United States
Department of
Agriculture

Statistical
Reporting
Service

Statistical
Research
Division

SRS Staff Report
Number 82

Computer Assisted Telephone Interviewing on the Cattle Multiple Frame Survey

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COMPUTER ASSISTED TELEPHONE INTERVIEWING ON THE CATTLE MULTIPLE FRAME SURVEY. By Carol C. House; Statistical Research Division; Statistical Reporting Service; U.S. Department of Agriculture; Washington, D.C. 20250; October, 1984; SFSRB Staff Report No. 82.

ABSTRACT

This report summarizes the results of a two phase study comparing CATI versus nonCATI telephone interviewing on the Cattle Multiple Frame Survey in California. The study shows 75 percent fewer errors on the CATI data, as measured by the SRS Generalized Edit program. Multivariate tests on eight selected variables indicates an overall difference in the level of the estimates between the two groups. Differences are significant for two individual variables -- total cattle deaths and response rate. Differences below 18 percent are not found to be statistically significant due to the lack of power in the tests. The observed effect of CATI on-line edits is to increase the estimates for some variables, and decrease them for others. This is in contrast to the effect of the SRS operational edit procedures which increase the level of all estimates. This study was conducted in cooperation with the Program for Computer Assisted Survey Methods at the University of California - Berkeley's Office of Computing Affairs.

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SUMMARY

This report summarizes the results of a two phase study comparing CATI versus nonCATI telephone interviewing on the Cattle Multiple Frame Survey in California. It demonstrates that on-line edit checking available with CATI can improve data quality by reducing response errors in SRS surveys, and provides preliminary measures of the magnitudes of these reductions. The Agency should continue with research in this area, incorporating additional states and surveys to broaden the base of the findings.

The second (and major) phase of the study shows 75 percent fewer errors on the CATI data, as measured by the SRS Generalized Edit program. Time constraints generally mandate that the statistician resolve these errors without recontacting the respondent. Thus we conclude that the CATI data, which requires less intervention by the statistician before summary, is of better quality than the nonCATI data. Multivariate tests on eight selected variables indicated an overall difference in the level of the estimates between the two groups. Differences are significant (higher for CATI) for two individual variables -- total cattle deaths and response rate. Differences below 18 percent were not found to be statistically significant due to lack of power in the tests. The difference in response rate reflects a fewer number of inaccessibles on the CATI side, rather than a fewer number of refusals. The effect of CATI on-line edits is to increase the estimates for some variables, and decrease them for others. This is in contrast to the effect of the SRS operational edit procedures which appear to increase the level of all estimates that are examined.

The first or pretest phase of this study found response errors from one percent in reporting milk cows to 58 percent in reporting steers. Inferences from this preliminary phase are limited in scope, but support findings from the other phase.

More research is needed as a followup to this study -- adding more states to increase the power of the statistical tests and adding more surveys to broaden the base of the findings. Future work should also explore the potential of CATI to reduce the time required for survey management and data processing, and to develop preliminary cost models for CATI data collection.

The Program for Computer Assisted Survey Methods at the University of California - Berkeley Office of Computer Affairs developed the CATI software and cooperated with SRS in this research study.

INTRODUCTION

Computer assisted telephone interviewing (CATI) refers to the use of computer systems for telephone interviewing and related forms of data collection, data entry, editing and coding. A telephone enumerator sits in front of a computer terminal with a cathode ray tube display (television screen) and speaks with a respondent through a telephone headset. The computer is programmed to display each question in turn on the screen. After reading the question to the respondent, the enumerator records each answer by depressing the keys on the terminal keyboard. The computer performs any desired edit checks and, if needed, displays a question requesting clarification. The computer stores the information, selects the next appropriate question and displays it on the screen. In addition to these basic functions, advanced CATI systems can assist with survey management from the initial assignment of the sample to enumerators and the scheduling of callbacks, to preparing summary reports of the status of the survey.

