

1. INTRODUCTION

The literature continues to have articles describing the effectiveness of call-backs in reducing the nonresponse rates and the resulting biases in surveys on human populations. Descriptive type of articles in this area have been frequently appearing in the applied journals like the Public Opinion Quarterly and the Journal of Marketing Research. The Proceedings of the Panel on Incomplete Data (1979) contain summaries, reviews, discussions, and statistical analyses of the procedures, including call-backs, used to minimize the effects of nonresponse on the estimates.

Cochran (1979, 1982) gives an historical account of the origin of the call-back method. Apparently, Hurwitz (1943) mentioned this procedure in a talk to the Department of Agriculture, and soon after that the article by Hansen and Hurwitz (1946) on subsampling the nonrespondents appeared. Deming (1953) suggested a model for call-backs, that can be used to determine the optimum number of calls needed for a proposed survey.

Some of the earlier articles illustrating the benefits of call-backs are Hilgard and Payne (1944) with the data of the personal interviews from urban households, Clausen and Ford (1947) with the data from a mail survey of Army veterans and Finkner (1950) with the data from a mail survey of fruit growers. Hansen, Hurwitz, and Madow (1953) noticed, for instance, that in spite of eleven million responses to a mail survey on employment, as a result of the non-response, the biases in estimating the population parameters differed between men and women and between age groups. Sharp and Feldt (1959) made similar observations from their studies.

The above illustrations emphasize the need for call-backs; they take the form of personal interviews, follow-up letters and telephone calls. The purpose of this article is to bring out the important aspects of the call-back procedures, that have been emphasized in the published literature.

2. RESPONSE RATES AND THE FACTORS EFFECTING THEM

2.1 Data from call-back surveys

The articles mentioned in Section 1 describe data from specific surveys and the journals mentioned there continue to have descriptions of data from call-back surveys. Analyses of the data from a number of surveys with call-backs have been performed by Stephan and McCarthy (1958), Kish (1965) and Jessen (1978). Data from some surveys in the U.K. are presented by Durbin and Stuart (1954). Recently, Kanuk and Berenson (1975) reviewed a number of mail surveys with follow-up letters, and Wiseman and McDonald (1978) describe the data from a number of telephone surveys. Bailar and Lanphier (1978) made a critical examination of the response rates and other features of 36 surveys conducted

during 1975 by government and private agencies.

2.2 Factors influencing the response rates

There are few surprises in the factors that effect the response rates.

The type of the individual chosen for the survey--housewife, college student, business executive, urban dweller, etc.--effects the response rates.

In some of the household surveys, any adult at home can respond to the questionnaire. In some others, the respondent is chosen randomly from all the eligible members of the household; and in some others, the respondent is specified, for instance, the head of the household or the housewife. Response rates have been found to be different for these different types of chosen individuals.

The subject matter of the survey--whether it is on family finances, consumer purchases, public opinions, etc.--has been found to have a significant influence on the responses. As expected, surveys related to personal incomes have been found to have very low response rates.

Articles in the marketing literature mention that gifts and monetary incentives increase the response rates; these include pencils, pens, diaries, paper clips, a quarter, Kennedy half-dollar, silver dollars, and so on. It is recorded that the color of the paper of the letter, the manner in which the respondent is addressed, the type of stamps used on the envelope have an effect on the response rates in mail surveys; see Kanuk and Berenson (1975) for a review. One surprising piece of information from this article is that the length of the questionnaire in some surveys does not have a significant influence on the responses.

It has been believed that the interviewers always use their ingenuity to elicit responses from the selected individual, but Bailar and Lanphier (1978) mention that in some surveys the low response rates are caused by the untrained interviewer.

The mode of conducting the surveys--personal interviews, mail surveys, telephone calls, and a combination of these procedures--has an effect on the response rates. However, if you are called to the phone to answer an interviewer just as you are getting home from work and parking your car, or you are preparing the dinner or bathing the baby or trying to help him go to sleep, your response is not expected to be positive nor will it be credible; similar negative results occur, if the interviewer wakes you up from your short Sunday nap by his telephone call or personally ringing your door bell. It is also hard to attach a high quality to a response that resulted from the quarter that has been sent to the respondent in the mail along with the questionnaire--to buy a cup of tea or a cool drink to refresh himself after filling the questionnaire, with about 100 or more questions!

The above narration on the different factors that are responsible for high or low responses

indicates the extent to which the interviewing agencies have gone to collect the opinions and attitudes of the public on various items of everyday interest; whether much quality can be attached to the elicited responses is a serious problem.

