HOW QUESTIONNAIRE DESIGN MAY AFFECT SURVEY DATA

WYOMING STUDY

DO YOU HAVE ANY CALVES? HOW MANY? _____

HOW MANY CALVES DO YOU HAVE? _____

By

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FOREWORD

This study provided a partial measurement of some of the factors involved in a probability sample survey. The analyses do not provide any answers. However, it does point out some problems and the findings should be food for thought for every SRS employee.

Let's consider for a minute some of the basic concepts involved in this particular study. Whenever we are sampling from a list frame, the sampling unit is normally a name on the list while the reporting unit, according to our concept, is the land operated by the name on the list at the time of interview. In any survey, the sampling unit and the reporting unit must be properly associated. The job is quite easy if indeed they are the same. When the sampling unit and the reporting unit are not the same, the questionnaire design must overcome the differences, thus the questionnaire design can become quite complicated.

To describe this complication let's look at the July 1 Calf Crop Survey. To determine the reporting unit we ask the respondent to report the land he owns, rents, and manages, then subtract land rented to others to determine what he operates. We assume at this point we have defined the reporting unit to the respondent. Next, ask the respondent to report cattle and calves of all ages, regardless of ownership, now on this land (land he operates). However, to adequately express all of the concepts, the wording of the questions includes several separate thoughts. Can the respondent adequately comprehend and associate each of these separate ideas? What is the result if the respondent only scans the question or reads only the portion that is emphasized by caps? What is the result if the respondent only hears a portion of the question in an interview? If the enumerator doesn't read the question completely or slowly enough? We assume he will report all cattle that happen to be on his land at the time of the interview. He is not to include those on somebody else's land but is to include those on his land but owned by someone else. Are these concepts adequately understood by the respondent when he is completing a mail questionnaire? Is it adequately understood, by both the interviewer and the respondent in communicating by telephone or personal interview? Is there any way to determine whether the respondent understood the concepts?

In this particular survey, the estimate of calf crop is from two parts: (1) calves to be born during the latter half of the year are estimated by obtaining cows and heifers expected to calve during that time, and (2) the calves that have already been born as reported by the respondent. To confound the issue, the reporting units for the calves born and cows and heifers expected to calve are different. The reporting unit for expected calf crop was cows and heifers now on the land operated and expected to calve before December 31. This means that cows and heifers the respondent has on someone else's land should not be reported but other's cows and heifers on his land should be reported. Now contrast this with the reporting unit for calves

born which is all calves born since January 1, 1974, on the land he now operates. These calves do not have to be on hand at the time of the interview. They could have been born to cows someone else owned and have since been sold, slaughtered or moved to other land. The respondent should not report calves from cows he owned but were born somewhere else whether they are currently on his land or not. Again, we might ask - Are these concepts adequately understood?

Clearly, we have a questionnaire from which all data does not need to be consistent. We have a situation where if the respondent reports correctly, there is a good possibility that data from one section of the questionnaire to another will be inconsistent and nonsampling errors are created if they are edited to be consistent.

Currently, we use the mail, telephone and personal interview techniques of data collection. Hopefully, each method of data collection will provide the same information. If it does not, we are creating an unknown amount of nonsampling error. Under ideal situations, a mail questionnaire should only be used when the respondent fully understands the concepts after they have been clearly related to him through the questionnaire. Theoretically, if this is true, the only role that the interviewer can play, using the same questionnaire, is to replace the postal service for the mail questionnaire. In practice, an enumerator is well trained in concepts and we hope aids in the communication process to the respondent. This study shows that a significant amount of additional editing was required on mail questionnaires while less editing was required on data collected by an interviewer. This fact alone raises more questions. For example, can we actually collect this type of data by mail? Does not our methodology and concepts require a questionnaire design which is complicated? Does not our methodology depend on being able to handle complicated operations? Our current procedures force all operators to use a questionnaire to adequately enumerate the most complicated operations. Perhaps there is only a small percentage of all operations which are complex enough to require a thorough understanding of our concepts to be critical. Perhaps it is time to simplify the concepts and develop a mail questionnaire which the respondent can complete for his operation as he thinks of it, providing the operation does not fall in the complicated category.

