DISCUSSION

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This is an anniversary year! It was 20 years ago, in 1964, that Sanford L. Cooper published his article "Random Sampling by Telephone" and initiated what we now call random digit dialing or RDD. In part, RDD sampling was developed to circumvent the problems of sampling telephone households from telephone directories. Traditionally, the problems of directory sampling have been: the omission of unlisted numbers; occasional duplication of numbers both within and between directories; and the awkwardness of working with large numbers of local directories for national samples.

Now, a generation later, we have an apparent alternative to sampling from telephone directories themselves.1/ We may purchase a sample from a national master frame of listed residential numbers, compiled and updated from local telephone directories. Unfortunately, as analysis of the Metromail sample by Landenberger, Groves, and Lepkowski has shown, the national master frame may present most of the familiar problems of telephone directories for sampling purposes, but apparently in even greater magnitude than previous articles on directory sampling have reported.2/ These investigators estimate that the Metromail sample included only 59 percent of the applicable listed residential numbers; approximately 16 percent of its entries were duplicates or nonresidences; and 10 to 15 percent of the entries did not have an address sufficient for mailing. Landenberger and his colleagues are to be commended for telling us everything we wanted to know about national telephone list frames but were afraid to ask; and they appear to have confirmed our worst fears!

There is one more question about national telephone list frames I wish these investigators could answer. Let us arbitrarily define a high quality national telephone frame as one that has: (1) current coverage of at least 80 percent of working listed residential numbers; (2) virtually no duplicate numbers; and (3) a complete name and mailing address for 98 percent of its entries. Is such a high quality national telephone frame feasible? Could any organization compile and maintain such a frame from local telephone directories or similar sources; or is a national telephone list frame of this quality simply impossible with currently available technology and resources?

If such a frame were available, it would open many promising options for telephone surveys. Landenberger and his colleagues mention several of these but not all. There are, for example, methods of sampling both listed and unlisted telephone numbers from a frame consisting only of listed numbers. One of the crudest of these is the Plus 1 method, which is examined by Ghosh. With Plus 1 procedures, a sample of listed numbers is selected, "1" is added to each number, and the modified numbers (now typically including some unlisted numbers) are then called.

As Ghosh observes, the Plus 1 method is biased. These biases are more easily seen if telephone numbers are viewed as divided into banks of (say 100) consecutive numbers and within each bank we assume that listed and unlisted residential numbers and nonresidential numbers are randomly distributed. With these assumptions the probability of a residential number's selection with the Plus 1 method can be shown to be proportional to: (1) the number of residential telephones among the 100 numbers in its bank; and (2) the proportion of these residential telephones which are listed.

Ghosh argues that the bias can be reduced by changing the calling rules. Instead of discarding a modified number which does not reach a residence, the next number is dialed (repeating the Plus 1 process) until a residence is reached. With this modified rule, the probability of a residential number's selection is no longer a function of the number of residential telephones in its bank, only of the proportion of these residential telephones which are listed. Observing that the listing rate varies with urbanism, Ghosh further proposes that this latter bias can be reduced or controlled by stratifying the sample by a measure of urbanism. Exactly how this last step is to be performed is not made clear and may present difficulties since typically one may only stratify by exchanges or central office codes, not individual banks.

An alternative change in the calling rules, not mentioned by Ghosh, is to continue calling next numbers in sequence, whatever the outcome, until the next listed number in the original sampling frame is completed. This would bring the "enhanced" Plus 1 method under the technique of half-open intervals as described by Kish (1967) and would ensure that listed and unlisted residential numbers had the same probability of selection, at least within banks having one or more listed residences. It also would introduce one-stage cluster sampling with clusters of unequal size. Another approach is to choose numbers within a selected bank at random but without replacement until k listed numbers are encountered. This change transforms the Plus 1 method into the method proposed by Sudman (1973) to select clustered RDD samples using telephone directories. Sudman's methods are generally preferable to Plus 1 methods when relatively unbiased estimates or (at least approximately) known probabilities of selection are desired. To reduce the bias from the omission of banks whose only residential numbers are unlisted, Sudman has proposed an increase in bank size, say from 100 to 1,000.

Hagen and Banks describe procedures they employed in a set of local health care utilization surveys to control telephone sample sizes and to reduce interviewer screening while sampling users of municipal health centers at a higher rate than nonusers. These authors have clearly described their largely clerical procedures in a manner suitable for (and apparently taken from) a methodological appendix to a substantive report. This discussant would have found their paper more informative if: (1)

relevant issues of statistical estimation and statistical inference had been addressed; and (2) alternative procedures to achieve the same objectives were explicitly mentioned and their relative advantages and disadvantages examined or at least discussed.

The final three papers to be discussed all address topics in random digit dialing. Two represent first attempts at relatively longstanding problems in RDD.