The Statistical Reporting Service (SRS) of the U.S. Department of Agriculture signed a research agreement with the Program for Computer Assisted Survey Methods (CSM) of the University of California-Berkeley in 1981 to investigate jointly the feasibility of using CSM's CATI software on surveys run by SRS. The initial tests were set up in California on the Cattle Multiple Frame Survey. This report summarizes the results from these tests and provides an overview of potential advantages a CATI system may have for data collection procedures in SRS.

POTENTIAL BENEFITS

CATI surveys have a number of potential advantages over traditional telephone data collection. The seven believed to have the greatest benefit to SRS are outlined below:

* Improvements in data quality through on-line editing and the standardization of survey procedures
* Reduction in processing time
* Efficiencies in survey management
* Improvements in enumerator training
* Flexibility in questionnaire design and pretesting capabilities

* Ability to provide a complete audit trail of data

* Potential sample size reductions through sequential estimation.

These are described below to give a broad overview of the role that CATI might play in SRS surveys. The remainder of the report narrows its attention to the work that has been done in quantifying the first benefit -- improvements in data quality.

Improvements in Data Quality

CATI has the potential to reduce nonsampling errors in telephone data collection, thus improving the quality of the data collected. On-line edit and consistency checks can be made between data items on a single questionnaire and against previously reported control data. Questionnaire skips and branches are computerized on CATI, so that they are always executed correctly for a given set of answers. This capability can eliminate the missing items produced when enumerators improperly skip questions that should be answered or ask questions that should be skipped. Therefore the enumerators are able to collect the appropriate information during the interview, reducing the likelihood that the statistician must impute a value or recontact a respondent. A CATI system can also provide greater consistency in the way and order in which questions are asked and can lead to standardization of unstructured probing for additional information. A specific example of this might be a set of questions to determine if an operation reported as a family partnership actually meets the SRS definition of "jointly operated." Overall, data collection would be more standardized both within and between SRS state offices.

Reduction in Processing Time

A CATI system creates the potential to reduce the time required for survey management and data processing. The latter is reduced primarily by eliminating a separate data entry step. In addition, the amount of post-interview editing should be substantially reduced. This will save time--both the statistician's and the respondent's--by necessitating fewer corrections to inconsistent data and less imputation for missing items. A further reduction in time can be realized by eliminating a portion of paper handling before and during the data collection through automated sample management capabilities.

Efficiencies in Survey Management

The most obvious improvements in survey management offered by CATI are automated procedures to schedule interviews and callbacks. In addition, most systems provide for instantaneous summary of the status of a survey at any time, allowing the supervisor or statistician to keep track of the progress being made, and to

calculate interview times and refusal rates by enumerator. In this way the supervisor can identify problem areas quickly and correct them early in a survey. Survey progress can be monitored by strata or district to redirect telephoning to low response areas. CATI systems also allow for improved capability to monitor and evaluate enumerators.

Improvements in Enumerator Training

With CATI, enumerator training sessions can spend less time on issues dealing with the mechanics of the questionnaire, and more time on understanding what is wanted in each question, and on reviewing specific interviewing techniques. This is because a CATI system takes over much of the work usually required of enumerators, allowing them to concentrate on interviewing. Preprogrammed skip patterns and probing reduce potential pitfalls for less experienced enumerators working on complicated questionnaires.

Tradeoffs on training time are required for inexperienced CATI enumerators to learn the commands necessary to control a computerized interview. SRS enumerators have spent around eight hours on a terminal before interviewing on a survey. It is too early to tell if the training period will remain the same length or shorten after the trainers become more experienced. So far, SRS enumerators have adapted very quickly to CATI, and there do not seem to be any obvious new requirements (such as typing ability) necessary for CATI beyond those required for traditional telephone interviewing.

