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SURVEY EVALUATION OF THE TRI-SERVICE LABORATORY INFORMATION SYS--ETC(U)
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HEALTH SYSTEMS STATISTICS AND EVALUATION
DIVISION NOTE

HSSEDN 79-2

SURVEY EVALUATION OF THE TRI-SERVICE LABORATORY INFORMATION SYSTEM (TRILAB I) AT WRIGHT-PATTERSON USAF MEDICAL CENTER

January 1979

Jonathan D. Hodgdon
Irving J. Casey

Approved by
P. W. Blackmon, Division Manager

Conducted for,
and in Cooperation With,
The TRIMIS Program Office
Assistant Secretary of Defense (Health Affairs)

anser Analytic Services Inc.

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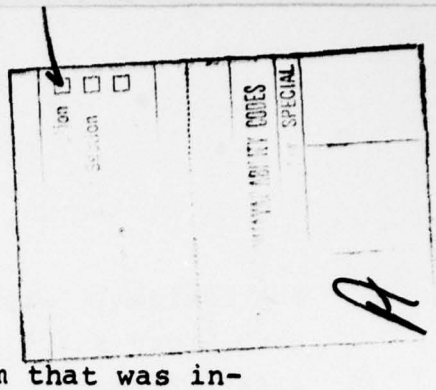

ABSTRACT

TRILAB I is a medical information system that was installed in the clinical laboratories of two U.S. Air Force medical centers. During design and implementation, TRILAB I was referred to as AFCLAS (Air Force Clinical Laboratory Automation System). Since this laboratory information system was designed, implemented, and evaluated as an Air Force project, it will be referred to as AFCLAS in this report. The goal of AFCLAS is to improve the operation and management of clinical laboratories, thereby enhancing the contribution of the laboratories to quality patient care. This report presents the results of physician, nurse, and laboratory staff surveys conducted at the Medical Center, Wright-Patterson (MCWP) AFB, in early 1978 (2½ years after installation of the system) to measure acceptance of AFCLAS and its impacts perceived by the hospital staff. This data collection period at MCWP is referred to as Period Z, and the results are compared with those from the same surveys administered during Period Y (6 months after system installation) and for the laboratory staff during Period X (6 months before system installation) as well.

The principal findings of these surveys may be summarized as follows. Physician acceptance of AFCLAS has increased from 47 percent in Period Y to 86 percent in Period Z, while nurses' acceptance of AFCLAS has remained at about 70 percent. Nondollar benefits of AFCLAS perceived by physicians are: improved patient care, improved ability to follow trends (by providing cumulative reports), improved legibility of reports, fewer lost reports, easier retrieval of test results, additional patient information, and improved report format. The job satisfaction of the laboratory staff has increased slightly since Period Y, and the Period Z scores show

statistically significant differences from those in Period X. Laboratory staff perceptions of working conditions are considerably more positive than those in Period Y, and slightly more positive than those in Period X.

ACKNOWLEDGMENTS

The authors are grateful to several members of the ANSER staff who made important contributions to the research and publication of this report. Dr. Richard C. Brooks (now at the Food and Drug Administration) participated in the initial design of the questionnaires and related computer programs used in their analysis and was the principal coordinator for all three data collection efforts. Dennis L. St. Clair coordinated the review and revision of this document, and Dr. Douglas R. Mackintosh and Roberta G. Carlisle provided helpful comments on the initial draft of the report. Beulah A. Page assisted in the tabulation of the data, and Francine P. Shorter performed the data reduction for all three data collection periods. Special thanks go to the Health Systems secretarial staff for their effort in producing the final version of this report.

Finally, the authors would like to take this opportunity to thank Dr. (Col.) John J. Halki, Commander, USAF Medical Center, Wright-Patterson AFB, and his entire staff for their excellent cooperation during the administration of the surveys used for this evaluation.

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TABLES

I. INTRODUCTION

This report presents the findings of an evaluation of hospital staff acceptance of, and satisfaction with, the Tri-Service Laboratory Information System (TRILAB I) in use at the Medical Center, Wright-Patterson (MCWP) Air Force Base, Dayton, Ohio. During design and implementation, TRILAB I was referred to as AFCLAS (Air Force Clinical Laboratory Automation System). Since this information system was designed, implemented, and evaluated as an Air Force project, it will be referred to as AFCLAS in this report.

The evaluation described in this report follows up a more comprehensive evaluation of the laboratory information system at MCWP. The earlier evaluation included two periods of full scale data collection—one during manual operation at MCWP and one during operation of the automated system (AFCLAS). The analysis compared the costs and benefits, both quantitative and qualitative, that were measured during the two data collection periods. The manual system data were collected during March 1975 (referred to as Period X); AFCLAS became operational at MCWP in September 1975; and the data on AFCLAS operation were collected during March 1976 (Period Y).

Following this earlier evaluation, major software modifications were undertaken to improve AFCLAS. Among these were increased memory capacity; online, end-of-day processing; improved cumulative reports; improved patient-sort capabilities; and expanded error messages. The more limited evaluation (Period Z) described in this report focuses on measuring the change since Period Y in perceptions of AFCLAS by various hospital groups through the use of interviews and questionnaires. The hospital groups that were surveyed are physicians,

registered nurses, and laboratory staff. The survey questions used are the same for both Period Y and Period Z at MCWP. Accordingly, the report focuses on comparing the results of Period Y and Period Z interviews and questionnaires (Period X results are also presented wherever they provide additional insight).

The data collection effort for Period Z occurred in March 1978 (except for physician interviews which were conducted in January 1978). Questionnaires were distributed to physicians, registered nurses, and laboratory staff members. In addition, a randomly selected sample of physicians was interviewed in depth. Since turnover of military staff is high, the study was not restricted to only those personnel who were assigned to MCWP during Period X or Period Y. The respondents in Period Z were instructed to compare AFCLAS with the previous manual system at MCWP or at other clinical laboratories where they have worked.

The results of the physician interviews and questionnaires are presented in Section II of this report. Sections III and IV discuss the questionnaire results for the registered nurses and the laboratory staff, respectively. Section V reviews the main findings of the study and discusses the limitations of the data. Copies of the questionnaires administered are presented in the Appendix. The areas investigated* and the design of the surveys are discussed in detail in the Evaluation Plan for the Air Force Clinical Laboratory Automation System (AFCLAS) (Reference 1).

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*See in particular, discussions relating to Hypotheses 39, 40, and 43.

II. PHYSICIANS

Physicians' perceptions of AFCLAS and the clinical laboratory were obtained by in-depth interviews of a random sample of physicians and a multiple-choice questionnaire administered to all MCWP physicians.

A. Physician Interviews

Early in January 1978, a list was obtained of all physicians assigned to MCWP who were expected to be present for duty during the third week in January. Physicians assigned to mental health, pathology, and radiology were deleted from the list because AFCLAS has little impact on their day-to-day clinical practice. A random sample of 25 physicians was selected from the revised list, and physicians were then scheduled to meet with the ANSER interviewer. The interviews were conducted in a private office in the administrative wing of the Medical Center with only the interviewer and the respondent present. The respondents were assured of the impartiality of the interviewer and of their own anonymity in responding.

Twenty-three of the physicians in the sample were interviewed. One physician did not appear for an undetermined reason. The other nonrespondent was unable to appear because of an unanticipated need for his professional services on the interview day.

Six specific questions were asked during the interview:

1. What effect has AFCLAS had upon your day-to-day practice?
2. What has improved since AFCLAS?
3. What has deteriorated since AFCLAS?

4. What was your initial reaction to AFCLAS?

5. What is your present reaction to AFCLAS?

6. What improvements in AFCLAS would help you in your practice?

After each question the interviewer used nondirective (neutral) probing to obtain a more complete response and to eliminate the possibility of interviewer bias. The length of the interviews ranged from 20 minutes to about 70 minutes, with an average of about 35 minutes. The responses to each question were categorized, and the number of responses in each category are shown in the tables that follow. Period Z responses are also compared with the responses from Period Y.

1. Physicians' Perception of the Impact of AFCLAS Upon Patient Care

The physician respondents were asked to discuss the impact of AFCLAS on their day-to-day delivery of patient care. Twenty physicians perceived some positive effect upon their day-to-day practice; two perceived no effect; and one perceived a negative effect.