The first is the problem of sparse clusters in Mitovsky-Waksberg RDD designs. Since clustered RDD was first described by Waksberg in 1978, it has been recognized that an occasional 100-bank will be selected which has very few residential numbers. When such a sparse cluster is encountered, every one of its telephone numbers may be called without reaching the desired cluster size of residential numbers. Exhaustion of sparse clusters can be wasteful of interviewer time and occasionally destructive of interviewer morale.

Various ad hoc methods have been devised to cope with this problem, but Hogue and Chapman are the first to propose publicly a defensible general approach and alternative sets of guidelines to treat it. Their approach seems both sound and readily understandable. The first recommended step, systematic reconfirming of primaries in clusters approaching a threshold of apparent sparseness, seems advisable even if one prefers to complete sparse clusters.

Jones, Massey, and Tenebaum also are breaking new ground by examining the treatment of special places in telephone surveys. Persons living in residences other than standard housing units have long been recognized as a potential problem for RDD telephone surveys but one which for the most part has been quietly ignored. The analysis by Jones and her colleagues demonstrates the distinctive characteristics of the special place population, while their experimental seeding of special places into an otherwise cross-sectional RDD sample confirms the suspicion that current RDD telephone survey field methods are not highly effective in distinguishing special places from regular housing units.

While generally applauding this needed and valuable paper, two somewhat critical comments are in order.

First, I would ask the authors to suspend - at least temporarily - their definition of the problem as one of "identifying special places." The term "special places" has no intrinsic meaning; it is only a summary label for several types of residences that personal visit interviewers are instructed to treat differently in area or list samples. This phrase is so tied to what personal interviewers are instructed to do in the field that it virtually begs the question to ask if telephone interviewers can do the same thing as well. "Identifying special places" is not an end in itself, only a means to appropriate sampling of various types of residences. The goals should be to find methods for telephone surveys to distinguish residences from nonresidences, housing units from institutions and other group quarters, nontransient from transient quarters, and when necessary to enumerate or subsample those encountered. These goals may be addressed more effectively with a renewed focus on the basic objectives than they can from a commitment to the terminology and methods appropriate for personal visit interviewers.

Second, I hope future seeding experiments will devote more efforts to trailer courts and student housing. Together they comprise more than two thirds of the special place population; but they received relatively slight attention in this first seeding experiment.

Since 6 to 7 percent of U.S. households are without telephones, telephone surveys cannot equal the household population coverage of high quality personal visit surveys. One method of combining the cost savings of telephoning with the population coverage of personal visit surveys is to complete two samples concurrently: one by telephone using RDD and another by personal interview from an area or list frame. Information from both samples is then used in dual frame estimators, following the methods proposed by Casady and Sirken (1980).

Lepkowski and Groves present a mean square error model and a cost model for dual frame survey designs with an application to the National Crime Survey. With these models, they investigate the optimal sample allocation between the telephone and area frames under varying assumptions about biases and complex but fixed assumptions about costs. The optima are not presented as simple point estimates; instead the curve of root mean square error values is shown across the range of possible allocation values. "Zones of relative indifference" therefore may be identified within which the allocation may change without greatly affecting the mean square error. An indifference zone extending from 0 to 70 percent telephone would obviously reduce the risk of gradual introduction of a telephone component to a personal visit survey.

The primary focus of the analysis is on the consequences of bias in the telephone sample. This reflects continuing concern about the typically higher nonresponse (and especially refusal) rates in RDD samples than in area/list frame samples of Federal surveys. When the bias for both samples is assumed to be zero, the optimal allocation is about 80 percent telephone for the two estimates examined. But if bias in the telephone sample greatly exceeds that in the personal visit sample, the optimal telephone allocation drops to zero, and a dual frame design ceases to be a viable option.

In a paper presented at last year's meetings, Biemer (1983) developed a similar mean square error model and cost model for a dual frame design which he applied the Current Population Survey. Biemer allocated optimally within strata rather than across strata as do Lepkowski and Groves; and the two analyses differ in a number of other respects. Biemer concluded that: "Given the survey objective of minimizing MSE of an estimator for fixed cost, a telephone survey bias as small as 5 percent could practically eliminate the telephone survey in the dual frame design for making national estimates in large scale surveys." Lepkowski and Groves had not completed their analysis and had reached no explicitly stated conclusions in their paper as presented. Nevertheless, their first results appear to provide a somewhat more encouraging

future for a dual frame design of the National Crime Survey, in part by suggesting that the MSE consequences of first steps toward such a design may be minimal. Further analyses and conclusions both by Lepkowski and Groves and by Biemer on this important topic are eagerly awaited.

FOOTNOTES

1/ The discussion is based on the latest version of each paper received prior to presentation.

2/ Cf. Glasser and Metzger (1972).

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