Flexibility

A CATI system provides flexibility in questionnaire design because questions are not dictated by paper size and shape. Intricate skip and branching patterns are possible because CATI makes them transparent to the enumerator. Questionnaires can be developed that are tailored to respondents' characteristics. Examples of this range from simply inserting the respondent's name in a question, to developing of a set of sophisticated queries to categorize the type of farming operation.

Computerized questionnaires are more convenient to use in pretesting new survey questionnaires because changes can be made quickly to try out different wordings, skips, etc. A final version of the questionnaire can be constructed from the pretest version with minimal effort. This capability simplifies methodological studies, making it easier to conduct split sample tests to determine the effects of different questionnaire wording, enumerators, etc.

Audit Trail

A sophisticated CATI system can provide a complete, computerized audit trail of all changes made to data, from its initial entry by an enumerator until the data is transferred for centralized processing. This audit trail would include all changes made by an enumerator during an interview, changes by a statistician during a review, and notes recorded in either situation. The audit trail maintained during the interview will assist the statistician in resolving inconsistencies in data that might remain after the interview. The audit trails will provide the tools for analysts to measure the types and amount of editing that is being done on questionnaires, and to locate particular questions that are giving respondents and enumerators trouble. The CATI system provides this audit trail automatically without requiring additional effort from the state office personnel.

Sequential Estimation

Finally, computerized interviewing systems provide increased opportunities for using techniques such as sequential estimation to reduce sample sizes. These are statistical techniques which are used at given times during data collection to determine if the responses received up to that point will give estimates with the required precision. If not, the data collection continues. If the precision has been reached, no additional sample units are contacted. With CATI, the data are computerized immediately, making possible preliminary estimates of variability.

Disadvantages

It is important to measure the actual gain from CATI rather than merely discuss the potential benefits because of the additional costs and complexities imposed by most CATI systems. Startup costs can be significant. These include hardware procurements, development or procurement of basic CATI software that is flexible enough to fill the need of the survey organization, adaptation of questionnaires to computerized formats, and the training of staff to program and direct CATI surveys and to run new ADP equipment. Although a detailed discussion of these issues is beyond the scope of this paper, recognizing their impact provides a better understanding of the need to investigate fully this new methodology.

BACKGROUND

SRS began empirical experimentation with CATI after initiating the research agreement with CSM. This agreement provides SRS with access to a sophisticated CATI system and the opportunity to support its continued development.1/

1 / The agreement actually gives SRS documented source code for CSM CATI Computer programs.

The major SRS interest in CATI centers around its potential to improve data quality and to reduce the processing time involved in data collection. This initial research study concentrates on quantifying the improvements in data quality resulting from the use of on-line edit and consistency checks during interviewing.

SRS set up a test site in the California SSO in Sacramento. This site consisted of four interview stations, each equipped with a CRT, 1200 baud high speed modem, and two telephone lines (one for data transmission and the other for interviewing). The interviewing phones were equipped with headsets. The data lines connected the interviewing stations in Sacramento to the DEC PDP 11/44 mini-computer on the Berkeley campus.

The Cattle Multiple Frame Survey was the first adapted to CATI. It is an important survey to SRS and to California agriculture, and has the potential for a full exploration of on-line edits to check the consistency of the inventory counts. SRS staff programmed the questionnaire using the CSM Q questionnaire development language that is a part of the CSM CATI software.

Wording differences between the CATI instrument and the original paper questionnaire were minimized in order to eliminate the effect such changes might have on the data analysis. During an interview, when data fails to pass a consistency check, an additional statement appears on the screen. This statement informs the enumerator that an edit check has failed, clearly states which one has failed, and gives the value(s) of the data under suspicion. The statement also gives the exact wording of a probe that can be used by the enumerator to try to reconcile the inconsistency. The enumerators may use this probe or their standard probing techniques to ascertain if reporting errors were made. Corrections of misreported data are then made by the enumerator. If the enumerator resolves the inconsistency without changing the data, then the program directs the enumerator to type in a short note explaining the resolution (eg. "calf crop appears high because some cows were sold").

