Chapter III. EVALUATION OF THE QUALITY CONTROL PROGRAM

General Evaluation

In the chapters which follow, the results of quality control are examined in detail for the period before enumeration, for Stage I of the enumeration, for Stage II, and for single-stage enumeration; and a quantitative examination is made on the basis of analytical tables which have been prepared. This chapter, however, offers a much broader assessment of the effectiveness of quality control in the census.

It will be evident in the following chapters and tables that the quality controls fell considerably short of their potential. Nevertheless, statistical quality control in 1960 was generally regarded as making important contributions, both in terms of improvement over what took place in earlier censuses and in its own right. It was a marked advance over past efforts primarily because formal specifications were provided for the various crew leader and office activities. Before 1960, the sole control lay in a crew leader's judgment about whether an enumerator was doing a satisfactory job, which led to divergent results.

The 1960 quality control program specified items for a crew leader or field reviewer to inspect and established well-defined standards for an enumerator to meet, and did the same for office inspection. Thus, it was possible for the first time in U.S. population and housing censuses for a crew leader to tell an enumerator that he must be released because he had failed to meet the standards established for the censuses. This was designed to relieve the crew leader of personal responsibility for such action and to motivate him to release enumerators who were not doing acceptable work.

The review by the crew leader also served as a check on the effectiveness of training. Being brand new himself, the crew leader could not be expected to know how to test for retention of the points brought out in training. The formal review procedure provided a "final exam."

A major improvement was the designation of a person known as a Technical Officer who was responsible for all quality control activities, both in the field and in the District Office. Although the Technical Officer was also responsible for the technical direction of the entire census, and much of the energy he might have directed to quality control was diverted because of this ambivalence, he represented an important advance over having no quality control supervision at all.

Process control was used in the inspection by crew leaders in the belief that a small proportion of the enumerators would contribute a large proportion of the errors. The evaluation of the quality control results indicates that this did occur. Thus, releasing the very worst and retraining the next worst enumerators had an important impact on the quality of the census.

Acceptance sampling was chosen for the office inspection to protect the census against inadequate work in any ED, which could have distorted block or small-area statistics involving that ED.

An innovation which was judged to have worked very well was the creation of a formal plan for map review and review of the preparatory work and a form on which to record the results. The purpose of this activity was to identify and eliminate, before the census began, the enumeration problems which could have been annoying if discovered in mid-census. Map problems, which included changes of street names and boundary problems, were uncovered and solved well ahead of time. Some assignments too large for one enumerator were recognized as such and were split among several enumerators. The crew leader's listing of a sample of addresses and making an estimate of the number of housing units in each block in urban areas was designed for coverage control.

The most direct evidence of the effectiveness of quality control is in the number of enumerators released. The best available information indicates that about 1,400 enumerators were eliminated before final review, as a result of quality control inspection of their work. This is an unprecedented number of dismissals for poor work. Because this group was producing a disproportionate share of the total errors, its release must have had a great impact on the quality of the census.

The quality was also improved by retraining enumerators who were not released. At first review, they were given a list of the errors that the reviewer discovered so that they could see what kinds of mistakes they were making. They were then instructed to correct these errors, not only on the questionnaires which fell in the review sample, but on all questionnaires. In both Stage I and Stage II, the number of errors that crew leaders reported finding was cut in half between first review and final review. Not all of this decrease can be attributed to retraining, of course; some portion of it was due to the releasing and replacing of the 1,400 failing enumerators.

At final review, about 800 EA's in each stage were rejected by crew leaders and were reassigned to other enumerators for cleanup work. Many of these EA's that needed more work might not have been identified without formal statistical standards. The same can be

said of the approximately 5,000 enumeration books rejected by office quality control in Stage I and the 2,000 rejected in Stage II.

Mention might also be made of the intangible effects of having a plan for quality control. The existence of a formal quality control system, with specific actions for varying levels of error, undoubtedly created a climate which helped engender good quality. The enumerator, knowing that his work was to be checked, was likely to use more care than he might have otherwise, to insure that the work would pass inspection. The crew leader, knowing that the work he turned in was subject to office inspection, was motivated to make it as good as possible.