There should be sufficient questions on this mail questionnaire to detect the five to 10 percent of the respondents for which the questionnaire does not suffice. These cases could then be followed up with a personal interview and a special questionnaire to collect the additional information necessary. Perhaps by this philosophy, we could more nearly balance sampling and nonsampling errors and arrive at a more reliable estimate.

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ACKNOWLEDGEMENTS

This project was an integral part of the July 1, 1974 Wyoming Cattle and Calf Multiple Frame Survey. It was based on the "split schedule" procedure. The procedure is not new, and is often used to evaluate alternate questionnaire designs.

A project of this nature only succeeds because of several individuals. Bob Carver provided the boost to start the project. The method of replicated sampling from the Wyoming list frame required considerable extra effort from Doug Hasslen. Estimates and Survey Division personnel provided much expertise in the questionnaire development phase. Bob Griffith's efforts to allow a smooth running summary of the survey data were very much appreciated. Most of the post-survey data analysis was completed by Jerry Thorson.

INTRODUCTION

A large part of the success or failure of a survey depends on the questionnaire's ability to properly obtain the required data.[1] One indication of the success of a questionnaire is the amount of editing required to remove respondent and/or interviewer errors and omissions.

The Wyoming SSO has noted that the multiple frame cattle questionnaire required considerable editing. They were especially concerned about the amount of editing required in the calf crop section. As a result of this concern, they developed an alternate questionnaire and recommended that it be used for the July 1, 1974 Multiple Frame Cattle Survey.

The Livestock Branch was reluctant to allow the operational questionnaire to be changed because a change in the specific wording of questions and the order in which they are asked may affect the level of survey estimates. This effect on an estimate can be difficult to determine because a pretest of the questionnaire may not identify all problems that might occur in the actual survey. For these reasons, it was suggested that the Sample Survey Research Branch delve into the matter.

A procedure often used to test a change in questionnaire design is to split the sample for a given survey. Then the operational questionnaire is used on one portion and the test or proposed questionnaire on the remaining portion of the sample. This is desirable because it allows the questionnaire to be tested in an actual survey with a sample size sufficiently large to obtain valid statistical tests of differences between questionnaire versions. After a preliminary analysis, all data is available to be used when setting the final estimate. These ideas formed the nucleus of the Wyoming study.

Further development of the Wyoming proposed questionnaire was accomplished jointly with the Livestock, Data Collection, and Sample Survey Research Branches. The objectives in mind when developing the test questionnaire were to:

(a) Test the procedure of obtaining total calves born before breaking it into subitems versus obtaining the subitems first and adding to total calves born as a check.

(b) Test the procedure of obtaining total calves born followed by the expected calf crop versus obtaining expected calf crop first.

(c) Test a new question concerning calves born on the respondent's land, but were on other privately-operated land during the survey period.

These objectives were to be measured by evaluating effects on the estimates and the frequency of editing.

SUMMARY

1. The use of two questionnaires in an operational survey was a practical way to measure the effect of a change in the ordering and wording of questions in a questionnaire design.

2. The change in the questionnaire did affect the estimates for most items concerning calves.

   (a) The test questionnaire indicated a significantly larger number of calves had died than the estimate obtained from the operational questionnaires.

   (b) Estimates for total calves born and those weighing less than 500 pounds were also significantly larger from the test questionnaire. All other items were not significantly different.

3. The questionnaire design did have an effect on the variability of the reported data. For most items, the test questionnaire had a smaller sampling error than did the operational version.

4. The operational version required considerably more editing for the calf crop items than did the test questionnaire. The editing was mostly either positive or negative for a given item and not offsetting. If the frequency of editing is an indication of the quality of the data obtained, the test version would be judged better. (Table 4)

5. The effect of editing on the level of the estimates was considerably larger (three times greater for some items) than variation due to random sampling. This was true for both questionnaire versions. If the quality of the data is judged by the amount of editing and the impact of the editing on the level of the estimate, then neither questionnaire version was entirely satisfactory. (Tables 5 and 6)

6. Questionnaires obtained by mail require editing more frequently than those obtained by telephone or personal interview. (Table 7)

7. The test questionnaire was handled with less editing than the current version when an enumerator was involved. (Table 7)

QUESTIONNAIRE DESIGN

Two questionnaire versions were used in the July 1, 1974 Multiple Frame Cattle Survey in Wyoming. One version was that used in the operational multiple frame livestock program while the test version had minor changes. Nonrespondents were interviewed with the same questionnaire (operational or test) they received through the mail.