PHASE ONE

SRS and CSM jointly conducted the interviewing for the first phase of the study during January 1982. The primary objectives of this phase were to pretest the CATI instrument and to allow the interviewing and professional staffs an opportunity to acquire experience in

CATI interviewing. A secondary objective was to provide preliminary indications of data differences resulting from on-line editing. These objectives were satisfied. The analysis showed indications of major differences in several important variables. The following describes the analysis in more detail.

A special research sample was selected from two list strata -- one beef stratum and one dairy stratum. Four enumerators with experience on this survey (but not with CATI), conducted the interviews. They completed 132 interviews.

The computerized questionnaire produces two sets of data. The first consists of the answers to questions as they were originally recorded by the enumerators. The second data set consists of the answers to the same questions, but after the program runs through the edit logic and the enumerator resolves any inconsistencies. Together, the two data sets provide a pair of answers for each question: 1) the answer as first provided by the respondent, and 2) the answer finally agreed to by the respondent and enumerator as the best answer to the question. A paired analysis was performed on these data to measure the impact of the edit on estimates of the number of head of cattle in each of several inventory groups. Because of the small sample sizes involved, the analysis treats the sample units as an unstratified simple random sample and makes no inference to the population of cattle operations in California. The inference level is the sample itself.

Differences between the data due simply to keystroke error were eliminated when they were detected. If an examination of the pair of answers indicated that the difference was clearly produced by transposed numbers or similar obvious keystroke errors, the difference between the pair was set to zero, and the zero difference was included in the analysis. On several occasions it was difficult to assess whether the difference was due to keystroke error, or if, in fact, the respondent had decided to change the answer. In these few specific cases, the paired answers were completely removed from the analysis.

The difference between the final answer to a question

and the first answer to the same question is defined by: diff=last-first. The distribution of these differences is highly skewed, consisting mainly of zeros and a few large values. This type of distribution, with a few very large values, makes the confidence intervals extremely large so that statistical tests of the mean differences are too weak to be useful. Therefore, analysis from Phase One consists only of descriptive statistics of the differences found in the livestock numbers.

The descriptive statistics (for each inventory category and for the overall sample) are presented in table 1 and include:

- total animals (based on the edited data)
- sum of the differences discussed above
- sum of the absolute value of those differences
- average difference per operation
- average absolute difference per operation.

Particular attention should be paid to the estimates of total absolute difference in number of animals reported. By not allowing the errors to cancel each other out from operation to operation, we get a measure of the total response error that is being corrected during the CATI interview and not just a measure of any bias that is being eliminated. The variable "Percent Abs Change" is calculated to give a relative indication of this number.

$$\text{Percent Abs Change} = \frac{\text{Total Abs Diff}}{\text{Total}} \times 100\%$$

Table 1--Results from paired comparisons in Phase 1, Cattle MF Survey, January 1, 1983, California

INVENTORY GROUP	TOTAL	TOTAL DIFF	TOTAL ABSOLUTE DIFF	AVERAGE DIFF PER OPERATION	AVERAGE ABSOLUTE DIFF PER OPERATION	PERCENT ABSOLUTE CHANGE
Beef Cows	3,064	-341	451	-3	4	15
Milk Cows	24,021	10	230	<1 c/	2	1
Bulls	519	5	5	<1 c/	<1	1
Beef Heifers	583	-58	62	<1 c/	<1	11
Milk Heifers	9,252	549	649	5	6	7
Other Heifers	331	71	131	<1 c/	1	40
Steers	2,661	1,556 a/	1,556 a/	13	13	58
Calves	8,027	-679	959	-6	8	12
TOTAL CATTLE	48,459	1,210 b/	2,918 b/	10	25	6

a/ Includes a single change of 1500 head made after an edit check probe caused the respondent to change his response.

b/ Refers to changes after the total was initially recorded. This would not reflect changes to inventory prior to that time.

c/ Average difference in absolute value is less than one.