On the other hand, there were important ways in which the quality control procedures, as carried out, fell short of what was intended to be accomplished.

The designers of the procedures had estimated that the number of enumerators released on first review, the number of assignments rejected on final review, and the number of enumeration books rejected in office review might be about 5 percent of the total. The actual percentages fell far below this, being more on the order of 1 percent.

Failure to identify and take action on some of the work which should have been rejected was anticipated. The levels for rejection were purposely set low in the expectation that the inspectors would not find all of the errors that existed, not only because they were inexperienced in this kind of review but also because finding a small number of errors was much like looking for needles in a haystack.

Progress-reporting machinery was set up to guard against controlling errors at an unrealistic level. That is, if the first reports from the field showed that the rejection rates on first review, final field review, and office review exceeded what the Bureau could afford for correcting rejected work and for recruiting and training replacement enumerators, the plan was to instruct District Offices immediately to relax the standards. As it turned out, fewer assignments than expected were rejected and there was no danger that the errors were being controlled at too stringent a level.

A post-census analysis of the actual error rates that occurred in Stage I was made for a national sample of ED's. The error rates reported in Stage I office quality control closely matched these actual error rates. On this evidence, the Stage I quality control is regarded as having gone very well. However, crew leaders and field reviewers reported only about a third of the actual errors at the time of final field review.

Control of quality in Stage II was considerably less effective than in Stage I. The actual error rates for population and housing items from the national sample were compared with error rates reported by crew leaders and by the office quality control staff, this time to determine what proportion of assignments should have been rejected. Of every 46 assignments which should have been rejected on Stage II final review, the reviewers rejected only one. Of every nine enumeration books which should have been rejected in the Stage II office review, only one was rejected. A major reason for the better review job in Stage I is believed to be a rather simple columnar enumeration questionnaire which facilitated a thorough and precise review, as compared with a cumbersome sample enumeration questionnaire in Stage II which had many more questions and a number of skip patterns.

Although progress was made in this first application of formal statistical quality control to a population and housing census, the Census Bureau staff has focused its attention on the aspects that did not go well. There are several reasons, some of them obvious, why parts of the quality control inspection were conducted poorly in the field. Almost all discussions of "statistical quality control" use an example of a product manufactured and controlled in a factory. The most characteristic feature of most factories is a relatively stable body of workers turning out the same product over a sustained period of time. Another significant characteristic of factory work is the presence of a supervisor who has usually had considerable experience with the job, under both normal and abnormal conditions. Neither of these characteristics is ever a feature of any decennial census.

The other reasons relate to the review conducted by crew leaders or field reviewers. The first is that the reviewers may have found it difficult to remain objective. If an enumerator's work did not pass, the reviewer had to go through the painful process of releasing the enumerator, whom he had initially recommended for employment, then recruiting a new one, reassigning the work, and making sure the new enumerator performed well—all in a short period of time.

Another reason may be that the vast amount of checking required in field review lead to poor inspection. Almost all of the items on the questionnaire were inspected in order to retrain enumerators on the questions they were mishandling. Inspecting fewer items might have given the reviewer a workload he thought he could handle and led to a more careful inspection.

A final reason was that the quality control work by crew leaders and field reviewers was virtually unsupervised. Such operational scrutiny as was designed for the 1960 field quality control plans was put in the busy hands of the 400 Technical Officers who themselves were inexperienced in statistical quality control. Furthermore, each Technical Officer had to supervise about 25 crew leaders and 25 field reviewers in widely scattered locations. The short duration of the census made it very difficult to achieve effective supervision of the quality control carried out by these people. In some offices, Technical Officers were required to take over the duties of District Supervisor and to abandon the supervision of quality control activities.

Considering the time pressures of the census and the fact that quality control operations were carried out over a very short period of time by a temporary staff of thousands of people, the quality control of the field work appears to have been reasonably effective.