The reason most often given for improved patient care was the cumulative report (Table 1), which provides physicians with chronological summary statistics on patient laboratory results. The second most popular reason for improvement in patient care was the provision of normal values for test results and identification (by asterisk) of abnormal reported test values. With the manual system, the physician either had to remember the normal values for a test or had to look up the values in a document. A reason cited by the physicians that is related to cumulative reports is the capability of deriving trends from the cumulative report. Under the manual system, physicians had to plot trends by leafing through the patient's laboratory reports.

TABLE 1
EFFECT OF AFCLAS ON DELIVERY OF PATIENT CARE–
POSITIVE RESPONSES

Response Category	Number of Responses in Period Z (N* = 23)	Number of Responses in Period Y (N = 24)
Printing cumulative reports	15	10
Printing normal values	6	0
Useful for trend derivation	3	0
Increased report legibility	2	4
Faster turnaround time of reports	2	0
Fewer lost reports	2	4
Easier report filing	1	0
More concise reports	1	0
Fewer errors in reports	1	0
Increased legibility of charts and records	0	4
Better patient identification	0	1

*N = sample size of respondents.

Table 1 also shows a comparative summary of the responses from both periods. Cumulative report printing was mentioned 15 times in Period Z and 10 times in Period Y. Normal values were mentioned 6 times in Period Z and were not mentioned at all in Period Y. However, the automated system provided cumulative reports and normal values before both Period Y and Period Z. This fact implies that as the physician becomes more accustomed to the system, he becomes more aware of its capabilities.

The number of respondents who found a negative effect of AFCLAS upon their delivery of patient care was reduced from three in Period Y to one in Period Z; the number of those who found no effect of AFCLAS upon patient care was reduced from five in Period Y to two in Period Z. There is perhaps little justification for comparing respondents in the Period Y and Z samples who perceived a negative effect of AFCLAS

upon patient care, since there was only one such response in Period Z. However, the responses of this one negative respondent are of some interest. His statements included: *"Stats* take too long. The system is inefficient. There are errors in normals. You cannot trust lab results."

In summary, when asked to discussed the impact of AFCLAS on their day-to-day practice, more of the physicians interviewed in Period Z found positive impacts of AFCLAS on their delivery of patient care than physicians interviewed in Period Y.

2. Physicians' Perception of Improvements in the Clinical Laboratory System as a Result of AFCLAS

The respondents were asked what had improved since the introduction of AFCLAS. Twenty of 23 respondents perceived improvements due to AFCLAS; three respondents found no improvements. Of the three who reported no improvements with AFCLAS, one respondent was positive toward the system when asked later in the interview about his reaction to AFCLAS; one was neutral toward the system; and the third respondent was negative.

The specific responses to the question are listed in Table 2. The modal response category in Period Z was cumulative reports, as it was in Period Y. The number of responses declined from 19 in Period Y to 8 in Period Z. This change cannot be explained except that, possibly, the physicians had become so accustomed to the cumulative report that they did not perceive it as a major improvement.

Printing normal values was cited four times in Period Z but was not mentioned at all in Period Y (Table 2), a result that is difficult to explain, since normal values were printed prior to both periods.

TABLE 2
RESPONSES ON IMPROVEMENTS SINCE AFCLAS

Response Category	Number of Responses in Period Z	Number of Responses in Period Y
Printing cumulative reports	8	19
Report format	6	5
Turnaround time of results	6	3
Legibility of reports	5	6
Fewer lost reports	5	2
Printing normal values	4	0
Report retrieval	3	7
More information on reports	3	0
Ability to follow trends	2	0
Lower error rate	2	1
Patient records	1	4
Stats	0	3
Request forms	0	2
Routine reports	0	1

The ability to follow trends was mentioned by the physicians in Period Z but not in Period Y. The system actually does not generate trends; however, the physician can follow trends more easily with cumulative reports than he could with the manual system's laboratory slips.

Problems with routine reports, request forms, and *stats* were cited in Period Y, but were not cited in Period Z. Most other categories were cited in both periods.

In summary, most improvements due to AFCLAS were cited in both Period Y and Period Z. The modal category, cumulative reports, was the same for both periods. The most significant exception (measured by the number of responses) to a common response for both interview periods was printing normal values, which was cited in Period Z only.

3. Physicians' Perception of What Has Deteriorated Since Introduction of AFCLAS

Respondents were asked what has deteriorated since AFCLAS became operational. Nineteen of 23 respondents cited some deterioration since AFCLAS. Nine of the 19 cited deterioration not directly related to AFCLAS, for example: "Hard to get reports entered. It is a people problem" and "The lab doesn't get results into the computer." One respondent said that reports are hand delivered, i.e., "People don't know how to use the terminals." Other respondents noted: "There is a distribution problem" and "Quality control is uncertain."

In addition to these comments, several other responses, which were made in both Period Y and Period Z and do not appear to be directly related to AFCLAS, are categorized in Table 3. These response categories are: reports not filed, number of lost reports, errors in input to the computer, and laboratory reports sent to the wrong place.

The modal response category to the question in Period Z was turnaround time of results (Table 3). The second most frequent category of response was printing wrong normal values. Because neither cumulative reports nor normal values were provided by the manual system, such responses might be interpreted as weaknesses of AFCLAS rather than as general laboratory deterioration. Since the purpose of the study was to evaluate the AFCLAS system and its impact on the laboratory and the hospital, it is any deterioration directly attributable to AFCLAS that is significant.

In summary, many physicians perceived some deficiencies at the time of the interviews in Period Y and Period Z that they did not find before AFCLAS—whether due to AFCLAS directly or to laboratory/AFCLAS interaction. However, fewer Period Z

TABLE 3
RESPONSES ON DETERIORATIONS SINCE AFCLAS

Response Category	Number of Responses in Period Z	Number of Responses in Period Y
Turnaround time of reports	7	5
Printing wrong normal values	6	0
Cumbersome records	5	8
Time to fill out requests	4	0
Getting results of specific tests	4	5
Turnaround time for *stats*	3	5
Reports not filed	2	6
Number of lost reports	2	5
Errors in input to computer	2	3
Laboratory reports sent to wrong place	2	2
Report format	1	0
Report legibility	1	0
Format and color of laboratory requests	0	8
Availability of system for results inquiry (called "less downtime")	0	5
Lost specimens	0	4

respondents expressed a sense of deterioration than did Period Y respondents, presumably as a result of improvements in both user proficiency and system performance.

4. Physicians' Initial and Subsequent Reaction to AFCLAS

Physicians were asked their initial reaction to AFCLAS and how their reaction had evolved to the present (Period Z). The purpose of the question was to obtain information on physicians' acceptance of AFCLAS. It should be reemphasized, however, that the physicians interviewed in Period Z were not

the same as those interviewed in Period Y, and that most of the Period Z respondents were not assigned to MCWP during Period X (manual laboratory operation). In Period Z, 10 of the 23 physicians said they were initially positive, five neutral, and eight negative. Ten respondents reacted in the same way initially as at present (Table 4). Of the 13 whose attitudes changed, 10 changed in a positive direction and three changed in a negative direction. Fewer respondents were initially positive (10) in Period Z than in Period Y (18). However, in Period Y, 7 out of 24 changed in a negative direction compared with the 3 out of 23 in Period Z who changed in a negative direction.

TABLE 4
PHYSICIANS' INITIAL AND
SUBSEQUENT REACTION TO AFCLAS

Response Category	Number of Responses in Period Z	Number of Responses in Period Y
Positive to positive	8	12
Positive to neutral	0	2
Positive to negative	2	4
Neutral to positive	2	2
Neutral to neutral	2	0
Neutral to negative	1	1
Negative to positive	5	2
Negative to neutral	3	0
Negative to negative	0	1
Total	23	24

In summary, considerable change occurred from initial to subsequent reactions in both Period Y and Period Z, but more had moved in a positive direction by Period Z (10) than had in Period Y (four).

5. Physicians' Present Reaction to AFCLAS

Physicians were asked their present reaction to AFCLAS during interviews in Period Y and Period Z. If acceptance is defined as either a neutral or positive reaction to AFCLAS, acceptance increased from 18 out of 23 respondents in Period Y (75 percent) to 20 out of 23 respondents in Period Z (87 percent). Thus, on the basis of the interviews, in the approximately 2 years between Period Y and Period Z, a positive change occurred in physician acceptance of AFCLAS.

