survey if an old list of housing units is not updated from the time of its original preparation say 10 years prior the current survey, newly added housing units in the selected enumeration area will not be part of the second stage frame of housing units. Similarly, some disbanded housing units will remain in the frame as blanks. In

such a situation, there may be both omission of units belonging to the population and inclusion of units not belonging to the population.

22. At times there is also failure to locate or visit some units in the sample. This is a problem with area sampling units in which the enumerator must identify and list the households according to some definition. This problem arises also from use of incomplete lists. Some times weather or poor transportation facilitates make it impossible to reach certain units during the designated period of the survey.

23. The underlying objective of a household sample survey is to obtain objective results to facilitate making of inferences about the desired target population from the observation of units in the sample. Survey results can, therefore, be distorted if the extent of non-coverage differs between geographical regions, sub groups, the population such as sex, age groups, ethnic and socio-economic classes. In general good frames should provide a list of sampling units from which a sample can be selected and sufficient information on the basis of which the sample units can be uniquely identified in the field.

24. Noncoverage errors differ from nonresponse. The latter, results from failure to obtain observations on some sample units, due to refusals, failure to locate addresses or find respondents at home and losses of questionnaires. The extent of nonresponse can be measured from the sample results by comparing the selected sample with that achieved. By contrast the extent of noncoverage can only be estimated by some kind of check external to the survey operation.

Sample selection and implementation errors

25. This strictly refers to losses and distortions within then sampling frame. Example, the wrong application of the selection procedures and selection probabilities. One glaring example is the inappropriate substitution of the selected units by others especially when systematic sampling is used in the field.

Reducing coverage error

26. The most effective way to reduce coverage error is to improve the frame by excluding erroneous units and duplicates and updating the frame through filed work to identify units missing from the frame. It is also important to undertake a good mapping exercise during the preparatory stages of a population and housing census. However, the frame prepared during the census should be updated periodically. It is also imperative to put in place procedures that will ensure the coverage of all selected sample units.

7.3.3. Nonresponse

27. Nonresponse refers to the failure to measure some of the sample units. Thus failure to obtain observations on some units selected for the sample. It is instructive to think of the sample population as split into two strata, one consisting of all sample units for which measurements can be obtained and the second for which no measurements could be obtained.

28. In most cases nonresponse is not evenly spread across the sample units but is heavily concentrated among subgroups. As a result of differential nonresponse, the distribution of the achieved sample across the subgroups will deviate from that of the selected sample. This deviation is likely to give rise to nonresponse bias if the survey variables are also related to the subgroups.

29. The *nonresponse* rate can be accurately measured if accounts are kept of all eligible elements that fall into the sample. Response rate for a survey is defined as the ratio of the number of questionnaires completed for sample units to the total number of sample units. Reporting of *nonresponse* is good practice in surveys. *Nonresponse* can be due to respondents not being -at-home, refusing to participate in the survey, being incapacitated to answer questions and to lost schedules/ questionnaires. All categories of non-response refer to eligible respondents and should exclude ineligibles. For example, if a survey is on fertility, the ultimate frame in the selected EAs will comprise only women in the reproductive age groups, thus excluding, for instance, young females who are not in this group.

30. There are two types of *nonresponses*: unit nonresponse and item nonresponse. Unit *nonresponse* implies that no information is obtained from certain sample units. This may be because respondents refuse to participate in the survey when contacted or they cannot be contacted. Item *nonresponse* refers to a situation where for some units the information collected is incomplete. Item noresponse is therefore, evidenced by gaps in the data records for responding sample units. Reasons may be due to refusals, omissions by enumerators and incapacity.

31. The magnitude of unit (total) nonresponse, among other reasons, is indicative of the general receptivity, complexity, organisation and management of the survey. The extent of item nonresponse is indicative of the complexity, clarity and acceptability of particular items sought in a questionnaire and the quality of the interviewer work in handling those items.

32. Non-response errors can introduce bias in the survey results especially in situations in which the nonresponding units are not representative of those that responded. Nonresponse increases both the sampling error, by decreasing the sample size, and nonsampling errors.

33. The basics assumption in the previous sections dealing with basic theory of sampling is that the probability of the sample unit being available for interview is one. In practice nonresponse occurs with varying degrees in different surveys. In general, follow ups can increase the number of responses.