The percent of absolute change ranges from 1 to 58 percent. The changes are the largest in animals for slaughter market (other heifers and steers) and the smallest in milk cows and bulls. The changes in sign from negative (beef cows) to positive (milk cows) within the total differences for cows, and a similar change in the heifer group (beef, milk and other) present evidence for possible question order bias. In each grouping, the first question (beef cows or heifers) appears to be over-reported initially, and subsequent questions of the same type (milk cows) (milk and other heifers) under-reported. Similar results for livestock inventory surveys were found earlier by Steiner and Kleweno [8].

As an additional measurement of the value of the on-line edit, both data sets were run through the SRS GE edit programs and counts of the number of critical and non-critical errors generated for each data set were obtained. There was no manual edit by a statistician before running the GE program. Table 2 presents the total number of errors identified through these edit runs and the number of corrections that the statistician deemed necessary before summary.

Table 2 -- Summary of edit errors, Phase 1,
Cattle MF Survey, January 1, 1983, California

	Type of Error		
	Total	Critical	Non-critical
Number of error messages on initial responses.	47	16	31
Number of error messages on final responses	20	6	14
Number of corrections before summary	7	6	1

Fifty-five percent of the non-critical errors from the original data set were corrected during the on-line edits. Of the 14 non-critical errors remaining, only one required correction before summarization, and it was accompanied by a note from the enumerator which revealed a misunderstanding. Six critical errors remained after the CATI edit checks, all of which were corrected for summary. Two of those were caused by a respondent's refusal to answer specific questions. The other four were accompanied by enumerator notes which indicate definitional problems and gave adequate information to make the corrections. Thus of the 47 errors and discrepancies flagged by the edit programs on the data originally reported by the respondents, only fifteen percent required intervention after the close of the interview.

No major conclusions can be drawn from this phase of the study because the inferences are limited. However several patterns emerged that should be discussed.

First, respondents in the study did revise a sizable number of their answers in response to the probing of an enumerator after an edit check revealed inconsistencies in that data. If one excludes milk cows (half of the total animals reported), then the percent absolute change over the remaining inventory categories is about fifteen percent. The question remains -- how many of these changes would have been caught by a "sharp" enumerator without the aid of CATI? Undoubtedly some would have been. One should recall, however, that most of the checks require some type of arithmetic calculation, and then need to be compared to preset limits which must be memorized or looked up. From this it is easy to conclude that the vast majority would slip by during a traditional interview, even with very sharp enumerators.

A second issue -- is there any particular advantage to correcting these data inconsistencies during an interview since the CE edit will probably find them later? First, Phase 2 analysis indicates that the effect of the two procedures may not be the same. Second, the assumption is simply made that the respondent is in a better position to resolve the inconsistency in most instances than is the statistician reviewing the CE edit results. Because time constraints in SRS surveys generally prohibit the statistician from recontacting the respondent, we conclude that there is a definite advantage to resolving these during the initial interview. In many cases the data are in fact correct, and should not be edited. CATI allows enumerators to type in notes to the statistician explaining the situation

in those cases. In all cases, the respondent does not have to be contacted again and the statistician can spend much less time reviewing edit printouts and second guessing what the respondent really meant to report.

In conclusion, CATI appears to have assisted the enumerators in this study in finding and correcting reporting errors during the interviews, thus providing data of better quality with less intervention from the statistician.

PHASE TWO

The primary purpose of the second phase was a controlled test of CATI verses nonCATI telephone interviewing by comparing the estimates generated from two half samples during an operational survey period. The operational sample in nine selected strata for the Cattle Multiple Frame Survey in California was split randomly into two subsamples. After eliminating sample units without telephone numbers, the effective sample size was 614 on the CATI sample and 609 for non-CATI.