Specific respondent comments during Period Z provide further insight. Statements from four respondents categorized as positive include: "Best system I ever worked with." "It rapidly changed from initial problems to a high level [of performance] and has remained at a high level." "Beneficial in a medical center." "It is a good system." Four of the neutral responses were: "Tolerable...can live with it." "It's here...have to put up with it." "Like it sometimes, dislike it sometimes." "Finally it's going and it's pretty nice." Negative responses included: "Doesn't work. Worthwhile to pursue the idea." "It is inefficient." "The system is useless."

The responses reflect a wide range of opinion. The comments during Period Z of those who were negative were not as strong as some comments made during Period Y when, for example, one respondent had said, "Burn the computer." During Period Z, no one suggested getting rid of the computer. The data thus imply that although the degree of enthusiasm for the system varies, almost all physicians generally accept it. Of the three who were negative, one was a qualified negative.

6. Improvements in AFCLAS That Would Help Physicians

The respondents were asked what improvements in AFCLAS would help them in their daily medical practice. There were some comments related to personnel rather than AFCLAS, but only one personnel category was mentioned more than once. That category was "better training." Comments mentioned only once each were: "Full-time manager"; "Better lab personnel"; "A specific person in the lab to respond to a physician's inquiry." This is in contrast with Period Y when three categories of personnel responses were mentioned two or more times, and four others were each cited once. This suggests that although there are still personnel problems, they were not as significant in Period Z as they were in Period Y.

The modal response category was "more terminals" (see Table 5), as was the case in Period Y; however, the number of physicians in the category increased from 7 in Period Y to 10 in Period Z. "Faster turnaround time of results" was the second most frequent response, and "better way to enter data" was the third. In Period Y the only response categories cited more than twice were "more terminals" and "better format and color of request forms." Table 5 clearly indicates more consensus in Period Z than in Period Y.

In summary, Period Z respondents expressed more unified opinions on what would improve AFCLAS. The modal response (more terminals) does not call for any changes in the basic system—merely additions to the system. For the most part, the other categories in Table 5 are improvements to the hardware and software systems. In addition, some improvements in the personnel area were suggested.

TABLE 5
PHYSICIANS' SUGGESTIONS FOR IMPROVEMENT TO AFCLAS

Response Category	Number of Responses in Period Z	Number of Responses in Period Y
More terminals	10	7
Faster turnaround time of results	7	2
Better way to enter data	5	0
CRT and printer	2	2
Data retrievable for longer period	2	2
Simpler retrieval	2	2
Less downtime	2	1
CRT instead of printer	2	0
Faster terminals	1	1
More background information on patient	1	1
Identification of patient's military base	1	1
Report of trends	1	1
Report of patient medication	1	0
Easier report filing	1	0
Elimination of printing normal values	1	0
Better format and color of request forms	0	3
Capability to change system at local level	0	2
Better distribution system	0	2
Need for backup system	0	1
More concise reports	0	1
Capability to provide more specific directions to the laboratory	0	1

B. Physician Questionnaires

The Physician Questionnaire (see Appendix) is designed to measure physician acceptance and perceived impacts of AFCLAS when compared with the previous manual system. All 115 physicians surveyed completed the questionnaire in Period Z. In this analysis we assume that Responses 1 and 2 to a question imply a perceived positive impact of AFCLAS, Response 3 implies no perceived impact, and Responses 4 and 5 imply a perceived negative impact.

An average of 20 percent of the physicians expressed no opinion about any given question in Period Z compared with an average of 8 percent in Period Y. These percentages suggest that in Period Z (after an additional 2 years of computer operations since Period Y), fewer physicians were familiar with the previous manual laboratory system, as would be expected. In fact, the responses to Question 33 indicate that only 29 of the 115 physicians (27 percent) surveyed in Period Z were assigned to MCWP during Period Y.* The responses of the 29 physicians, however, were found to be very similar to those of the 86 physicians assigned since Period Y; therefore, all 115 responses are presented together. Thirty-four percent of the physicians (39 out of 115) indicated on Question 34 that they had worked with an automated laboratory system before coming to MCWP.

Table 6 presents the results by question for both Period Y and Period Z. The data indicate a substantial improvement in physician acceptance of AFCLAS and in their perception of its performance since Period Y. Question 5 asks the physicians

*No separate analyses were performed for the subset of physicians, nurses, and laboratory staff who were assigned to MCWP during all three data collection periods, since in each case the number of respondents was fewer than 15.

to make an overall comparison between AFCLAS and the manual system. The results for all physicians, omitting responses of "no opinion" and blanks (35 in Period Z and 10 in Period Y), are:

	Period Y	Period Z
AFCLAS Superior to Manual System	32 percent	66 percent
AFCLAS No Different From Manual System	15 percent	20 percent
AFCLAS Inferior to Manual System	53 percent	14 percent

After 6 months of computer operations in the laboratory, (i.e., during Period Y) the majority of physicians at MCWP felt that the manual system was better; however, after 30 months of computer operations (i.e., during Period Z) the majority preferred AFCLAS to the manual system. If we define acceptance of AFCLAS by physicians as the percent who consider AFCLAS to be at least as good as the previous system, then based on Question 5 physician acceptance of AFCLAS increased from 47 percent in Period Y to 86 percent in Period Z. This reversal of opinion is similarly reflected in the responses to Question 12 on the overall efficiency of the laboratory. In Period Y, most physicians (63 percent) felt that the laboratory functioned more smoothly under the manual system, whereas in Period Z, the majority (51 percent) perceived smoother laboratory operations under AFCLAS.

The results presented in Table 6 show that in Period Z, on most questions a majority of physicians perceived a positive AFCLAS impact and that no question evoked a majority who perceived a negative AFCLAS impact. The magnitudes of positive agreement varied greatly among questions, however, and Table 7 orders the questions according to the percent who responded positively.

TABLE 6
PHYSICIAN QUESTIONNAIRE RESPONSES

Question Number*	Period Y					Period Z					Impact Perceived by Majority† in Period	
	Percentage of Opined Responses			Frequencies		Percentage of Opined Responses			Frequencies			
	Positive	No Change	Negative	Opined Responses	No Opinion or Blank	Positive	No Change	Negative	Opined Responses	No Opinion or Blank	Y	Z
1	30	24	46	105	7	52	35	13	92	23		+
2	22	31	47	103	9	41	39	20	90	25		
3	54	36	10	105	7	71	24	5	84	31	+	+
4	52	33	15	107	5	68	28	4	99	16	+	+
5	32	15	53	102	10	66	20	14	80	35	–	+
6	28	34	38	101	11	53	32	15	80	35		+
7	51	20	29	105	7	80	7	13	86	29	+	+
8	14	36	50	101	11	27	43	30	86	29	–	
9	27	31	42	106	6	57	30	13	100	15		+
10	44	20	36	106	6	73	10	17	102	13		+
11	20	49	31	103	9	33	57	10	91	24		0
12	19	18	63	94	18	51	28	20	78	37	–	+
13	22	42	36	105	7	46	48	6	100	15		
14	10	51	39	106	6	33	58	9	98	17	0	0
15	44	16	40	106	6	77	10	13	91	24		+
16	17	35	48	105	7	28	48	24	89	26		
17	38	50	12	99	13	60	36	4	85	30	0	+
18	44	14	42	107	5	72	11	17	102	13		+
19	25	40	35	99	13	48	26	26	89	26		
20	43	20	37	99	13	63	20	17	92	23		+
21	10	41	49	98	14	23	55	22	91	24		0
22	25	33	42	102	10	55	30	15	93	22		+
23	18	36	46	102	10	35	48	17	90	25		
24	75	13	12	105	7	93	5	2	100	15	+	+
25	76	11	13	106	6	95	4	1	99	16	+	+
26	33	34	33	100	12	37	49	14	91	24		
27	24	27	49	105	7	51	30	19	100	15		+
28	11	33	56	102	10	27	51	22	84	31	–	0
29	19	49	32	104	8	36	49	15	95	20		
30	74	15	11	105	7	86	11	3	93	22	+	+
31	34	44	22	102	10	58	35	7	86	29		+
Overall	33	31	36	3,159 (92%)	277 (8%)	55	31	14	2,836 (80%)	729 (20%)		+

*The change in percentage of positive responses from Period Y to Period Z is statistically significant at the 0.05 level for each question except Question 16 and Question 26.