Improvements Planned for Quality Control Procedures

A major purpose of the analysis of quality control was to identify the areas that need strengthening before the next decennial censuses take place. Some new ideas have already been put into effect in test censuses conducted since 1960, and other experimental work is planned for future test censuses. The following are some of the improvements that look feasible:

a. Allowing crew leaders more time at the beginning of the census to list the housing units used for the coverage check. (If plans for a mail census materialize, other means of coverage control would be used in many areas of the country.)

b. Letting crew leaders continue to conduct the coverage check on first review, but having the final review coverage check made in the District Office in order to eliminate crew leader bias.

c. Increasing the training for quality control; perhaps adding to the training a 4-hour or 6-hour session on quality control alone, which would include practice exercises in reviewing dummy questionnaires.

d. Simplifying field review by having only a sample of items reviewed instead of all items. A test in an experimental census may show that an improvement in crew leader performance will result from such a step.

e. Having the crew leader note the identification of the units he has reviewed so that it is possible to verify his work.

f. Motivating the crew leader to reject assignments that should be rejected and to achieve a better cleanup in the following way:

(1) On final review, having the crew leader merely mark the assignment "pass" or "fail" and send it into the office without having to clean it up; then—

(2) Having the office verify assignments rejected by crew leaders (and enumeration books rejected in the office) on a 100-percent basis, with all omissions plainly marked, so that cleanup will be specific and complete; and—

(3) Using a fresh staff of people with no other responsibilities to handle the cleanup job.

g. Improving supervision of crew leaders by having several supervisory crew leaders in each District Office instead of one Technical Officer.

h. Removing payroll work, including whatever payroll verification is required, from the quality control operation and placing it in the hands of a payroll section.

i. Inspecting office quality control work itself either by verification of a sample of enumeration books reviewed by each clerk or by an error-noting program in which someone examines an enumeration book ahead of time, records the errors he finds, and checks later to see how many of them have been found by the clerk.

Table 5.—**Cumulative Proportions of Work Completed, by Enumeration Day and Type of Work**

Enumeration days completed	Date	District Office received books from crew leader	Transcription verification complete	Stage I books to Jeffersonville	Stage II books to crew leader	Received Stage II books from crew leader	Stage II office Q C complete	Stage II books to Jeffersonville
1.....	April 1	(Z)	-	-	-	-	-	-
2.....	2	(Z)	(Z)	-	(Z)	-	-	-
3.....	4	(Z)	(Z)	-	(Z)	-	-	-
4.....	5	(Z)	(Z)	-	(Z)	-	-	-
5.....	6	(Z)	(Z)	-	(Z)	-	-	-
6.....	7	(Z)	(Z)	-	(Z)	-	-	-
7.....	8	.01	(Z)	-	(Z)	-	-	-
8.....	9	.01	(Z)	-	(Z)	-	-	-
9.....	11	.02	(Z)	-	(Z)	-	-	-
10.....	12	.03	(Z)	-	(Z)	-	-	-
11.....	13	.06	.01	(Z)	(Z)	-	-	-
12.....	14	.11	.02	(Z)	(Z)	-	-	-
13.....	15	.17	.04	(Z)	(Z)	(Z)	-	-
14.....	16	.24	.06	(Z)	(Z)	(Z)	-	-
15.....	18	.33	.10	(Z)	.01	(Z)	-	-
16.....	19	.40	.16	.01	.05	(Z)	-	-
17.....	20	.46	.23	.01	.07	(Z)	-	-
18.....	21	.54	.30	.02	.13	(Z)	-	-
19.....	22	.60	.37	.02	.20	(Z)	(Z)	-
20.....	23	.63	.41	.03	.24	(Z)	(Z)	-

See footnotes at end of table.

Table 5.—**Cumulative Proportions of Work Completed by Enumeration Day and Type of Work**—Con.