The operational and test questions are shown below. Note that the operational questionnaire asked about cows and heifers expected to calve before asking the number of calves already born. These questions were reversed in the test questionnaire to allow the operator to report the number of calves he had on hand, and then his calving expectations.

QUESTIONS USED IN THE OPERATIONAL QUESTIONNAIRE TO OBTAIN THE NUMBER OF CALVES BORN AND THE EXPECTED CALF CROP, WYOMING CATTLE AND CALF MULTIPLE FRAME SURVEY, JULY 1974

EXPECTED CALF CROP

12. How many of the **COWS** and **HEIFERS** now on the land you operate are expected to calve between now and December 31, 1974? 361

CALVES BORN

13. How many **CALVES** were born on the land you operate since January 1, 1974? *(Include those still on this farm, sold, slaughtered or died. Exclude calves purchased.)* 362

14. How many of the (question 13) calves born: .....
    a. Are still on this farm or ranch? 363
    b. Have been sold or slaughtered? 364
    c. Have died? 365

QUESTIONS USED IN THE TEST QUESTIONNAIRE TO OBTAIN THE NUMBER OF CALVES BORN AND THE EXPECTED CALF CROP, WYOMING CATTLE AND CALF MULTIPLE FRAME SURVEY, JULY 1974

CALVES BORN

12. Report below the **CALVES** born since January 1, 1974 on the land you operate.

How many:.....

a. Are still on this farm or ranch?.... 363

b. Have been sold or slaughtered?..... 364

c. Have died? 365

d. Are now on another persons privately operated land in this state or in another state?..... 473

13. Add questions 12a through d, this should be the **TOTAL CALVES** born since January 1, 1974 on the land you operate..... 362

EXPECTED CALF CROP

14. How many of the **COWS** and **HEIFERS** now on the land you operate are expected to calve between now and December 31, 1974?..... 361

15. What is your usual calving period *(underline or circle approximate month(s).)*

Jan., Feb., Mar., Apr., May, June, July, Aug., Sept., Oct., Nov., Dec. 474

An additional change was to revise the method of asking for calves born on the operator's land during the past six months. In the operational questionnaire, the respondent reported the total number of calves born; then he was asked to break the total into those still on his land and those that had been sold or had died. Data obtained in this manner required considerable editing in the past because the breakdown of calves reported did not sum to the total calves reported. The test questionnaire reversed the sequence. It first asked for calves that were on the land operated, then for calves sold or slaughtered, followed by the number of calves that had died. A question was added to the test version to obtain the number of calves born on the operator's land but that were on another person's privately-operated land at the time of the survey. These subitems were then added to obtain a total number of calves born on the operator's land. The question about calves that were born on the respondent's land, but were on other land at the time of the survey did not appear on the operational questionnaire, but the enumerator's manual stated these calves were to be reported as sold. The respondent receiving the operational questionnaire through the mail did not have a place to report these calves.

An additional question was added to determine the usual calving period for the ranch to aid in verifying the item *cows and heifers expected to calve between now and January 1.* It was believed that sometimes operators reported their total number of cows including those that had already calved rather than those remaining to calve.

The only change made in the inventory questions concerned heifer, steer and bull calves weighing less than 500 pounds. The question asking for calves weighing less than 500 pounds was changed to emphasize the word *calves* because livestock producers often do not report calves not weaned since they consider the cow and calf to be one animal unit.

INVENTORY QUESTIONS USED IN OPERATIONAL QUESTIONNAIRE FOLLOWED BY QUESTION CHANGED IN TEST VERSION (Q. 8), WYOMING CATTLE AND CALF MULTIPLE FRAME SURVEY, JULY 1974

CATTLE AND CALVES

Please report below all* CATTLE *and* CALVES *on the land you operate, regardless of ownership (include those now on feed). Also include those owned by this farm or ranch that are now on public grazing land.