†Over 50 percent of the opined responses are favorable (+), no change (0), or negative (–).

TABLE 7
RESPONSES DURING PERIOD Z ON PHYSICIAN QUESTIONNAIRE–
PERCENTAGE DISTRIBUTION

Percentage Perceiving Positive AFCLAS Impact	Question Numbers	Impact Area
80 or more	7, 24, 25, 30	Retrieval of Results Report Legibility Need to Telephone Cumulative Reports
70 to 79	3, 10, 15, 18	Amount of Statistical Information Report Format
60 to 69	4, 5, 17,20	Amount of Patient Information Overall Comparison Data Utility Retrieval of Results
50 to 59	1, 6, 9, 12, 22, 27, 31	Quality of Care Request Accuracy Lab Efficiency Completeness of Filing Physician Time
No Positive Consensus	2, 8, 11, 13, 14, 16, 19, 21, 23, 26, 28, 29	*Stat* Report Response Time Report Accuracy Confidence in Report Data Routine Report Response Times Telephone Retrieval Physician-Lab Relations Calls or Visits to Lab

Eighty percent or more of the physicians who expressed an opinion felt that AFCLAS improved test result retrieval and report legibility, reduced their need to telephone the laboratory, and improved laboratory service with the introduction of cumulative reports. Seventy to 79 percent of physicians perceived improvements due to AFCLAS in the amount of statistical information provided and in the format of laboratory reports. Improvements in the amount of patient information, the utility of laboratory data to physicians

and the speed with which test results were retrieved were attributed to AFCLAS by 60 to 69 percent of physicians.

A majority agreed (though not a large majority) that AFCLAS positively impacted: the contribution of the laboratory to the quality of patient care (52 percent), the accuracy of test requests (53 percent), the efficiency of the laboratory (51 percent), the completeness of report filing (55 percent), and physician time spent obtaining and using laboratory reports (51 percent); and that AFCLAS had no impact on: the accuracy of reports (57 percent), *stat* report turnaround time (55 percent), and relations between physicians and the laboratory staff (51 percent).

The average percentage who perceived a positive AFCLAS impact for each question rose from 33 in Period Y to 55 in Period Z, and the increase was statistically significant at the 0.05 level for each question except Question 16 (waiting time for routine reports) and Question 26 (number of telephone calls for results).

In summary, AFCLAS was accepted (as defined here) by 86 percent of physicians at MCWP in Period Z compared with 47 percent in Period Y. Physicians perceived many more positive impacts of the system after 2½ years of operation than they had reported after its first 6 months. The improvement in the physician assessment of AFCLAS may be attributed to such factors as the modifications made to the system between Period Y and Period Z, the additional 2 years of familiarity with computerized operations, general improvements in laboratory operations, and the high proportion of physicians newly assigned to MCWP and hence less familiar with the previous manual system (and in many cases, more familiar with automated procedures).

C. Nondollar Benefits

Because physicians are the primary users of laboratory reports, their questionnaire and interview responses form the basis for assessing nondollar benefits. For the interviews, nondollar benefits were established by taking those responses from Table 1 mentioned three or more times by physicians in Period Z, and those responses from Tables 2 and 3 in which a net direction of an AFCLAS impact was perceived by three or more interviewed physicians. For example, five physicians in Period Z reported that the frequency of lost reports decreased since AFCLAS (Table 2), and two felt that the frequency increased (Table 3). Therefore, the category of lost reports is included in this analysis as having improved, based on the interviews.

For the questionnaires, the percentages in Table 6 were used to determine whether the impact area addressed by each question improved, remained the same, or deteriorated (based on plurality of responses) with the installation of AFCLAS. The results of nondollar benefits from the questionnaires (summarized in Table 6) are presented more fully below:

- Patient Care

Question 1	Favorable
Question 8	Unchanged
Question 9	Favorable
Question 10	Favorable
Question 13	Unchanged
Question 14	Unchanged
Question 17	Favorable
	Overall Improvement*

*The overall assessments were made on the basis of a subjective weighting of the relative importance of each question.

- Cumulative Reports

Question 30	Favorable
	Overall Improvement
Question 22	Favorable
Question 31	Favorable
	Overall Improvement

- Legibility of Reports

Question 24	Favorable
Question 25	Favorable
	Overall Improvement

- Turnaround Time for Routine Reports

Question 16	Unchanged
	No Overall Impact

- Turnaround Time for *Stat* Reports

Question 21	Unchanged
	No Overall Impact

- Retrieval of Test Results

Question 7	Favorable
Question 19	Favorable
Question 20	Favorable
Question 27	Favorable
	Overall Improvement

- Report Format

Question 10	Favorable
Question 15	Favorable
Question 18	Favorable
	Overall Improvement

- Accuracy of Test Results

Question 2	Favorable
Question 6	Favorable
Question 11	Unchanged
Question 14	Unchanged
	No Overall Impact

- Amount of Patient Information

Question 3	Favorable
Question 4	Favorable
	Overall Improvement

The results for both survey instruments and from both Period Y and Period Z are summarized in Table 8. In Period Z, physicians perceived an improvement in 14 instances and no net impact in 6 instances, compared with Period Y where improvements were perceived in 13 instances and deteriorations in 7 instances. The impacts derived from the questionnaire match those derived from the interviews in Period Z but disagree in three instances in Period Y.

Table 8 suggests that after 2½ years of computer operation, physicians were more consistent in their perceptions of the nondollar impacts of AFCLAS than they were after its first 6 months of operation and were considerably less negative in their assessments. The physicians continued to perceive no positive AFCLAS impact on the turnaround time for either routine or *stat* reports and no positive impact on the accuracy of reports, but they did perceive improvements or benefits from AFCLAS in the other seven nondollar areas.

TABLE 8
SUMMARY OF THE AFCLAS NONDOLLAR BENEFITS IDENTIFIED BY PHYSICIANS

Item	Period Y		Period Z	
	Questionnaire	Interview	Questionnaire	Interview
Patient Care	Deteriorated	Improved	Improved	Improved
Cumulative Reports (Ability to Follow Trends)	Improved	Improved	Improved	Improved
Lost Reports	Deteriorated	Improved	Improved	Improved
Legibility of Reports	Improved	Improved	Improved	Improved
Turnaround Time for Routine Reports	Deteriorated	Improved	No Change	No Change
Turnaround Time for *Stat* Reports	Deteriorated	Deteriorated	No Change	No Change
Retrieval of Test Results	Improved	Improved	Improved	Improved
Report Format	Improved	Improved	Improved	Improved
Accuracy of Test Results	Deteriorated	Deteriorated	No Change	No Change
Amount of Patient Information	Improved	Improved	Improved	Improved

III. REGISTERED NURSES

A multiple-choice questionnaire similar to the one completed by physicians was administered to registered nurses at MCWP during both Period Y and Period Z. Operating room nurses, nurse practitioners, and nurse anesthetists, who were affected very little by AFCLAS, were not included in the survey. The questionnaire (see Appendix) was designed to measure nurses' acceptance of AFCLAS and their perception of its impacts. In this analysis we assume that Responses 1 and 2 to a question imply a perceived positive impact of AFCLAS, Response 3 implies no perceived impact, and Responses 4 and 5 imply a perceived negative impact. In Period Y, 73 nurses (94 percent of those surveyed) completed the questionnaire, and in Period Z all 112 nurses surveyed (100 percent response rate) completed the questionnaire. Seven recently assigned nurses in each period returned a blank questionnaire with a note explaining their unfamiliarity with AFCLAS, and were excluded from the target population.

Table 9 presents the results for each of the questions. There is no statistically significant change in the percentage of positive responses from Period Y to Period Z for any of the questions. Overall, less than one-third of the nurses were favorable in their evaluation of AFCLAS in both periods. Question 7 asks nurses to make the same overall comparison between AFCLAS and the previous system (or a manual system with which they were familiar) that was asked of physicians. The results for all nurses, omitting "no opinion" responses and blanks (36 in Period Z and 11 in Period Y), are:

	Period Y	Period Z
AFCLAS Superior to Manual System	31 percent	30 percent
AFCLAS No Different From Manual System	43 percent	38 percent
AFCLAS Inferior to Manual System	26 percent	32 percent

If acceptance of AFCLAS is defined as the percentage of respondents who consider AFCLAS at least as good as the previous system, nurses' acceptance of the automated system decreased from 74 percent in Period Y to 68 percent in Period Z. Although this decrease is not statistically significant at the 0.05 level, we can safely conclude that acceptance of AFCLAS by nurses (as defined above) did not increase after the additional 2 years of computer operations at MCWP since in both time periods a virtually complete census of nurses was obtained (as opposed to sampling).