Enumeration days completed	Date	District Office received books from crew leader	Transcription verification complete	Stage I books to Jeffersonville	Stage II books to crew leader	Received Stage II books from crew leader	Stage II office Q C complete	Stage II books to Jeffersonville
21	April 25	.70	.49	.04	.34	(Z)	(Z)	-
22	26	.74	.57	.05	.43	(Z)	(Z)	-
23	27	.79	.62	.05	.51	(Z)	(Z)	-
24	28	.82	.68	.05	.57	(Z)	(Z)	-
25	29	.84	.72	.05	.64	.01	(Z)	-
26	30	.85	.73	.06	.66	.01	(Z)	-
27	May 2	.88	.78	.06	.72	.02	(Z)	-
28	3	.90	.82	.07	.76	.03	.01	-
29	4	.91	.85	.08	.80	.04	.01	-
30	5	.93	.86	.09	.82	.06	.02	-
31	6	.93	.89	.13	.85	.08	.03	.01
32	7	.93	.89	.13	.86	.08	.03	.01
33	9	.95	.91	.14	.88	.12	.05	.01
34	10	.95	.92	.16	.90	.16	.08	.01
35	11	.96	.93	.17	.91	.19	.11	.01
36	12	.97	.94	.20	.92	.23	.15	.01
37	13	.97	.95	.24	.93	.27	.18	.01
38	14	.97	.96	.24	.94	.28	.19	.01
39	16	.97	.96	.26	.94	.34	.23	.01
40	17	.97	.97	.29	.95	.39	.27	.01
41	18	.98	.97	.32	.95	.43	.32	.02
42	19	.99	.97	.37	.96	.48	.37	.05
43	20	.99	.98	.39	.96	.53	.42	.07
44	21	.99	.98	.40	.96	.54	.43	.07
45	23	.99	.98	.43	.97	.59	.49	.11
46	24	.99	.98	.47	.97	.63	.54	.14
47	25	.99	.99	.50	.97	.67	.58	.16
48	26	.99	.99	.54	.98	.70	.62	.25
49	27	.99	.99	.56	.98	.73	.65	.32
50	28	.99	.99	.59	.98	.74	.66	.32
51	31	1.00	.99	.61	.98	.78	.71	.37
52	June 1	-	.99	.64	.98	.80	.74	.39
53	2	-	.99	.67	.98	.82	.77	.44
54	3	-	.99	.71	.99	.84	.79	.51
55	4	-	.99	.71	.99	.85	.80	.52
56	5	-	.99	.72	.99	.86	.82	.56
57	7	-	1.00	.75	.99	.88	.84	.59
58	8	-	-	.79	.99	.89	.86	.64
59	9	-	-	.81	.99	.90	.87	.71
60	10	-	-	.82	.99	.91	.88	.76
61	11	-	-	.82	.99	.92	.88	.76
62	13	-	-	.82	.99	.92	.90	.78
63	14	-	-	.85	.99	.93	.91	.81
64	15	-	-	.85	.99	.94	.92	.83
65	16	-	-	.87	1.00	.95	.93	.85
66	17	-	-	.89	-	.95	.93	.86
67	18	-	-	.90	-	.96	.94	.86
68	20	-	-	.91	-	.96	.95	.87
69	21	-	-	.92	-	.96	.95	.88
70	22	-	-	.92	-	.97	.96	.91
71	23	-	-	.92	-	.97	.97	.91
72	24	-	-	.93	-	.98	.97	.92
73	25	-	-	.93	-	.98	.97	.92

See footnotes at end of table.

Table 5.—**Cumulative Proportions of Work Completed by Enumeration Day and Type of Work** --Con.

Enumeration days completed	Date	District Office received books from crew leader	Transcription verification complete	Stage I books to Jeffersonville	Stage II books to crew leader	Received Stage II books from crew leader	Stage II office QC complete	Stage II books to Jeffersonville
74.....	June 27	-	-	.96	-	.98	.97	.93
75.....	28	-	-	.96	-	.98	.97	.93
76.....	29	-	-	.96	-	.98	.98	.95
77.....	30	-	-	.96	-	.99	.99	.98
78.....	July 1	-	-	.96	-	.99	.99	.98
79.....	2	-	-	.96	-	.99	.99	.98
80.....	4	-	-	.96	-	.99	.99	.98
81.....	5	-	-	.97	-	.99	.99	.98
82.....	6	-	-	.98	-	.99	.99	.99
83.....	7	-	-	.98	-	.99	.99	.99
84.....	8	-	-	.98	-	1.00	1.00	1.00

(Z) Less than .005

Source: Forms F-261, District Office Processing Control.