How many are:

3. **BEEF COWS?** *(Include heifers that have calved)*..... 351

4. **MILK COWS,** whether dry or in milk? *(Include milk heifers that have calved.)*..... 352

5. **BULLS** weighing 500 pounds or more?..... 353

6. **HEIFERS** weighing 500 pounds or more:
   a. For **BEEF COW** replacement? *(Exclude heifers that have calved.)*..... 354
   b. For **MILK COW** replacement? *(Exclude heifers that have calved.)*..... 355
   c. **OTHER HEIFERS** weighing 500 pounds or more? *(Exclude heifers that have calved.)*..... 356

7. **STEERS** weighing 500 pounds or more?..... 357

8. **HEIFER, STEER and BULL CALVES** weighing less than 500 pounds?..... 358

9. **Add all entries above (questions 3 through 8) This should be the TOTAL number of CATTLE and CALVES now on the land you operate**..... 350

8. **CALVES – heifer, steer and bull calves weighing less than 500 pounds?**..... 358

SAMPLE DESIGN AND SURVEY PROCEDURES

The sample was selected using a replicated sampling procedure. 1/ This facilitated assigning part of the sample to the operational questionnaire and the other portion to the test questionnaire. The replicated sampling procedure permits valid statistical tests to evaluate the effect of the change in questionnaire design. Thus, several independent samples were selected from the list with half assigned to the operational questionnaire and half to the test questionnaire. Table 1 shows the sample allocation by stratum. To facilitate handling, strata codes 1 through 7 were assigned to the operational questionnaire and 11 through 17 to the test questionnaire. The coding also allowed a quick comparison of survey results when data were summarized in the multiple frame summary program.

Table 1--Sample allocation by stratum using replicated method of sampling, Wyoming Cattle and Calf Multiple Frame Survey, July 1974

Stratum identification			Number of replications selected	Number in each replication	Total selected
Size group	Operational questionnaire code	Test questionnaire code			
No cattle	1	11	4	3	12
1-99	3	13	16	28	448
100-199	4	14	10	25	250
200-299	5	15	10	20	200
300-499	6	16	10	20	200
500 +	7	17	10	15	150

Two sets of mailing labels were printed for each questionnaire version. One set was used for mail questionnaires, the other for the telephone or interview questionnaires. This insured that each selected name was assigned to the correct questionnaire version for both the initial mailing and the nonresponse follow-up.

1/ A report is being prepared that will explain replicated sampling as it applies to a list frame.

The use of two different questionnaire versions had little effect on survey procedures. The same method of mailing to all respondents followed by telephone and personal enumeration was used for both questionnaires. Since the questionnaire changes were fairly minor, all enumerators were assigned both versions to optimize the workload.

During the edit phase, each time an edit was required the original entry was recorded along with a code indicating the reason for the edit. The purpose was to determine if one questionnaire version required less editing than the other. Another purpose was to determine what impact editing had on the level of the estimates by questionnaire version. Since questions about joint operations and out-of-State operations were not affected by the change in questionnaire design, editing resulting from these questions was not recorded.

During the manual edit, an attempt was made to recontact respondents to verify the need for each edit action. However, it was very difficult to recontact many of those returning questionnaires by mail. Thus, much of the editing was done without recontacting the respondent.

Survey data from both questionnaire versions were included in the multiple frame estimate. As mentioned previously, the assignment of strata codes allowed a quick analysis of estimates by questionnaire version. This was important because it is desirable to use the entire sample to make final estimates if possible.

ANALYSIS

Sample Estimates

The hypothesis for the calf and cattle questions was that the direct expansions and sampling errors from the independently selected samples should not differ by more than that explained by the variability due to sampling. All survey procedures imposed on the independently selected samples were held constant except for the different questionnaire versions. Therefore, if any differences in estimates are larger than what can be explained by sampling variability, then the difference can be attributed to the different questionnaire versions.