Table 9 also shows that in general fewer nurses agreed on the direction of the computer impacts than did physicians. In Period Z, a majority of nurses did agree, however, that with AFCLAS the legibility of reports had improved (73 percent favorable), that posting of reports in the patient's chart was easier (72 percent), that the organization of specimen collection was unchanged (57 percent), that telling what laboratory work will be performed on a given day was neither easier nor harder (58 percent), that scheduling patients for laboratory tests was neither easier nor harder (64 percent), and finally, that the nursing time spent in clerical work relating to laboratory reports had increased (54 percent). More nurses perceived a negative impact of AFCLAS on the time spent on laboratory-related tasks (Question 1 through Question 4) than perceived either a positive impact or no change, which may explain their continued low level of AFCLAS acceptance. Table 9 also shows that in Period Z, one-fourth of all responses were "no opinion" (compared with the one-fifth for physicians), perhaps suggesting that nurses are less involved in the laboratory computer tasks than are physicians.

In summary, the positive assessment of AFCLAS by physicians is not shared by the nursing staff, whose opinions have remained

TABLE 9
REGISTERED NURSE QUESTIONNAIRE RESPONSES

Question Number*	Period Y					Period Z					Impact Perceived by Majority† in Period	
	Percentage of Opined Responses			Frequencies		Percentage of Opined Responses			Frequencies			
	Positive	No Change	Negative	Opined Responses	No Opinion or Blank	Positive	No Change	Negative	Opined Responses	No Opinion or Blank	Y	Z
1	25	39	36	61	12	17	38	45	82	30		
2	26	28	46	61	12	19	27	54	83	29		–
3	38	12	50	58	15	35	27	39	83	29	–	
4	26	28	46	61	12	32	24	44	82	30		
5	18	34	48	62	11	17	42	42	84	28		
6	28	47	25	57	16	23	41	36	83	29		
7	31	43	26	62	11	30	38	32	76	36		
8	17	61	22	60	13	21	57	22	77	35	0	0
9	27	57	16	56	17	28	58	14	81	31	0	0
10	44	20	36	64	9	49	24	27	90	22		
11	25	27	48	63	10	28	35	37	93	19		
12	59	13	28	64	9	73	13	14	93	19	+	+
13	17	70	13	54	19	28	64	8	76	36	0	0
14	58	18	24	62	11	72	16	12	89	23	+	+
15	31	51	18	55	18	32	49	19	85	27	0	
16	22	38	40	60	13	21	35	44	89	23		
Overall	31	36	33	960 (81%)	219 (19%)	33	37	30	1,346 (75%)	449 (25%)		

*The change in percentage of positive responses from Period Y to Period Z is not statistically significant at the 0.05 level for any question.

†Over 50 percent of the opined responses are favorable (+), no change (0), or negative (–).

fairly constant since the system's first year of operation. Four out of five nurses found no reduction in the amount of time spent in clerical work relating to laboratory reports since AFCLAS, and over half of the nurses perceived an increase in clerical work due to AFCLAS. The automated system is acceptable, however, to both physician and nursing staffs at MCWP. After 6 months of operation the nurses' evaluations of AFCLAS were more favorable than those of physicians, but after 2½ years of computer operations, nursing acceptance had remained at about 70 percent while physician acceptance had increased from 47 percent to 86 percent. Improved legibility of reports due to AFCLAS was perceived by the highest percentage of respondents for both physicians (95 percent) and nurses (73 percent).

IV. LABORATORY STAFF

The laboratory staff completed identical questionnaires in Periods X, Y, and Z containing questions about their general satisfaction with their jobs and with laboratory operations. Period X data are thus included in the analysis that follows. Technicians, students, and administrative personnel working in the clinical laboratory during any of the data collection periods were included in the study, while commissioned officers, secretaries, and volunteers were excluded. Questionnaires (see Appendix) were completed by the entire target population in each time period, yielding 53 respondents in Period X, 61 in Period Y, and 69 in Period Z. Part 1 of the questionnaire is a job satisfaction scale that asked respondents to indicate the extent of their agreement with each of 23 statements about their jobs. Part 2 posed 12 specific, multiple choice questions about clinical laboratory operations.

A total score on the job satisfaction scale was computed for each respondent. From these we obtained the mean scores for Periods X, Y, and Z and conducted a statistical significance test on the difference between means for Period Y and Period Z, and for Period X and Period Z.

To score the job satisfaction questionnaire we assigned numerical values from 1 to 5 to the responses to each question—from "strongly agree," which was assigned a value of 1, to "strongly disagree," which was assigned a value of 5. We then summed the scores for the 23 questions on the scale to obtain an overall score. A lower total score indicates greater job satisfaction.

The mean score in Period Z was 54.0 with a standard deviation of 9.4, compared to 55.2 in Period Y (standard deviation = 9.1) and 58.4 in Period X (standard deviation = 8.3). Job

satisfaction scores improved from before AFCLAS to after AFCLAS and the difference between the Period X and Period Z scores is statistically significant at the 0.05 level (t test with 82 degrees of freedom). The proportion of all Part 1 responses that were either "strongly agree" or "agree" was 66 percent in both Period Y and Period Z and was not significantly lower (63 percent) in Period X. The data indicate that while job satisfaction of the laboratory staff showed some improvement over time, the percentage satisfied remained virtually unchanged. This is certainly possible since computing the percentage satisfied results in a dichotomization of the data and a subsequent reduction in sensitivity to measuring change. Also, AFCLAS may have caused some technicians' jobs to be easier while causing other jobs to be more difficult or less enjoyable as reflected in the increasing variance of the satisfaction scores over time, although the difference in the variances of Period X and Period Z scores is not statistically significant at the 0.05 level (F test with 68 and 52 degrees of freedom).

Table 10 displays for each of the 23 statements on the job satisfaction scale, the percentage of respondents who agreed (responded "agree" or "strongly agree"). The percentage of responses to Statement 10 ("Dealing with other people in the laboratory is an important part of my job.") and Statement 11 ("The laboratory is a great place to develop close friends."), increased significantly between Period X and Period Z. However, neither of these response changes can be directly related to AFCLAS implementation. There are no statistically significant changes in the percentage who agreed with any job satisfaction statement between Period Y and Period Z.

TABLE 10
PERCENTAGE OF LABORATORY STAFF WHO AGREE OR STRONGLY AGREE WITH JOB SATISFACTION STATEMENTS

Statement No.*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Overall	Sample Size
Period X	91	57	62	64	77	8	76	85	91	64	25	68	34	64	43	68	91	58	70	62	81	79	6	63	53
Period Y	100	51	64	49	85	15	84	89	92	74	41	80	38	66	43	84	87	69	62	64	85	74	11	66	61
Period Z	91	55	65	59	83	14	80	83	83	87	43	88	46	73	39	80	90	67	68	57	80	78	13	66	69
Significance Level of Change†	NS‡	NS	NS	NS	NS	NS	NS	NS	NS	.01	.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

*Refers to statement numbers on Laboratory Staff Questionnaire #1.

†The χ^2 test with 1 degree of freedom was used to test for a statistically significant change in the proportion of respondents who either agreed or strongly agreed from Period X to Period Z. There are no statistically significant changes in the proportion of respondents who either agreed or strongly agreed with any job satisfaction statement between Period Y and Period Z.

‡NS indicates that the change between Period X and Period Z is not statistically significant.