34. In summary the types of nonrespondents include:

a. Not-at-homes: prospective respondents who may not be at home when enumerators visit their households.
b. Refusals: respondents who refuse to give information for whatever reasons.
c. Not identifiable respondents.

Causes of nonresponse

35. Respondents to provide information can cause nonresponse error, they are being *not- at-home* or by sample units not being accessible. This introduces errors in the survey results because sample units excluded may have different characteristics from the sample units for which information was collected. Refusal by a prospective respondent to take part in a survey may be influenced by many factors, among them, lack of motivation, shortage of time, sensitivities of the study to certain questions, etc. Groves and Couper (1995) suggest a number of causes of refusals, which include social context of the study, characteristics of the respondent, survey design (including respondent burden), interviewer characteristics and the interaction between interviewer and respondent.

36. Errors arise from the exclusion of some of the units in the sample. This may not be a serious problem if the characteristics of the nonresponding units are similar to those of the responding units, serve for large sampling errors. But such similarity is not common in practice. For example, in order to increase response in the 1978 Fertility Survey in Zambia, female teachers were recruited as enumerators to ask questions on contraception etc. If young men were used as enumerators there should have been a higher rate of refusals as it was taboo for young men to ask especially elderly women questions about sex related matters including contraception.

37. With specific reference to item non-response, questions in the survey may be perceived by the respondent as being embarrassing, sensitive or/and irrelevant to the stated objective. The enumerator may skip a question or ignore recording an answer. In addition, a response may be rejected during editing.

38. Nonresponse cannot be completely eliminated in practice, however it can be minimized by persuasion through repeated visits or other methods. Methods for handling item nonresponse in survey data are discussed in chapter 5).

Reducing nonresponse

39. It is important in designing and executing a household survey to develop good survey procedures aimed at increasing response rates, in a bid to minimise response bias. A number of procedures can be used in survey design in an attempt to reduce the number of refusals. For example in face-to-face interviews, interviewers are supposed to be carefully trained in strategies to avoid refusals, and they are to return to conduct an interview at the convenience of the respondent. The objectives and value of the surveys should generally and carefully be explained to respondents so that they can appreciate and cooperate. Assurance of confidentiality can help to alleviate fear respondents may have about the use of their responses for purposes other than those stipulated for the survey.

40. The following are some of the steps that can be undertaken to reduce nonresponse on household surveys:

a. *Good frames*:
In many developing countries there are problems of locating sample units. This results in some form of nonresponse error. In such cases it would be helpful to have

good frames of both area units and housing listings, to facilitate easy identification of all respondents. In addition, the workloads of enumeration staff should be manageable within the allotted time frame for the survey. This enables them to reach all sample units within the assigned cluster or enumeration area. During listing of households, for example, enough auxiliary information should be collected to facilitate distinction and easy location of the sample unit. Whenever, possible enumerators should know the area they work in very well and should preferably be stationed in the assigned work areas.

b. *Interview training, selection and supervision*:
In personal interview surveys, the enumerator can play an important role in maximising response from respondents. The way interviewers introduce themselves, what they say about the survey, the identity they carry, and the courtesy they show to respondents matter. In most household surveys the enumerator is the only link between the survey organisation and respondent. It is for this reason that enumerators and their supervisors should be carefully selected, well trained and motivated. Close supervision of enumerator's work and feedback on achieved response rate is of paramount importance.

c. *Follow up of nonresponding units*:
There should be follow up of nonrespondents or make all effort to collect information from a sub-sample of the units who did not respond in the first place. This can be treated as a different stratum, from the responding stratum, in which better enumerators or supervisors may be assigned to interview respondents. The extent of refusals will depend on the subject matter of the survey (sensitive subjects are prone to high refusals), length of and complexity of the questionnaire and skills of the survey team. The not-at-home respondents should be followed up. Depending on the resources and duration of the survey in face-to-face interviews at least four callbacks are recommended. These should be made during different days and different times of the day (villages give example of farming period).

7.3.4. Measurement error

41. These errors arise from the fact that what is observed or measured departs from the actual values of sample units. These errors centre on the sustentative content of the survey such as definition of survey objectives, their transformation into usable questions, and the obtaining, recording, coding and processing of responses. These errors concern the accuracy of measurement at the level of individual units.

42. For example at the initial stage wrong or misleading definitions and concepts on frame construction and questionnaire design lead to incomplete coverage and varied interpretations by different enumerators leading to inaccuracies in the collected data.