The difficulties in collecting the data from the respondents seems to have made Roper, Gallup and others to resort to quota sampling. For surveys on households, Sudman (1976) suggests randomization up to the block level, and quota sampling inside the blocks.

2.3 Response rates at different calls

Cochran (1977) presents the average response rates computed from the data of several surveys presented by Stephan and McCarthy. When the respondent is "any adult", these average rates at the end of the first, second, third or later call respectively are 70, 17, and 8 percent. Corresponding figures for the "random adult" are 37, 32 and 23 percent. The author collected data from 22 surveys conducted before 1965 and presented the average response rates in P.S.R.S. Rao (1966), which are close to the above figures obtained by Cochran. However, some surveys may have very low response rates; for instance, one survey mentioned by Bailar and Lanphier has only 50 percent response in spite of 5 call-backs. Most of the telephone surveys reported by Wiseman and McDonald (1978) have response rates lower than 40 percent.

3. MODELS FOR CALL-BACKS

Deming (1953) proposes a model to describe the call-back procedures. Cochran (1977) describes the procedure for finding the optimum number of calls, using the above model. The author chose the parameters of the model with the information obtained from data obtained from surveys and obtained the optimum number of calls required for several situations met in practice. One of the major conclusions of this study is that when the relative costs at successive calls are "moderate", about 3 to 4 calls are required to obtain the estimator of the population mean with minimum mean square error; see P.S.R.S. Rao (1966) for details.

Frankel and Dutka (1979) consider the beta distribution for the probability of response and illustrates its use in determining the optimum policy for call-backs. Drew and Fuller (1980) relate the probability of response to a relevant variable.

Let p_i and f_i denote respectively the probabilities of classifying the chosen individual as a respondent or confirmed respondent. The probability of obtaining a response by the k th call is $p_1 + p_2(1-p_1-f_1) + p_3(1-p_1-f_1)(1-p_2-f_2) + \dots + p_k[(1-p_1-f_1) \dots (1-p_{k-1}-f_{k-1})]$. Thomsen and Siring (1979) consider all the p_i ($i \geq 2$) to be equal and all the f_i ($i=1, \dots, k$) to be equal.

However, it should be noted that in practice a selected individual should be classified as a confirmed nonrespondent only if he does not provide response after a specified number of calls.

The above model can be modified to suit this practical situation.

A procedure of adjusting for the nonresponse without call-backs is considered by Politz and Simmons. The Bayesian approach is considered for instance by Erickson (1967), J.N.K. Rao and Gangurde (1972) and Singh and Sedransk (1979).

In the call-back procedures, the nonrespondents are not subsampled at the successive calls as in the procedure of Hansen and Hurwitz, which was extended to more than two calls by El Badry (1956). In the latter procedures, the optimum sizes of the initial sample and the subsamples depend on the unknown sizes and variances of the nonresponse strata. Srinath (1971), J.N.K. Rao and P.S.R.S. Rao (1979) discuss this problem of finding the sample sizes.

4. SOME COMMENTS

The response rates reported in the literature are expressed in some cases as a percent of the number of contacts and attempts made and in other cases as a percent of only the number of attempts made after the contact. The latter procedure conveys the relevant information; a number of telephone calls made to contact the chosen individual should not be used as a base for computing the response rates.

For the sake of public acceptance, of late increased number of studies are being conducted through surveys. A large segment of the public are reluctant to sacrifice their privacy and provide responses to the interviewing agencies. Murthy (1979) distinguishes between target population, frame population and sampled population. To be true to statistics, the agencies should repeatedly emphasize that the responses are related only to the sampled population and not to the entire population, even if call-backs are used for increased response.

The models mentioned in the previous section presume simple random sampling. There is a need to examine the call-back procedures with other types of sampling.

With more women working, the response rates for today's surveys on households are expected to be lower than the rates twenty years ago. In addition, the "confidentiality" aspect results in lower responses at successive calls. As a result, the number of call-backs have to be increased. But the cost and time factors constrain this number. Some proper adjustments to the data through regressions or imputations have to be done before estimating the unknown parameters. Much work needs to be done on these adjustments that would add to the quality of the data from the call-backs.

While the models proposed are helpful for studying the call-back policies, in practice the decision for successive calls are made at every stage, taking into account the available budget and time. The decision to call for the third time may be made only if there is a significant difference in the results of the first two calls. Methodological treatment of the call-back procedures with such decisions may result in an increased accuracy of the estimators.