Table 11 presents the results for Part 2 of the questionnaire. Percentages are shown for Responses 1, 2, and 3 to enable a test for statistically significant differences in proportions between Period Z and both Period X and Period Y. For most of the 10 tabulated questions this dichotomization results in a clear separation of the desirable and undesirable response categories. Question 1 asked respondents what was the normal workweek in the laboratory. Before AFCLAS, in Period X, most of the laboratory staff (79 percent) reported a workweek of under 45 hours. After 6 months of computer operations (i.e., during Period Y), less than half (48 percent) perceived an average of under 45 hours per week, even though the size of the laboratory staff had increased 15 percent. In Period Z, however, 87 percent perceived the normal workweek as under 45 hours, a portion somewhat greater than that in Period X and nearly double that (48 percent) in Period Y. Questions 2, 3, and 5, also related to hours worked, had the same pattern of change, though less pronounced, over the three time intervals. In Period Z, 47 percent of the staff reported recent overtime (Question 5) compared with 76 percent in Period Y and 59 percent in Period X.

With the exception of Question 10, which asks the respondent to compare the quality of laboratory reports at MCWP with that of reports in similar laboratories, Questions 6 through 12 reflect the extent to which the staff feel they have enough time to work effectively. The responses to all six questions exhibit the same pattern of change over time, a pattern consistent with that found in the workweek category. In Period Z, the majority of respondents (57 percent) felt they had enough time to accomplish their tasks (Question 6); only 26 percent felt that way in Period Y and 49 percent in Period X.

TABLE 11
RESPONSES TO LABORATORY STAFF QUESTIONNAIRE #2

Question Number	Response Number	Period X (Percent*)	Period Y (Percent*)	Period Z (Percent*)	Period X (Percentage with Responses 1, 2, or 3)	Period Y (Percentage with Responses 1, 2, or 3)	Period Z (Percentage with Responses 1, 2, or 3)	Statistical Significance Level† (X to Z)	Statistical Significance Level† (Y to Z)
1	1	0	0	0	79	48	87	NS‡	0.001
	2	25	10	16					
	3	54	38	71					
	4	11	31	10					
	5	10	21	8					
2	1	2	0	9	70	57	86	NS	0.001
	2	29	13	16					
	3	39	44	61					
	4	17	23	12					
	5	12	20	2					
3	(not included in analyses)								
4	(not included in analyses)								
5	1	41	24	53	78	71	94	0.01	0.001
	2	27	32	26					
	3	10	15	15					
	4	10	20	4					
	5	12	8	2					
6	1	0	0	5	42	28	57	NS	0.001
	2	0	10	9					
	3	42	18	43					
	4	42	46	31					
	5	16	26	12					
7	1	4	0	6	49	29	64	NS	0.001
	2	6	3	7					
	3	39	26	51					
	4	35	26	26					
	5	18	44	10					
8	1	11	2	9	53	38	70	NS	0.001
	2	21	23	33					
	3	21	13	28					
	4	26	33	17					
	5	21	29	13					
9	1	0	2	2	30	26	68	0.001	0.001
	2	4	2	13					
	3	26	22	53					
	4	45	37	26					
	5	24	38	6					
10	1	11	11	6	91	73	88	NS	0.05
	2	26	11	25					
	3	54	51	57					
	4	4	15	6					
	5	4	13	6					
11	1	2	2	5	60	40	71	NS	0.001
	2	40	21	46					
	3	18	17	20					
	4	27	21	18					
	5	13	38	11					
12	1	0	0	7	66	52	78	NS	0.01
	2	43	28	51					
	3	23	24	20					
	4	27	24	18					
	5	7	23	4					

*Percentage of valid responses in the category indicated.

†The χ^2 test with 1 degree of freedom was used to test for a statistically significant change in the proportion of respondents in Categories 1, 2, or 3 between periods.

‡NS indicates that the change between periods is not statistically significant.

The responses to Question 10 indicate that the perceived quality of laboratory reports at MCWP deteriorated somewhat after the first 6 months of automation but in Period Z had returned to the high level observed before AFCLAS installation.

The results of the laboratory staff survey in Period Z show a slight improvement in job satisfaction and staff perceptions of working conditions since Period X. While in most cases this improvement is not statistically significant, the deterioration in staff perceptions of working conditions observed after AFCLAS' first 6 months of operation (i.e., during Period Y) has now been reversed (on the basis of Part 2 responses) and the differences between Period Y and Period Z are highly significant.

V. CONCLUSIONS

The surveys administered for this evaluation in Periods X, Y, and Z were used to measure changes in acceptance of AFCLAS and in perceptions of clinical laboratory operations by physicians, nurses, and the laboratory staff. The principal findings of these surveys may be summarized as follows:

- Physician acceptance of AFCLAS has substantially increased (from 47 percent to 86 percent) between the two periods according to the questionnaire results, but has moderately increased (from 75 percent to 86 percent) from Period Y to Period Z according to the interview results. Since the questionnaires were completed by the entire target population of physicians, we can conclude that physician acceptance has increased to a high level since Period Y. The benefits of AFCLAS perceived most often by physicians are the provision of cumulative reports, improved legibility of reports, and improved retrieval of results. Their suggestions for improvements to the system centered on more terminals, faster turnaround time of results, and better ways to enter data.

- Nurses' acceptance of AFCLAS has remained at about 70 percent since Period Y. The benefits of AFCLAS perceived most often by nurses are improved legibility of results and easier posting of the laboratory reports in the patient's chart.

- The job satisfaction of the laboratory staff has increased slightly since Period Y, and the Period Z scores show statistically significant differences from those in Period X. Laboratory staff perceptions of working conditions are much more favorable than they were in Period Y and slightly more favorable than in Period X.

While we believe we have successfully measured the changes that have occurred since AFCLAS was introduced at MCWP, a number of factors make it difficult to draw conclusions about the primary causes of those changes. Most of the respondents to the four questionnaires in Period Z, for example, were not assigned to MCWP during manual operation of the laboratory, and also, the surveys were not designed to isolate the impacts of the software modifications implemented between Period Y and Period Z. As a result, we do not know how much of the change observed between these periods is due to the modifications (listed on page 1) and how much is due to changes in staff familiarity with automated information procedures.

An observation that supports the validity of our findings is that the level of acceptance of AFCLAS and the direction of its impacts perceived by the hospital staff at MCWP in Period Z correspond closely to staff perceptions of a similar automated system at Malcolm Grow Medical Center (MGMC), Andrews Air Force Base (Reference 2). This observation is based on the responses to similar questionnaires administered 2 years after system implementation at MGMC. Physician acceptance,* for example, was about 85 percent after 2 years of operation at MGMC and after 2½ years at MCWP. In addition, 18 of the 19 positive impacts of AFCLAS observed by a majority of physicians at MCWP (see Table 6) were also reported by a majority of physicians at MGMC.

While only subjective data were obtained during Period Z, the performance of AFCLAS at MCWP, particularly relating to physicians, seems to have improved considerably since its first 6 months of operation.

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* Physician acceptance is defined as the percentage who consider the automated system to be at least as good as the previous manual system.

REFERENCES

(1) R. C. Brooks, R. G. Carlisle, I. J. Casey, and P. W. Blackmon, Jr. *Evaluation Plan for the Air Force Clinical Laboratory Automation System (AFCLAS)*, HSDN 77-3. Analytic Services Inc., 1975.

(2) D. S. Allen II, R. F. Corn, J. D. Hodgdon, and R. C. Brooks. *Evaluation of the Tri-Service Laboratory Information System (TRILAB I) at Malcolm Grow USAF Medical Center*, HSDN 77-7. Volume II—Analysis. Analytic Services Inc., 1977.

APPENDIX

QUESTIONNAIRES

The schedules (questionnaires) in this appendix were designed to measure attitudes toward the clinical laboratory and acceptance of AFCLAS.

PHYSICIAN'S QUESTIONNAIRE

Instructions

1. Complete the questionnaire on the basis of your knowledge and personal experience with the clinical laboratories at the Wright-Patterson Medical Center and other clinical laboratories (Air Force and non-Air Force).

2. A Clinical Laboratory Automation System (AFCLAS) was installed at the Wright-Patterson Medical Center 2 years ago. We would like to know your opinion—as a practicing physician—of the impact AFCLAS has had on your professional activities.

3. Finally, insert the completed questionnaire in the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

Name
Department.

This information will be used only to ensure that responses from all physicians at Wright-Patterson Medical Center will be included in the study. The sealed envelope will be opened only by the research team of Analytic Services Inc. (ANSER), and the information you provide will be available only to the team.

ANSER
W-P, March 1978

1. AFCLAS has

- [] significantly increased
- [] slightly increased
- [] had no effect on
- [] slightly decreased
- [] significantly decreased

the quality of patient care.