Table 2--Estimates of selected items by questionnaire version, Wyoming Cattle and Calf Multiple Frame Survey, July 1, 1974 1/

Item	Operational questionnaire		Test questionnaire		t test 3/ for estimates	F test 3/ for variances
	DE	SE	DE	SE		
	(000)	(000)	(000)	(000)		
Calves born and still on land	245.4	10.2	266.4	8.9	1.55	1.15
Calves born, sold, or slaughtered	5.2	1.4	2.1 (6.3)	0.6 (1.5)	2.04 (.73)2/	2.33 (1.07)
Calves born - moved	-	-	4.2	1.4	-	-
Calves born - died	12.3	.7	16.7	1.5	2.59**	2.14 **
Total calves born since Jan. 1	263.0	10.7	289.4	9.9	1.81 *	1.08
Cows & heifers expected to calve	17.0	2.2	16.5	1.7	.18	1.29
Beef cows	293.5	12.2	317.5	10.8	1.48	1.13
Heifers for beef cow replacement	57.0	3.7	56.4	2.9	.13	1.27
Calves weighing < 500 lbs.	259.6	10.5	284.8	9.7	1.77 *	1.08
Total cattle and calves	732.3	26.2	762.2	23.6	.85	1.11

1/ Estimates do not include extreme operators nor the nonoverlap domain, estimates from each questionnaire version must be added together to obtain a total list estimate.

2/ Calves born, sold or slaughtered plus calves born but on other privately-operated land during survey period.

3/ Significant levels for testing for differences between direct expansions and sampling errors from questionnaire versions.

If there is no significant difference between direct expansions	If there is no significant difference between sampling errors
Probability t > 1.697 < 10 percent *	Probability F > 1.70 < 10 percent *
Probability t > 2.042 < 5 percent **	Probability F > 1.98 < 5 percent *

The effect the test questionnaire had on the level of the estimates was of primary concern. Significant differences between estimates from questionnaire versions occurred for items concerning calves.

The estimates for calves born, but sold, or slaughtered were difficult to evaluate. The difficulty is caused by the number of calves born on the operator's land, but which were on other privately-operated land during the survey period. The operational questionnaire (both mail and interview versions) had no place to record such livestock. However, the interviewer's manual instructed the interviewer to record such animals as "sold or slaughtered." Therefore, there was a potential for differences to occur between method of collection of the operational questionnaire. Unfortunately, it was not possible to test for a difference between mail and interview data. The test questionnaires (both mail and interview) had a specific question that asked the respondent to report calves born on his land but were on another person's land during the survey. There was no significant difference between test and operational questionnaires in the estimates of calves born, but sold, slaughtered or moved to other privately-operated land.

The test questionnaire did indicate a significantly larger number of calves that had died. In the operational questionnaire, the respondent may enter a total number of calves born and skip the remainder of the section without reading the part asking for the number of calves that died. He may only think of the number saved as his calf crop. The operator did not have a chance in the test questionnaire to enter a total figure until he had entered all of the subitems, including calves that died.

The test questionnaire indicated significantly more calves born since January 1, 1974 than the operational questionnaire at the 90 percent level. However, the increase in the reported number of calves that died or were moved to other land does not account for all of the difference in total calves between questionnaire versions.

The estimate of calves weighing less than 500 pounds also differed significantly by questionnaire version. Again, the difference was significant at the 90 percent level of probability. The magnitude of the difference between the current and test questionnaire was about the same for this item as it was for total calves born. These are closely related because calves born after January 1 and still on the farm or ranch during the survey period should be reported as calves weighing less than 500 pounds. The different results of the questionnaires pertaining to calves weighing less than 500 pounds is probably confounded with calves born because both questions were changed in the test questionnaire.

In most cases the test questionnaire had a smaller sampling error than did the operational version. The conclusion is that the questionnaire design did have some effect on the variability of the reported data. This may have occurred because the test questionnaire required less editing than did the operational questionnaire.

Table 3 summarizes the results from the question on the test questionnaire asking for the usual calving period. The question was completed on about 83 percent of the usable test questionnaires. Most respondents indicated a calving period ending in June. Nearly half of the cows and heifers still to calve were reported by respondents with a calving period ending in June. This indicates a problem - either with the expected calf crop question or with the usual calving period question.