Team assignments split the group of enumerators subjectively into two teams of nearly equal experience and ability. All enumerators had worked before on this survey, and two enumerators on the CATI team and one enumerator on the nonCATI team had previous CATI experience. Interviewing was conducted during the last week of December, 1982 and the first week of January, 1983. The cattle questionnaire received only minor modifications between phases, such as those to correct a few program bugs or to make the introduction flow more smoothly.

Table 3 displays counts of critical and non-critical errors from the SRS generalized edit programs that are generated for the CATI and nonCATI samples. Overall, there were 76 percent fewer corrections needed before summary on the CATI sample than on the nonCATI sample. Since time constraints generally mandate that the statistician make these changes without recontacting the respondent, we conclude that the CATI data is of higher quality than the nonCATI data.

Table 3 -- Summary of edit errors, Phase 2,
Cattle MF Survey, January 1, 1983, Californ

	Type of Error		
	Total	Critical	Non-critical
Total Error Messages			
Non-CATI	245	53	192
CATI	199	12	187
% Rel Difference 1/	19%	77%	3%
Errors Corrected for Summary			
Non-CATI	84	53	31
CATI	20	12	8
% Rel Difference 1/	76%	77%	74%

1/ % Rel Difference = ((NonCATI - CATI) / NonCATI) x 100%

The table shows that the CATI sample has 77 percent relatively fewer critical errors than the non-CATI sample. Seven of the twelve critical errors from the CATI sample result from a consistency check inadvertently left out of the programming of the on-line CATI checks. This check has since been added. The remaining five indicate that the amount of feed fed to cattle-on-feed, although verified with the respondent, is too low to be classified as "on-feed" by SRS.

There is only a three percent difference in non-critical errors between the two data sets. However, because all inconsistencies were verified by the respondents during the interview for the CATI sample, there were 74 percent relatively fewer changes made to the CATI data than to the non-CATI data as a result of these error flags.

The purpose of the following analysis is to investigate

possible biases resulting from the response errors discussed above. It compares the levels of the estimates between the half-samples at two different stages of the processing. One comparison is of the data exactly as they come from the completed interview, before any operational SRS hand or batch editing. A second comparison is of the data after they have proceeded through the full operational editing procedures and are ready for summary. Differences that are detected between the CATI and nonCATI estimates can indicate the presence of a bias due to these response errors. However, they can also reflect differences due to a general change in the mode of data collection (even though reasonable precautions were taken to minimize these other effects). A failure to detect differences can indicate that the response errors tend to cancel each other out, or simply that the tests are not powerful enough to accurately measure the bias.

Seven representative inventory variables and the response rate were chosen for comparison. Stratum totals for each variable were expanded by the appropriate stratum expansion factors to produce overall totals, and are presented in table 4. 1 / Note that these are not estimates of state totals for California, but represent only the nine selected strata. The expanded response rate was computed by dividing the expanded number of responses by the population total.

Table 4 also presents the results from multivariate and univariate tests. All test statistics are computed using replicate totals instead of individual data to avoid the complications of a stratified sample design in test procedures that assume a simple random sample. [4] There are ten replicates across strata in each half-sample of data.

Results from two multivariate tests 2 / -- Hotelling-Lawley Trace and Wilks' Criterion -- provided identical results and are presented in the table as a single statistic. These tests show significant differences for a=.10 for both edited and unedited data.

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1 / These data were adjusted to handle a large outlier in one of the smaller stratum by setting its expansion factor to "one" and recalculating the original expansion factor in that stratum. This treats the outlier as if it were in a stratum of preselected units and allows it to represent only itself in summary. Earlier presentations of these data were not adjusted for this outlier, and the adjustment did not affect the outcome of any of the tests and made only modest changes in the levels of the estimates.

2 / Computations used SAS GLM multivariate procedures.