- [] No opinion

2. AFCLAS has

- [] virtually eliminated
- [] slightly reduced
- [] had no effect on
- [] slightly increased
- [] significantly increased

errors in clinical laboratory reports.

- [] No opinion

3. AFCLAS has provided

- [] much more
- [] slightly more
- [] about the same amount of
- [] slightly less
- [] significantly less

statistical information.

- [] No opinion

4. AFCLAS has

- [] significantly increased
- [] slightly increased
- [] had no effect on
- [] slightly decreased
- [] significantly decreased

the amount of information available from clinical laboratory reports.

- [] No opinion

5. AFCLAS is

- [] far superior to
- [] slightly superior to
- [] about the same quality as
- [] slightly inferior to
- [] far inferior to

the previous system.

- [] No opinion

6. AFCLAS is

- [] far superior to
- [] slightly superior to
- [] about the same as
- [] slightly inferior to
- [] significantly inferior to

the previous system in providing accurate requests for laboratory tests.

- [] No opinion

ANSER
W-P, March 1978

7. AFCLAS has been

[] far more effective than
[] slightly more effective than
[] about as effective as
[] slightly less effective than
[] significantly less effective than

} the previous system in retrieving test information on patients.

[] No opinion

8. AFCLAS responds to STAT requests in a way that

[] significantly improves
[] slightly improves
[] does not differ from the previous system in providing
[] slightly impairs
[] significantly impairs

} patient care.

[] No opinion

9. AFCLAS has

[] significantly improved
[] slightly improved
[] had no effect on
[] slightly impaired
[] significantly impaired

} the ability of the physician to use clinical laboratory data.

[] No opinion

10. AFCLAS has

[] significantly improved
[] slightly improved
[] had no effect on
[] slightly impaired
[] significantly impaired

} the physician's ability to locate patient's clinical laboratory data in the laboratory report.

[] No opinion

11. AFCLAS has

[] significantly increased
[] slightly increased
[] had no effect on
[] slightly decreased
[] significantly decreased

} the accuracy of clinical laboratory reports.

[] No opinion

12. With AFCLAS, the clinical laboratory

[] functions much more smoothly.
[] functions slightly more smoothly.
[] functions about the same.
[] functions slightly less smoothly.
[] functions significantly less smoothly.

[] No opinion

13. With AFCLAS, I am

[] significantly more knowledgeable
[] slightly more knowledgeable
[] about as knowledgeable as in the past
[] slightly less knowledgeable
[] significantly less knowledgeable

} about my patients.

[] No opinion

14. With AFCLAS, I am

[] much more confident with
[] slightly more confident with
[] about as confident as I was in the past with
[] slightly less confident with
[] significantly less confident with

the clinical laboratory information that I use with my patients.

[] No opinion

15. With AFCLAS, the format of information in lab reports is

[] significantly more
[] slightly more
[] no more
[] slightly less
[] significantly less

convenient to use than was the previous format.

[] No opinion

16. AFCLAS has

[] significantly decreased
[] slightly decreased
[] had no effect on
[] slightly increased
[] significantly increased

the time that I have to wait for routine laboratory reports.

[] No opinion

17. AFCLAS provides statistical information that is

[] significantly more useful in
[] slightly more useful in
[] no more useful than in the past in
[] slightly less useful in
[] significantly less useful in

patient care.

[] No opinion

18. AFCLAS has made chart reading

[] significantly easier.
[] slightly easier.
[] about as easy as before AFCLAS.
[{ slightly more difficult.
[] significantly more difficult.

[] No opinion

19. AFCLAS has

[] significantly improved
[] slightly improved
[] had no effect on
[] slightly impaired
[] significantly impaired

telephone retrieval of test information by calling the laboratory.

[] No opinion

20. AFCLAS has

[] significantly increased
[] slightly increased
[] had no effect on
[] slightly decreased
[] significantly decreased

the speed in retrieving test information on patients.

[] No opinion

21. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the response time for STAT reports.

- [] No opinion

22. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the number of lost test reports.

- [] No opinion

23. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the number of repeat requests for laboratory work.

- [] No opinion

24. AFCLAS has

- [] significantly increased
- [] slightly increased
- [] had no effect on
- [] slightly decreased
- [] significantly decreased

the legibility of laboratory reports filed in the patient's medical record.

- [] No opinion

25. AFCLAS has

- [] significantly increased
- [] slightly increased
- [] had no effect on
- [] slightly decreased
- [] significantly decreased

the legibility of laboratory reports.

- [] No opinion

26. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the number of times that I call the laboratory to obtain test results.

- [] No opinion

27. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the total time that I spend obtaining and using laboratory reports.

- [] No opinion

28. AFCLAS has

[] significantly improved
[] slightly improved
[] resulted in no change in
[] slightly impaired
[] significantly impaired

relations between physicians and laboratory personnel.

[] No opinion

29. AFCLAS has

[] significantly decreased
[] slightly decreased
[] had no effect on
[] slightly increased
[] significantly increased

the number of times that I visit the laboratory to obtain test results.

[] No opinion

30. Cumulative laboratory reports provided by AFCLAS are

[] much more useful than
[] more useful than
[] about as useful as
[] less useful than
[] much less useful than

the previous laboratory reports.

[] No opinion

31. AFCLAS has

[] significantly increased
[] slightly increased
[] had no effect on
[] slightly decreased
[] significantly decreased

the percentage of laboratory reports filed in the patient's medical record.

[] No opinion

32. My primary responsibility is

[] inpatient care.
[] outpatient care.
[] other. Please specify _____

33. Were you assigned to the Wright-Patterson Medical Center during March 1976?

[] Yes
[] No

34. Had you worked with an automated laboratory information system before coming to the Wright-Patterson Medical Center?

[] Yes
[] No

Please place your completed questionnaires into the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

Name
Department.

ANSER
W-P, March 1978

REGISTERED NURSING STAFF QUESTIONNAIRE

Instructions

1. Complete the questionnaire on the basis of your knowledge and personal experience with the clinical laboratories at the Wright-Patterson Medical Center and other clinical laboratories (Air Force and non-Air Force).

2. A Clinical Laboratory Automation System (AFCLAS) was installed at Wright-Patterson Medical Center 2 years ago. We would like to have your opinion—as an R.N.—of the impact AFCLAS has had on your professional activities.

3. Please indicate your response to each question by placing a mark in the appropriate box.

4. When you have completed the questionnaire, insert it in the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

Name
Department or Ward.

This information will be used only to ensure that responses from all R.N.'s at Wright-Patterson Medical Center will be included in the study. The sealed envelope will be opened only by the research team of Analytic Services Inc. (ANSER), and the information you provide will be available only to the team.

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1. There has been

- [] a significantly smaller
- [] a somewhat smaller
- [] about the same
- [] a somewhat greater
- [] a significantly greater

number of telephone calls for STAT results with AFCLAS.

- [] No opinion

2. With AFCLAS, the time that I spend on clerical work related to laboratory reports has been

- [] significantly reduced.
- [] slightly reduced.
- [] about the same as before AFCLAS.
- [] slightly increased.
- [] significantly increased.

- [] No opinion

3. AFCLAS has made it

- [] much easier
- [] somewhat easier
- [] as easy as in the past
- [] somewhat more difficult
- [] much more difficult

to obtain information on status of laboratory tests being performed.

- [] No opinion

4. AFCLAS has

- [] significantly decreased
- [] slightly decreased
- [] had no effect on
- [] slightly increased
- [] significantly increased

the total time I spend processing test requests and laboratory reports.

- [] No opinion

5. STATS are being returned

- [] much faster
- [] somewhat faster
- [] about as fast as in the past
- [] somewhat slower
- [] much slower

with AFCLAS.

- [] No opinion

6. AFCLAS has permitted me to interact

- [] much more effectively
- [] slightly more effectively
- [] about as effectively as in the past
- [] slightly less effectively
- [] much less effectively

with clinical laboratory personnel.

- [] No opinion

7. AFCLAS is

- [] far superior to
- [] superior to
- [] about the same as
- [] inferior to
- [] far inferior to

the previous system.

- [] No opinion

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8. The collection of specimens has been

- [] much better organized
- [] better organized
- [] about as well organized as in the past
- [] less organized
- [] much less organized

with AFCLAS.