REFERENCES

- BAILLAR, B.A. and LANPHIER, M.C. (1978) Development of Survey Methods to Assess Survey Practices, Am. Statist. Ass. Washington, D.C.
- CLAUSEN, J.A. & FORD, R.N. (1947) "Controlling Bias in Mail Questionnaires," J. Am. Statist. Ass. 42, 497-511.
- COCHRAN, W.G. (1977) Sampling Techniques, John Wiley & Sons.
- _____ (1979) Panel on Incomplete Data, National Research Council.
- _____ (1982) Contributions to Statistics, John Wiley & Sons.
- DEMING, W.E. (1953) "On a Probability Mechanism to Attain an Economic Balance Between the Resultant Error of Non-response and the Bias of Non-response," J. Am. Statist. Ass. 48, 743-772.
- DREW, J.H. & FULLER, W.A. (1980) "Modeling Non-response in Surveys with Call-backs," Research report.
- DURBIN, J. & STUART, A. (1954) "Callbacks and Clustering in Sample Surveys: An Experimental Study," J. of Royal Statist. Society. A117, 387-428.
- EL BADRY, M.A. (1956) "A Sampling Procedure for Mailed Questionnaires," J. Am. Statist. Ass. 51, 209-227.
- ERICSON, W.A. (1967) "Optimal Sample Design with Nonresponse," J. Am. Statist. Ass. 62, 63-78.
- FINKNER, A.L. (1950) "Methods of Sampling for Estimating Commercial Peach Production in North Carolina," N.C. Agricultural Experimental Station Bulletin, 91.
- FRANKEL, L.R. & DUTKA, S. (1979) "Survey Design in Anticipation of Non-response & Imputation," Proceedings of the Symposium on Incomplete Data, Panel on Incomplete Data.
- HANSEN, M.H. & HURWITZ, W.N. (1946) "The Problem of Nonresponse in Sample Surveys," J. Am. Statist. Ass. 41, 517-29.
- HANSEN, M.H., HURWITZ, W.N. & MADOW, W.G. (1953) Sample Survey Methods & Theory, John Wiley & Sons, NY, Vols. I & II.
- HILGARD, E.H. & PAYNE, S.F. (1944) "Those Not at Home: Riddle for Pollsters," Public Opinion Quarterly. 8, 254-61.
- JESSEN, R.J. (1978) Statistical Survey Techniques, John Wiley & Sons, NY.
- KANUK, L. & BERENSON, C. (1975) "Mail Surveys & Response Rates: A Literature Review," J. of Marketing Research. 12, 440-53.
- KISH, L. (1965) Survey Sampling. John Wiley & Sons, NY.
- MURTHY, M.N. (1979) "A Framework for Studying Incomplete Data with a Reference to the Experience in Some Countries of Asia and the Pacific," Proceedings of the Symposium on Incomplete Data, Panel on Incomplete Data.
- RAO, J.N.K. & GANGURDE, P.D. (1972) "Bayesian Optimization in Sampling Finite Populations," J. Am. Statist. Ass. 51, 209-29.
- RAO, P.S.R.S. (1966) "A Study of Call-back Policies in Sample Surveys," Tech. Report No. 10, Harvard University & Office of Naval Research.
- _____ (1979) "Call-backs, Follow-ups and Repeated Telephone Calls," Panel on Incomplete Data, National Research Council.
- _____ (1979) "Nonresponse & Double Sampling," Panel on Incomplete Data, National Research Council.
- SINGH, B. & SEDRANSH, J. (1979) "Bayesian Procedure for Survey Design when There is Non-response," Proceedings on the Symposium on Incomplete Data, Panel on Incomplete Data.
- SHARP, H. & FELDT, A. (1959) "Some Factors in a Probability Sample Survey of a Metropolitan Community," Am. Soc. Rev. 24, 650-61.
- SRINATH, K.P. (1971) "Multiphase Sampling In Nonresponse Problems," J. Am. Statist. Ass. 16, 583-86.
- STEPHAN, F.F. & MCCARTHY, P.J. (1958) Sampling Opinions, John Wiley & Sons, NY.
- SUDMAN, S. (1976) Applied Sampling, Academic Press.
- THOMSEN, I.G. & SIRING, E. (1979) "On the Causes and Effects of Non-response: Norwegian Experience," Proceedings on the Symposium on Incomplete Data, Panel on Incomplete Data.
- WISEMAN, F. & MCDONALD, P. (1978) "An Empirical Investigation of Refusal Rates in Consumer Surveys," Proceedings of the Survey Research Section, Am. Statist. Assoc. 283-87.