Table 4 -- Direct expansion estimators, multivariate and univariate tests
Phase 2, Cattle MF Survey, January 1, 1983, California

VARIABLE	CATI	NON-CATI	% DIFF 1/	DIFF IS SIGNIFICANT 2/ (PROB>F)
Multivariate tests				
Unedited	-	-	-	yes (.06)
Edited	-	-	-	yes (.05)
Response Rate	80.1	65.4	22.5%	yes (.00)
Total Cattle				
Unedited	2,570,089	2,457,652	4.6%	no (.36)
Edited	2,595,691	2,541,160	2.1%	no (.63)
% EdDiff 3/	1.0%	3.3%	-	-
Total Beef Cows				
Unedited	514,833	581,498	-11.5%	no (.26)
Edited	518,025	581,907	-11.0%	no (.28)
% EdDiff 3/	0.6%	0.1%	-	-
Total Milk Cows				
Unedited	773,403	708,353	9.2%	no (.11)
Edited	782,698	731,942	6.9%	no (.19)
% EdDiff 3/	1.2%	3.2%	-	-
Total Other Heifers				
Unedited	70,806	59,455	19.1%	no (.61)
Edited	70,860	61,680	14.9%	no (.68)
% EdDiff 3/	0.1%	3.6%	-	-
Total Steers				
Unedited	136,771	149,360	-8.4%	no (.67)
Edited	137,531	164,337	-16.3%	no (.41)
% EdDiff 3/	0.6%	9.1%	-	-
Total Calves Born				
Unedited	1,038,447	1,020,273	1.8%	no (.65)
Edited	1,113,247	1,122,601	-0.8%	no (.92)
% EdDiff 3/	6.7%	9.1%	-	-
Total Cattle Deaths				
Unedited	39,235	32,885	19.3%	yes (.04)
Edited	40,283	33,918	18.8%	yes (.03)
% EdDiff 3/	2.6%	3.0%	-	-

1/ % Diff = ((CATI - NONCATI)/NONCATI) x 100%
2/ multivariate and univariate tests for a=.10 significance level
3/ % EdDiff = ((Edited - Unedited)/Edited) x 100%

When variables are examined individually, the response rate in the two groups is found to be significantly different. For both the unedited and edited data, one inventory variable - total cattle deaths - is found to be significantly different for a=.10. Other inventory variables showed fairly large differences for both edited and unedited data, but these differences are not detectable at the given significance level due to lack of power in the tests. Before more powerful univariate comparisons can be made for many of the cattle variables, the tests must include several states, and thus must wait until additional states have CATI capabilities.

The significant difference in response rate is caused by the number of inaccessibles rather than the number of refusals (which expanded to about eight percent of the population in each group). An examination of the procedures used to distribute and manage the sample provides the most likely explanation for this difference. Sample management for both groups were handled by hand but the procedures were considerably different.

> On the nonCATI sample, enumerators were given a stack of questionnaires at the beginning of the survey and were responsible for completing as many interviews from that stack as possible before the end of the survey period. Exceptions occurred -- if the enumerator was not available for a callback appointment; if the enumerator was not working a full shift through the survey; or in other situations where either the enumerator or supervisor felt that it would be useful to redistribute part of the assignments -- but, the general pattern was one of minimal shuffling of assignments.
>
> On the CATI side, two circumstances mandated a different approach to sample distribution and management. First, because equipment availability limited the test to only four interview stations, each of these stations had to be used optimally at all times. The five enumerators working on CATI on a given shift would rotate their breaks so that interviewing was going on at each station continuously. Second, because the enumerators were generally inexperienced with CATI, a supervisor was

constantly in attendance to assist immediately with any difficulty that might arise during an interview. The supervisor used much of this time to sort through "no answers", "busys", and "callbacks", and to redistribute them to enumerators in a more optimal fashion. The general pattern that emerged was that enumerators were assigned a small number of calls to make at any one time, but these assignments were updated (and added too) frequently during each shift.

The end result is a significantly higher response rate on the CATI sample. Although the monitoring procedures required a considerable amount of staff time the same positive results may be possible soon without the personnel costs. A computerized sample manager and scheduler is being developed for the CATI system that will perform these functions. It is expected to be operational by the end of this year.