- [] No opinion

9. With AFCLAS, it has been

- [] much easier
- [] easier
- [] about as easy as in the past
- [] more difficult
- [] much more difficult

to tell what laboratory work is to be done on a given day.

- [] No opinion

10. AFCLAS has made it

- [] much easier
- [] somewhat easier
- [] about as easy as in the past
- [] somewhat more difficult
- [] much more difficult

to obtain information about patients' clinical laboratory results.

- [] No opinion

11. AFCLAS has made the nurses' tasks in ordering laboratory tests

- [] much easier.
- [] somewhat easier.
- [] about as easy as in the past.
- [] somewhat more difficult.
- [] much more difficult.
- [] No opinion

12. Clinical laboratory reports provided by AFCLAS are

- [] much easier
- [] somewhat easier
- [] about as easy as in the past
- [] somewhat more difficult
- [] much more difficult

to read.

- [] No opinion

13. With AFCLAS, it is

- [] significantly easier
- [] slightly easier
- [] about as easy as in the past
- [] slightly more difficult
- [] significantly more difficult

to schedule patients for laboratory procedures.

- [] No opinion

14. AFCLAS has made posting of clinical laboratory reports in a patient's chart

- [] much easier.
- [] somewhat easier.
- [] about the same as before AFCLAS.
- [] somewhat more difficult.
- [] much more difficult.
- [] No opinion

15. AFCLAS has

[] significantly increased
[] slightly increased
[] had no effect on
[] slightly decreased
[] significantly decreased

} the quality of patient care.

[] No opinion

16. With AFCLAS, the number of telephone calls that I make to the laboratory is

[] much smaller.
[] slightly smaller.
[] about the same as before AFCLAS.
[] slightly greater.
[] much greater.

[] No opinion

17. My primary responsibility is

[] inpatient care.
[] outpatient care.
[] other. Please specify _____

18. Were you assigned to the Wright-Patterson Medical Center during March 1976?

[] Yes
[] No

19. Had you worked with an automated laboratory information system before coming to the Wright-Patterson Medical Center?

[] Yes
[] No

Please place your completed questionnaire into the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

Name
Department or Ward.

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LABORATORY STAFF QUESTIONNAIRES

Instructions

1. Complete the first attached questionnaire entitled "Laboratory Staff Questionnaire #1" before completing the second attached questionnaire entitled "Laboratory Staff Questionnaire #2."

2. Indicate your response to each question by placing a mark in the appropriate block.

3. Insert the completed questionnaires into the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

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Section.

This information will be used only to ensure that responses from all laboratory staff at Wright-Patterson Medical Center will be included in the study. The sealed envelope will be opened only by the research team of Analytic Services Inc. (ANSER), and the information you provide will be available only to the team.

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LABORATORY STAFF QUESTIONNAIRE #1

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. During my day in the laboratory, I do many different tasks.					
2. There is an opportunity in the laboratory for independent thought and action.					
3. In contrast with workers in industry, laboratory people know the final results of their work.					
4. Supervisors in the laboratory provide valid comments on my performance.					
5. The most important part of my job is helping other people.					
6. Laboratory people get together after work more frequently than do people in other parts of the hospital.					
7. My laboratory assignment permits me to do many different test procedures.					
8. My supervisor leaves me pretty much alone to perform my work in the laboratory.					
9. I know how well I am performing my job each day.					
10. Dealing with other people in the laboratory is an important part of my job.					
11. The laboratory is a great place to develop close friends.					
12. My laboratory assignment permits me to use many different kinds of equipment.					
13. Supervisors in the laboratory provide frequent comments on my performance.					
14. Dealing with people outside the laboratory is an important part of my job.					
15. I perform tasks in the laboratory that are important but outside of my technical specialty.					
16. During a day in the laboratory, I use many different pieces of equipment.					
17. I am responsible for doing complete test procedures in the laboratory.					
18. While on duty, there is almost always an opportunity to talk with laboratory people about nonlaboratory subjects.					
19. When I am on duty, the order in which I perform my tasks, except STATs, is left up to me.					
20. Automated equipment in the laboratory does not interfere with my decisions about the tasks I perform.					
21. When I complete a laboratory test procedure, I consider it a result of my own efforts.					
22. When I start a test procedure, I know that I will have the opportunity to see it through to the end and know the result.					
23. Supervisors often get together with laboratory people after duty hours.					

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LABORATORY STAFF QUESTIONNAIRE #2

1. The normal work week in this laboratory is

- ☐ less than 35 hours.
- ☐ 35-40 hours.
- ☐ 40-45 hours.
- ☐ 45-50 hours.
- ☐ over 50 hours.

2. During the past week, I worked in the laboratory

- ☐ less than 35 hours.
- ☐ 35-40 hours.
- ☐ 40-45 hours.
- ☐ 45-50 hours.
- ☐ over 50 hours.

3. During the past week, I spent

- ☐ 2 hours or less
- ☐ 2-5 hours
- ☐ 5-8 hours
- ☐ 8-11 hours
- ☐ over 12 hours

on military duties outside the laboratory.

- ☐ I have no military duties outside the laboratory.

4. During the past week, I was on pass or leave

- ☐ no
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

days.

5. During the past week, I worked

- ☐ less than 1
- ☐ 1-3
- ☐ 3-6
- ☐ 6-10
- ☐ over 10

more hours than the normal work week in the laboratory.

6. In performing my tasks in the laboratory, I feel that I have

- ☐ much more than
- ☐ more than
- ☐ all of
- ☐ somewhat less than
- ☐ much less than

the time that I need to accomplish my tasks.

7. In performing my tasks in the laboratory, I feel that I have

- ☐ much more
- ☐ more
- ☐ about the same amount of
- ☐ less
- ☐ much less

time than (that) I would expect for a laboratory of this type.

8. When performing my tasks in the laboratory, I am rushed

- ☐ rarely.
- ☐ occasionally.
- ☐ moderately often.
- ☐ often.
- ☐ very often.

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9. When performing my tasks in the laboratory, I am rushed

- ( ) much less often than
- ( ) less often than
- ( ) about as often as
- ( ) more often than
- ( ) much more often than

( ) No opinion

} I would expect in a clinical laboratory of this kind.

10. The quality of reports in this laboratory is

- ( ) far superior to
- ( ) slightly superior to
- ( ) about the same quality as
- ( ) slightly inferior to
- ( ) far inferior to

( ) No opinion

} reports for similar laboratories.

11. The time available for quality control in this laboratory is

- ( ) more than is needed.
- ( ) all that is needed.
- ( ) almost all that is needed.
- ( ) slightly less than is needed.
- ( ) much less than is needed.

( ) Quality control is not part of my job.

12. In laboratories such as this, there is typically

- ( ) more than enough time
- ( ) all the time that is needed
- ( ) almost as much time as is needed
- ( ) less time than is needed
- ( ) much less time than is needed

( ) No opinion

} for quality control.

13. Please give your rank _____

14. Please give AFSC number _____

15. Are you a student?

( ) Yes
( ) No

16. Were you assigned to the Department of Pathology at the Wright-Patterson Medical Center during March 1976?

[] Yes
[] No

Please place your completed questionnaires into the accompanying envelope, seal the envelope, and print the following information on the front of the envelope:

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Section.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the results of physician, nurse, and laboratory staff surveys conducted at the Medical Center, Wright-Patterson AFB (Ohio) in early 1978 (2½ years after installation of the system). The surveys were designed to measure acceptance of the Tri-Service Laboratory Information System (TRILAB I) and its impacts as perceived by the hospital staff. This data collection period at Wright-Patterson AFB is referred to as Period 2, and the results are compared with those from the

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20. ABSTRACT (continued)

same surveys administered during Period Y (6 months after system installation) and for the laboratory staff during Period X (6 months before system installation) as well.

The principal findings of these surveys may be summarized as follows. Physician acceptance of TRILAB I has increased from 47 percent in Period Y to 86 percent in Period Z, while nurses' acceptance of TRILAB I has remained at about 70 percent. Nondollar benefits of TRILAB I perceived by physicians include improvements in patient care, ability to follow trends, legibility of reports, and report format. The job satisfaction of the laboratory staff has increased over the three observation periods. Laboratory staff perceptions of working conditions are considerably more positive than those in Period Y, and slightly more positive than those in Period X.