Table 6.--**Dates of District Office Receipt and Transmittal of EA's: Two-Stage Areas**

(Cumulative proportion of EA's)

Enumeration days completed	Received from Stage I crew leader			Sent to Stage II crew leader			Received from Stage II crew leader		
	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]
1.....	(Z)	-	(Z)	-	-	-	-	-	-
2.....	(Z)	-	(Z)	-	-	-	-	-	-
3.....	(Z)	(Z)	(Z)	-	(Z)	-	-	-	-
4.....	(Z)	(Z)	(Z)	-	(Z)	-	-	-	-
5.....	(Z)	.01	(Z)	-	(Z)	-	-	-	-
6.....	(Z)	.01	(Z)	-	(Z)	-	-	-	-
7.....	(Z)	.01	(Z)	-	(Z)	-	-	-	-
8.....	(Z)	.01	.01	-	(Z)	-	-	-	-
9.....	.01	.01	.02	-	(Z)	-	-	-	-
10.....	.02	.03	.04	-	(Z)	-	-	-	-
11.....	.04	.06	.08	(Z)	(Z)	(Z)	-	-	-
12.....	.09	.10	.12	(Z)	(Z)	(Z)	-	-	-
13.....	.15	.18	.19	(Z)	(Z)	(Z)	-	-	(Z)
14.....	.20	.25	.25	(Z)	(Z)	(Z)	-	-	(Z)
15.....	.27	.36	.34	.01	.01	.01	-	-	(Z)
16.....	.36	.42	.41	.02	.01	.08	-	-	(Z)
17.....	.43	.48	.47	.02	.03	.13	-	-	(Z)
18.....	.48	.55	.55	.04	.09	.20	-	-	(Z)
19.....	.55	.61	.61	.10	.15	.26	-	-	(Z)
20.....	.58	.64	.65	.14	.19	.31	-	-	(Z)
21.....	.62	.71	.71	.19	.32	.41	(Z)	-	(Z)
22.....	.67	.76	.76	.26	.40	.52	(Z)	(Z)	(Z)
23.....	.71	.79	.82	.35	.48	.60	(Z)	(Z)	(Z)
24.....	.74	.83	.85	.40	.55	.65	(Z)	(Z)	.01
25.....	.76	.85	.87	.45	.64	.71	(Z)	(Z)	.01
26.....	.79	.86	.87	.47	.66	.73	(Z)	(Z)	.01
27.....	.81	.89	.91	.53	.72	.79	(Z)	.01	.03
28.....	.83	.91	.92	.59	.76	.82	.01	.02	.04
29.....	.85	.93	.93	.63	.80	.86	.02	.03	.06
30.....	.87	.94	.94	.67	.82	.88	.02	.04	.08

See footnotes at end of table.

Table 6.--**Dates of District Office Receipt and Transmittal of EA's: Two-Stage Areas**--Continued

(Cumulative proportion of EA's)