Some general patterns are observable in the data presented in table 4 which may shed light on the relationships between estimates from the CATI and nonCATI samples, and the effects that SRS operational edit procedures have on these estimates.

There are relatively large differences between CATI and nonCATI for individual variables but the direction of these changes differ and they tend to cancel each other out when combined. For example, two variables -- total cattle, total calves born -- are both sums of other variables actually reported by respondents. The absolute relative difference between CATI and nonCATI for these two variables (including edited and unedited estimates) is 4.2%. In contrast, the difference for individually reported variables (beef cows, milk cows, other heifers, steers, cattle deaths) is 10.3%.

The effect of CATI on-line editing is not always consistent with the effects of SRS batch editing. Without exception, the SRS operational editing procedures have the effect of increasing the levels of the estimates. These increases ranged from 0.1% to 9.1%. The effect of having CATI on-line editing verses nonCATI with no on-line editing increases

the estimates of some variables and decreases the estimates of others. The direction of these changes are consistent with those measured in Phase 1 between CATI and the original responses before the on-line edit checks. Of the five variables included in both analyses, only the direction of the change for steers was different.

The effect of editing was consistently greater on the nonCATI sample than on the CATI sample. The median increases were 3.3% and 1.0% respectively.

Finally, average interview times were computed for the CATI and nonCATI samples, and the results presented in table 5 show little difference. However, there were problems in getting comparable data for this variable. The CATI program can measure interview time very precisely. It began timing the interview when an appropriate respondent came to the phone and ended when the phone was hung up. On the nonCATI side, the beginning and ending of the interview can not be defined as precisely, but is thought to be measured from the time the phone began to ring until the phone is hung up. If this is the case, it would tend to overstate the length of the nonCATI interviews in relation to the CATI interviews. Because time may have been measured differently no statistical comparisons are presented along with the estimates.

Table 5 -- Expanded estimates of average interview time, in minutes, Cattle NF Survey, Jan. 1, 1983, California

VARIABLE	CATI	NON-CATI
All Responses	8.2	8.2
Responses reporting cattle	8.5	8.4

CONCLUSIONS

CATI has the potential to benefit SRS data collection in a number of important ways. This study measures the effect that on-line editing has on data quality and indicates that it can reduce errors in SRS surveys. The study provides preliminary measures of the magnitude, including a 75% reduction in the number of response errors as measured by the statisticians' changes before summary. Testing to detect specific biases due to these response errors is inconclusive at this time. Differences as high as 15 percent were common, but the tests were only powerful enough to detect those approaching 20 percent. Further testing on this and other surveys in multiple states is needed.

The comparison of CATI versus nonCATI data via the GE edit runs shows that critical errors were substantially fewer in number for CATI. Non-critical errors flags occurred in equal number for both groups, but the statistician made substantially fewer changes on the CATI data because the respondent had already verified those inconsistencies. All together there were 75 percent fewer corrections made to the CATI data after the GE edit than to the nonCATI data.

The direction of change -- whether the effect of editing is an increase or decrease in the estimate -- is different for individual variables and the level differences tend to cancel each other out when combined. However, the direction of change is consistent between the two phases of the study for variables measured in both. This indicates that the effects of on-line editing may be different from those of SRS operational edit procedures which invariably increased the level of an estimate. Again, further testing is needed.

The reduction in the number of corrections from the GE is significant because it demonstrates the potential to save staff time in data collection in addition to improving data quality. The reduction in time for data processing and survey management is a major area of potential benefit for SRS that was not addressed extensively in this study but needs to be evaluated in the future. The Agency should proceed with plans to develop an automatic scheduler for the CATI system. This scheduler should greatly reduce staff time in managing a CATI survey. Further, the response rates in Phase 2 indicate that the automatic scheduler can help improve response rates in telephone surveys.

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