Table 3--Summarization of responses to the question in the test questionnaire asking for the usual calving period, Wyoming Cattle and Calf Multiple Frame Survey, July 1974

Calving period	Percent of reports for each calving period	Percent of cows and heifers expected to calve by calving period
JAN - FEB only	.7	
MAR - APR only	20.4	
MAY - JUN only	2.3	
JAN - JUN only	50.3	
JAN - JUN Total	73.7	46.7
JUL - AUG only	1.1	
SEP - OCT only	.2	
NOV - DEC only	.2	
JUL - DEC Total	1.5	7.6
JAN - DEC	7.9	35.8
(Did not complete item)	16.9	9.9
	100.0	100.0

The question is, "Which questionnaire provided the best estimate?" So far, we only know that some of the differences are not explained by sampling variation. In the absence of the "truth" for the items in question, other means are required to evaluate the questionnaires. Since one of the objectives of the project was to develop a questionnaire that would require less editing, changes caused by editing and the frequency of editing are measures of the ability of the questionnaire to communicate with the respondent. This assumes reported data are more consistent and accurate when no editing is required. However, it also assumes that if editing is required, it removes a source of nonsampling error. Therefore, the next section evaluates editing by questionnaire version.

Edit Actions

Any one of several factors can lead to an edit action.

a) The questionnaire asks for information the respondent does not have available.

b) The respondent does not understand what is wanted.

c) The respondent or interviewer does not read (ask) the questions completely.

d) Poor communication between the interviewer and the respondent.

e) The statistician misinterprets reported data by editing for consistency when reported data may not need to be consistent.

This is not an exhaustive listing of reasons for editing - but it does indicate more than one factor may be involved. The point is that editing is done to improve the quality of the data. The need for an edit indicates some inconsistencies with other information, which may be elsewhere in the questionnaire.

Since it is a usual practice to edit all survey data, it should be important to measure the effect editing has on the estimate. After data are collected and edited, direct expansions and sampling errors are computed for all survey items. The only measure of reliability available is the sampling error which does not measure editing effects. Since editing may sometimes remove outlier reports, it can artificially reduce the sampling errors.

Table 4 summarizes edit actions made on major questionnaire items for the Wyoming Cattle and Calf Multiple Frame Survey. The number of edit actions, the expanded difference between original and edited values, and the standard error of the difference was computed using paired data procedures.

Table 4--A summary of edit actions made on major questionnaire items, Wyoming Cattle and Calf Multiple Frame Survey, July 1974

Item	Edit action	Number by questionnaire version	Expanded differences	
			DE 1/	SE
			(000)	(000)
Total calves born	Sum of calves born sub-items did not add to total	Current 62 Test 25	6.4	1.7
Calves born and still on farm or ranch	Number reported contained calves sold or died	Current 1 Test 15	- .3 - 1.7	- .9
	Number was left blank	Current 21 Test 1	9.3 .3	2.1 -
Cows and heifers expected to calve	Cows and heifers expected to calve greater than cows & heifers now on hand	Current 15 Test 13	- 8.3 - 4.7	2.0 1.4
Heifer, steer and bull calves weighing < 500 lbs.	Number of calves born and still on farm or ranch exceeds all calves weighing < 500 lbs.	Current 50 Test 50	23.8 28.0	3.8 4.0
	Calves now on another person's privately-operated land included in calves < 500 lbs.	Current -- Test 2	- .3	-
Total cattle & calves	Sum of individual items do not add to total inventory	Current 84 Test 89	43.7 60.2	7.5 10.3

1/ Difference = edited value minus reported value.

The number of times the sum of the calves born subitems did not add to total calves born is the first item shown in Table 4. This edit action was required 62 times in the operational questionnaire compared with 25 times in the test questionnaire. Some of the editing in the operational version reduced the estimated number of calves born, thus offsetting some of the editing resulting in larger numbers. However, the total number of animals involved in the editing was about the same for both questionnaire versions. One should be concerned about the total amount of editing because the effects were not offsetting.