Enumeration days completed	Received from Stage I crew leader			Sent to Stage II crew leader			Received from Stage II crew leader		
	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]
31	.88	.94	.95	.71	.85	.91	.04	.06	.10
32	.89	.94	.95	.72	.86	.91	.04	.07	.11
33	.90	.95	.96	.75	.89	.93	.06	.10	.15
34	.91	.96	.97	.78	.91	.94	.09	.14	.21
35	.92	.97	.98	.80	.92	.95	.10	.18	.25
36	.93	.97	.98	.82	.94	.96	.12	.22	.29
37	.94	.97	.98	.84	.94	.96	.14	.26	.33
38	.94	.97	.98	.84	.95	.96	.15	.27	.34
39	.95	.97	.99	.86	.96	.97	.15	.33	.41
40	.95	.98	.99	.88	.96	.97	.19	.38	.47
41	.96	.98	.99	.89	.97	.97	.23	.42	.51
42	.96	.98	.99	.90	.97	.98	.25	.47	.57
43	.97	.98	.99	.90	.97	.98	.28	.50	.61
44	.97	.98	.99	.91	.97	.99	.33	.54	.62
45	.97	.99	.99	.91	.97	.99	.37	.58	.69
46	.97	.99	.99	.92	.98	.99	.40	.63	.72
47	.98	.99	.99	.93	.98	.99	.43	.68	.76
48	.98	.99	.99	.93	.98	.99	.45	.72	.79
49	.98	.99	.99	.93	.98	.99	.49	.76	.82
50	.98	.99	.99	.94	.98	.99	.49	.76	.83
51	.98	.99	.99	.94	.98	.99	.52	.81	.86
52	.99	.99	.99	.94	.99	.99	.56	.83	.88
53	.99	.99	.99	.95	.99	.99	.57	.85	.91
54	.99	.99	.99	.95	.99	.99	.59	.86	.93
55	.99	.99	.99	.95	.99	.99	.60	.86	.94
56	.99	.99	.99	.96	.99	.99	.62	.88	.95
57	.99	.99	.99	.96	.99	.99	.66	.90	.96
58	.99	.99	.99	.96	.99	.99	.68	.91	.97
59	.99	.99	1.00	.96	.99	1.00	.70	.92	.98
60	.99	.99	-	.97	.99	-	.73	.93	.98
61	.99	.99	-	.97	.99	-	.73	.93	.98
62	.99	.99	-	.97	.99	-	.75	.94	.99
63	.99	.99	-	.98	.99	-	.77	.95	.99
64	.99	1.00	-	.98	.99	-	.79	.95	.99
65	.99	-	-	.98	.99	-	.81	.96	.99
66	.99	-	-	.98	.99	-	.83	.96	.99
67	.99	-	-	.98	.99	-	.83	.97	.99
68	.99	-	-	.98	1.00	-	.85	.98	.99
69	.99	-	-	.98	-	-	.86	.98	.99
70	.99	-	-	.99	-	-	.88	.99	.99
71	.99	-	-	.99	-	-	.89	.99	.99
72	.99	-	-	.99	-	-	.90	.99	.99
73	.99	-	-	.99	-	-	.91	.99	.99
74	.99	-	-	.99	-	-	.92	.99	1.00
75	.99	-	-	.99	-	-	.93	.99	-
76	.99	-	-	.99	-	-	.95	.99	-
77	.99	-	-	.99	-	-	.96	.99	-
78	.99	-	-	.99	-	-	.96	.99	-
79	.99	-	-	.99	-	-	.96	.99	-
80	.99	-	-	.99	-	-	.96	.99	-

See footnotes at end of table.

Table 6.—**Dates of District Office Receipt and Transmittal of EA's: Two-Stage Areas**—Continued

(Cumulative proportion of EA's)

Enumeration days completed	Received from Stage I crew leader			Sent to Stage II crew leader			Received from Stage II crew leader		
	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]	Group 1 areas[1]	Group 2 areas[2]	Group 3 areas[3]
81.....	.99	-	-	.99	-	-	.97	.99	-
82.....	.99	-	-	.99	-	-	.97	.99	-
83.....	1.00	-	-	.99	-	-	.97	.99	-
84.....	-	-	-	.99	-	-	.97	.99	-
85.....	-	-	-	.99	-	-	.98	.99	-
86.....	-	-	-	1.00	-	-	.98	.99	-
87.....	-	-	-	-	-	-	.99	.99	-
88.....	-	-	-	-	-	-	.99	.99	-
89.....	-	-	-	-	-	-	.99	.99	-
90.....	-	-	-	-	-	-	.99	1.00	-
91.....	-	-	-	-	-	-	.99	-	-
92.....	-	-	-	-	-	-	.99	-	-
93.....	-	-	-	-	-	-	.99	-	-
94.....	-	-	-	-	-	-	.99	-	-
95.....	-	-	-	-	-	-	.99	-	-
96.....	-	-	-	-	-	-	.99	-	-
97.....	-	-	-	-	-	-	.99	-	-
98.....	-	-	-	-	-	-	.99	-	-
99.....	-	-	-	-	-	-	.99	-	-
100.....	-	-	-	-	-	-	1.00	-	-

Z Less than .005.
[1]District Offices in metropolitan areas with cities of more than 500,000 population.
[2]District Offices in metropolitan areas with cities of 100,000 to 500,000 population.
[3]All other District Offices.

Source: Forms F-261, District Offices Processing Control.