43. Inadequate instructions to field staff are another source of error. For some surveys instructions are vague and unclear leaving enumerators to use their own judgement in carrying out fieldwork. At times sample units in the population lack precise definition, thereby resulting in defective and unsatisfactory frames. The enumerators themselves can be a source of error. At

times the information on items for all units may be wrong, this is mainly due to inadequate training of field workers.

44. For example, age reporting in Africa is another common measurement problem through age heaping and digital preference. Depending on the type and nature of enquiry or information collected, these errors may be assigned to respondents or enumerators or both. At times there may be interaction between the two, which may contribute to inflating such errors. Likewise, the measurement device or technique may be defective and may cause observational errors. Reasons for such errors are:

- Inadequate supervision of enumerators.
- Inadequately trained and experienced field staff.
- Problems involved in data collection and other type of errors on the part of respondents.

45. Nonsampling errors occur because procedures of observation or data collection are not perfect and their contribution to the total error of the survey may be substantially large thereby affecting the survey results adversely. At times respondents may introduce errors because of the following reasons:

- Failure to understand the question.
- Careless and incorrect answers from respondent due to, for example, lack of adequate understanding of the objective(s) of the survey. The respondent may not give sufficient time to think over the questions.
- Respondents answering questions even when they do not know the correct answer.
- Deliberate inclination to give wrong answers, for example, in surveys dealing with sensitive issues, such as income and stigmatised diseases.
- Memory lapses if there is along reference period, a case in point is the collection information on non-durable commodities in expenditure surveys.

46. The cumulative effect of various errors from different sources may be considerable since errors from different sources may not cancel. The net effect of such errors can be a large bias.

7.3.5. Processing errors

47. Processing errors comprise:

- Editing errors.
- Coding errors.
- Data entry errors.
- Programming errors etc.

48. The above errors arise during the data processing stage. For example in coding open ended answers related to economic characteristics, coders may deviate from the laid out procedures in coding manuals, and therefore assign wrong codes to occupations. In addition, the weighting procedures may be wrongly applied during the processing stage, etc.

7.3.6. Errors of estimation

49. These arise in the process of extrapolation of results from the observed sample units to the entire target population. These include errors of coverage, sample selection and implementation, non-response, as well as sampling variability and estimation bias. This group of errors centres on the process of sample design, implementation and estimation.

50. Biases of the estimating procedure may either be deliberate, due to the uses of a biased estimation procedure or it may be due to inadvertent use of wrong formula.

7.4. Bias and variable error

51. The main types of survey errors are generally divided into two main kinds:

- Survey biases due to definitions, measurement and responses.
- Sampling variable errors.

However, we should also take note that there are sampling biases and variable nonsampling errors.

52. Bias refers to systematic errors that affect any sample taken under a specified survey design with the same constant error. Ordinarily, sampling errors account for most of the variable errors of a survey, and biases arise mainly from nonsampling sources. In this connection, bias arises from the flaws in the basic survey design and procedures. While variable error occurs because of the failure to consistently apply survey designs and procedures.

53. A widely accepted model combines the variable error and the bias into total error, which is a sum of variable error, and bias.

54. The mean square error (MSE) for an estimate is equal to the variance plus the squared bias. If for arguments sake the bias were zero, the MSE would therefore be the variance of the estimate. In most cases bias is not zero. As earlier indicated measuring bias in surveys may not be easy, partly because its computation requires the knowledge of the true population value which in most cases is not a practical proposition.

Mean Square Error (MSE) = Variance + Squared bias

55. In practice nonsampling errors can decompose into variable component and systematic errors. According to Biemer and Lyberg (2003) there are two types of nonsampling error, namely systematic and variable error, the latter are generally noncompensating errors and therefore tend to agree (in most cases, mostly in the same direction e.g. positive), while the latter are compensating errors that tend to disagree (cancelling each other).

7.4.1. Variable component

56. The variable component of an error arises from chance (random) factors affecting different samples and repetition of the survey. In the case of the measurement process we can imagine that the whole range of procedures from enumerator selection, data collection to data processing can be repeated using the same specified procedures, under the same given conditions, and independently without one repetition affecting another. The results of repetitions are affected by random factors, as well as systematic factors, which arise from conditions under which repetitions are undertaken and affect the results of the repetition the same way.