The next item in Table 4 is calves born and still on the farm or ranch. The assumption made when editing was that 16 respondents did not read the words, *"are still on this farm or ranch,"* and entered the total calf crop for that question. The difference between the edited and the reported data is a negative figure, indicating animals that died or were sold or slaughtered were subtracted during the editing process from the total born and still on the farm or ranch. This did not significantly change the level of the estimate of calves born and still on the farm or ranch for either questionnaire version. In the operational questionnaire, there was sometimes an entry for total calves born on the land operated and yet the remainder of the section was blank. Thus, an edit to obtain the number still on the farm or ranch occurred 21 times and significantly increased the level of the estimate of calves born and still on the farm or ranch for the operational questionnaire. This only occurred once with the similar question on the test questionnaire. The number of calves born was asked first in the operational questionnaire, while in the test version calves born and still on the farm or ranch was asked first.

The only item changed in the inventory questions concerned heifer, steer, and bull calves weighing less than 500 pounds. Calves not weaned were not entered as calves weighing less than 500 pounds even though they should have been because they were still on the farm or ranch. When that occurred, the number of calves reported as born and still on the farm or ranch exceeded all calves weighing less than 500 pounds. The test questionnaire did not solve this problem. As much editing was required to correct this problem in the test questionnaire as in the operational questionnaire. Editing significantly increased the level of the estimate of calves weighing less than 500 pounds in both questionnaire versions and also had a considerable impact on the total inventory.

The final edit action considered was when the sum of individual inventory items did not add to the total inventory. This edit was a composite of several factors. Sometimes the respondent or enumerator did not add correctly. If the sum of the inventory items did not add to the total inventory, the total was changed to equal the sum of the subitems. The assumption that the sum of the subitems was the more correct figure may not always be correct. Other times this edit was required because one of the subitems was edited. For example, whenever it was necessary to edit the entry for calves weighing less than 500 pounds, the total inventory also required an edit. Editing increased the level of the estimate for total inventory considerably in both questionnaire versions.

Table 5 compares the direct expansions and sampling errors between reported and edited data by questionnaire version. The table shows that editing had a greater impact on the direct expansions than it did on the sampling errors.

Table 5--A comparison of estimates and sampling errors between reported and edited data by questionnaire version, Wyoming Cattle and Calf Multiple Frame Survey, July 1974 1/

Item	Data source	Questionnaire version				Combined	
		Operational		Test			
		DE	SE	DE	SE	DE	SE
		Thousand					
Calves born and still on ranch	Edited	245.5	10.2	266.4	8.9	511.8	13.5
	Original	236.4	10.3	267.8	8.9	504.2	13.6
	Difference	9.0	2.1	- 1.4	.9	7.6	2.3
Total calves born	Edited	263.0	10.7	289.4	9.9	552.4	14.6
	Original	256.5	10.7	282.8	10.0	539.3	14.6
	Difference	6.5	1.7	6.7	2.0	13.1	2.6
Cows and heifers expected to calve	Edited	17.0	2.2	16.5	1.7	33.5	2.8
	Original	25.3	3.1	21.2	2.4	46.5	3.9
	Difference	- 8.3	2.0	- 4.7	1.4	-13.0	2.4
Calves weighing < 500 lbs.	Edited	259.6	10.5	284.8	9.7	544.4	14.3
	Original	235.8	10.5	256.8	9.7	492.6	14.3
	Difference	23.8	3.8	28.0	4.0	51.8	5.5
Total cattle and calves	Edited	732.3	26.2	762.2	23.6	1,494.5	35.3
	Original	688.6	25.8	702.0	22.7	1,390.6	34.4
	Difference	43.7	7.5	60.2	10.3	103.9	12.7

1/ Estimates do not include data from extreme operators nor the nonoverlap domain.

Table 6 shows the percent change in the estimate resulting from edit actions for major survey items. The effect of the edit actions is shown separately by questionnaire version. The relative sampling errors for each item are also shown.

Table 6--Effect of edit actions on survey estimates, Wyoming Cattle and Calf Multiple Frame Survey, July 1974 1/

Item	Questionnaire version	Percent change in estimates resulting from edit 2/	Relative sampling errors of final data
Calves born and still on ranch	Operational	+ 3.8	4.2
	Test	- .5	3.3
	Combined	+ 1.5	2.6
Total calves born	Operational	+ 2.5	4.1
	Test	+ 2.3	3.4
	Combined	+ 2.4	2.6
Cows and heifers expected to calve	Operational	- 32.8	13.2
	Test	- 28.2	10.4
	Combined	- 28.0	8.4
Calves weighing < 500 lbs.	Operational	+ 10.1	4.0
	Test	+ 10.9	3.4
	Combined	+ 10.5	2.6
Total cattle and calves	Operational	+ 6.3	3.6
	Test	+ 8.6	3.1
	Combined	+ 7.5	2.4

1/ Estimates do not include data from extreme operators nor the nonoverlap domain.