57. When the variable errors (VE) are caused only by sampling errors, VE squared equals sampling variance. The deviation of the average survey value from the true population value is the bias. Both variable errors and biases can arise either from sampling or nonsampling operations. The variable error will measure the divergence of the estimator from its expected value and it comprises both sampling variance and nonsampling variance. The difference of the expected value of the estimator from its true value is total bias and comprises both sampling bias and nonsampling bias.

7.4.2. Systematic error

58. This occurs when there is a tendency either to consistently underreport or over report in a survey. For example in some societies where there are no birth certificates, there is a tendency among men to exaggerate. This will result in systematic bias of the average age in the male population, producing a higher average than what the true average age should be.

59. Variable errors can be assessed on the basis of appropriately designed comparisons between repetitions (replications) of survey operation under the same conditions. Reduction in variable errors depends on doing more of something e.g. larger sample size, more interviewers etc. on the other hand bias can be reduced only by improving survey procedures by doing something more, e.g. additional quality control measures at various stages of the survey operation.

7.4.3. Sampling bias

60. Sampling biases may arise from inadequate or faulty conduct of the specified probability sample or from faulty methods of estimation of the universe values. The former includes defects in frames, wrong selection procedures, and partial or incomplete enumeration of selected units.

61. In general, biases are difficult to measure, that is why we emphasize their rigorous control. Their assessment can only be done by comparing the survey results with external reliable data sources. On the other hand variable error can be assessed through comparisons between sub-divisions of the sample or repetition of the survey under the same conditions. Bias can be reduced by improving survey procedures. As earlier stated biases can be negative or positive.

62. In summary, bias arises from factors, which are a part of essential conditions and affect all repetitions in more or less the same way. Biases arise from shortcomings in the basic survey design and procedures. In general, biases are harder to measure and can only be assessed on the basis of comparison with more reliable sources outside the normal survey or with information obtained by using improved procedures.

63. According to Verma (1991) some sources of error appear mainly in the form of bias, among them coverage, nonresponse, and sample selection. On the other hand errors in coding and data entry may appear largely as variable error.

64. Although both systematic and variable error reduce accuracy, bias is more damaging in estimates such as population means, proportions and totals. These linear estimates are sums of observations in the sample. It should be noted that variable nonsampling errors like sampling errors could be reduced by increasing the sample size. For nonlinear estimates such as correlation coefficients, standard errors and regression estimates both variable and systematic error can lead to serious bias (Biemer and Lyberg, 2003). However, in many cases in household surveys the main aim is to provide descriptive measures of the population such as means, population totals and proportions, therefore the emphasis here is on reducing systematic error.

7.5. Precision and accuracy

65. These terms are widely used to separate the effects of bias. Precision generally refers to small variable errors; at times it denotes only the inverse of the sampling variance, i.e. it excludes bias.

66. Accuracy refers to small total errors and includes the effect of bias. A precise design must have small variable errors while an accurate design must be precise and have zero or small bias. A survey design is still precise if it has a large bias but with small variable errors. Such a design is however, not accurate.

67. Note that reliability refers mainly to precision of measurements whereas validity to lack of bias in the measurements.

7.6. Assessing nonsampling errors

7.6.1. Consistency check

68. In designing the survey instruments (questionnaires), special care has to be taken to include certain items of information that will serve as a check on the quality of the data to be collected. If the additional items of information are easy to obtain, they may be canvassed for all units covered in the survey, otherwise, they may be canvassed only for a sub-sample of units.

69. For example, in a post census enumeration survey (PES), where the *de jure* method is followed it may be helpful to also collect information on *de facto* basis, so that it will be possible to work out the number of persons temporarily present and the number of persons temporarily

absent. A comparison of these two figures will give an idea of the quality of data. Similarly, inclusion of items leading to certain relatively stable ratios such as sex ratios may be useful in assessing the quality of survey data.

7.6.2. Sample check/verification

70. One way of assessing and controlling nonsampling errors in surveys is to independently duplicate the work at the different stages of operation with a view to facilitating the detection and rectification of errors. For practical reasons the duplicate checking can only be carried out on a sample of the work by using a smaller group of well-trained and experienced staff. If the sample is properly designed and if the checking operation is efficiently carried out, it would be possible, not only to detect the presence of nonsampling errors, but also to get an idea of their magnitude. If it were possible to completely check the survey work, the quality of the final results could be considerably improved. With the sample check, rectification work can only be carried out on the sample checked. This difficulty can be overcome by dividing the output at different stages of the survey, e.g. filled in schedules, coded schedules, computation sheets, etc., into lots and checking samples from each lot. In this case, when the error rate in a particular lot is more than the specified level, the whole lot may check and corrected for the errors, thereby improving the quality of the final results.