2/ Percent change = Edited value ÷ original value.

The relative sampling error only shows the variability resulting from random sampling. If the sampling process was completed many times, the level of the estimate for total cattle and calves in Wyoming should fall into a range that is plus or minus about 2.4 percent of the direct expansion about two-thirds of the time. Table 6 shows that the amount of editing required on some questions resulted in changes in the level of estimates two to three times larger than the error explained by random sampling. Is it then correct to say the direct expansion has a confidence interval of $\pm$ 2.4 percent when editing changed the estimate 7.5 percent?

One should also consider the amount of editing required on data collected by different procedures i.e., mail, telephone or personal interview. If the three collection procedures obtain the same data, then they should also require about the same amount of editing. If the amount of editing required for data collected by one method is different from that required for another, then it is necessary to examine the questionnaire design and/or collection procedures.

The final analysis of the editing is shown in Table 7 which compares the editing by questionnaire version and by data collection method. The results show that about 40 percent of both questionnaire versions returned by mail required at least one edit indicating both were misunderstood in some way by the respondent.

Table 7--A comparison of the amount of editing required by questionnaire version and by type of response, Wyoming Cattle and Calf Multiple Frame Survey, July 1974

Type responses	Questionnaire version	Questionnaires requiring no edit		Questionnaires requiring at least one edit		Total
		No.	Pct.	No.	Pct.	No.
Mail	Current	160	59.7	108	40.3	268
	Test	173	61.6	108	38.4	281
Telephone	Current	170	83.7	33	16.3	203
	Test	178	93.6	12	6.4	190
Interview	Current	67	80.7	16	19.3	83
	Test	80	95.2	4	4.8	84
Total	Current	397	71.7	157	28.3	554
	Test	431	77.6	124	22.4	555
		828		281		1,109

The editing required in both questionnaires declined when an interviewer was involved. However, the test questionnaire resulted in considerably less editing than the operational version when the interview was completed by telephone or in person. This indicates the test questionnaire was probably followed better by the interviewer. Perhaps this was because the test version followed the principle of asking subitems and summing to a total which is the usual practice.

Another point to consider was that the actual wording of the questions was the same on the mail and interview questionnaires. If it is desirable to reduce the amount of editing, it appears efforts should be directed towards the mail questionnaire.

RECOMMENDATIONS

The test and operational questionnaires used the same format and wording on the mail and interview versions. Thus, the difference in editing required for data collected by mail versus interview indicates the interviewer had an effect on the survey. Hopefully, the interviewer effect improved the survey data.

But, two problems need to be resolved:

(1) How can the questionnaire be changed to obtain the desired data from the mail respondent?

(2) How can the questionnaire be changed so the interviewer obtains the desired data from the respondent?

It is recommended that the interviewer effect be given additional study and an alternative questionnaire be developed and tested for the mail portion of the survey.

It is also recommended that consideration be given to the inclusion of supplemental instructions or structured probes for the mail questionnaire.

It is recommended that questions the enumerator is instructed to obtain be included on the questionnaire.

The fundamental problem not solved by this study was the reason(s) why the questions were not completed. For example, why did the operator include the total cows and heifers for cows and heifers expected to calve, or total calves instead of for calves still on the ranch? Future studies should delve deeper into this and related communication problems.

It is recommended that the entry before editing be retained when additional studies of this sort are conducted. In fact, this should be

done occasionally in all surveys as a means of evaluating the quality of data collected by method of collection as well as point out areas needing improvement.

Finally, care should be taken when making more than one change at a time in a questionnaire. Items within most questionnaires are closely related, and changes in one item may affect another item. If two closely related items are changed, it is difficult to measure the independent effects with only two questionnaire versions.