7.6.3. Post-survey checks

71. An important sample check, which may be used to assess nonsampling errors consists of selecting a sub-sample, or a sample in the case of a census, and re-enumerating it by using better trained and more experienced staff than those employed for the main investigation. For this approach to be effective, it is necessary to ensure that;

- The re-enumeration is taken up immediately after the main survey to avoid any possible recall error.
- Steps are taken to minimise the *conditioning effect that* the main survey may have on the work of the post survey check.

72. Usually the check-survey is designed to facilitate the assessment of both *coverage* and *content errors*. For this purpose, it is first desirable to re-enumerate all the units in the sample at the high stages, e.g. EAs and villages, with the view of detecting coverage errors and then to re-survey only a sample of ultimate units ensuring proper representation for different parts of the population which have special significance from the point of view of nonsampling errors.

73. A special advantage of the check-survey is that it facilitates a unitary check, which consists first, of matching the data obtained in the two enumerations for the units covered by the check-sample and then analysing the observed individual differences. When discrepancies are found, efforts are made to identify the cause of their presence and gain insight into the nature and types of nonsampling errors.

74. If the unitary check is a problem due to time and financial constraints, an alternative but less effective procedure called *aggregate check*, may be used. This method consists in comparing

estimates of parameters given by check-survey data with those from the main survey. The aggregate check gives only an idea of net error, which is the resultant of positive and negative errors. The unitary check provides information on both net and gross error.

75. In post survey check, the same concepts and definitions, as those used in the original survey should be followed.

7.6.4. Quality control techniques

76. There is ample scope for applying statistical quality control techniques to survey work because of the large scale and repetitive nature of the operations involved in such work. Control charts and acceptance-sampling techniques could be used in assessing the quality of data and improving the reliability of the final results in large-scale surveys. Just for illustration, work of each data entry clerk could be checked 100 percent for an initial period of time, but if the error rate falls below a specified level, only a sample of the work may be verified.

7.6.5. Study of recall errors

77. Response errors, as earlier mentioned in this chapter, arise due to various factors such as:

- The attitude of the respondent towards the survey.
- Method of interview.
- Skill of the enumerator.
- Recall error.

78. Of these, *recall error* needs particular attention as it presents special problems often beyond the control of the respondent. It depends on the length of reporting period and on the interval between the reporting period and the date of the survey. The latter may be taken care of by choosing for the reporting period a suitable interval preceding the date of survey or as near a period as possible.

79. One way of studying recall error is to collect and analyse data relating to more than one reporting period in a sample or sub-sample of units covered in a survey. The main problem with this approach is the effect of certain amount of *conditioning effect* possibly due to the data reported for one reporting period influencing those reported for the other period. To avoid the conditioning effect, data for the different periods under consideration may be collected from different sample units. Note that large samples are necessary for this comparison.

80. Another approach is to collect some additional information, which will permit estimates for different reporting periods to be obtained. For example in a demographic survey one may collect not only age of respondent, but also date month and year of birth. The discrepancy will reveal any recall error that may be present in the reported age.

7.6.6. Interpenetrating sub-sampling

81. This method involves drawing from the overall sample two or more sub-samples, which should be selected in an identical manner and each capable of providing a valid, estimate of the population parameter. This technique helps in providing an appraisal of the quality of the information, as the interpenetrating sub-samples can be used to secure information on nonsampling errors such as differences arising from differential enumerator bias, different methods of eliciting information, etc.

82. After the sub-samples have been surveyed by different groups of enumerators and processed by different teams of workers at the tabulation stage, a comparison of the estimates based on sub-samples provides a broad check on the quality of the survey results. For example, in comparing the estimates based on four sub-samples surveyed and processed by different groups of survey personnel, if three estimates are close to each other and the other estimate differs widely from them despite the sample size being large enough, then normally one would suspect the quality of work in the discrepant sub-sample.

7.7. Conclusion

83. *Nonsampling errors* should be given due attention in household sample surveys because they can cause huge biases in the survey results if not controlled. In most surveys very little attention is given to the control of such errors at the expense of producing results that may be unreliable. The best way to control nonsampling errors is to follow the right procedures of all survey activities from planning, sample selection up to the analysis of results.

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